16.0 Greenhouse Gas Emissions and Climate Change

16.1 Introduction

16.1.1 This Chapter reports the likely significant effects of the Proposed Development on the global climate in terms of greenhouse gas emissions (GHG) and climate change. This specifically includes embodied carbon, traffic-related emissions and carbon dioxide emissions from the operation of the project. Where appropriate, it also identifies proposed mitigation measures to prevent, minimise or control likely negative effects arising from the Proposed Development and the subsequent anticipated residual effects.

16.1.2 The effects of the Proposed Development are considered over the demolition and construction, operational and end of life phases.

16.1.3 This Chapter has been updated on the basis of the changes to the existing floorspace for the O2 Centre and includes the updated calculations that have been run for the updated Sustainability Statement (Buro Happold, December 2022).

16.1.4 The GHG Protocol which was originally published in 2001, defines carbon dioxide equivalent (CO2e) as the standard unit for measuring and reporting emissions (GHG Protocol, 2001). The terms 'carbon dioxide (CO_2)' and 'greenhouse gas (GHG)' are used interchangeably in this chapter in accordance with the terminology of referenced documents. CO_2, methane (CH_4) and nitrous oxide (N_2O) are the main greenhouse gases of concern due to their high global warming potential (GWP) and/or concentration levels in the atmosphere.

16.1.5 In accordance with Regulation 18(3) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (hereinafter referred to as the 'EIA Regulations') (UK Government, 2017), this ES chapter sets out the information relating to climate change outlined in Schedule 4 as follows:

- An estimate, by type and quantity, of expected GHG emissions, generated during the construction and operational phases, produced on the basis of the available environmental information and scientific knowledge.

- A description of the likely significant effects of the Proposed Development on the environment resulting from:

    - Impacts of the Proposed Development on the nature and magnitude of GHG emissions;

    - Impacts of the Proposed Development relevant to adaptation in a changing climate; and

    - Impacts of the Proposed Development associated with its vulnerability to climate change.

16.1.6 Where the effects resulting from any potential changes caused by the Proposed Development are expected to be significant, a description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant negative effects on the environment in the context of the following:

- Climate change mitigation (i.e. measures implemented in the design of the Proposed Development to avoid, prevent, reduce or offset GHG emissions); and
- Climate change resilience & adaptation (i.e. measures implemented to future-proof the Proposed Development and adapt to the anticipated impacts of a changing climate).

16.1.7 This Chapter (and its associated figures) should be read together with the Introductory Chapters of this ES (Chapters 1 – 5), as well as **Chapter 17: Cumulative Effects** and the submitted standalone Energy Strategy (Buro Happold, 2022) and Sustainability Statement (Buro Happold, 2022) submitted with the planning application.

Competence

16.1.8 This assessment has been undertaken by Elizabeth Ray, Associate Sustainability Consultant and Ruth Ayers, Sustainability Consultant, both of Hoare Lea.

16.1.9 Elizabeth Ray has a BEng in Architectural Environment Engineering (University of Nottingham), MSc in Environmental Design and Engineering (UCL), is a Chartered Engineer and Member of Chartered Institute of Building Services Engineers and has 12 years' experience in the sustainability and energy sectors.

16.1.10 At Hoare Lea, Elizabeth supports the firm's sustainability strategy, energy strategy, building physics, and EIA climate change assessment service offering, having worked on projects including a range of medium- to large-scale residential-led and mixed-use masterplan developments.

16.2 Legislation, Planning Policy and Guidance

16.2.1 The following national, regional and local planning policy and guidance is of relevance to the assessment of the effects of the Proposed Development in relation to GHG emissions and climate change.

Climate Change Act (2008)

16.2.2 The Climate Change Act (UK Government, 2008) established the legal framework for government action to enable the UK to achieve its long-term carbon reduction goals. Through the Climate Change Act, the UK government has set a target to reduce UK GHG emissions by at least 80% by the year 2050, relative to 1990 levels, and outlined a path to get there.

16.2.3 The Act incorporates a requirement for the government to produce a UK Climate Change Risk Assessment (CCRA) every five years and to develop a National Adaptation Programme (NAP) to address the opportunities and risks arising from climate change.

16.2.4 The Act also further introduced a key institutional innovation in the form of legally-binding five-year 'carbon budgets' with distinct five-year targets to act as stepping stones towards the 2050 target. A carbon budget is essentially a cap on the amount of GHGs that are allowed to be emitted in the UK over a five-year period. The Act also established the Committee on Climate Change (CCC) to ensure that emissions targets are evidence-based and independently assessed.

The Town and Country Planning (Environmental Impact Assessment) Regulations 2017

16.2.5 The EIA Regulations (UK Government, 2017) require a detailed examination of the potential impacts of development projects on climate . They require a description of 'the impact of the Proposed Development on climate', and 'the vulnerability of the Proposed Development to climate change' (Schedule 4, paragraph 5(f)).

The Climate Change Act 2008 (2050 Target Amendment) Order 2019

16.2.6 On 26th June 2019, the UK parliament passed the Climate Change Act 2008 (2050 Target Amendment) ("Order") (UK Government, 2019) implementing the recommendations of the Committee on Climate Change committing the country to a new legally binding "net-zero" carbon target for 2050. This replaced the previous legally binding net GHG emissions reduction target of 80% relative to 1990 levels, introduced by the Climate Change Act, with the updated target of a 100% reduction when compared to the 1990 baseline. With this act the UK became the first G7 economy to introduce a legal obligation on its Government to achieve net zero emissions.

16.2.7 The Order was enacted following a recommendation made by the UK Committee on Climate Change that the UK should adopt a target of "net-zero" emissions by 2050 contained in a report which was published shortly after the UK Parliament had declared a climate change emergency.

The UK Climate Change Risk Assessment (CCRA) (2017)

16.2.8 The Government and the Adaptation Sub-Committee (part of the CCC) published the second five-year CCRA in January 2017 (UK Government, 2017). The CCRA draws upon the findings contained in the Adaptation Sub-Committee's (ASC) independent evidence report for a range of potential impacts of climate change in a UK context.

16.2.9 The Government commissioned the ASC to produce an Evidence Report to inform the second CCRA (CCRA2). The full CCRA2 Evidence Report (The Climate Change Committee, 2017) comprises eight chapters written by leading academics, consultants and other experts in the public and private sectors and civil society representing organisations across Great Britain and Northern Ireland. It highlights priority risks across different sectors where additional action is recommended over the next five years to tackle current and future risks, and realise opportunities, arising for the UK from climate change.

16.2.10 The ASC's CCRA2 Evidence Report identified six key areas of climate change risk that need to be managed as a priority over the next five years. It divided the key groups of risk into areas where there is an urgent case for stronger policies and areas where additional research is required in order to inform future policy approaches.

16.2.11 More action needed:

- Flooding and coastal change risks to communities, businesses and infrastructure;
- Risks to health, wellbeing and productivity from high temperatures;
- Risk of shortages in the public water supply, and for agriculture, energy generation and industry, with impacts on freshwater ecology;
- Risks to natural capital including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity; and
- Risks to domestic and international food production and trade.

16.2.12 Research priority:

- New and emerging pests and diseases, and invasive non-native species, affecting people, plants and animals.

16.2.13 Figure 16.1 **Error! Reference source not found.**presents the 'urgency scores' assigned to the 56 individual risks and opportunities identified by leading academics and experts in the CCRA2 Evidence Report.

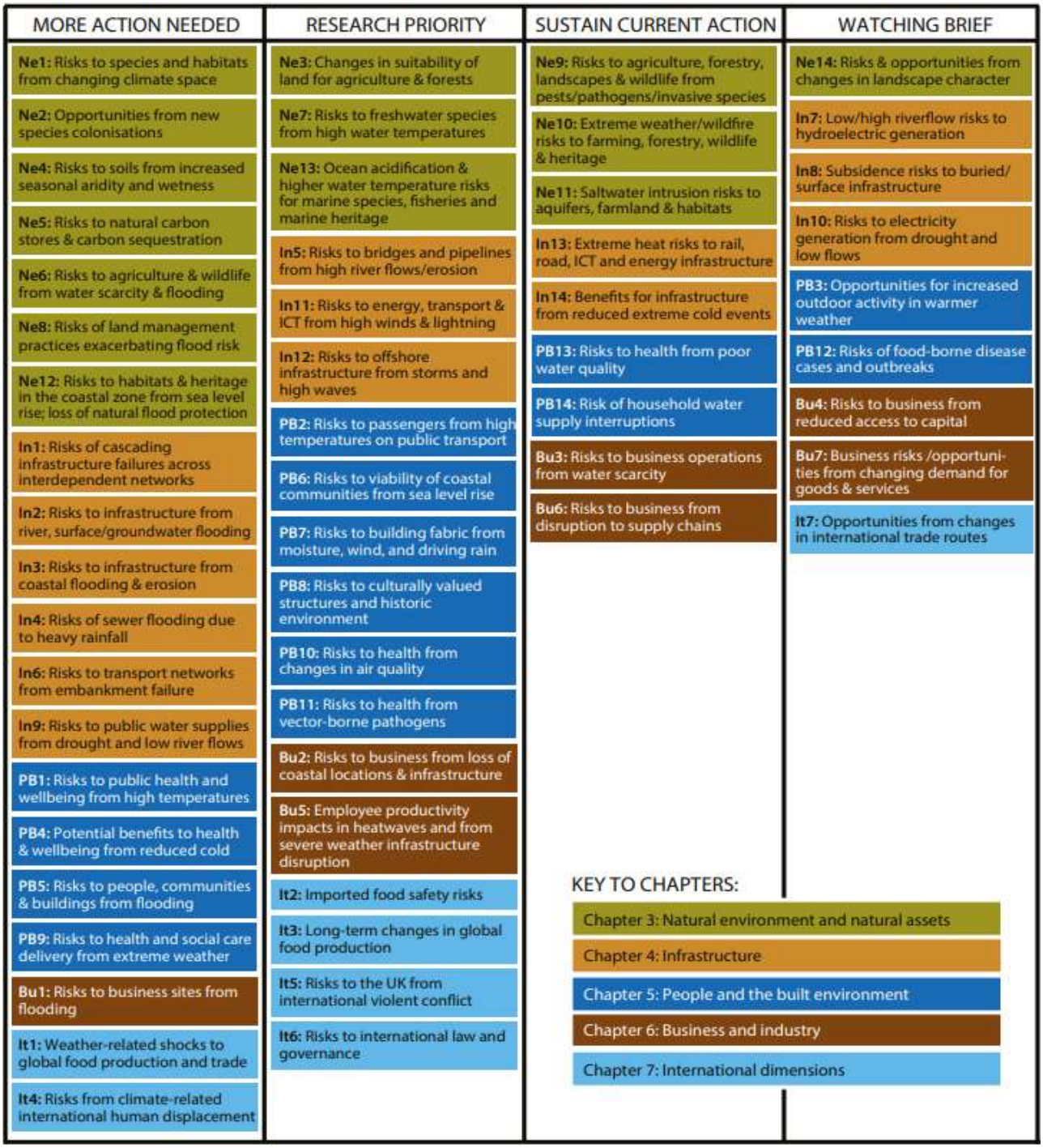

Figure 16.1: Risks and opportunities identified in the CCRA2 Evidence Report (The Climate Change Committee, 2017).

Planning Policy Context

National

16.2.14 The following national level policy and guidance documents are of relevance to the Proposed Development:

National Planning Policy Framework (2021)

16.2.15 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government , 2021) was revised on 20th July 2021 and sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. In relation to meeting the challenge of climate change, flooding and coastal change, the NPPF states the following: (MHCLG, 2021)

16.2.16 New development should be planned for in ways that:

a. **Avoid increased vulnerability** to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b. **Can help to reduce greenhouse gas emissions**, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

16.2.17 To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a. Provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that negative impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b. Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c. Identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

Planning Practice Guidance (NPPG) (2019)

16.2.18 National Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2014) relating to climate change (updated March 2019) has been developed to support the NPPF. The guidance advises how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change.

16.2.19 Addressing climate change is one of the core planning principles regarding the use of land which the NPPF expects to underpin both plan-making and decision-taking.

16.2.20 Paragraph 005 of the PPG on climate change states that the impact of climate change needs to be taken into account in a realistic way. In doing so, local planning authorities will want to consider:

- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity;

- Building in flexibility to allow future adaptation if it is needed, such as setting back new development from rivers so that it does not make it harder to improve flood defences in future; and

- The potential vulnerability of a development to climate change risk over its whole lifetime.

16.2.21 Paragraph 007 of the PPG on climate change 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 and design of new development and the potential for servicing sites through sustainable transport solutions, are particularly important considerations that affect transport emissions. Sustainability appraisal should be used to test different spatial options in plans on emissions.

- Different sectors may have different options for mitigation. For example, measures for reducing emissions in agricultural related development include anaerobic digestion, improved slurry and manure storage and improvements to buildings. In more energy intensive sectors, energy efficiency and generation of renewable energy can make a significant contribution to emissions reduction.

Regional

London Plan 2021

16.2.22 Under the legislation establishing the Greater London Authority (GLA), the Mayor is required to publish a Spatial Development Strategy (SDS) and keep it under review. The SDS is known as the London Plan (Greater London Authority, 2021). As the overall strategic plan for London, it sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years.

16.2.23 The general objectives for the London Plan, and the process for drawing it up, altering it and replacing it, are set out in the Greater London Authority Act 1999 (as amended) and the Town and Country Planning (London Spatial Development

Strategy) Regulations 2000. The London Plan has been developed in line with these requirements.

16.2.24 The legislation stipulates that the London Plan should only deal with things of strategic importance to Greater London taking account of the principal purposes of the Greater London Authority which are:

- Promoting economic development and wealth creation in Greater London;
- Promoting social development in Greater London; and
- Promoting the improvement of the environment in Greater London.

16.2.25 In developing the SDS, in accordance with the legislation and associated regulations, the Mayor has had regard to:

- The principle that there should be equality of opportunity for all people;
- Reducing health inequality and promoting Londoners' health;
- Achieving sustainable development in the United Kingdom;
- Climate change and the consequences of climate change;
- The desirability of promoting and encouraging the use of the Thames, particularly for passenger and freight transportation; and
- The resources available to implement the Mayor's strategies.

Policy SI 2 Minimising greenhouse gas emissions

16.2.26 Major development to be net zero carbon, through reducing greenhouse gas emissions in operation and minimising annual and peak energy demand following the energy hierarchy:

a. be lean: use less energy and manage demand during operation

b. be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly

c. be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site

d. be seen: monitor, verify and report on energy performance.

16.2.27 A minimum on-site reduction of at least 35 per cent beyond Building Regulations (Part L 2013) is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the

zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:

a. through a cash in lieu contribution to the borough's carbon offset fund, or

b. off-site provided that an alternative proposal is identified and delivery is certain.

16.2.28 Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.

16.2.29 Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

Policy SI 4 Managing heat risk

16.2.30 Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

16.2.31 Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

a. reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure

b. minimise internal heat generation through energy efficient design

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

d. provide passive ventilation

e. provide mechanical ventilation

f. provide active cooling systems.

Policy SI 7 Reducing waste and supporting the circular economy

16.2.32 Resource conservation, waste reduction, increases in material re-use and recycling, and reductions in waste going for disposal will be achieved by the Mayor, waste planning authorities and industry working in collaboration to:

a. promote a more circular economy that improves resource efficiency and innovation to keep products and materials at their highest use for as long as possible

b. encourage waste minimisation and waste prevention through the reuse of materials and using fewer resources in the production and distribution of products

c. ensure that there is zero biodegradable or recyclable waste to landfill by 2026

d. meet or exceed the municipal waste recycling target of 65 per cent by 2030

e. meet or exceed the targets for each of the following waste and material streams:

    a. construction and demolition – 95 per cent reuse/recycling/recovery

    b. excavation – 95 per cent beneficial use

f. design developments with adequate, flexible, and easily accessible storage space and collection systems that support, as a minimum, the separate collection of dry recyclables (at least card, paper, mixed plastics, metals, glass) and food.

16.2.33 Referable applications should promote circular economy outcomes and aim to be net zero-waste. A Circular Economy Statement should be submitted, to demonstrate:

a. how all materials arising from demolition and remediation works will be re-used and/or recycled

b. how the proposal's design and construction will reduce material demands and enable building materials, components and products to be disassembled and re-used at the end of their useful life

c. opportunities for managing as much waste as possible on site

d. adequate and easily accessible storage space and collection systems to support recycling and re-use

e. how much waste the proposal is expected to generate, and how and where the waste will be managed in accordance with the waste hierarchy

f. how performance will be monitored and reported.

16.2.34 Development Plans that apply circular economy principles and set local lower thresholds for the application of Circular Economy Statements for development proposals are supported.

Policy SI 12 Flood risk management

16.2.35 Current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

16.2.36 Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues including with authorities outside London.

16.2.37 Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

16.2.38 Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. The Mayor will work with the Environment Agency and relevant local planning authorities, including authorities outside London, to safeguard an appropriate location for a new Thames Barrier.

16.2.39 Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

16.2.40 Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.

16.2.41 Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat.

Policy SI 13 Sustainable drainage

16.2.1 Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

16.2.2 Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

a. rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)

b. rainwater infiltration to ground at or close to source

c. rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)

d. rainwater discharge direct to a watercourse (unless not appropriate)

e. controlled rainwater discharge to a surface water sewer or drain

f. controlled rainwater discharge to a combined sewer.

16.2.3 Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

16.2.4 Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

Local

London Borough of Camden Local Plan (2017)

16.2.5 Within its Local Plan, the London Borough of Camden aims to tackle the causes of climate change in the borough by ensuring developments use less energy and assess the feasibility of decentralised energy and renewable energy technologies.

16.2.6 Green Action for Change: Camden's environmental sustainability plan (2011-2020) commits Camden to a 27% borough wide Carbon Dioxide (CO_2) reduction by 2017 and a 40% borough wide CO2 reduction by 2020 (London carbon reduction target). Over 90% of Camden's carbon dioxide emissions are produced by the operation of buildings.

Policy CC1 Climate change mitigation

16.2.7 The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

16.2.8 The policy states that the Council will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;

c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

d. support and encourage sensitive energy efficiency improvements to existing buildings;

e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and

f. expect all developments to optimise resource efficiency.

For decentralised energy networks, the Council will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;

h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and

i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

16.2.9 To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

Policy CC2 Adapting to climate change

16.2.10 The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as:

a. The protection of existing green spaces and promoting new appropriate green infrastructure;

b. Not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;

c. Incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and

d. Measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

16.2.11 Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement submitted with the planning application.

16.2.12 **Sustainable design and construction measures**

16.2.13 The Council will promote and measure sustainable design and construction by:

a. Ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;

b. Encouraging new build residential development to use the Home Quality Mark and Passivhaus design standards;

c. Encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and

d. Expecting non-domestic developments of 500 sqm of floorspace or above to achieve “excellent” in BREEAM assessments and encouraging zero carbon in new development from 2019.

Guidance

The UK Carbon Budgets

16.2.14 The emissions from the Proposed Development will be compared with the UK carbon budget covering the year of the occurrence of the emissions. As such all relevant UK carbon budgets will be used to assess effect significance. The most recent of these was the sixth carbon budget (The Climate Change Committee, 2020), covering the period 2033-2037, which was issued by the CCC in 2020. The two main outcomes of this report were:

- A recommended level for the sixth carbon budget for the period covered (2033-2037) set at 965 Mt CO2e, including emissions from international shipping; and

- A recommended limit to annual emissions in the period covered to an average 78% below 1990 levels.

16.4 Consultation

16.4.1 As discussed in **Chapter 2: Approach to Assessment**, consideration has been given to the formal EIA Scoping Opinion provided by LBC and consultees and any additional consultation that may have occurred during the design period of the Proposed Development.

Table 16.1: Consultation Feedback

Consultee	Comment	Where is this addressed?
LBC	The assessment of GHG emissions will be assessed in line with IEMA's Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2017) the Royal Institution of Chartered Surveyors (RICS) Whole Life Carbon Assessment for the Built Environment (2017) guidance, BS EN 15978:2011, Sustainability of Construction Works - Assessment of Environmental Performance of Buildings - Calculation Method (BSI, 2011) and the draft Greater London Authority (GLA) Whole Life-Cycle Carbon Assessments Guidance (GLA, 2020).	Addressed throughout this chapter, with relevant guidance consulted and followed. The Method of Assessment section discusses how calculation methodology follows the recommended guidance.
LBC	The sources of GHG emissions proposed to be scoped in and scoped out of the assessment, as set out on page 96 of the report, are supported. The significance of the likely GHG effects of the proposed development should be assessed and reported in the ES chapter.	Scoped in emissions are assessed in this chapter.
LBC	Subject to the comments above, the proposed approach to the assessment of climate change is considered acceptable.	The proposed approach is followed throughout this chapter

16.5 Assessment Methodology and Significance Criteria

16.5.1 The following section outlines the methodologies applied to identify and assess the potential impacts and likely effects to result from the Proposed Development.

Scope of the Assessment

16.5.2 An EIA Scoping Report was issued to LBC in April 2021 (**Appendix 2.1**). LBC's formal Scoping Opinion was issued in October 2021 (**Appendix 2.2**).

Greenhouse Gas Emissions

16.5.3 The following potential effects are scoped into the assessment:

- A1-A3 Product stage: GHG emissions associated with the material extraction, transportation and manufacturing of construction products;

- A4-A5 Construction process stage: GHG emissions associated with product delivery to site and the installation process;

- B1-B5 In-use stage: GHG emissions associated with the operation of the built asset over its entire lifecycle, from practical completion to the end of its service life;

- B6 Operational energy: GHG emissions associated with the estimated total operational energy;

- B7 Operational water: GHG emissions associated with operational water consumption and foul water;

- C1-C4 End of Life Stage: GHG emissions associated with the demolition and disassembly of the proposed development, as well as the exploration of circular economy principles; and

- GHG emissions associated with operational transport, directly linked to site. This excludes occupant use of public transport but includes expected deliveries and private car and taxi emissions.

16.5.4 The following potential effects were scoped out of the assessment:

- Operational waste: the opportunities for design and construction decisions to significantly influence the reduction of GHG emissions associated with operational waste are low as it is highly dependent on occupant behaviour and waste processing at the city scale by the Local Authority. However, operational waste infrastructure to enable and encourage waste separation is detailed in the Operational Waste Management Plan submitted as a standalone report in support of the application (Arup, 2022); and

- Carbon sequestration of green infrastructure: GHG emissions associated with carbon sequestration of proposed green infrastructure will be low relative to total GHG emissions over the whole life of the Proposed Development.

Climate change resilience and adaptation

16.5.5 A Climate Change Resilience Risk Assessment has been included in this Chapter. This assesses the risk of effects relating to climate change on the Proposed Development based on the probability of an event occurring and the consequence of that event occurring. This has been completed in line with IEMA's EIA Guide to Climate Resilience and Adaptation (IEMA, 2020) and uses Met Office UK Climate Projections 2018 (UKCP18) data (Met Office, n.d.).

Extent of The Study Area

16.5.6 The carbon emissions assessment study area considers all carbon emissions arising over the lifecycle of the Proposed Development (subject to the limitations and assumptions listed within). The assessment of the Proposed Development's carbon footprint for the purpose of EIA provides an opportunity to identify the potential for effects to be designed out or reduced/offset through iterative design, and thereby maximise the Proposed Development 's contribution towards a net zero carbon society.

16.5.7 Climate change is the most pressing environmental issue currently facing humanity. It is recognised that all new development produces carbon emissions that contribute towards global climatic change. The 2017 IEMA Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance stipulates that all carbon emissions might be considered significant because "the GHG emissions from all projects will contribute to climate change…". However, we also recognise that new developments need to work within the constraints of a changing climate and have the potential to contribute positively towards a thriving, net zero carbon society.

Method of Baseline Collection

16.5.8 To complete this assessment, the baseline was established through a desktop study of publicly available data from the Department for Business, Energy & Industrial Strategy on local (Camden), regional (London) and national (UK) emissions (Department for Business, Energy & Industrial Strategy, 2021).

16.5.9 The baseline operational carbon emissions of the existing buildings have been determined by the whole life-cycle carbon (WLC) assessment described in the Method of Assessment section below, with relevant limitations noted with the baseline calculation.

Method of Assessment

16.5.10 There is no standard methodology for identifying and assessing the significance of GHG emissions within the EIA process. This assessment has followed the recommendations and best practice contained within the IEMA Principles Series: Climate Change Mitigation & EIA (2010) (IEMA, n.d.), the IEMA Environmental Impact Assessment Guide to: Delivering Quality Development (2016) (IEMA, 2016) and IEMA Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating Their Significance (2017) (IEMA & ARUP, 2017). Key legislative instruments and national and local planning policy and related guidance have been reviewed to inform the approach.

All Phases and existing baseline – Whole Life Carbon Analysis

16.5.11 The project engineers (Buro Happold) undertook a whole life-cycle carbon (WLC) assessment of the Proposed Development in accordance with the British Standard BS EN15978:2011 (Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method), and the RICS Professional Statement 'Whole life carbon assessment for the built environment 2017'. Furthermore, the guidance set out by the Mayor of London – Whole Life-Cycle Carbon

Assessments guidance – Pre-consultation draft (April 2020) was adopted for this assessment. The full WLC assessment can be found in the submitted Sustainability Statement (Buro Happold, 2022) submitted with the planning application.

16.5.12 The assessment required collation of the most up-to date and representative data available for the Detailed Proposals. This considers Plots N3E, N4 and N5, as well as the hard landscaping works across the Site. This process involved the collection of data from the design team on their latest designs and specifications, as well as the use of benchmarks, previous project experience and industry guidance where this information was not available.

16.5.13 The Outline Proposals did not have detailed material quantities for such an assessment to be undertaken. The whole life carbon quantities were therefore derived through the use of benchmarks taken from Appendix 2 in the GLA Whole-Life Carbon Assessments Guidance (April 2020) document. Where certain use types present in the development proposal were not available as benchmarks (e.g. car parks & service yards), the retail benchmark was used to represent these.

16.5.14 The following life cycle stages have been assessed in this Chapter using the emission values calculated in the WLC assessment:

Demolition & Construction Phase

- A1-A3 Manufacturing of construction materials
- A4 Transportation to site
- A5 Site works

Operational Phase

- B1-B5 Maintenance and material replacements
- B6-B7 Operational energy and water use

End of Life Phase

- C1-C4 Deconstruction

16.5.15 The key assumptions used in these calculations were as follows:

- Calculated for 60-year time frame (assumed life of building, RICS best practice guidance).
- 15-year construction time frame

LCA software

16.5.16 The software used in this study was One Click LCA. The software has been third party verified for compliancy with the following LCA standards: EN 15978, ISO 21931–1 and ISO 21929, and data requirements of ISO 14040 and EN 15804.

Operational Phase

Regulated / Unregulated CO2 Emissions from Buildings

16.5.17 This assessment has reviewed the estimated total operational energy of the Proposed Development. This is made up of regulated components – including heating, cooling, hot water, fans, pumps and lighting – and unregulated ones, such as IT equipment, plug-in devices and catering facilities.

16.5.18 Regulated energy uses are inherent in the design of a building. Estimated carbon emissions from regulated operational energy uses of buildings have been calculated from modelling undertaken in line with Part L 2013 of the Building Regulations (Conservation of fuel and power). Residential areas were assessed by modelling a sample of dwellings using SAP methodology, non-residential areas were modelled using IESve 2019. SAP10 carbon factors have been utilised in line with GLA Energy Assessment Guidance issued in 2020 (Greater London Authority, 2020).

16.5.19 The unregulated operational emissions are typically mainly attributable to energy consumption associated with IT equipment, domestic appliances, plug-in devices and catering facilities. Unregulated carbon emissions have been calculated with the same methods described above for regulated energy. Although unregulated carbon emissions are not included within Part L targets, an estimate of unregulated energy consumption is still an output produced as part of this methodology.

GHG Emissions from Operational Traffic

16.5.20 The anticipated GHG emissions from operational traffic associated with the Proposed Development have been estimated on the basis of traffic flow data provided by the transport consultant and an average distance of travel based on national data (Further detail provided in Chapter 8: Transport).

16.5.21 In order to calculate emissions arising from operational traffic, the predicted vehicle numbers and distances travelled are multiplied by emissions factors for each key vehicle type using 2021 BEIS emissions factors (Department for Business, Energy & Industrial Strategy, 2021).

16.6 Significance Criteria

Greenhouse Gas Emissions

16.6.1 The assessment of the potential impacts and likely effects as a result of the Proposed Development has taken into account the Demolition and Construction Phases, Operational Phase and End of Life Phase. The significance level attributed to each effect has been assessed based on the magnitude of change due to the Proposed Development and the sensitivity of the affected receptor/receiving environmental to change, as well as a number of other factors that are outlined in more detail in **Chapter 2: Approach to Assessment**.

16.6.2 Magnitude of change and the sensitivity of the affected receptor/receiving environmental are both assessed on a scale of high, medium, low and negligible (as shown in **Chapter 2: Approach to Assessment).**

Receptor Sensitivity

16.6.3 The global climate has been identified as the 'sensitive receptor' for the purposes of the carbon impact assessment, which is highlighted in the IEMA GHG assessment guideline. In light of the extreme importance of limiting global warming to below 2°C and in the absence of published standard definition of receptor sensitivity of carbon emissions, this assessment asserts that the sensitivity of global climate to increases in carbon emissions is always considered to be 'high'.

Impact Magnitude

16.6.4 The magnitude of impact has been considered as the change experienced from the baseline conditions at the sensitive receptor. The assessment of magnitude is carried out taking account of embedded/inherent design mitigation that forms part of the Proposed Development. In the absence of clearly defined criteria for assessing magnitude in the context of GHG emissions, a blended quantitative-qualitative assessment utilising professional judgement relying on standard GHG accounting and reporting principles has been conducted.

16.6.5 To provide context and to assist with determining the magnitude, the carbon emissions generated by the Proposed Development have been assessed in the context of emissions at a local scale (Camden), regional scale (London), and national scale (the UK as a whole) reflecting the various levels where emissions may occur. Carbon emissions data at local and regional level have been sourced from UK national statistics collated by the Department for Business, Energy and Industrial Strategy (Department for Business, Energy & Industrial Strategy, 2021).

16.6.6 The national-scale data is based on the five-year National Carbon Budgets produced by the Committee on Climate Change (CCC), which reflect the requirement to remain within agreed global emission limits. This has been supplemented with the relevant local (Camden) and regional (London) carbon budgets, to contextualise potential impacts of the Proposed Development on the globally sensitive climate receptor. Carbon budgets have been apportioned to reflect the contribution of the built environment towards the UK total carbon footprint, estimated to be nearly 40% (UK Green Building Council, n.d.). This approach is consistent with Section 6.2 of the IEMA guidance to Assessing Greenhouse Gas Emissions and Evaluating Their Significance 2017 (IEMA & ARUP, 2017), which provides advice on contextualising a project's carbon footprint.

16.6.7 The 4th (2023-2027), 5th (2028-2032) and 6th (2033-2037) UK national, London and Camden carbon budgets are the ones deemed to be applicable to the demolition and construction phase of the Proposed Development. The Opening Year of the detailed phase of the Proposed Development is expected to be 2027, with subsequent phases completed by 2037. Consequently, the 6th national carbon budget and the (2038-2042) London and Camden carbon budgets are deemed to be most applicable to the operational phase of the Proposed Development (refer to Table 16.2) and the worst case scenario with regards to carbon budget allocations. The opening year of 2037 is

the final year of the 6th national carbon budget, therefore operation of the Proposed Development is predicted to fall within future carbon budgets. Considering this in light of the ambitious national sustainability targets set by the UK government i.e. the new legally binding 'net-zero' carbon target for 2050, it can be expected that the magnitude of operational emissions will only increase in significance as a proportion of the total national carbon budget as the size of those carbon budgets continues to decrease.

Table 16.2: UK National Carbon Budgets

Budget	Carbon Budget Level	Reduction Below 1990 Levels
1st carbon budget (2008 - 2012)	3,018 Mt CO_2e	25%
2nd carbon budget (2013 - 2017)	2,782 Mt CO_2e	31%
3rd carbon budget (2018 - 2022)	2,544 Mt CO_2e	37% by 2020
4th carbon budget (2023 - 2027)	1,950 Mt CO_2e	51% by 2025
5th carbon budget (2028 - 2032)	1,725 Mt CO_2e	57% by 2030
6th carbon budget (2033 – 2037)	965 Mt CO_2e	78% by 2035

16.6.8 The proposed all-electric energy strategy for the Proposed Development will however benefit from the incremental reductions in grid electricity carbon intensity between now and commencement of the operational development, and subsequently throughout its operational life. The UK electricity grid has seen significant reductions in carbon intensity over the past 15 years as the contribution of renewables has increased and that of coal-fired power stations has decreased. Carbon intensity of electricity is projected to continue to decrease over coming years meaning current estimates of operational emissions are likely to represent a worst-case scenario, and the Proposed Development will benefit from an energy strategy which makes most pragmatic use of national drivers towards a zero carbon economy.

16.6.9 In GHG accounting, it is a widely accepted practice to exclude emission sources that do not have a material contribution to the overall carbon footprint on the basis of the De Minimis rule. ISO guidance on GHG reporting (ISO 14064-1) (International Organization for Standardization, 2018) states that 'the organisation may exclude from quantification direct or indirect GHG sources or sinks whose contribution to GHG emissions or removals is not material or whose quantification would not be technically feasible or cost effective'. In this context, multiple sources have introduced a 'materiality threshold'. PAS 2050 (British Standards Institution, 2011) for example, stipulates that in order to be considered 'material', the contribution from any one source of GHG emissions should be more than 1% of the anticipated total GHG emissions associated with the product being assessed.

16.6.10 The UK Emissions Trading System (UK ETS) replaced the EU Emissions Trading System (EU ETS) from 1st January 2021. It retains the provision for small installations (Department for Business, Energy & Industrial Strategy, 2021), which states that small installations whose emissions do not exceed a threshold of 25,000 $tC0_2e$ per annum and, where they carry out combustion activities, have a rated thermal input below 35 MW, excluding emissions from biomass, can opt out from the scheme.

16.6.11 Additionally, as part of its public reporting under the Task Force on Climate-related Financial Disclosures framework (IFC Performance Standard 3: Resource Efficiency and Pollution Prevention (International Finance Corporation, 2012)), the International Finance Corporation (IFC) discloses emissions of projects with estimated annual emissions over 25,000 metric tons of carbon dioxide equivalent through the Environmental and Social Review Summary for each project.

16.6.12 In line with the above, a 1% materiality threshold has been implemented in this assessment when determining magnitude of the relevant change in carbon emissions. To ensure a robust approach, a second reference point has been included, i.e. 25,000 t CO_2e annual emission maximum level. It is, therefore, assumed that any annual carbon emissions quantum <1% of the (proportional value) of the relevant carbon budget(s) and < 25,000 t CO_2e would not be considered to have a 'material' contribution to the relevant UK GHG inventory. For determining the magnitude of impact against a national baseline, more details are provided in Table 16.3.

Table 16.3: Criteria for determining magnitude of impact – against national baseline.

Receptor Sensitivity to Change	Impact Magnitude	Magnitude Criteria
High	High (Major)	Annual difference in carbon emissions represents a contribution equal to or higher than 1% of the national baseline emissions and/ or annual proportion of the relevant UK national carbon budget's share attributable to the built environment sector; and Annual difference in carbon emissions is higher than 25,000 t CO_2e in any year.
	Medium (Moderate)	Annual difference in carbon emissions represents a contribution lower than 1% of the national baseline emissions and/ or annual proportion of the relevant UK national carbon budget's share attributable to the built environment sector; and Annual difference in carbon emissions is higher than 25,000 t CO_2e in any year.
	Low (Minor)	Annual difference in carbon emissions represents a contribution lower than 1% of the national baseline emissions and/ or annual proportion of the relevant UK national carbon budget's share attributable to the built environment sector; and Annual difference in carbon emissions is lower than 25,000 t CO_2e in any year.

16.6.13 The national carbon budget is advised by the Committee on Climate Change and is set by the UK Government in accordance with the Climate Change Act. Recently carbon budgets for London and Camden have been produced for BEIS by the University of Manchester Tyndall Centre as part of the City Area Targets and Trajectories for Emissions Reduction (SCATTER) project, to set carbon emissions

targets that are consistent with the United Nations Paris Climate Agreement (The Tyndall Centre for Climate Change Research, 2022). This allows for a comparison of the estimated emissions of the Proposed Development with local and regional carbon budgets, the criteria for determining magnitude of impact in these comparisons are presented in Table 16.4. The carbon budget for London (The Tyndall Centre for Climate Change Research, 2022), is presented in Table 16.5 and the carbon budget for Camden (The Tyndall Centre for Climate Change Research, 2022), is presented in Table 16.6.

Table 16.4: Criteria for determining magnitude of impact – against local/regional baseline.

Receptor Sensitivity to Change	Impact Magnitude	Magnitude Criteria
High	High (Major)	Annual difference in carbon emissions represents a contribution higher than 1% of the local/regional baseline emissions share attributable to the built environment sector; AND Annual difference in carbon emissions represents a contribution higher than 1% of the relevant local/regional carbon budget's share attributable to the built environment sector.
	Medium (Moderate)	Annual difference in carbon emissions represents a contribution lower than 1% of the local/regional baseline emissions; share attributable to the built environment sector; OR Annual difference in carbon emissions represents a contribution higher than 1% of the relevant local/regional carbon Budget's share attributable to the built environment sector.
	Low (Minor)	Additional annual carbon emissions represent a contribution lower than 1% of the local/regional baseline emissions; AND Additional annual carbon emissions represent a contribution lower than 1% of the relevant local/regional carbon Budget's share attributable to the built environment sector.

Table 16.5: Impact Magnitude Criteria (1% Carbon Emissions Threshold) – London carbon budget (The Tyndall Centre for Climate Change Research, 2022).

Carbon budget period	Carbon budget level (Mt CO2e)	Built environment share – 40% (Mt CO2e)	Annual built environment share (Mt CO2e)	Magnitude criteria (1%) (Mt CO2e)
2018 – 2022	123.3	49.32	9.864	0.09864

2023 – 2027	65.9	26.36	5.272	0.05272
2028 – 2032	34.3	13.72	2.744	0.02744
2033 – 2037	17.9	7.16	1.432	0.01432
2038 – 2042	9.3	3.72	0.744	0.00744
2043 – 2047	4.9	1.96	0.392	0.00392
2048 – 2100	5.3	2.12	0.040	0.00040

Table 16.6: Impact Magnitude Criteria (1% Carbon Emissions Threshold) – Camden carbon budget (The Tyndall Centre for Climate Change Research, 2022).

Carbon budget period	Carbon budget level (Mt CO2e)	Built environment share – 40% (Mt CO2e)	Annual built environment share (Mt CO2e)	Magnitude criteria (1%) (Mt CO2e)
2018 - 2022	4.3	1.72	0.3440	0.003440
2023 - 2027	2.4	0.96	0.1920	0.001920
2028 - 2032	1.3	0.52	0.1040	0.001040
2033 - 2037	0.7	0.28	0.0560	0.000560
2038 - 2042	0.4	0.16	0.0320	0.000320
2043 - 2047	0.2	0.08	0.0160	0.000160
2048 - 2100	0.2	0.08	0.0015	0.000015

Effect Significance

16.6.14 Currently there is no single approved methodology to assess and evaluate the significance of GHG emissions; nor is there a defined significance threshold for GHG assessments. The IEMA Guidance (IEMA & ARUP, 2017) states that the application of the standard EIA significance criteria is not considered to be appropriate for climate change mitigation assessments. In this context, as set out above, the proposed approach is to assess the potential effects on climate change of the carbon emissions arising as a result of the Proposed Development in the context of the published UK national carbon budgets, London carbon budgets, Camden carbon budgets, local and regional baselines.

16.6.15 While the emission thresholds outlined above have been used to provide context, it is important to recognise that the application of professional judgement is a critical additional component, as recognised by IEMA guidance (IEMA & ARUP, 2017) which may result in a different overall conclusion than the one suggested by quantitative criteria alone based on a percentage increase/decrease relative to the baseline.

16.6.16 It is important to recognise the limitations of benchmarking against domestic national, regional, and local emissions and budget data in the context of EIA which employs a whole life carbon assessment. The domestic emissions and budget data relates only to CO_2e emissions from the generation of energy and processing of fuels within the United Kingdom. Furthermore, the SCATTER methodology for local and regional excludes emissions from aviation, shipping, process CO_2 emissions from

cement production and those from land use, land use change and forestry, and only accounts for emissions from energy generation and processing of fossil fuels where the end use is within the relevant administrative boundary.

16.6.17 The UK domestic emissions and budget data does not make an allowance for materials used in construction projects nor ongoing maintenance activities that were manufactured abroad, and the local and regional emissions and budget data does not make any allowance for materials that were manufactured (have an end use) in different regions or local authority areas. As such, whist a comparison against benchmarks is useful to contextualise the potential impacts from carbon emissions of the Proposed Development in the UK context, the assessment of likely significant effects moreover must be based on a professional judgement of the cumulative effect of the Proposed Development on the global climate receptor. This is consistent with the IEMA 2017 methodology, which advocate the use of professional judgement when contextualising emissions against benchmarks.

16.6.18 The consideration of significance is also informed by an evaluation of the anticipated environment within which the Proposed Development is expected to exist driven by the ongoing decarbonisation of the national electricity grid and the country's new legally binding "net-zero" carbon target for 2050 as well as the influence and validity of any assumptions adopted when undertaking the prediction of impacts.

16.6.19 Prior to undertaking this assessment, all greenhouse gas emissions have considered to be potentially significant and embedded mitigation measures have been considered to reduce the potential significance of any effects. This reasoning is consistent with both the IEMA guidance and the Precautionary Principle (IUCN Council, 2007), which stipulates that if there is a threat or risk of serious or irreversible damage to human health or the environment, precautionary actions must be taken even if there is lack of full certainty surrounding the issue.

16.6.20 Within this assessment, effects have been be categorised as positive or negative. To determine level of significance, the assessment of likely significant effects to sensitive receptors has considered the sensitivity of the receptor (for global climate this is always considered to be 'high') and the anticipated magnitude of change in the baseline conditions – on a scale of high (major), medium (moderate), and low (minor) and very low (negligible). Significant effects have been determined on the basis of the impact magnitude criteria described above and through professional judgment.

16.6.21 In line with general EIA practice, effects that are deemed to be 'significant' for the purpose of the assessment are those which are described as being moderate or major positive/ negative. Effects deemed as below moderate are considered to be not significant.

16.6.22 In categorising effect significance, due consideration has also been given to the nature, duration, and geographical scale of the effect in question (e.g., direct/indirect, temporary/permanent, short/medium-term, etc).

16.6.23 For the purposes of this assessment, the geographical scope of the identified likely significant effects has been assumed to be 'international' in all cases due to the global nature of climate change and its transnational ramifications. Furthermore, in view of the findings of the IPCC Special Report on the effects of global warming of 1.5

°C that some effects from climate change may be long-lasting or irreversible (IPCC, 2018), the duration of all effects assessed in this chapter is assumed to be long-term and permanent.

16.6.24 A number of design principles and solutions have been embedded within the Proposed Development's design to minimise climate-related risks (referred to as primary mitigation). Moreover, there are certain actions that are required regardless of the EIA process such as measures imposed by other existing legislative requirements and/or standard sectorial practices which are known as 'tertiary'/ 'inexorable' mitigation. In arriving at the significance of the identified environmental effects, primary together with tertiary mitigation measures have been considered as inherent components of the Proposed Development. Embedded/inherent design measures of particular relevance to the present carbon emissions assessment have been highlighted. Table 16.7 presents an effect significance matrix which has been used as a tool to aid in assessing significance.

Table 16.7: Effect significance matrix.

Criteria	Receptor sensitivity	Impact Magnitude / Effect scale	Definition
High	High	Major	The Proposed Development is likely to cause a considerable change from the baseline conditions and the receptor has limited adaptability, tolerance or recoverability or is of the highest sensitivity. This effect is considered to be 'Significant'.
Medium	High	Moderate	The Proposed Development is likely to cause either a considerable change from the baseline conditions at a receptor which has a degree of adaptability, tolerance or recoverability or a less than considerable change at a receptor that has limited adaptability, tolerance, or recoverability. This effect is considered more likely to be 'Significant' but will be subject to professional judgement.
Low	High	Minor	The Proposed Development is likely to cause a small, but noticeable change from the baseline conditions on a receptor which has limited adaptability, tolerance or recoverability or is of the highest sensitivity; or where the Proposed Development is likely to cause a considerable change from the baseline conditions at a receptor which can adapt, is tolerant of the change or/and can recover from the change. This effect is considered less likely to be 'Significant' but will be subject to professional judgement.

16.6.25 The effects are categorised as either negative or positive in order to allow easy comparison between impacts. These terms are defined as follows:

- **Negative** – Detrimental or negative effects to an environmental / socio-economic resource or receptor. The quality of the environment is diminished or harmed; or

- **Positive** – Advantageous or positive effect to an environmental / socio-economic resource or receptor. The quality of the environment is enhanced.

16.6.26 For the majority of development projects, the individual contribution to total GHG emissions (from local through to global scale) will be very small; however, the IEMA guidance recognises that the contribution of GHG emissions to climate change is a cumulative global issue, and as such it is important for developments of all scales to acknowledge the significance of any increases in GHG emissions, and that the EIA should ensure the project addresses their occurrence by suggesting mitigating action.

16.6.27 IEMA recommends that mitigation should in the first instance seek to avoid GHG emissions. Where GHG emissions cannot be avoided, the development should aim to reduce a project's residual emissions at all stages. Where additional GHG emissions remain but cannot be further reduced at source, approaches should be considered that compensate the project's remaining emissions, for example offsetting.

16.6.28 The approach to defining likely significant effects has been carried out in three steps:

- The first step is to compare the Proposed Development's GHG emissions in the opening year to the baseline GHG emissions to determine whether there is a net increase or decrease in GHG emissions as a result of the development;
- The second step is to compare the calculated change in emissions to local GHG emissions for context; and
- The third step applies professional judgment on the significance of those emissions taking into account the changes in emissions, their contribution to local, regional and national GHG emissions, their consistency with relevant policy, and an evaluation of the mitigation measures proposed to avoid, reduce and compensate GHG emissions.

Climate Change

16.6.1 This assessment has followed the climate change risk assessment methodology described in the IEMA EIA Guide to Climate Change Resilience and Adaptation June 2020 (IEMA, 2020). The UKCP18 (Met Office, n.d.), which are the latest published national climate projections for the UK, have been used to help formulate suitable and forward-looking resilience and adaptation measures for the Proposed Development.

16.6.2 Carrying out a climate change risk assessment, at the simplest level, can be summarised into the following steps:

- identifying potential climate change risks to a scheme or project;
- assessing these risks (potentially prioritising to identify the most severe); and
- formulating mitigation actions to reduce the impact of the identified risks.

16.6.3 In this assessment flood risk and overheating impacts are considered and mitigation measures are discussed. A qualitive assessment is conducted to determine if the residual effect after mitigation methods have been implemented needs to be further assessed.

16.7 Baseline Conditions

16.7.1 This section sets out the baseline conditions and explains how these are considered at various spatial scales. This approach helps to contextualise any emissions generated by the Proposed Development and implement a proportional approach to the later evaluation

Site

16.7.2 The Site is occupied by the O2 Centre including associated car parking, Homebase store, car showrooms and Builder's merchant. Further detail is provided in Chapter 1: Introduction.

16.7.3 The baseline operational carbon emissions of the existing buildings have been determined by the WLC assessment described in the Method of Assessment section above.

Table 16.8: Area schedule for buildings on existing Site.

Use	Area (m^2)
O2 Centre	28,418

16.7.4 Where certain data was unavailable, generic benchmarks have been used in their place to provide a realistic, hypothetical scenario for what the WLC, of the scenario in question, might look like. Benchmarks have been used for operational carbon calculations where the data available was not deemed sufficient to carry out an accurate assessment. See the standalone Sustainability Statement submitted with the planning application for the details on which benchmarks have been adopted, along with their sources.

16.7.5 The use of OneClick LCA software to analyse the existing buildings on Site has meant that the assessment considers the project as if it were being built in present day, opposed to in 1996. Variations are therefore expected from the actual embodied carbon of the existing site, including but not limited to the manufacture of various materials/products, the emissions associated with transportation, as well as the longevity or quality of the products/materials used. This excludes embodied carbon emissions in existing building stock as they were emitted as part of historical development and construction in the past. This study only considers the changes that are being made to the Site related to the Proposed Development for which the study system boundaries are designed as lifecycle assessment modules in EN 15978 (BSI, 2011).

Table 16.9: An estimate of the operational emissions of the existing buildings on the Site for a building lifetime of 60 years.

Lifecycle stage	Estimated Carbon Emissions (t CO_2e)
B6 Operational Carbon	33,224

16.7.6 The existing buildings are currently occupied. Therefore, the 3rd national carbon budget and the 2018-2022 London and Camden carbon budgets are applicable to the operational phase for the existing buildings on site.

16.7.7 The annual emissions are estimated to be 553.7 t CO_2e, this is less than 25,000 t CO_2e and accounts proportionally for:

- 0.0572% of local (Camden 2019) baseline emissions;
- 0.00194% of regional (London 2019) baseline emissions;
- 0.000272% annual proportion of the 3rd national carbon budget (2018 - 2023) (40% share attributable to the built environment sector);
- 0.161% annual proportion of the Camden carbon budget (2018 – 2023) (40% share attributable to the built environment sector).
- 0.00561% annual proportion of the London carbon budget (2018 – 2023) (40% share attributable to the built environment sector).

Local – Camden

16.7.8 The latest available BEIS annual CO_2 emissions data for Camden from 2019 were 968 kt CO_2 (Department for Business, Energy & Industrial Strategy, 2021). This is based on the latest available data from the Department for Business, Energy & Industrial Strategy, published in 2021.

16.7.9 The data show emissions allocated on an 'end-user' basis where emissions are distributed according to the point of energy consumption (or point of emission if not energy related). Except for the energy industry, emissions from the production of goods are assigned to where the production takes place. Therefore, emissions from the production of goods which are exported are included, and emissions from the production of goods which are imported are excluded.

Regional – London

16.7.10 The latest available BEIS annual CO_2 emissions data for the London region from 2019 were 28,524 kt CO_2 (Department for Business, Energy & Industrial Strategy, 2021).

16.7.11 In order to help understand the trends in carbon emissions at a regional level, a breakdown of total carbon emissions from three main sources (industry & commercial, domestic and transport) has been provided for London. The BEIS[2] national statistics data from the UK government are available for the period 2005-2019, an extract of the full dataset for London is shown in Table 16.10 (Department for Business, Energy & Industrial Strategy, 2021). The 'Grand Total' values also include a contribution from Land use, land-use change and forestry which is not shown here, this contribution can be negative if it represents a CO_2 sink which is removing CO_2 from the atmosphere.

Table 16.10: Carbon Emissions within London 2005-2019.

Year	Industry & Commercial Total (kt CO_2)	Domestic Total (kt CO_2)	Transport Total (kt CO_2)	Grand Total (kt CO_2)	Population ('000s, mid-year estimate)	Per Capita Emissions (t)
2005	16,764.60	17,061.6	9,704.5	46,972.3	7,519.0	6.2
2006	17,985.70	16,966.1	9,577.5	48,102.7	7,597.8	6.3
2007	17,358.40	16,541.7	9,476.0	46,763.9	7,693.5	6.1
2008	17,529.70	16,699.9	8,963.8	46,646.4	7,812.2	6.0
2009	15,518.30	15,186.6	8,697.3	42,483.7	7,942.6	5.3
2010	16,458.00	16,286.5	8,809.6	44,870.8	8,061.5	5.6
2011	14,616.70	14,292.2	8,612.7	40,455.1	8,204.4	4.9
2012	16,060.10	15,416.4	8,560.3	43,327.8	8,308.8	5.2
2013	15,180.00	15,094.0	8,455.1	41,741.2	8,417.5	5.0
2014	12,589.50	12,666.8	8,547.9	36,473.1	8,539.4	4.3
2015	11,052.30	12,291.6	8,467.9	34,427.9	8,666.9	4.0
2016	9,452.70	11,603.8	8,642.8	32,039.7	8,769.7	3.7
2017	8,756.60	10,825.0	8,664.7	30,184.3	8,825.0	3.4
2018	8,450.40	10,844.1	8,655.5	29,936.1	8,908.1	3.4
2019	7,694.10	10,537.1	8,543.0	28,524.4	8,962.0	3.2

National - United Kingdom

16.7.12 The latest BEIS data available for the UK was published in 2021 and relates to the year 2019 (Department for Business, Energy & Industrial Strategy, 2021). The total CO_2 emissions generated in the UK in 2019 amount to 344,512 kt CO_2. According to a report by the World Resources Institute, the UK demonstrates one of the largest declines in CO_2 emissions, with a 20% reduction in the period 2000-2014 (World Resources Institute, 2016). This is one of the biggest percentage reductions in CO_2 emissions of all large economies.

16.7.13 In line with this trend, the statistics for London demonstrate a continuing downward trend over the 2005-2019 period, whereby the per capita CO_2 emissions have decreased by approximately 48%. Total emissions have also gone down by 39% over the studied period despite the observed population growth.

16.7.14 The most significant reductions are observed in industry and commercial emissions, with a reduction of 54%, followed by domestic emissions, at 38%. In comparison, the reduction observed in the transport sector for the region is considerably smaller, at approximately 12%.

16.7.15 A study conducted by analysts Carbon Brief (Carbon Brief, 2019) reveals that the decline in industry, commercial and domestic emissions is driven by a combination of the introduction of a low- and zero-carbon electricity mix based on gas and

renewables instead of coal and reduced non-electric energy consumption in the industrial and residential sectors. The latter is explained mainly by improvements in energy efficiency and switching to lower-carbon fuels. A structural movement towards a less carbon-intensive mix of industrial output, with some energy-intensive industry moving to other countries and UK industry increasingly focusing on higher-value manufacturing with lower energy intensity is also considered to have been a significant factor in the case of industry-related emissions.

16.8 Future Baseline

16.8.1 In the absence of the Proposed Development, the future use of the land is assumed to remain as it is. If the land use remains unchanged, it should be assumed that there are no new GHG emissions associated with the construction phase and that the fossil fuel related operational emissions associated with the Proposed Development will also remain largely unchanged, e.g. continued use of gas boilers.

16.8.2 With the future policy changes and expected trends such as The Climate Change Act (2008), decarbonisation of the grid, promotion of sustainable forms of transport, increases in homeworking, GHG emissions across the UK are anticipated to reduce.

Future Energy

Decarbonisation of the electricity grid.

16.8.3 The carbon factor of the National Grid – the amount of carbon dioxide released per kilowatt hour of electricity generated and distributed – is recognised in current Building Regulations as being 0.519 kgCO_2/kWh (BRE, n.d.). However, the national mix of electricity generation methods is progressing towards greener solutions with renewable sources accounting for 43.1% of the electricity generated in the UK in 2020; up from 24.5% in 2016 (Department for Business, Energy & Industrial Strategy, 2021).

16.8.4 Consequently, the Building Regulations Part L 2013 value of the National Grid carbon factor has been shown to be substantially higher than how the grid is performing in reality. This severely impacts the calculated emissions produced by all heat raising plant which either use electricity directly or generate it to offset other emissions. Figure 16.2 shows how the grid carbon factor (affected by the mix of generation techniques serving the National Grid), has varied over the past fifteen years. The carbon intensity of the grid has reduced to below a third of its original value between 2012 and 2020 – to 0.159 kgCO_2/kWh (Department for Business, Energy & Industrial Strategy, 2021). The carbon emissions associated with electricity consumption are therefore much lower than reported in Building Regulations. This means that, under the Part L 2013 methodology the CO_2 emissions associated with electrically driven plant are being overestimated by over 200%.

Future Projections

16.8.5 The Future Energy Scenarios (FES) document, produced by the National Grid, discusses how the UK's energy landscape is changing. The latest version, FES 2021 (National Grid ESO, 2021), discusses these projections in four scenarios and Figure 16.2 combines these future trajectories with the actual carbon intensity of the National Grid over the past 15 years. The reported emissions associated with electricity

generation have fallen steeply since 2012 and in three cases, the FES 2021 scenarios see carbon factors trending towards zero by the early 2030s. This is on the basis that FES 2021 have deemed it necessary to offset other industries such as freight, shipping and aviation, which will be unable to reduce their carbon emissions to zero. Offsetting the emissions of other industries will involve Carbon Capture and Storage (CCS) technologies on a significant scale in order for the UK as a nation to meet net zero carbon by 2050. It is important to note that CCS technology is not currently commercially demonstrated at a large scale, but the FES 2021 studies are useful as future forecasts.

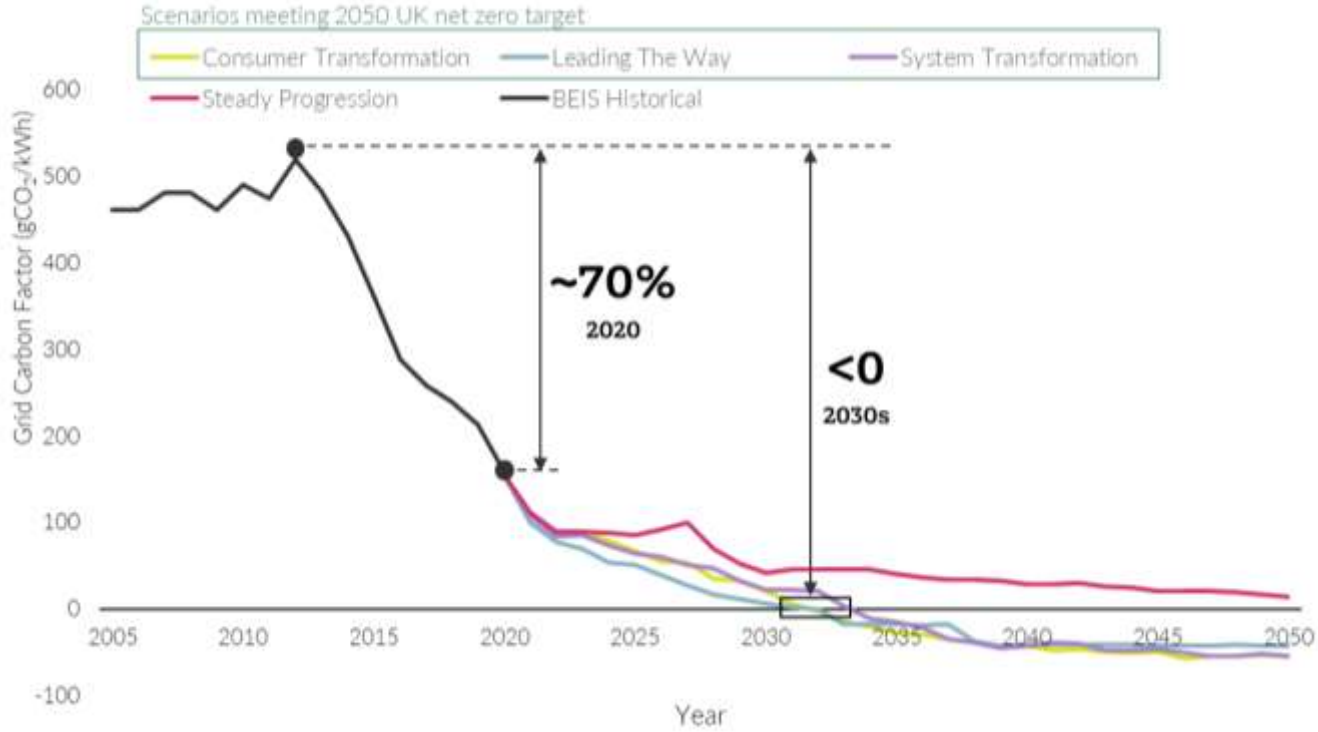

Figure 16.2: Historic and future projected carbon factor for the National Grid. Sources: BEIS Green Book (historic carbon factors); National Grid Future Energy Scenarios (FES) 2021 (future projected carbon factors). Source: Hoare Lea infographic.

Climate Change

16.8.6 The climate is changing. Even with strong efforts to limit the impacts of climate change, there is an overwhelming consensus that further changes are unavoidable. Therefore, it is essential to have up-to-date information on climate change to support decision-making and effectively manage the increasing risks associated with climate change.

16.8.7 The UKCP18 (Met Office, n.d.) national climate projections for the United Kingdom provide the latest scientific evidence on projected climate changes. Adopting a conservative approach, a future scenario of global mean warming of 2°C has been utilised to inform this assessment and help articulate suitable additional mitigation and enhancement measures.

16.8.8 Over land the projected general trends of climate change in the 21st century are similar to UKCP09, with a move towards warmer, wetter winters and hotter, drier summers. However, natural variations mean that some cold winters, some dry winters, some cool summers and some wet summers will still occur.

16.8.9 The UKCP18 projections show that there are likely to be changes to the average weather conditions in the future. Not all years will fit a clear trend of change, leading to a variable and unpredictable climate. The projections do, however, enable the identification of the likely effects of climate change, and inform appropriate recommendations for changes to design, construction and maintenance policies, standards and practices.

16.8.10 UKCP18 uses scenarios for future greenhouse gases called the representative concentration pathways (RCPs) which were designed to cover a more up to date range of assumptions around future population, economic development and to explicitly include the possibility of mitigation of greenhouse gas emissions towards international targets (Moss et al, 2010).

16.8.11 The RCPs are expressed for future radiative forcing targets in 2100 of 2.6, 4.5, 6.0 and 8.5 watts per square metre (W m^{-2}), and these targets are incorporated into the names of the RCPs; RCP2.6, RCP4.5, RCP6.0 and RCP8.5 pathways. Each pathway drives a different range of projected global mean temperature increases over the 21st century, taking account of uncertainty in aspects such as the transient climate response and rate of ocean heat uptake. The RCP pathways lead to a broad range of climate outcomes but are neither forecasts nor policy recommendations.

16.8.12 RCP2.6 represents a future in which the world aims for and is able to implement sizeable reductions in emissions of greenhouse gases. Many studies show that following this scenario gives a sizeable chance of limiting global average warming to near 2°C above pre-industrial levels. Some simulations in the published literature also suggest the RCP2.6 scenario could produce a response as low as the more ambitious target in the Paris climate agreement, which includes provision to aim for limiting warming to below 1.5°C.

16.8.13 RCP8.5 represents a world in which global greenhouse gas emissions continue to rise. It is a potential future where the nations of the world choose not to switch to a low-carbon future. The temperature increases associated with this are much higher than RCP2.6.

16.8.14 Where appropriate, this assessment will assume the future baseline predicted by the high emissions scenario (Met Office UKCP18 RCP8.5) in line with IEMA Climate Change Resilience & Adaptation guidance (IEMA, 2020).

16.8.15 A comparison of predicted annual temperature changes in the UK with RCP2.6 and RCP8.5 is shown in Figure 16.3.

Future UK temperatures

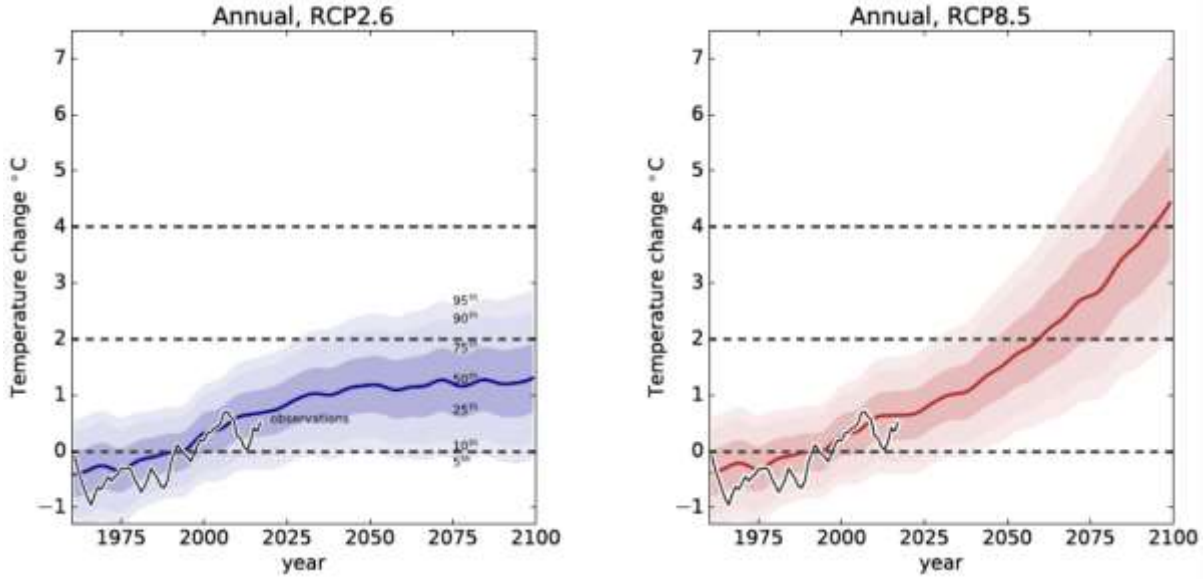

Figure 16.3: Comparison of the predicted future annual temperature change in the UK according to RCP2.6 and RCP8.5 of the UKCP18 National Climate Projections (Met Office, n.d.).

16.8.16 At 2°C of global mean warming (Met Office, 2019):

- For temperature:
  - The largest warming in the UK will be in the South East where summer temperatures may increase another 3 to 4°C relative to present day (1981-2000);
  - Median warming will be at least 1 to 2°C throughout the year across the whole of the UK;
  - Winter cool days will warm by 1 to 1.5°C across the country, whilst temperatures on warmer winter days increase by less than 1°C;
  - In summer both hot and cool days warm by 1 to 1.5°C across Scotland and 1.5 to 2°C across England.
- For precipitation:
  - Changes are uncertain, but suggest slightly wetter winters and drier summers, with summer drying more in the South;

- Dry days in summer have 30% less precipitation in parts of the South West.

16.8.17 At 4°C of global warming, changes compared to present day have a similar spatial pattern to those at 2°C but larger;

- For temperature:
  - All seasons warm, but summers warmer than winters
  - Summer temperatures rise by another 4 to 5°C in the south of England and 3 to 4°C elsewhere in the country
  - Hot summer days warm by 4.5 to 5°C compared to present day (1981-2000), across much of Southern England, possibly exceeding 5°C in some locations (Figure 5)
  - Cooler summer days warm by 4 to 4.5°C across England and up to 5°C in the south east. Increases reduce toward to north to under 3°C in the far North West of Scotland
  - Cool winter days warm by 2.5 to 3°C across the country
  - Warm winter days warm by 2.5 to 3°C in England but by 2 to 2.5°C in Wales and Scotland
- For precipitation:
  - Median winter precipitation increases by up to 20% across most of the country (Figure 4)
  - Median summer precipitation decreases most in the south with median reductions of up to 20 to 30% across much of the England and Wales
  - Dry summer days decrease in precipitation by up to 50% in summer across much of Southern Wales and England. This drying reducing toward the north to under 20% in Northern Scotland
  - The wettest summer days dry by up to 40% on parts of the south coast. This decreases toward zero in the north

16.8.18 Visualisations of the UKCP18 projected changes in temperature are included in Figure 16.4 and precipitation in Figure 16.5.

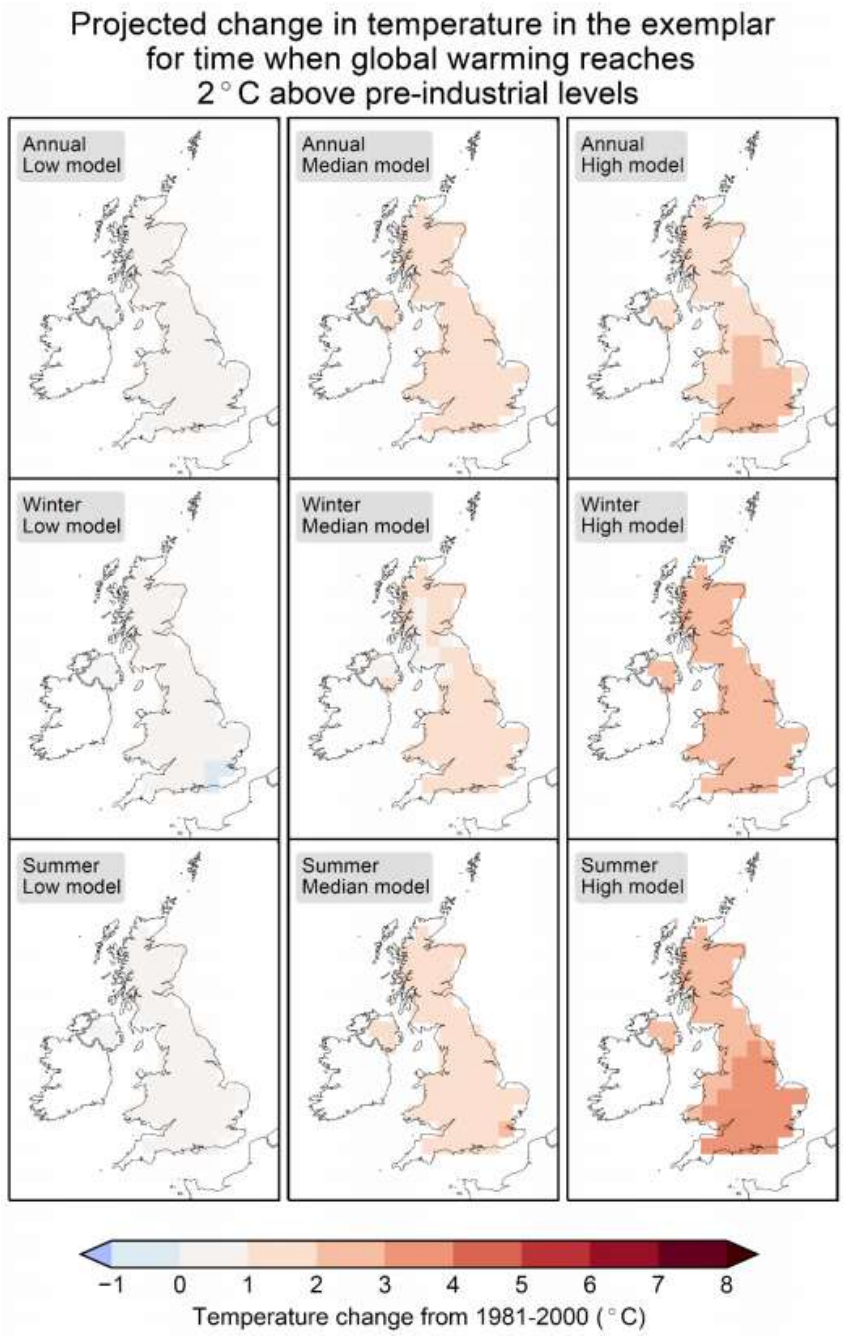

Figure 16.4: Projected changes in UK temperatures at a global mean warming of 4°C (GWL4) above pre-industrial (1850-1900). Changes are shown relative to present day (1981-2000). Rows show annual (top), winter (December-February; middle) and summer (June-August; bottom) changes. Columns shows maps for the model projection with a UK mean temperature changes which are relatively low (left), high (right) or median (centre) (Met Office, 2019).

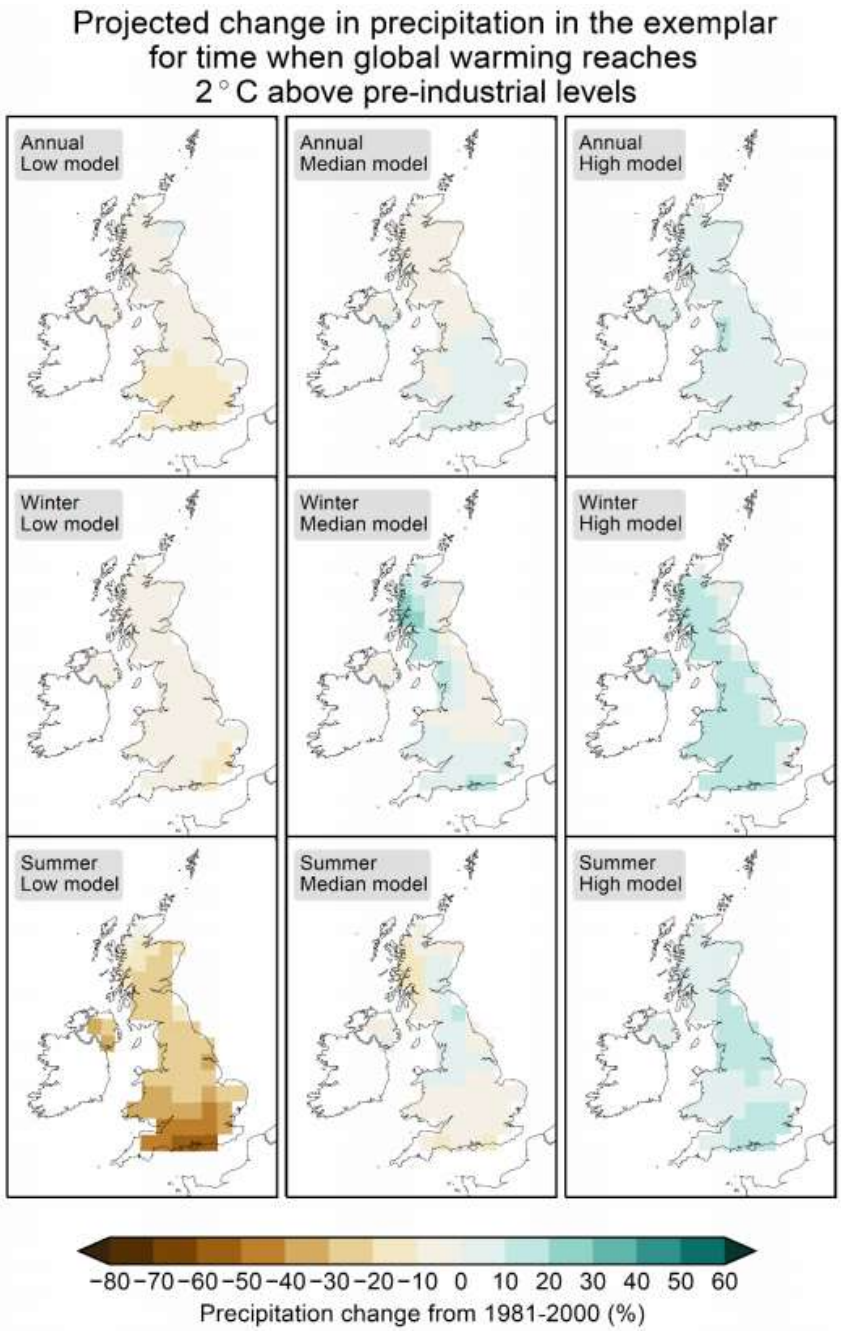

Figure 16.5: Projected changes in UK precipitation at a global mean warming of 2°C (GWL2) above pre-industrial (1850-1900). Changes are shown relative to present day (1981-2000). Rows show annual (top), winter (December-February; middle) and summer (June-August; bottom) changes. Columns shows maps for the model projection with a UK mean precipitation changes which are relatively low (left), high (right) or median (centre) (Met Office, 2019).

16.8.19 It is projected that average sea levels will continue to rise in the future, increasing the risk of coastal flooding and erosion, but the pattern of sea level rise is not uniform across the UK. Extreme coastal water levels driven mainly by increases in mean sea level rise are expected. For example, for London, sea level rise by the end of the century (when compared to 1981-2000), for the low emission scenario is very likely to be in the range 0.29 m to 0.70 m. For a high emission scenario, the range is very likely to be 0.53 m to 1.15 m (Met Office, 2019). This, combined with a predicted increase in storm surges, will lead to a significantly increased risk of flooding.

16.8.20 The future baseline for flood risk is established in Chapter 9: Water Resources, Drainage and Flood Risk, sections relevant to climate change are included below for ease of reference:

- The future baseline considered how potential flood risk and river dynamics will be affected by climate change impact on rainfall intensity, peak river flows and sea level change as determined in the NPPF. As it considers the impact of climate change, it is typically considered a long-term future baseline potentially occurring throughout the anticipated design life of a development. For instance, sea level rise is considered up to the year 2115.

- Mapping included as part of the London Borough of Camden SFRA includes an allowance for climate change when considering flood extents from rivers and the sea. This can inform the future baseline for flood risk and is discussed in further detail as part of the Flood Risk Assessment.

- The mapping included as part of the SFRA shows the site is unlikely to be affected by the River Medway when accounting for potential increases in river flows and sea level rise associated with Climate Change up to 2115, however, it should be noted, as the on-site watercourse is an Ordinary Watercourse, the mapping will not consider impacts to this from climate change.

16.8.21 Further assessment of flood risks from other sources are discussed within the Flood Risk Assessment (**Appendix 9.1**).

16.9 Sensitive Receptors

Greenhouse gas emissions

16.9.1 The following are the sensitive receptors which will be considered in the following assessment:

- Global climate

16.9.2 In addition, the UK GHG emissions budget is also identified as sensitive receptors for the purposes of this assessment. All GHG emissions are considered to be highly sensitive, as any GHG emissions at the Proposed Development will count towards the UK's climate budget and have a further effect on the global climate.

Climate change adaptation and resilience

16.9.3 The following are the sensitive receptors which will be considered in the following assessment:

- Members of the public
- Site and sewers

16.9.4 Members of the public are considered to be a high sensitivity receptor. Property and infrastructure are considered receptors of medium sensitivity.

16.10 Greenhouse Gas Emissions: Assessment of Effects, Mitigation and Residual Effects

Demolition & Construction Phase

16.10.1 This section identifies and assesses the scale and nature of the main effects arising from the Proposed Development during the demolition and construction phase.

Embodied Carbon & Construction Process Emissions

16.10.2 Traditionally the greatest impact on an asset's whole life carbon has been associated with its operational phase. As discussed above, this trend is shifting due to the ongoing decarbonisation of the UK electricity grid and increasing adoption of all electric solutions for new developments, as demonstrated by the Proposed Development. In accordance with this, the embodied carbon of the Proposed Development is expected to be a considerable source of carbon emissions at construction phase.

16.10.3 An appraisal of the anticipated carbon emissions associated with the product and construction stages of the development lifecycle has been completed, following the requirements of EN 15978 (BSI, 2011). This study assesses carbon emissions associated with raw material extraction, manufacturing of the building materials, transporting these to site and erecting the buildings. The lifecycle stages are shown as part of the project timeline in Figure 16.6.

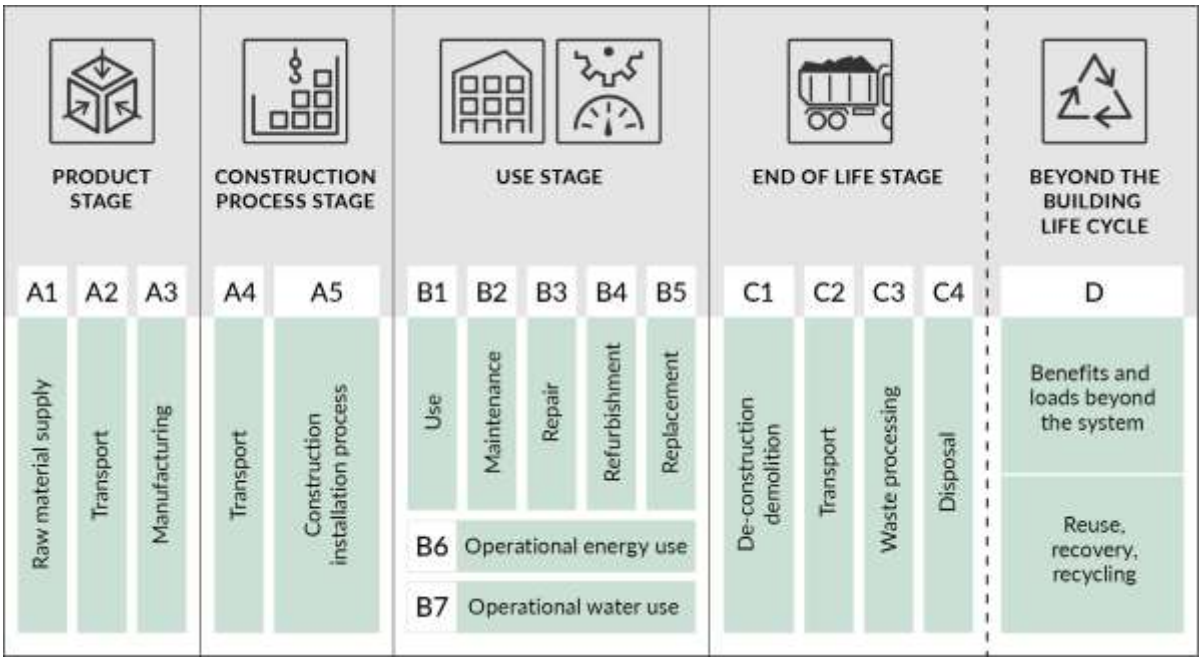

Figure 16.6: Lifecycle modules as determined in EN 15978. Source: Hoare Lea infographic

16.10.4 Further information on the calculation methodology is included in the Method of Assessment section above and the standalone Sustainability Statement submitted with the planning application. As discussed there, the whole life carbon analysis had to be performed separately for the Detailed and Outline Proposals, due to the difference in the information available in each case. Table 16.11 is a summary of the calculated A1 to A5 construction phase emissions. This includes A1-A3 Product stage: GHG emissions associated with the material extraction, transportation and manufacturing of construction products and A4-A5 Construction process stage: GHG emissions associated with product delivery to site and the installation process.

Table 16.11: Construction phase emissions.

	Total emissions for lifecycle stages A1 – A5 (kg CO_2e)
Sitewide	104,120,176

16.10.5 Assuming a 15-year construction period (2023 to 2037), the annual carbon emissions resulting from the combined construction lifecycle stages A1 – A3 (product stages), A4 (transport) and A5 (site operations) is currently estimated to be approximately 6,941t CO_2e. This is less than 25,000 t CO_2e and accounts proportionally for:

- 0.717% of local (Camden 2019) baseline emissions;
- 0.024% of regional (London 2019) baseline emissions;

To account for the worst-case scenario, the construction emissions are compared with the local, regional and national carbon budgets at the end of the construction period:

- 0.009% annual proportion of the 6th national carbon budget (2033 – 2037) (40% share attributable to the built environment sector).
- 12.395% annual proportion of the Camden carbon budget (2033 – 2037) (40% share attributable to the built environment sector).
- 0.485% annual proportion of the London carbon budget (2033 – 2037) (40% share attributable to the built environment sector).

16.10.6 While the emission benchmarks outlined above have been used to provide context, it is important to recognise that the application of professional judgement is a critical additional component, as recognised by IEMA guidance. In the context that the nationally derived carbon emissions and budget data only accounts for CO_2e emissions from the generation of energy and processing of fuels within the United Kingdom, and the local and regional data additionally excludes concrete production and only accounts for emissions from energy generation and processing of fossil fuels where the end use is within Camden and London boundaries (therefore excludes embodied carbon emissions from manufactured products produced elsewhere). The professional judgement has therefore taken into account that a significant proportion of emissions will be likely to be embodied within materials manufactured outside of these areas, and therefore the end use has not been accounted for in the benchmarks presented above.

16.10.7 Carbon debt emissions have also been considered when undertaking the Whole Life Carbon assessment in the standalone Sustainability Statement submitted with the planning application. As the building was built in 1996, if it were to be demolished in 2026, prior to reaching its' 60 lifespan, the owner of the building forgoes the use of a structure that would be functional for a further 30 years. Therefore, the inherited carbon debt would represent the embodied carbon of the materials not reused from the existing building, pro-rated to represent those 30-years that the owner has decided to forgo. To account for this, the design of the Proposed Development considers reuse of existing materials as a primary mitigation measure embedded within the design.

16.10.8 The design of the Proposed Development also considers reuse of existing foundations to minimise demolition works. Design work has been undertaken by the Structural Engineers (Pell Frischmann) to understand the feasibility of retention of the concrete super and substructure, and the reuse of some of the steel elements of the building. The reuse of the façade is also being investigated, see the accompanying Circular Economy statement for more information. New Build elements have been designed around low embodied carbon materials and efficient design. This is a primary mitigation measure embedded within the design.

16.10.9 The sensitivity of the global climate is high, and the magnitude of change is low. Therefore, there is likely to be a direct, permanent, long-term minor negative effect on the global climate.

Mitigation

16.10.10 Pre-demolition audit to be commissioned and Proposed Development to commit to 95% waste diverted from landfill, as reported in the standalone Sustainability Statement submitted with the planning application.

Residual Effect

16.10.11 The sensitivity of the global climate is high, and the magnitude of change, following mitigation, is low. Therefore, there is likely to be a direct, permanent, long-term minor negative residual effect on the global climate following the implementation of mitigation measures.

Operational Phase

16.10.12 This section identifies and assesses the scale and nature of the main effects arising from the Proposed Development during the operational phase.

Emissions from Regulated and Unregulated Energy

16.10.13 The Proposed Development will meet the carbon emission limits specified in Part L 2013 of the Building Regulations 2013 (Ministry of Housing, Communities & Local Government, 2013). Operational emissions calculations presented in this assessment have used SAP 10 carbon factors in line with GLA Energy Assessment Guidance issued in 2020 (Greater London Authority, 2020). Using the methodology outlined in the Method of Assessment section above, the target sitewide regulated emission rate has been calculated to be ~1,251,206 kg CO_2 per year for the Proposed Development. The regulated operational emissions are attributable to energy consumption associated with regulated components including heating, cooling, hot water, fans, pumps and lighting.

16.10.14 It is anticipated that the Proposed Development will achieve this target emission rate through the combination of passive design and energy efficiency, and low and zero carbon technologies such as air source heat pumps and rooftop renewables such as Photovoltaic panels. The proposed all-electric energy strategy for the Proposed Development will benefit from the incremental reductions in grid electricity carbon intensity between now and commencement of the operational development, and subsequently throughout its operational life.

16.10.15 Unregulated carbon emissions have likewise been calculated based on Part L of the Building Regulations. Although unregulated carbon emissions are not included within Part L results, an estimate of unregulated energy consumption has nevertheless been provided as an output of this methodology. The annual unregulated energy usage anticipated for the Proposed Development is ~ 1,392,188 kg CO_2 per year. The unregulated operational emissions are typically mainly attributable to energy consumption associated with IT equipment, domestic appliances, plug-in devices and catering facilities.

16.10.16 The total emissions associated with operational energy (regulated and unregulated) have been estimated to be ~ 2,643,394 kg CO_2 per year.

16.10.17 The operational emissions of the Proposed Development are 2.089 t CO_2 per year greater than the baseline emissions of the Site.

16.10.18 The additional annual operational emissions as a result of the Proposed Development are less than 25,000 t CO_2e and account proportionally for:

- 0.216% of local (Camden 2019) baseline emissions;
- 0.00733% of regional (London 2019) baseline emissions;
- 0.00271% of annual built environment proportion of the 6th national carbon budget (2033 – 2037) (40% share attributable to the built environment sector).

16.10.19 Since the completion of the Proposed Development construction in 2037 is at the end of one of the 5-year periods of the local and regional carbon budgets, it has been deemed appropriate to compare the Site operational emissions to the Camden and London carbon budgets for the period 2038 – 2042. This allows for a comparison of the annual operational emissions with the carbon budget periods covering the first complete years of operation:

- 6.53% annual proportion of the Camden carbon budget (2038 – 2042) (40% share attributable to the built environment sector).
- 0.281% annual proportion of the London carbon budget (2038 – 2042) (40% share attributable to the built environment sector).

16.10.20 The potential significant environmental effects are the carbon emissions as result of the Proposed Development during operation.

16.10.21 Primary and tertiary mitigation measures in the design of the Proposed Development include:

- Adopt fabric first design approach to reduce emissions through passive measures where possible.
- Use of solar PV on rooftops to provide renewable energy on site.
- All electric strategy to benefit from UK grid decarbonisation.
- Operational energy modelling undertaken during detailed design to determine key contributors to anticipated operational energy and identify opportunities for energy consumption reduction through operational and management strategies.
- Installation of smart meters and/or sub-meters to monitor operational consumption more accurately.

16.10.22 In view of the findings of the recent IPCC Special Report on the effects of global warming of 1.5 °C that some effects from climate change may be long-lasting or irreversible (IPCC, 2018), the duration of all effects assessed in this Chapter is assumed to be long-term and permanent.

16.10.23 The sensitivity of the global climate is high, and the magnitude of change, is low. Therefore, there is likely to be a direct, permanent, long-term minor negative effect on the global climate.

Mitigation

16.10.24 No additional mitigation is proposed.

Residual Effect

16.10.25 The sensitivity of the global climate is high, and the magnitude of change is low. Therefore, there is likely to be a direct, permanent, long-term minor, negative residual effect on the global climate.

Emissions from Repair and Replacement

16.10.26 A sitewide estimate for the emissions from lifecycle stages B1 – B5 (use, maintenance, repair, replacement and refurbishment) for the building in use lifetime is included in Table 16.12.

Table 16.12: Operational phase, use repair and maintenance emissions.

	Total emissions for lifecycle stages B1 – B5 (kg CO_2e)
Sitewide	81,297,313

16.10.27 Assuming a 60-year lifespan of the buildings, this gives annual emissions of 1,355 ~~(765)~~ kt CO_2e. We note that this is less than 25,000 kt CO_2e. Comparing this figure to local regional and national baselines shows that this magnitude of emissions corresponds to:

- 0.140% of local (Camden 2019) baseline emissions;
- 0.005% of regional (London 2019) baseline emissions;
- 0.002% of annual built environment proportion of the 6th national carbon budget (2033 – 2037) (40% share attributable to the built environment sector).

Since the opening year of 2037 is at the end of one of the 5-year periods of the local and regional carbon budgets, it has been deemed appropriate to compare the Site operational emissions to the Camden and London carbon budgets for the period 2038 – 2042. This allows for a comparison of the annual operational emissions with the local and regional carbon budget periods covering the first complete years of operation:

- 2.42% annual proportion of the Camden carbon budget (2038 – 2042) (40% share attributable to the built environment sector).
- 0.095% annual proportion of the London carbon budget (2038 – 2042) (40% share attributable to the built environment sector).

16.10.28 While the emission benchmarks outlined above have been used to provide context, it is important to recognise that the application of professional judgement is a critical additional component, as recognised by IEMA guidance. In the context that the nationally derived carbon emissions and budget data only accounts for CO_2e emissions from the generation of energy and processing of fuels within the United Kingdom, and the local and regional data additionally excludes concrete production and only accounts for emissions from energy generation and processing of fossil fuels where the end use is within Camden and London boundaries (therefore excludes embodied carbon emissions from manufactured products produced elsewhere). The professional judgement has therefore taken into account that a significant proportion of emissions will be likely to be embodied within materials manufactured outside of these areas, and therefore the end use has not been accounted for in the benchmarks presented above.

16.10.29 The design of the Proposed Development considered the emissions associated to maintenance and replacement, developing strategies to minimise these through the life cycle. See the Circular economy statement for more detail. New Build elements should be designed around low embodied carbon materials and efficient design. The main priority is to extend the lifetime of the building through careful design and specification and to ensure that if the building is to be deconstructed, it should be at as late a date as possible. Design for disassembly and re-use of different building components at the end of their useful life.

16.10.30 The sensitivity of the global climate is high, and the magnitude of change, is low. Therefore, there is likely to be a direct, permanent, long-term minor negative effect on the global climate

Mitigation

16.10.31 No further mitigation measures are proposed.

Residual Effect

16.10.1 The sensitivity of the global climate is high, and the magnitude of change, is low. Therefore, there is likely to be a direct, permanent, long-term minor negative effect on the global climate

Emissions from Operational Traffic

16.10.2 The total anticipated emissions associated with the operational traffic have been calculated using data from the traffic consultant, using the method discussed in the Method of Assessment section above. Emissions from operational traffic entering and leaving the site via Blackburn road, have been calculated to be 1,272 t CO_2e per annum. This represents a reduction of 3,461 t CO_2e per annum over the site continuing to be used as it is, see Table 16.13. This reduction is predominantly caused by the shift from retail to residential use of the site. In line with Camden Council Policy, the Proposed Development is planned to be car free (apart from blue badge holders) which will encourage the use of sustainable and active transport modes.

Table 16.13: Operational traffic breakdown.

	AADT		Average distance (miles)		Carbon Factor (kg CO_2e/mile)		Annual emissions (t CO_2e)		TOTAL annual emissions (t CO_2e)
	HDV	LDV	HDV	LDV	HGV all diesel, average load	Average petrol car	HDV	LDV	
Baseline (2019)	17	5,160	55.0	13.5	0.86407	0.17431	295	4,438	**4,733**
Baseline + Full Development (2037)	18	1,116	55.0	13.5	0.86407	0.17431	312	960	**1,272**
Difference	**1**	**-4,044**	**55.0**	**13.5**	**0.86407**	**0.17431**	**17**	**-3,478**	**-3,461**

16.10.3 The completion of the construction of the Proposed Development is expected to be 2037. Therefore, the 6th national carbon budget and local carbon budgets for 2038-2042 are expected to be the most appropriate budgets to compare with the operational phase emissions.

16.10.4 The reduction in emissions from operational transport with the Proposed Development as compared to the site continuing to be used as it is, is estimated to be 3,461 t CO_2e per annum. This is less than 25,000 t CO_2e and accounts proportionally for:

- -0.358% of local (Camden 2019) baseline emissions;
- -0.0121% of regional (London 2019) baseline emissions;

  -0.00448% of annual built environment proportion of the 6th national carbon budget (2033 – 2037) (40% share attributable to the built environment sector).

Since the opening year of 2037 is at the end of one of the 5-year periods of the local and regional carbon budgets, it has been deemed appropriate to compare the Site operational emissions to the Camden and London carbon budgets for the period 2038 – 2042. This allows for a comparison of the annual operational emissions with the local and regional carbon budget period covering the first complete years of operation:

- -10.8% annual proportion of the Camden carbon budget (2038 – 2042) (40% share attributable to the built environment sector).
- -0.465% annual proportion of the London carbon budget (2038 – 2042) (40% share attributable to the built environment sector).

16.10.5 The potential significant environmental effects are the carbon emissions as result of the Proposed Development during operation.

16.10.6 In view of the findings of the recent IPCC Special Report on the effects of global warming of 1.5 °C that some effects from climate change may be long-lasting or irreversible (IPCC, 2018), the duration of all effects assessed in this Chapter is assumed to be long-term and permanent.

16.10.7 While the emission benchmarks outlined above have been used to provide context, it is important to recognise that the application of professional judgement is a critical additional component, as recognised by IEMA guidance. In the context that traffic vehicles are required to decarbonise in the coming years and efforts to reduce car usage in London are being made by the London Borough of Camden and generally across the capital, the professional judgement has therefore taken into account that a significant proportion of emissions will be further reduced in future.

16.10.8 The sensitivity of the Global Climate is high, and the magnitude of change, is low. Therefore, there is likely to be a direct, permanent, long-term minor positive effect on the global climate.

Mitigation

16.10.9 The change in use of the site is predicted to result in a reduction of traffic which means that the impact of the Proposed Development on operational traffic is likely to be of a minor positive nature and not significant. Nevertheless, to maximise the opportunity to increase the uptake of sustainable transport modes a Framework Travel Plan will be produced to set out all relevant targets/measures in relation to encouraging more sustainable travel patterns and identify future monitoring and management arrangements.

Residual Effect

16.10.10 The sensitivity of the global climate is high, and the magnitude of change, following mitigation, is low. Therefore, there is likely to be a direct, permanent, long-term minor, positive residual effect on the global climate following the implementation of mitigation measures.

End of Life Phase

16.10.11 This section identifies and assesses the scale and nature of the main effects arising from the Proposed Development during the end of life phase (C1-C4).

16.10.12 A sitewide estimate for the emissions from lifecycle stages C1 – C4 (de-construction and demolition, transport, waste processing and disposal) for the building at the end of the in-use lifetime is included in Table 16.14.

Table 16.14: End of life phase emissions.

	Total emissions for lifecycle stages C1 – C4 (kg CO_2e)
Sitewide	1,676,509

16.10.13 Assuming a 1-year deconstruction timeframe, this gives annual emissions of 1.676kt CO_2e. We note that this is much less than 25,000 kt CO_2e. Comparing this figure to local regional and national baselines shows that this magnitude of emissions corresponds to:

- 0.173% of local (Camden 2019) baseline emissions;
- 0.00589% of regional (London 2019) baseline emissions;
- 0.00217% of annual built environment proportion of the 6th national carbon budget (2033 – 2037) (40% share attributable to the built environment sector).

Assuming a 60-year lifetime from the opening year would mean deconstruction would occur in 2097. Therefore, the end of life emissions are compared with the local and regional carbon budgets for the period 2048 – 2100:

- 64.5% annual proportion of the Camden carbon budget (2048 - 2100) (40% share attributable to the built environment sector).
- 2.72% annual proportion of the London carbon budget (2048 - 2100) (40% share attributable to the built environment sector).

16.10.14 While the emission benchmarks outlined above have been used to provide context, it is important to recognise that the application of professional judgement is a critical additional component, as recognised by IEMA guidance. In the context that the nationally derived carbon emissions and budget data only accounts for CO_2e emissions from the generation of energy and processing of fuels within the United Kingdom, and the local and regional data only accounts for emissions from energy generation and processing of fossil fuels where the end use is within Camden and London boundaries. The professional judgement in this case has taken into account the high level of uncertainty in assessing an effect happening so far in the future. During the building lifetime there is expected to be continued grid decarbonisation and it would be reasonable to expect that the lifecycle stages assessed in this phase (deconstruction demolition, transport, waste processing and disposal) would also undergo decarbonisation. Therefore, it is likely that the high estimates of proportions of the future Camden and London carbon budgets would reduce with decarbonisation improvements in energy carbon factors and industrial processes.

16.10.15 The sensitivity of the Global Climate is high, and the magnitude of change, is low. Therefore, there is likely to be a direct, permanent, long-term minor negative effect on the global climate.

Mitigation

16.10.16 No additional mitigation measures are proposed.

Residual Effect

16.10.17 The sensitivity of the global climate is high, and the magnitude of change, is low. Therefore, there is likely to be a direct, permanent, long-term minor, negative residual effect on the global climate.

16.11 Greenhouse Gases: Limitation and Assumptions

16.11.1 To ensure transparency within the EIA process, the following limitations and assumptions have been identified.

- Estimated carbon emissions from operational energy uses of buildings have been calculated from modelling undertaken in line with Part L 2013 of the Building Regulations (Conservation of fuel and power). Residential areas were assessed by modelling a sample of dwellings using SAP methodology, non-residential areas were modelled using IESve 2019. SAP10 carbon factors have been utilised in line with GLA Energy Assessment Guidance issued in 2020 (Greater London Authority, 2020). The Part L methodology uses standardised parameters, including operational profiles, ventilation rates, and heating and cooling setpoints, based on the building use, which may be different from how the buildings will operate in practice.

- Full detail on the assumptions and limitations used to conduct the whole life carbon analysis can be found in the standalone Sustainability statement submitted with the planning application. Briefly, quantities were either taken from the cost plan or based on latest structural design information and the building life-span has been assumed to be 60 years. Where project data was not available, benchmarks, previous Buro Happold project experience and industry guidance were used. The construction time period is assumed to be 15 years and the deconstruction period is assumed to be one year.

- Operational traffic emission estimates are made using traffic flow data provided by the transport consultant. Average distances of travel are based on a national data. Blackburn Road note transport data have been assumed to account for trips in and out of the Site. It is also assumed that current fuel conversion factors have been included in the analysis.

- It is acknowledged that there will be carbon emissions associated with demolition activities (operation of demolition equipment, processing of materials for recycling/disposal). These will strongly be influenced by the demolition contractor and therefore, to accurately quantify carbon emissions stemming from demolition on site at this stage is difficult. This ES chapter has calculated the carbon emissions from pre-construction and end of life demolition.

16.12 Climate Change Resilience and Adaptation: Assessment of Effects, Mitigation and Residual Effects

16.12.1 As discussed in the greenhouse gasses assessment above, there are several primary mitigation measures recommended to be incorporated into the design to ensure the Proposed Development avoids, prevents or reduces carbon emissions to the extent possible and thus limits the effect it has on contributing to climate change. These have been set out in the body of the text above with further detail available in the standalone Energy Strategy, Circular Economy statement and Sustainability Statement submitted with the planning application. This section will assess the effects of the Proposed Development in terms of climate resilience and adaptation.

16.12.2 Where appropriate, this assessment will assume the future baseline predicted by the high emissions scenario (Met Office UKCP18 RCP8.5) in line with IEMA Climate Change Resilience & Adaptation guidance (IEMA, 2020).

16.12.3 Water supply is scoped out of consideration in this section since this effect was determined to be negligible in the technical assessment conducted in Chapter 9: Water Resources, Drainage and Flood Risk.

Flood Risk Impacts

16.12.4 For London, sea level rise by the end of the century (when compared to 1981-2000), or a high emission scenario (RCP8.5) is very likely to be 0.53 m to 1.15 m (Met Office, 2019). This, combined with a predicted increase in storm surges, will lead to a significantly increased risk of flooding.

16.12.5 Here we consider the effect of flood risk on the site due to future climate change. This aligns with the operational phase assessment of flood risk impacts in Chapter 9: Water Resources, Drainage and Flood Risk and the appended Flood Risk Assessment and Sustainable Drainage Report. The assessment made in Chapter 9 is also appropriate here, the assessment is as follows:

*"The Development Site is wholly within Flood Zone 1 with no areas of Flood Zones 2 and 3 nearby, as modelled by the Environment Agency, and so considered at low risk from flooding from fluvial and tidal sources. As part of the Flood Risk Assessment (**Appendix 9.1**) several improvements to the sewerage system has been proposed alongside the commitments made by Thames Water to provide further capacity to meet the needs of the Proposed Development. The SuDS Strategy will also help mitigate the surface water flooding risk."*

16.12.1 Mitigation measures planned for inclusion in the masterplan include:

- Implement a holistic drainage strategy which incorporates blue roofs, swales and rain gardens, and includes an allowance of 40% for increased rainfall due to the effects of climate change.

Mitigation

16.12.2 The mitigation discussed in the operational phase flood risk assessment is also included here for ease of reference:

"The surface water drainage strategy will also provide some management and control of flows within the remaining infrastructure on the Development Site, reducing the potential flood risk from these sources. Any new sewers or drainage systems should be designed in such a way as to minimise the risk of blockage and offer a design that provides ease of maintenance. For all new structures, the appropriate body should be identified for the ownership and maintenance of these assets to ensure ongoing suitable maintenance activities.

These design parameters are incorporated into the Design and Access Statement, with mitigation incorporated into the Flood Risk Assessment and Sustainable Drainage Report. The mitigation will then be secured through appropriate planning conditions related to the detailed design and compliance with the recommendations of the FRA."

Residual Effect

16.12.3 The flood risk impacts residual effect is considered negligible after mitigation in the technical assessment conducted in Chapter 9 and is therefore considered to have no significant residual effect in the context of climate change adaptation and resilience.

Overheating

16.12.4 An overheating risk assessment is conducted in the standalone Energy Strategy. This risk assessment takes into account embedded mitigation measures. A discussion of the findings of this overheating risk assessment is included in the residual effect section below.

16.12.5 The following mitigation measures are embedded within the Proposed Development:

- Energy efficient lighting (such as LED) with low heat output
- Insulation to heating and hot water pipework and minimisation of dead legs to avoid standing heat loss (from pipework to dwellings)
- Energy efficient equipment with low heat output to reduce unnecessary heat gain
- Overheating Risk reduction strategies implanted in building design to meet CIBSE TM59 and BREEAM Hea04 requirements for current and future climate change scenarios to 2040.
- Facades will be developed with suitable glazing-to-solid ratios, with particular focus on south facing orientations.
- Suitable g-values will be specified to further control solar heat gains as required.
- Office units will have the capability for internal blinds to be installed to improve occupant comfort.
- Implement a tree strategy which includes taller and smaller trees and shrubs in a mix of evergreen and deciduous clusters to mitigate wind, provide shade and shelter from external environment.

16.12.6 Overheating risk assessments utilising dynamic thermal modelling will be undertaken for the residential areas in the outline planning application as part of the reserved matters application. (An assessment for the residential areas within the detailed application is included in Appendix B of the Energy Strategy). The risk assessments follow the appropriate CIBSE guidance (TM59) and weather files as specified in GLA guidance, including consideration of the urban heat island effect, future weather, and any acoustic and security constraints which may impact on the likely operation of openable windows.

16.12.7 In the overheating risk assessment described in the mitigation measures above the building has been assessed against the predominantly naturally ventilated criteria. This is representative of 'free running' type buildings where people expect internal temperature to follow external temperature, and as such they can adapt and tolerate higher temperatures in accordance with the adaptive comfort model. It is currently anticipated that 86% of the assessed spaces will meet the adaptive thermal comfort criteria for naturally ventilated spaces.

16.12.8 Reliance on openable windows alone for mitigating overheating has been identified by acoustic surveys to lead to unacceptable internal noise levels and therefore mechanical ventilation systems with air tempering are recommended to any flats where unacceptable internal comfort conditions are predicted in accordance with the cooling hierarchy.

Mitigation

16.12.9 No further mitigation measures are proposed.

Residual Effect

16.12.10 A qualitative assessment has found that the overheating risk impacts residual effect is considered negligible after mitigation in the technical assessment conducted in the standalone Energy Strategy and is therefore considered to have low significant residual effect in the context of climate change adaptation and resilience.

16.13 Climate Change Resilience and Adaptation: Limitation and Assumptions

Flood Risk

16.13.1 As per the limitations and assumptions of Chapter 9: Water Resources, Drainage and Flood Risk.

"The scope of the assessment has been based upon a review of available information within the study area to identify the baseline conditions and development receptors. This has been supported by detailed assessments where necessary and is based on the best data available at the time of production."

Overheating

16.13.2 As detailed in the standalone Energy Strategy, Appendix B: Summary of overheating risk assessment (CIBSE TM59). The overview of parameters/ modelling assumptions is provided there in Table 31: Summary of input parameters used in the TM59 assessment (Detailed Proposals).

16.14 Summary

16.14.1 This chapter of the environmental statement has assessed the likely effect of the Proposed Development in terms of greenhouse gas emissions and climate change.

16.14.2 This assessment has not identified any CO_2 emissions expected to be generated throughout the lifecycle of the Proposed Development that are likely to result in effects which are considered significant (either 'moderate' or 'major'). The effects assessed are not considered significant for the global climate. Following a blended quantitative-qualitative approach based on widely accepted GHG accounting and reporting principles and professional judgement, all likely effects associated with the CO_2 emissions reviewed as part of this assessment have been classified as being 'minor'. On this basis, the assessment concludes that no likely significant effects are expected as a result of the Proposed Development.

16.14.3 Emissions produced as a result of the construction phase, operational energy consumption and operational building use, maintenance, repair, replacement and refurbishment and end of life phase are all expected to have minor negative effects on the global climate. However, mitigation measures in the form of maximising reuse of the existing materials on site, following a fabric first design approach and implementing an all-electric strategy are aimed to reduce the magnitude of these effects. The change in land use from retail to residential and the implementation of a car free development is expected to result in a reduction of operational traffic emissions and therefore is predicted to have a minor positive effect on the global climate.

16.14.4 This assessment has not identified any impacts of climate change adaptation and resilience that are likely to result in effects which are considered negative and either 'moderate' or 'major'. Flood risk and overheating impacts and the relevant mitigation measures are discussed, the implementation of the described mitigation measures is found to reduce the residual effects to a negligible level

Table 16.15: Summary of Effects

DESCRIPTION OF SIGNIFICANT EFFECTS	RECEPTOR	SIGNIFICANCE OF EFFECTS					SUMMARY OF MITIGATION / ENHANCEMENT MEASURES	SIGNIFICANCE OF RESIDUAL EFFECTS					RELEVANT POLICY	RELEVANT LEGISLATION
		MAJOR / MODERATE / MINOR / NEGLIGIBLE	POSITIVE / NEGATIVE	P / T	D / I	ST / MT / LT		MAJOR / MODERATE / MINOR / NEGLIGIBLE	POSITIVE / NEGATIVE	P / T	D / I	ST / MT / LT		
GREENHOUSE GAS EMISSIONS														
Demolition & Construction														
Lifecycle stages A1 – A5	Global climate	Minor	Negative	P	D	LT	Pre-demolition audit to be commissioned.	Minor	Negative	P	D	LT	Camden Local Plan, London Plan	NPPF, PPG
Operation														
Operational energy	Global climate	Minor	Negative	P	D	LT	-	Minor	Negative	P	D	LT	Camden Local Plan, London Plan	NPPF, PPG
Repair and Maintenance (Lifecycle stages B1 – B5)	Global climate	Minor	Negative	P	D	LT	-	Minor	Negative	P	D	LT	Camden Local Plan, London Plan	NPPF, PPG
Operational traffic	Global climate	Minor	Positive	P	D	LT	Production of a framework travel plan.	Minor	Positive	P	D	LT	Camden Local Plan, London Plan	NPPF, PPG
End of Life														
Lifecycle stages C1 – C4	Global climate	Minor	Negative	P	D	LT	-	Minor	Negative	P	D	LT	Camden Local Plan, London Plan	NPPF, PPG
CLIMATE CHANGE														
Operation														
Flood Risk Impacts	Site and Sewers	No significant effect after embedded mitigation measures are implemented.												
Overheating risk impacts	Members of the public	No significant effect after embedded mitigation measures are implemented.												

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