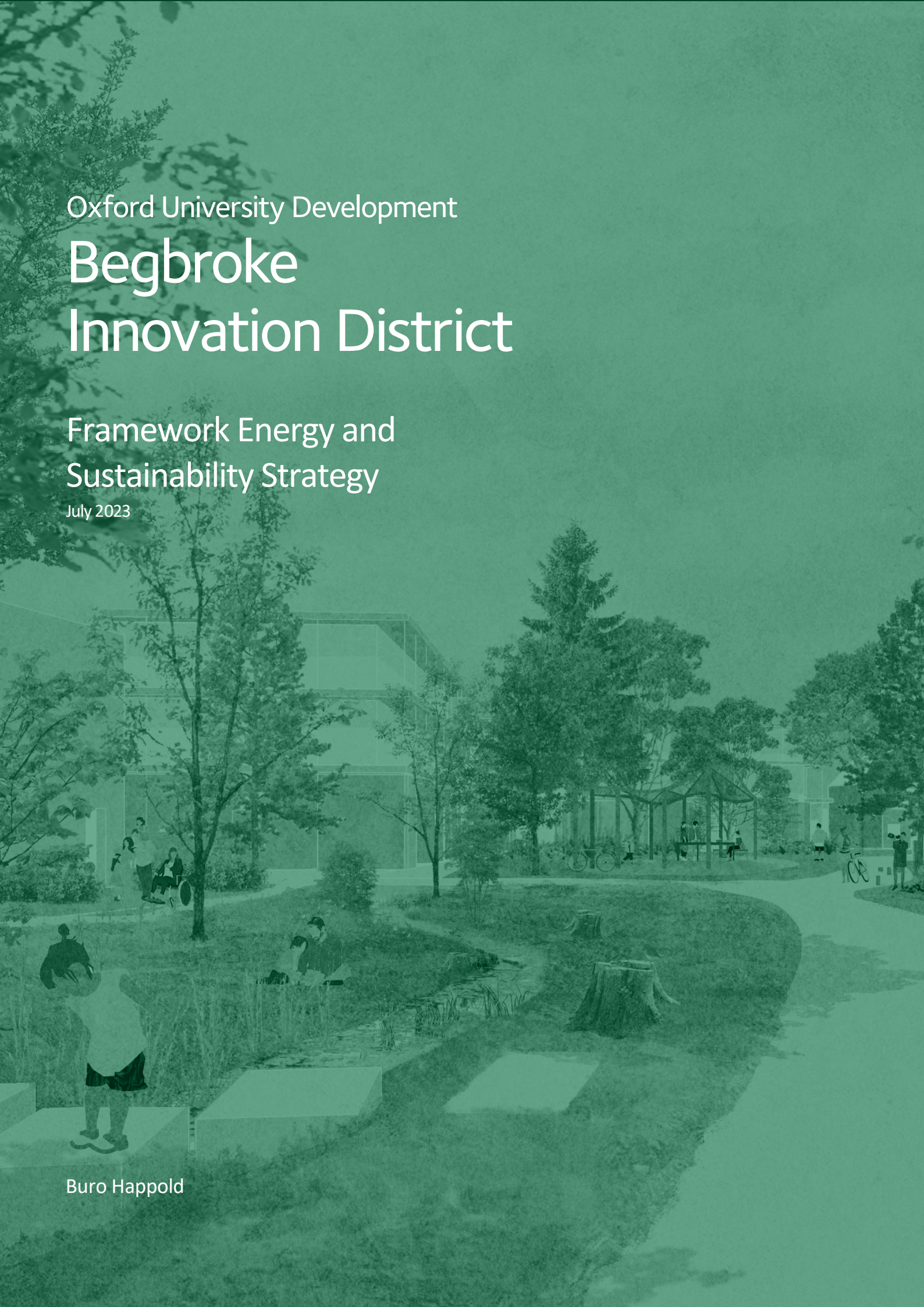
Oxford University Development

Begbroke Innovation District

Framework Energy and Sustainability Strategy

July 2023



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Begbroke Innovation District
Framework Energy and Sustainability Strategy

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P01	First draft	EA	05/05/2023	MD
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Glossary

Term	Definition
ASHP	Air Source Heat Pump
BER	Building Emission Rate
BNG	Biodiversity Net Gain
BREDEM	Building Research Establishment Domestic Energy Model
BREEAM	Building Research Establishment's Environmental Assessment Methodology
BSP	Begbroke Science Park
CC	Climate change
CDC	Cherwell District Council
CEMP	Construction Environment Management Plan
CIBSE	Chartered Institution of Building Services Engineers
CO_2	Carbon Dioxide
COP	Coefficient of Performance
DFEE	Design Fabric Energy Efficiency
DHW	Domestic Hot Water
GEA	Gross External Area
GSHP	Ground Source Heat Pump
HQM	Home Quality Mark
IAQM	Indoor Air Quality Management
IPCC	Intergovernmental Panel on Climate Change
LEL	Low Energy Lighting
LETI	Low Energy Transformation Initiative
LLFA	Lead Local Flood Authority
MVHR	Mechanical Ventilation with Heat Recovery
NABERS	National Australian Built Environment Rating System
NPPF	National Planning Policy Framework
OUD	Oxford University Development
OWMS	Operational Waste Management Strategy
PCDB	Product Characteristics Database
PPG	Planning Policy Guidance Notes
PPS	Planning Policy Statements
PV	Photovoltaics
QBAR	Mean annual maximum flow rate
SAP	Standard Assessment Procedure
SBEM	Simplified Building Energy Model
SFP	Specific Fan Power
SPD	Supplementary Planning Document
SuDS	Sustainable Urban Drainage Systems
TER	Target Emission Rate
TFEE	Target Fabric Energy Efficiency Rate
UKGBC	UK Green Building Council
WELL	WELL Building Standard
WWHR	Waste Water Heat Recovery

1 Executive Summary

1.1 Overview

This Framework Energy and Sustainability Strategy has been prepared by Buro Happold on behalf of Oxford University Development/OUD ("The Applicant"), in support of an outline planning application for the transformation of the Begbroke area to deliver a high-quality residential-led mixed-use development. Begbroke Innovation District (the 'Proposed Development') will bring together different uses and users, including residential, academic, commercial and educational functions, in an attractive and stimulating working environment. Sustainability is at the heart of the proposals, as is responding to the natural features of the existing Site such as the canal and existing landscape.

This statement sets out how the illustrative masterplan has been prepared in relation to local, regional and national planning policies. It summarises, at a strategic level, how the Proposed Development aims to exceed the minimum requirements, aiming for aspirational energy and sustainability targets by adopting and following market-leading sustainability standards including Building with Nature, BREEAM Infrastructure, Passivhaus principles, NABERS UK, Home Quality Mark (HQM) and the WELL Building Standard.

1.2 Sustainability Vision

The approach to sustainability for Begbroke Innovation District focuses on creating a regenerative illustrative masterplan with positive outcomes for people and planet which regenerates the landscape, rethinks movement, reinforces innovation and uses renewable resources.

Begbroke Innovation District seeks to be a world class development with ambitious sustainable principles including Net Zero Carbon in operation, a prioritisation of healthy and active movement, climate resilience, and ambitiously enhancing and connecting the natural environment.

OUD's vision for Begbroke Innovation District is underpinned with ambitious headline objectives. These must be delivered to ensure that we leave a positive legacy in Oxford, delivering places that are sustainable and improve the quality of life for all. Data will be used to monitor and report performance to feedback important learnings for the future.

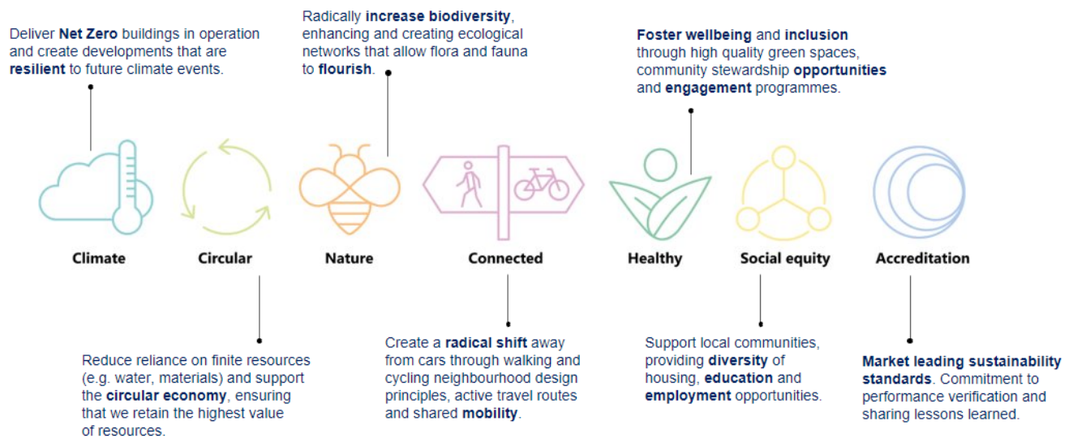


Figure 1—1 Headline objectives from OUD's Sustainability Strategy (17th October 2022), as adapted to Begbroke Innovation District

Figure 1—2 Begbroke aims to be a regenerative masterplan generating positive environmental outcomes which are resilient to climate change. By comparison, many traditional developments focus on short term goals and can have a negative impact on the environment.

There is a distinct opportunity at Begbroke to create a regenerative development where positive outcomes for people and planet are enabled through a series of measures, including:

- Ambitious Biodiversity Net Gain and multifunctional green and blue infrastructure
- Net Zero Carbon, with Passivhaus design principles, on-site renewable energy generation and storage
- Prioritising healthy and active travel, and reducing car use
- Resource efficiencies, including energy, water and a circular approach to materials
- Sustainable drainage
- Long term governance and stewardship

1.3 Energy Statement Summary

The approach to energy for Begbroke Innovation District focuses on passive demand reduction and low and zero carbon technologies. The ambition for Begbroke Innovation District is Net Zero Carbon in operation, to be achieved by demand reduction, an all-electric approach and decentralised energy. Energy will be supplied by on-site renewables as far as possible, with the remainder procured off-site renewable energy to meet Net Zero Carbon targets. By combining approaches proposed in the lean, clean, green methodology, a significant reduction of regulated carbon emissions is possible. The energy strategy is set out in line with the energy hierarchy: Lean, Clean, Green as described in the adopted Cherwell Local Plan and Core Policy 38 of the upcoming Draft Cherwell Local Plan 2040, focusing on regulated carbon emissions with an estimate of unregulated emissions.

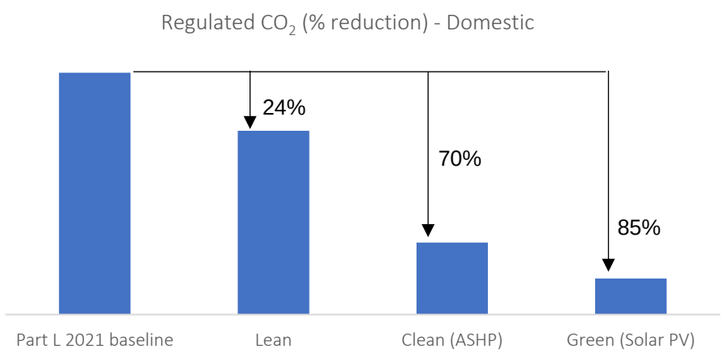


Figure 1—3 Regulated CO2 emissions reductions from lean, clean green methodology – domestic buildings. Preliminary calculations based on SAP modelling for the scheme.

2 Introduction

This Framework Energy and Sustainability Strategy has been prepared by Buro Happold on behalf of Oxford University Development/OUD ("The Applicant"), in support of an outline planning application for the transformation of Begbroke Innovation District (the 'Proposed Development") into a high-quality residential-led mixed-use development.

2.1 Proposed Development Description

Oxford University Development Ltd ('the Applicant') is seeking outline planning permission for a phased, mixed-use development ('the Proposed Development') which would provide up to 155,000 square metres ('sqm') gross external area ('GEA') of new faculty, and research and development space associated with the expansion of the existing Begbroke Science Park, up to 215,000sqm GEA of residential floorspace that would deliver apartments, communal and sharer accommodation and traditional houses and associated amenity, education and community uses.

The masterplan area aligns with strategic land allocation 'PR8' within Cherwell Council's local plan. The illustrative masterplan is shown in Figure 2—1 Masterplan Layout.

Figure 2—1 Masterplan Layout

2.2 Proposed Development Location

The site is bound by the A44 Woodstock Road to the west, Rowel Brook to the north and Oxford Canal to the east. The Cherwell Valley railway line intersects the Site from north to south, in the east of the Site. Oxford Airport is located to the north of the site.

The site mainly comprises open greenfield land used for arable farming, with Begbroke Science Park (BSP) located at the centre. Rushy Meadows SSSI is situated adjacent to the north-eastern boundary of the site, adjacent to the Oxford Canal.

Access to BSP is provided via the Begbroke Hill road connecting with the A44 in the west. Two key roads intersect the site, providing east/west access, Begbroke Hill and Sandy Lane. Sandy Lane crosses both the Cherwell Valley railway line (via level crossing) and Oxford Canal (via bridge) on its route toward Kidlington.

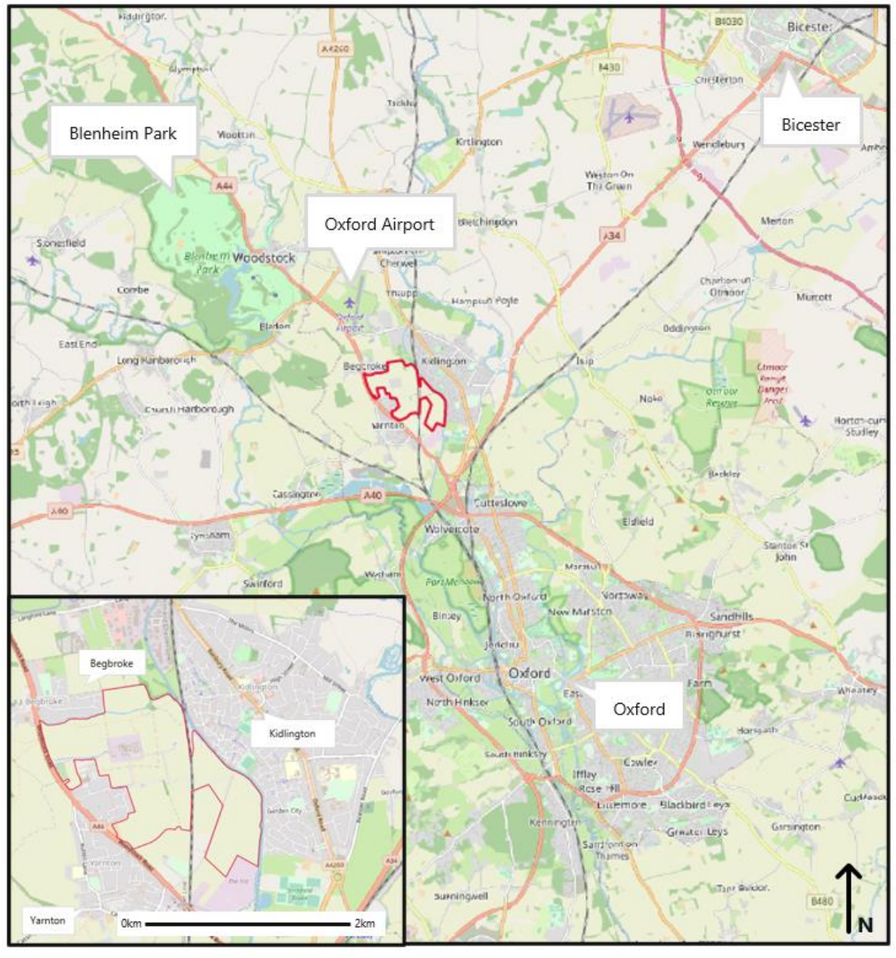


Figure 2—2 Site Location and Boundary, January 2023

2.3 Summary of the Proposed Development

The Proposed Development seeks an outline planning permission, with all matters reserved, for a comprehensive residential-led mixed use development. Table 2—1 summarises the proposed planning use classes and areas for the development based on quantum fix details prepared by Quod.

Table 2—1 Quantum of development

Use	Proposed Use (Use Class)	Area (GEA, sqm, ha)
Uses associated with the expansion of Begbroke Science Park	Classes B2, B8, E(g), and F1(a)	155,000 sqm
Residential	C3/C4/Sui Generis	215,000 sqm[1]
Ancillary / Supporting Uses **	As below	21,000 sqm
• Retail (including the sale of food and drink)	E(a), (b), and (c)	3,500 sqm
• Hotel	C1	10,000 sqm
• Non-residential and leisure institutions, including nursery, medical or health services, indoor sport or fitness facilities, and creches and/or nurseries.	E(d), (e), and (f)	5,600 sqm
• Halls and meeting places	F2(b)	1,200 sqm
• Sui generis uses including (but not limited to) public houses, wine bars or drinking establishments	Sui generis	700 sqm
Open outdoor recreation, play and sport space	F2(c)	22.13 ha[2]
Education facilities	F1(a)	19,800 sqm[3]

[1] For the purposes of this assessment, this is assumed to equate to 1,800 residential units. The specific number of residential units delivered on the Site will be subject to later planning applications.

[2] Based on a 1,800 unit scheme. The actual provision may change as a result of a detailed planning application made later in the development process.

[3] Based on delivering a 1,100 place secondary school, a 3FE primary school and a 2FE primary school.

3 Planning Policy

3.1 Overview

The Begbroke and OUD sustainability strategies have been developed in line with international, national, regional and local policy requirements. The following section provides a summary of the key planning policies.

3.2 International Law

Paris Agreement (Nov 2016)

The Paris Agreement is a major international climate action agreement to which the UK is signatory. The 194 countries under the agreement have committed to limit global warming to 2°C over pre-industrial levels, while pursuing efforts to limit the increase even further to 1.5 degrees. The Agreement is a legally binding international treaty, which entered into force in November 2016. It has led the UK Government to commit to Net Zero Carbon by 2050.

Begbroke aims to demonstrate compliance with the Paris agreement through the site's energy strategy (e.g. avoiding fossil fuels and minimising carbon emissions), as well as broader design principles such as low carbon transport.

3.3 National Planning Policy

Climate Change Act 2008 (updated Jun 2019)

The Climate Change Act sets out the UK Government's pathway to reduce greenhouse gas emissions by at least 80% (relative to 1990 levels) by 2050. This includes the requirements to set legally binding carbon budgets over five-year periods to act as intermediate milestones. On 27th June 2019, a more ambitious target of net zero carbon by 2050 was adopted by the UK Government in response to public sentiment and the release of the Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming of 1.5ºC (October 2018).

National Planning Policy Framework (updated Jul 2021)

The National Planning Policy Framework and relevant planning practice guidance sets out the Government's planning policies for England. The presumption in favour of sustainable development is at the heart of the framework, cascading through to local plans and the approval process for planning applications.

Key issues covered in the NPPF are summarised below:

Delivering a sufficient supply of homes	Achieving well-designed places
Building a strong, competitive economy	Protecting Green Belt land
Ensuring the vitality of town centres	Meeting the challenge of climate change, flooding and coastal change
Promoting healthy and safe communities	Conserving and enhancing the natural environment
Promoting sustainable transport	Conserving and enhancing the historic environment
Supporting high quality communications	Facilitating the sustainable use of minerals
Making effective use of land	

The NPPF consolidates previously issued documents called Planning Policy Statements (PPS) and Planning Policy Guidance Notes (PPG). A greater focus is now placed on the dissemination of energy policy within regional development frameworks. The NPPF's planning guidance relating to energy and sustainability is set out in Section 14: and relates to "meeting the challenge of climate change, flooding and coastal change". This requires local authorities to set sustainability targets and ambitions. NPPF does however stipulate that no Local authority can enforce a policy that is not currently technically feasible or economically viable.

Environment Act (Nov 2021)

Enacted in November 2021, the Environment Act 2021 sets to deliver long-term targets to improve air quality, biodiversity, water, and waste reduction and resource efficiency. One of the most significant requirements to be introduced is the requirement for developments to achieve at least a 10% Biodiversity Net Gain (BNG) as condition of planning permission from November 2023. This supports the target to halt the decline of nature by 2030.

25 Year Environmental Plan (2018)

This plan sets out the Government's ambition to '…champion sustainable development, lead in environmental science, innovate to achieve clean growth and increase resource efficiency to provide benefits to both our environment and economy'.

The plan provides fresh impetus for the principles of sustainable development to be at the heart of decision-making, setting out clear objectives and common language for policy and decision makers to adopt. This Plan formed the basis of the Environment Bill 2021, which brought into UK law new environmental protections and recovery to deliver the ambitions set out in the 25 Year Environment Plan.

Policies and actions are structured around six key areas:

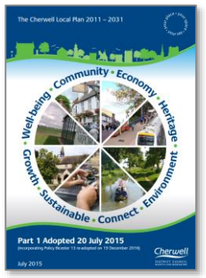
Chapter 1: Using and managing land sustainability
Chapter 2: recovering nature and enhancing the beauty of landscapes
Chapter 3: Connecting people with the environment to improve health & wellbeing
Chapter 4: Increasing resource efficiency and reducing pollution and waste
Chapter 5: Securing clean, healthy, productive and biologically diverse seas and oceans
Chapter 6: Protecting and improving our global environment

Future Homes Standard (Introduced by 2025)

The Future Homes Standard is proposed to come into effect from 2025 to ensure new homes produce circa 75-80% less carbon emissions than homes delivered under the 2013 Part L Building Regulations. Ahead of the Standard coming into effect, interim Part L and updates to the Standard Assessment Procedure (SAP) carbon factors in June 2022 were introduced to start the transition towards 'net zero carbon ready' homes.

A key feature of the Future Homes Standard is that no new homes will be able to connect to the gas network, which in effect means a gas boiler ban and shift to all-electric low carbon technologies such as air source heat pumps complemented by significantly higher building fabric standards nearing Passivhaus.

3.4 Local Planning Policy



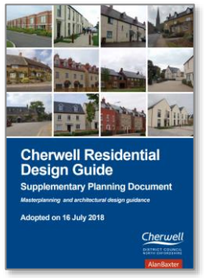
The Cherwell Local Plan 2011 – 2031 Part 1 (Adopted on 20th July 2015)

The Cherwell Local Plan contains strategic planning policies for development and the use of land. It forms part of the statutory Development Plan for Cherwell District Council to which regard must be given in the determination of planning applications. Relevant policies for ensuring sustainable development are summarised below.

Table 3—1 Summary of Cherwell District Council ESD Policy

Policy References	Requirements
ESD 1 Mitigating and Adapting to Climate change	• Reduce the need to travel • Reduce carbon emissions and increase resource efficiency • Use decentralised or renewable energy where possible • Design that is resilient to climate change • Minimise the risk of flooding
ESD 2 Energy hierarchy and allowable solutions	• Application of the 'Energy hierarchy' which seeks to reduce energy use in the first instance, followed by efficient low carbon supply, renewable energy and allowable solutions.
ESD 3 Sustainable construction	• Water consumption limit of 110 l/p/d • Residential development expected to achieve zero carbon development • Non-residential development to achieve BREEAM Very Good • Demonstrate sustainable design and construction best practice
ESD 4 Decentralised energy systems	• Feasibility assessment for decentralised energy systems, e.g., District Heating.
ESD 5 Renewable energy	• Feasibility assessment of the potential for renewable and low carbon energy provision on site.
ESD 6 Sustainable flood risk management	• Site specific flood risk assessment to demonstrate no increase in surface water discharge rates up to and including 1 in 100-year event (including climate change allowance) and safe containment on site with no surface water flooding beyond the 1 in 30 year event.
ESD 7 Sustainable drainage systems	• Incorporate SuDS to reduce flood risk and pollution and provide landscape and wildlife benefits.
ESD 8 Water Resources	• Maintain and enhance water quality and phase development in accordance with the delivery of relevant water infrastructure.
ESD 9: Protection of the Oxford Meadows SAC	• Avoid adverse effects on the water quality or quantity of nearby or adjacent watercourses during construction
ESD 10 Protection and enhancement of Biodiversity and the natural environment	• Seeks protection and enhancement of biodiversity and the natural environment
ESD 11: Conservation Target Areas	• Requires biodiversity enhancement to CTAs from proposals within or adjacent to them.
ESD 13: Local Landscape Protection and Enhancement	• Restore and enhance the local landscape character, especially in urban fringe locations.
ESD 14: Oxford Green Belt	• Development proposals within the GB will be assessed in accordance with the NPPF
ESD 16: The Oxford Canal	• Protect and enhance the Oxford Canal as a green transport route, significant industrial heritage, tourism attraction and major leisure facility.

Cherwell Residential Design Guide SPD (Adopted on 16th July 2018)



This Supplementary Planning Document provides master-planning and architectural design guidance for residential developments. It seeks to ensure new development contributes to creating vibrant, sustainable, safe, and attractive places. Sustainability is a key part of the design guide, with example guidance including:

- Consider sustainability objectives at the masterplan, plot and building scale
- Incorporate innovation in a manner which reinforces the principles of good urban design
- Create robust places which can adapt to future changes in the way we live and use technology
- Create healthy buildings which provide a safe and comfortable environment for their inhabitants
- Opportunities to incorporate sustainable technologies and raise levels of energy efficiency should be taken wherever this can be successfully achieved without detriment to the urban form and placemaking objectives
- All schemes should consider the potential to deliver Passivhaus buildings.
- In choosing building materials, embodied carbon should be considered alongside the carbon savings arising from the performance of the material in the home
- Retaining and incorporating existing hedgerows, trees and other landscape features as part of a connected blue-green infrastructure network across the site
- Planning sustainable drainage features early-on, to allow sufficient space within the masterplan and considering the implications for street design and character.
- Using existing landscape features such as tree belts and hedges or the planting of street trees, tree belts, shrubs and grassland to provide shelter from strong winds and to moderate extremes of temperature through evaporative cooling
- Considering the impact of street orientation and street proportions on the natural day lighting/ shading and temperature of buildings, gardens and public spaces.
- All homes should be designed to allow natural cross ventilation and cooling in summer
- Use of water in the home from the mains should be minimised in all developments

Cherwell District Council Local Plan Review 2040

Cherwell District Council are in the process of reviewing and updating their Local Plan. The process commenced in July 2020 with the publication of the first Community Involvement Paper highlighting issues to be considered in preparing the new Local Plan. Comments and a 'Call for Sites' were invited from the community and captured in the Community Involvement Paper Consultation (31 July 2020 - 14 September 2020). The Paper set out three key themes for comment:

- Theme 1: Maintain and developing a sustainable local economy
- Theme 2: Meeting the challenge of climate change
- Theme 3: Healthy place-shaping

The Community Involvement Paper 2: Developing our Options Consultation (29 September 2021 - 10 November 2021) consolidates and builds on the first consultation to set out the options under consideration for the Local Plan update, proposing a place and people-based vision for the district with a focus on developing a sustainable local economy, meeting the climate change challenge and healthy place shaping. This document is not a draft local plan but provides an indication of emerging planning policy and priorities for future developments.

In January 2023, a draft of the updated Local Plan ('Draft for Executive') was published for consultation. This includes a number of draft policies, particularly energy related items of relevance to this Framework Energy and Sustainability Strategy. Key policies impacting on this statement are detailed in Table 3—2 to Table 3—6 and have been used to guide energy calculations.

Energy Strategy policies from the Cherwell District Council Draft Local Plan 2040:

The following draft planning policies have been used to guide the Energy Statement calculations. For Begbroke Innovation District, which has a long build-out plan, having sight of how the policy landscape may change helps to ensure the development is future-ready and can manage any potential future planning risks.

Table 3—2 Draft Local Plan, Core Policy 37

Core Policy 37: Zero or Low Carbon Energy Sources
All new dwellings and new non-residential development of 1,000sqm or more should deliver zero and low carbon energy technologies on-site to achieve on-site net zero operational carbon (regulated and unregulated energy) wherever possible. This energy demand to be met with renewable technologies should be calculated using the following methodologies: • regulated energy: SAP or SBEM methodologies (latest versions available) • unregulated energy: SAP Appendix L or BREDEM (homes) or CIBSE TM54 (non- residential buildings), and/or • alternatively, total energy demand may be calculated using CIBSE TM54 or the Passivhaus Planning Package. Where full compliance is not feasible or viable proposals must: i. demonstrate through the energy statement that additional renewable, zero and low carbon energy technologies have been provided to the greatest extent feasible and viable, and ii. incorporate 'zero carbon ready'* (as opposed to immediately providing 'low/zero carbon') technologies. **a.** *this may include off site existing or planned zero, low carbon or renewable energy generation or heat network provision where there is a direct off-grid connection to the development which has capacity to serve the development.

Table 3—3 Draft Local Plan, Core Policy 38

Core Policy 38: The energy hierarchy and Energy
All new development will be expected to achieve net zero carbon emissions from total operational energy use (regulated and unregulated) by incorporating measures to reduce greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy: i. be lean: use less energy and manage demand during operation ii. be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly iii. be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site, and iv. be seen: monitor, verify and report on energy performance. All Major development proposals will be required to be supported by a detailed energy statement that demonstrates how the net zero-carbon target will be met within the framework of the energy hierarchy. For steps i-ii. of the energy hierarchy, all new dwellings and new non-residential development of 1,000sqm or more should deliver: v. residential: achieve a Part L Fabric Energy Efficiency metric of no more than 15-20kWh/m2/year vi. non-residential: a 19% reduction in carbon emissions compared to Part L 2013 through energy efficiency measures (fabric efficiency, efficient services and efficient energy supply) Performance against the above targets should be using the latest version of SAP. Where full compliance is not feasible or viable, proposals must demonstrate through the energy statement that carbon reductions to the greatest extent feasible through energy efficiency measures have been considered and incorporated.

Table 3—4 Draft Local Plan, Core Policy 39

Core Policy 39: Achieving Net Zero Carbon Development
All new dwellings and new non-residential development of 1,000sqm or more should achieve net zero operational regulated carbon emissions by implementing the energy hierarchy. i. for new dwellings, a minimum 63% reduction in carbon emissions should be achieved by on-site measures (before the addition of renewable electricity measures), as compared to the baseline emission rate set by Building Regulations Part L 2021 ii. in new non-residential buildings, at least a 35% reduction in carbon emissions through on-site measures compared to the rate set by Building Regulations 2013 (or equivalent percentage reduction on Building Regulations 2021) should be achieved before addition of renewable electricity measures iii. subsequent to points (i) and (ii) above, deliver sufficient renewable energy generation to comply with Core Policy 37: Zero or Low Carbon Energy Sources iv. where any residual operational carbon emissions remain (over the course of 30 years; regulated and unregulated), these should be calculated and offset to zero. Offsetting will only be considered acceptable in exceptional circumstances if it can be demonstrated that achieving net zero operational carbon development via on-site measures (and near-site renewables) is demonstrably unfeasible or unviable. Where full compliance is not feasible or viable, proposals must demonstrate through the energy statement that carbon reductions to the greatest extent feasible have been considered in accordance with the energy hierarchy (as per Core Policy 38).

Table 3—5 Draft Local Plan, Core Policy 40

Core Policy 40: Carbon Offsetting
All new dwellings and new non-residential development of 1,000sqm or more that cannot achieve net zero carbon (regulated and unregulated energy uses) will be required to address any residual carbon emissions forecast over a period of 30 years, by a financial contribution to the Council's carbon offsetting fund. Contributions to an offsetting scheme shall be secured through Section 106 Agreements and will be required to be paid prior to the occupation of the development.

Table 3—6 Draft Local Plan, Core Policy 41

Core Policy 41: Renewable Energy
The Council supports renewable and low carbon energy provision providing any adverse impacts can be addressed satisfactorily. Planning applications involving renewable energy development will be encouraged provided that any adverse impacts can be addressed satisfactorily, including cumulative impact, on the following issues, which are considered to be of particular local significance in Cherwell: i. landscape and biodiversity including designations, protected habitats and species, and Conservation Target Areas ii. visual impacts on local landscapes iii. best and most versatile agricultural land iv. the historic environment including designated and non-designated assets and their settings v. the Green Belt, particularly visual impacts on openness vi. aviation activities vii. public rights of way and pedestrians, cyclists and equestrians viii. highways and access issues, and ix. residential amenity

4 Sustainability Strategy

4.1 Overview

The sustainability strategy for Begbroke Innovation District is focused on creating a regenerative development which creates positive outcomes for people and planet. Building upon OUD's vision for sustainable places and drawing from key regenerative principles from relevant sustainability frameworks, Begbroke Innovation District aspires to be a global exemplar of sustainable development which brings people closer to nature.

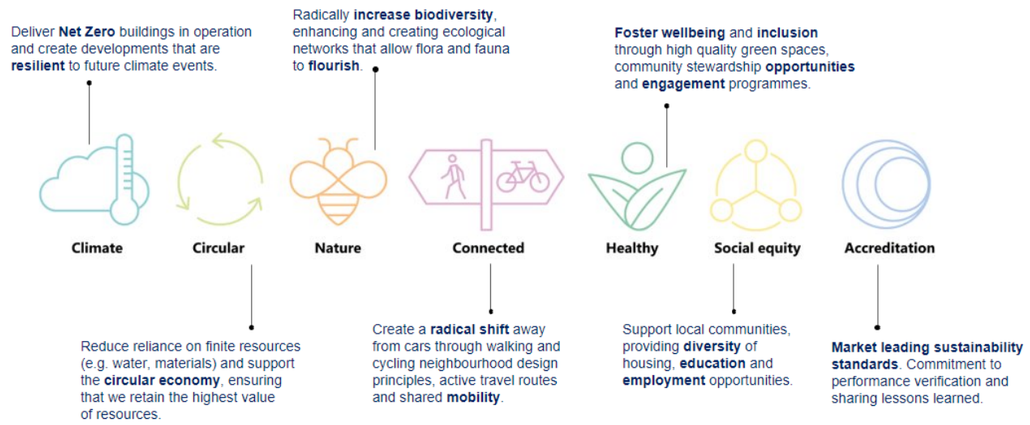


Figure 4—1 Headline objectives from OUD's Sustainability Strategy (17th October 2022), as adapted to Begbroke Innovation District

The spatial approach to Begbroke Innovation District can be summed up with five placemaking principles which include (i) a restorative landscape; (ii) mixed neighbourhoods for social sustainability; (iii) prioritising active travel and limiting car use to improve air quality; (iv) opening to Oxfordshire through inclusivity, connectivity and identity; and (v) active stewardship, monitoring the long term performance of the site.

The sustainability strategy works in tandem with the placemaking principles and is approached through four overarching moves: restoring the landscape for people and planet; rethinking movement, so the car takes a back seat; reinforcing innovation through integration of living and research; and renewable resources, supporting a Net Zero Carbon community.

These key moves are starting points in OUD's ambitions for Begbroke Innovation District and will develop through the detailed design stage.

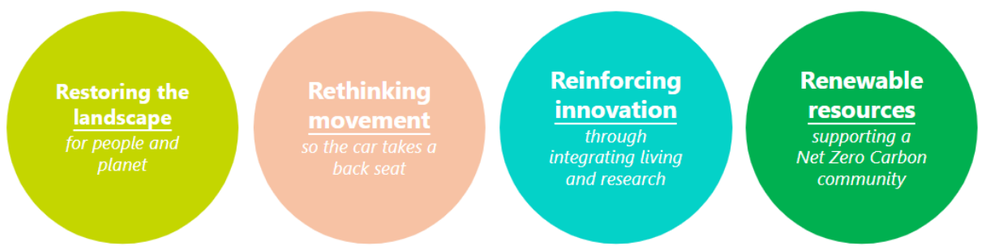


Figure 4—2 Four key sustainability moves for a regenerative Begbroke Innovation District

Sustainability outcomes at the illustrative masterplan level will consist of a healthy and connected landscape; streets with reduced car use and a focus on pedestrians and cyclists; and supporting Net Zero Carbon by passive measures such as massing and orientation.

4.2 Embodied Carbon

While the specification of materials and construction methods will come at a more detailed stage and are not part of this Outline Planning Application, it is envisaged that embodied carbon in buildings and infrastructure will be reduced. Ways to achieve this include reducing street widths (increasing landscape area) optimising cut and fill for on-site use, and an optimised sustainable drainage strategy using a combination of nature-based solutions and minimal sub-surface engineering.

4.3 Operational Carbon

In striving for a regenerative development, reducing operational carbon and operating at Net Zero are key principles of the sustainability strategy and OUD's vision for sustainable places. The approach to addressing energy and operational carbon for Begbroke Innovation District involves the 'Lean, Clean, Green, Seen' model.

From the outset, a number of workshops have taken place involving passive design principles drawn from best practice and a number of key sustainability frameworks, influencing the early formation of the illustrative masterplan to take advantage of opportunities in orientation; spacing, massing and block structure; shading; and the avoidance of overheating. Taking advantage of these opportunities will reduce energy demand in buildings and, in doing so, reduce operational carbon.

As required in Core Policy 39 of the Draft Local Plan, all new dwellings and new non-residential development of 1,000sqm or more should achieve Net Zero operational regulated carbon emissions. See Energy (above) for details of how this will be achieved.

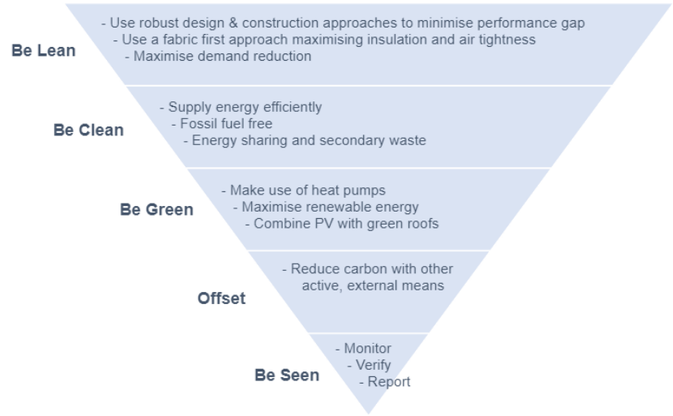


Figure 4—3 Energy hierarchy applied for the Proposed Development

4.4 Circular Economy

While the majority of enablers of a circular economy (such as materials specifications and construction methods) will be detailed at a later stage following Outline Planning Permission, a regenerative development at the illustrative masterplan scale will target circularity in water, making use of rain water and grey water harvesting, cleaning and reuse (see 4.9 Water), as well as circularity in waste (see 4.10 Waste).

OUD has an aspiration to obtain 20% of materials via circular sourcing, with a priority to source 100% of materials responsibly to reduce impacts on the environment, health and social welfare, as well as an aspiration to reuse 80% of on-site construction materials. All non-hazardous waste will be diverted from landfill with no more than 10% incinerated in the construction and operational phases. More detail will be available at the detailed design stage. For further information, see the Begbroke Site Waste Management Plan.

4.5 Ecology

As outlined in the illustrative masterplan, in alignment with the Environment Act and its requirement for 10% biodiversity net gain (BNG) from the end of 2023, the Proposed Development should be able to achieve at least 20% BNG within the development area. The increase in BNG is achieve d in part by enhancing the land along the eastern edge of the illustrative masterplan bordered by the Oxford Canal, as well as the provision of a series of public green spaces and green spines, where an increase in tree canopy cover is targeted, addressing requirements in Cherwell District Council ESD Policies 9, 10 and 16.

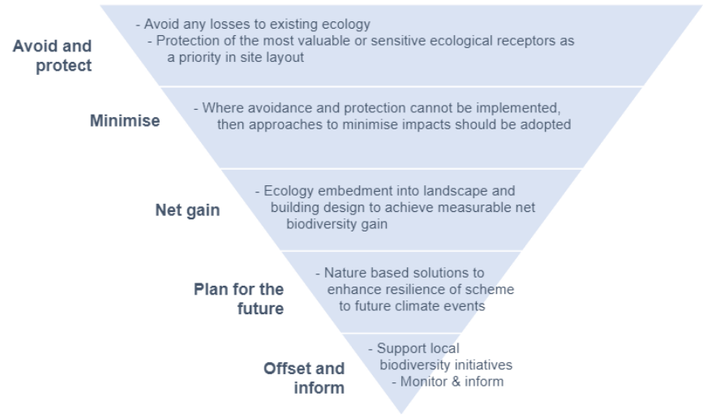


Figure 4—4 Ecological mitigation hierarchy applied for the Proposed Development

The regional network along the Oxford Canal and Rowel Brook will be strengthened, while green arteries within the development create, enhance and connect habitats and bring people closer to nature, linking to the existing Sandy Lane corridor. Streets will host roadside planting and pocket parks. This is demonstrated in Figure 4-5 below.

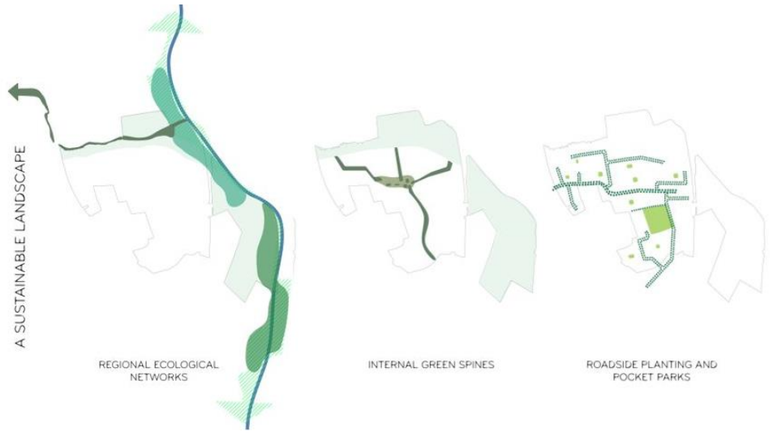


Figure 4—5 A layered approach to landscape and ecology

Planting strategies include the following themes:

- Biodiversity
- Seasonality
- Edible landscape
- Heat reduction
- Wind mitigation
- Water management
- Climate resilience

Strategies for area of hardscape include the following:

- Minimising paved areas
- Permeable paving
- High albedo materials
- Durable materials
- Reusable materials
- Sustainable materials

The combination of the above combines to provide a sustainable landscape strategy and addresses requirements set out in the Cherwell Residential Design Guide SPD.

Furthermore, the development of the illustrative masterplan design has been influenced from Stage 2 onwards by the Building with Nature framework, which strives for excellence in green/blue infrastructure, biodiversity, connectivity, climate resilience and ongoing stewardship, as well as protecting and enhancing local landscape character, as required by Cherwell District Council ESD Policy 13.

4.6 Transport

In re-thinking movement, the illustrative masterplan aims to prioritise the pedestrian and cyclist. This will be achieved by creating and enhancing links to nearby Begbroke, Yarnton, Kidlington and Oxford, enabling more equitable and inclusive access, and minimising vehicular movement.

Cherwell District Council ESD Policy 1 points to the requirement to reduce the need to travel and to reduce carbon emissions. The illustrative masterplan achieves this by focusing the design on pedestrian and cycle movement, and connecting the centre of Begbroke Innovation District to existing surrounding communities within a 5 minute walk. Need to travel is reduced further by creating walkable neighbourhoods and a co-located mix of uses, including equitable and inclusive access to green infrastructure. Another key way to support low carbon mobility will be through shared mobility provision, such as electric car clubs.

Types of transport measures included in the proposed development include:

- Roads will promote a low car mode share, where the principle of 'living streets' is applied.
- A mobility hub is also proposed within the Proposed Development, in the vicinity of the Local Centre. It is envisaged that the mobility hub would include bus stops, cycle parking, EV charging spaces and car club spaces
- A range of new and improved public transport networks are included (e.g. new bus route, community bus service and increased frequency of buses on the existing S3 bus route).
- Sustainable travel to and from the Site will be further encouraged through the Framework Site-Wide Travel Plan.

The illustrative masterplan also proposes a central spine road linking from the A44, enhancing connectivity and access to public transport, which it is anticipated would run through the development at a high frequency, linking the development to Kidlington, Oxford and Woodstock / Blenheim Palace.

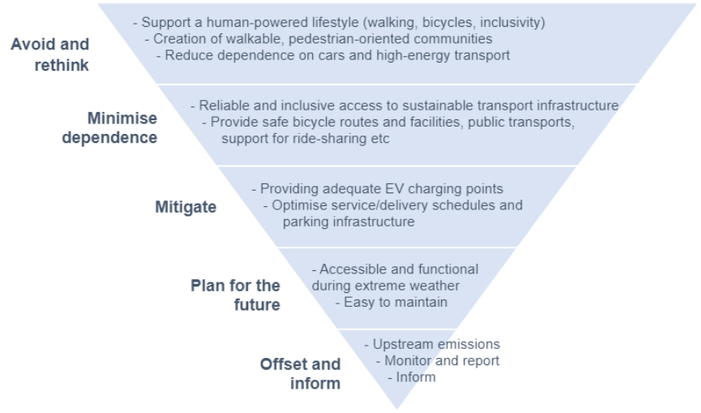


Figure 4—6 Transport hierarchy applied for the Proposed Development

4.7 Flooding

The majority of the Site falls within Flood Zone 1, with areas along the northern and eastern boundaries in Flood Zones 2 and 3 associated with Rowel Brook and the Oxford Canal. The majority of Site is at very low risk of surface water flooding. The areas at risk are associated with drainage ditches in the south and east of the Site, and land adjacent to Rowel Brook. Fluvial flood extents have been confirmed by detailed hydraulic modelling.

The development is designed to be resilient to flooding and has been tested against 26% and 41% climate change scenarios. For further information, see the Flood Risk Assessment report.

4.8 Sustainable Drainage Systems (SuDS)

Sustainable drainage for Begbroke Innovation District is envisaged to use natural conveyance where possible and has formed a key part of the design process early on, as required in the Cherwell Residential Design Guide SPD and Cherwell District Council ESD Policy 7. Furthermore, the illustrative masterplan has been influenced by a number of Building with Nature principles, taking opportunities to create multifunctional green and blue infrastructure addressing flooding, but also acting as amenity space in areas and defining active travel routes in others.

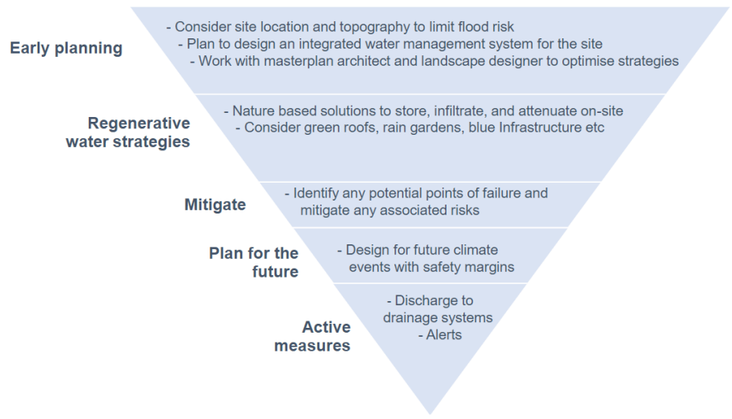


Figure 4—7 SuDS hierarchy applied for the Proposed Development

The LLFA have advised that discharge from the development into local watercourses should not exceed current greenfield runoff rates. The Surface Water Drainage Strategy uses the design hierarchy, outlined in Figure 4—8, to achieve this as follows:

- Improved water quality – this will be achieved by water capture by permeable and impermeable paving and roofs before conveying into infiltration basins above and below ground.
- Resilience to storm events – all storm events up to the "1 in 100 year +40% climate change event" have been allowed for and are proposed to be attenuated on-site and discharged at greenfield runoff rates. Infiltration is promoted, where possible, to reduce discharge of surface water from the Site.
- Bioretention systems and rain gardens – these small, landscaped areas can reduce runoff rates while naturally filtering runoff through vegetation, improving its quality and thus the water quality of local water courses where there is discharge from the Site.
- Swales – these low flow, linear vegetated strips are used to attenuate water during storm events, helping to remove pollutants, and also as a key piece of green / blue infrastructure with properties to support habitats in the correct conditions.
- Rainwater attenuation basins – these open water features could be proposed for additional capacity to accommodate future scenarios including exceedance events, as well as a wetland habitat and blue infrastructure feature.
- Rainwater attenuation (below ground) – tanks which can be useful in attenuating flows, released either via infiltration or into a public sewer if appropriate.
- Permeable paving – these hard surfaces allow rainwater to pass through them to be treated and stored in the sub-base aggregate below, where it will be attenuated and slowly discharge into the next stage of the sustainable drainage system. The extent of permeable paving will be defined at detailed design stage.

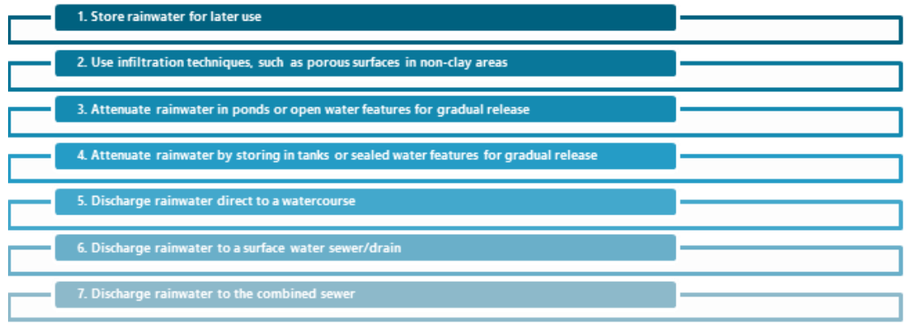


Figure 4—8 Surface Water Drainage Strategy design hierarchy

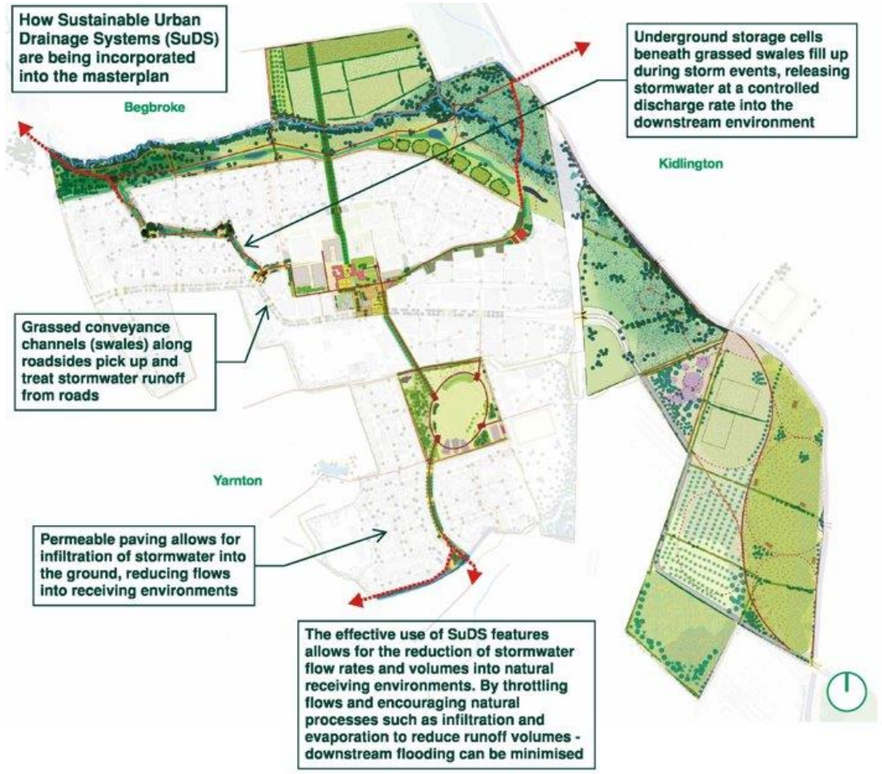


Figure 4—9 Water management for Begbroke Innovation District

The strategic surface water drainage design will be adapted to accommodate the surface water arising from increased rainfall due to climate change within attenuation and non-critical landscape areas. A surface water drainage network is proposed for adoption along adopted highways which will include swales that capture run off from the road, as well as pits and pipes capturing surface water runoff from highways as well as piped discharge from plots.

The following design criteria will be adhered to in accordance with the relevant guidance where deemed reasonably practicable:

- Peak flow control - Limit discharge rates for rainfall events up to and including the 1 in 100-year event (including climate change allowances) to the agreed QBAR rate (or 2l/s/ha whichever is greater) and 1 in 1 year event to the corresponding green field event.
- Volume control - Where reasonably practicable, for greenfield runoff development, the runoff volume from the development to any highway drain sewer or surface waterbody in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.
- Flood risk within the development –
    - Surface water will be confined to the drainage system in a 1 in 30-year (+25% CC) rainfall event.
    - The proposed buildings on-site will be protected from flooding in the 1 in 100-year (+40% CC) events.
    - Exceedance in the 1 in 100-year rainfall events is to be managed in exceedance routes that minimise the risks to people and property.

4.9 Water

Sustainable use of water and water security are key issues set against a backdrop of growing demand and an increase in extreme weather events due to climate change, such as droughts. The Cherwell District Council ESD Policy 3 requires a maximum water use of 110 l/p/d, with the Cherwell Residential Design Guide SPD requiring mains water use in homes to be minimised. The strategic water infrastructure has been designed on the basis of achieving these targets.

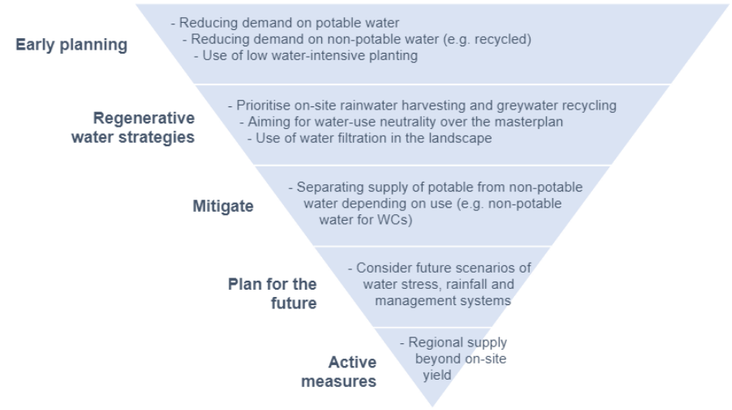


Figure 4—10 Water management hierarchy applied for the Proposed Development

The proposed potable water strategy, which has been discussed with Thames Water, keeps potable water use to a minimum by addressing the following:

- Initial potable water demand calculations for residential buildings are limited to 95 l/p/d through measures such as low flow fittings and on-plot rain water harvesting.
- Potable water demand for commercial buildings and lab-enabled spaces kept to the absolute minimum, with an aspiration to target <13 l/p/d at detailed design stage, with non-potable water demand being met by rainwater harvesting.

Opportunities have been considered for green / blue roofs on appropriate typologies, as well as grey water capture, cleaning and reuse. The use of these approaches would be further developed as part of building design strategies for the masterplan. Blue/Green roods restrict the rate that water runs off from a building into storm drains or natural watercourses after a downpour, thus minimising the impact on water quality, biodiversity, and flooding. Greywater capture also serves to minimise dependence on potable water sources.

Sensitive landscaping and planting choices (see Ecology) will reduce the need for irrigation, though opportunities for rain water harvesting will provide a water source for irrigation.

The management and use of rain water is part of both the surface water flow management (SuDS) proposals and the potable water management plans.

4.10 Waste

The Proposed Development will look to implement the waste hierarchy of prevent, reuse, recycle, recover and, finally, dispose. In line with this, the Proposed Development will prioritise measures that look to reduce waste generation through the design process. Opportunities to design out waste have been investigated and will potentially be integrated as the project develops, with several potential options outlined in the section that follows.

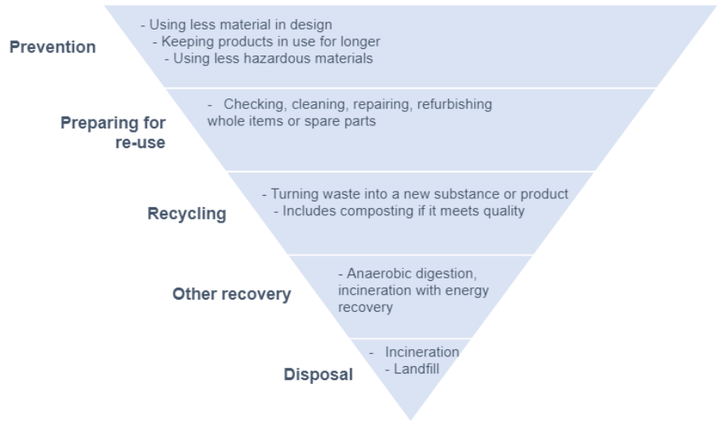


Figure 4—11 Waste hierarchy applied for the Proposed Development

Consultation has been undertaken with the Waste Officer at Cherwell District Council (CDC) between November 2022 and February 2023. A number of options have been considered for managing waste in residential areas, in alignment with Begbroke Innovation Campus CDC requirements. The following outputs have been agreed the Cherwell Waste Officer:

- Waste generation rates and composition for residential and commercial properties.
- Waste segregation and the collection frequencies for different waste streams.
- As outlined in the OWMS (Operational Waste Management Strategy), developers should provide 330 litre home composters for properties at their own cost for residential areas.
- Food waste collection in flats will use 140 L food bins.
- Commercial waste collection service can be provided by the Council.
- Waste collection vehicle specifications, to inform design.
- Waste collection processes and design considerations e.g., maximum bin drag distances.

The OWMS states that, for commercial uses, bins or compactors may be utilised. This would be determined at detailed design stage.

4.11 Air Quality

The overarching air quality strategy for the Site is to minimise air pollutant emissions associated with the construction and operation of the Proposed Development, whilst ensuring that Site occupants will not be exposed to unhealthy levels of air pollutants. This is done through strategic siting of sensitive receptors and implementation of mitigation where necessary. The illustrative masterplan design had been influenced from an early stage by a number of sustainability frameworks, including WELL Community, which includes air quality standards. Outcomes include the planting of street trees and landscape buffers, as well as avoiding development besides areas of poorer air quality, such as the A44.

Mitigation measures should follow the IAQM mitigation hierarchy by giving priority to designing out any potentially significant effects by separating receptors from pollution sources as far as practicable. Where it is not possible to reduce negative impacts to an acceptable level, it may be necessary to consider compensatory offset measures.

4.12 Noise and Vibration

Measures will be undertaken during the construction and post construction phases in order to minimise disruption and manage construction noise and, where applicable, vibration impacts of the Proposed Development. Prior to construction, a Construction Environment Management Plan ('CEMP') will be agreed with the Local Planning Authority containing measures to minimise environmental impacts during this phase. It is assumed that a Noise & Vibration Management Plan would be required post-planning, which would detail mitigation measures.

Noise and vibration mitigation measures included in the outline CEMP are as follows:

- Selection of appropriate equipment and construction methods, i.e., hydraulic plant will be used in preference to pneumatic plant where possible.
- Plant and equipment will be maintained in good working order and fitted with silencers and acoustic panels where appropriate.
- All plant will be switched off when not in use or throttled down between periods of use.
- Acoustic enclosures and temporary hoardings/screens will be used where required.
- Works will take place during agreed Site hours and there will be appropriate management of working hours for noisier tasks.
- 'White noise' type reversing warnings should be used on mobile plant in preference to 'bleepers' in order to minimise intrusion.
- Site personnel instructed on the masterplan to reduce noise and vibration as part of their Site induction training and as required prior to specific work activities.
- Liaison with residents in advance of works commencing and on an ongoing basis to provide information regarding the programme.
- Plant to be located as far as reasonably practicable from noise-sensitive receptors.

Measures to mitigate noise impacts post construction are as follows:

- The Proposed Development includes buffer zones of 10m to major infrastructure sources to aid in mitigating noise impacts. This is reflected in the Parameters Plan – Development Zones drawing and in the Development Specification.
- Noise barriers are proposed at proposed school sites to mitigate noise from the railway.

4.13 Certifications

Cherwell District Council ESD Policy 3 requires that non-residential buildings target BREEAM Very Good. This outline planning application will commit to this and targets above this standard. During the outline planning stage, nothing has been done which would undermine the position of achieving BREEAM certification. Going further than this, the illustrative masterplan design has been influenced and developed with a number of other sustainability frameworks:

- BREEAM Infrastructure has been used to support decision making on matters such as flood attenuation / SuDS design and the mobility strategy.
- WELL Community has been used as a framework to support decision making on matters such as acoustics and noise for residents, light pollution and proximity / equitable access to community facilities and amenity space. There are a number of areas within the WELL Community standard where there is overlap with Building with Nature.
- Building with Nature has also been used to heavily influence the illustrative masterplan design, supporting decision making for green and blue infrastructure, flood water attenuation, multifunctional and connected spaces, and climate resilience.

Additionally, the design of buildings at this stage has been influenced by a number of other sustainability frameworks. The Cherwell Residential Design Guide SPD requires illustrative masterplans to consider the potential of Passivhaus for buildings. Passivhaus principles will be adopted for housing during design and construction to focus on performance based outcomes.

4.14 Sustainability strategy commitments

Table 4—1 Summary of Sustainability commitments

Ambitions	
• Deliver Net Zero buildings in operation • Support the circular economy by reducing reliance on finite materials • Regenerate the landscape and radically increase biodiversity • Prioritise pedestrians and cyclists, supporting a modal shift away from private car use • Foster wellbeing and inclusivity • Equitable access to housing, education and employment • Designed to certifiable standards	
Operational Carbon Measure	**Suggested Design Response**
Net Zero operational regulated carbon	Commitment to achieve Net Zero Carbon in operation for all buildings (Draft Local Plan – Core Policy 39).
Ecology Measure	**Suggested Design Response**
Biodiversity Net Gain (BNG)	Commitment to achieve a minimum of 10% BNG, with an aspiration to achieve 20% (Environment Act (2021), ESD Policy 10).
Landscape character	Commitment to restore and enhance local landscape character (ESD Policy 13).
Protect and enhance Oxford Canal	Commitment to protect and enhance character of Oxford Canal as an amenity and leisure facility (ESD Policy 16).
Transport Measure	**Suggested Design Response**
Reduce reliance on cars	Commitment to reduce reliance of cars by focusing design on pedestrian and cycle movement, walkable neighbourhoods and a co-located mix of uses, including equitable and inclusive access to green infrastructure, reducing the need to travel (ESD Policy 1).
Flooding Measure	**Suggested Design Response**
Flood resilience	Commitment to flood resilience measures (ESD Policy 6): • Designed to be resilient to flooding, with flood modelling to account for 26% and 41% climate change scenarios. • Surface water will be confined to the drainage system in a 1 in 30-year (+25% CC) rainfall event. • Proposed buildings on-site will be protected from flooding in the 1 in 100-year (+40% CC) events. • Limit discharge rates for rainfall events up to and including the 1 in 100-year event (including climate change allowances)
SuDS Measure	**Suggested Design Response**
Incorporate sustainable drainage systems (SuDS)	• Commitment to incorporate SuDS to reduce flood risk and pollution, while also providing landscape and wildlife benefits (ESD Policy 7). • Commitment to maintain or enhance water quality (ESD Policy 8).
Water Measure	**Suggested Design Response**
Protection of the Oxford Meadows SAC (ESD 9)	Commitment to avoid adverse impacts to quality and quantity of water in local watercourses during construction phase.
Reduce potable water use	Commitment to limit water use to 110 l/p/d (ESD Policy 3, Cherwell Residential Design Guide SPD)
Waste Measure	**Suggested Design Response**
Resource efficiency	Commitment to increase resource efficiency (ESD Policy 1).
Certifications	**Suggested Response**
BREEAM Very Good for non-residential buildings	Commitment to achieving BREEAM Very Good for non-residential buildings, with aspiration to go above this (ESD Policy 3).
Demonstrate sustainable design and construction best practice	Decision-making has been supported by best practice and standards including BREEAM Infrastructure, WELL Community and Building with Nature (ESD Policy 3).

5 Energy

5.1 Overview

The following section describes the energy strategy intention for the proposed Begbroke Innovation District based on a benchmarking exercise of similar typologies and in line with the energy hierarchy: Lean, Clean, Green, Seen described in the adopted Cherwell Local Plan and Core Policy 38 of the Draft Cherwell Local Plan 2040. Reference is made to the illustrative masterplan to demonstrate how the principles put forward in this framework energy strategy could be delivered on the Site as part of the benchmarking study.

Detailed proposals made through later planning submissions may differ from the illustrative material shown, but the overarching strategy will be adhered to in order to ensure that Begbroke Innovation District meets its operational net zero targets. This has been carried out principally for the residential component of the Proposed Development only, but would apply equally to the non-residential components.

This approach aims to minimise the energy consumption from the outset with low energy, passive measures, and highly efficient systems before the deployment of low and zero-carbon technologies.

Figure 5—1 and Figure 5—2 give a first indication of the methodology aligning with the energy hierarchy. The methodology applies to the regulated carbon emissions associated with the Proposed Development with an estimate of the unregulated emissions presented as well, as required by local planning policy.

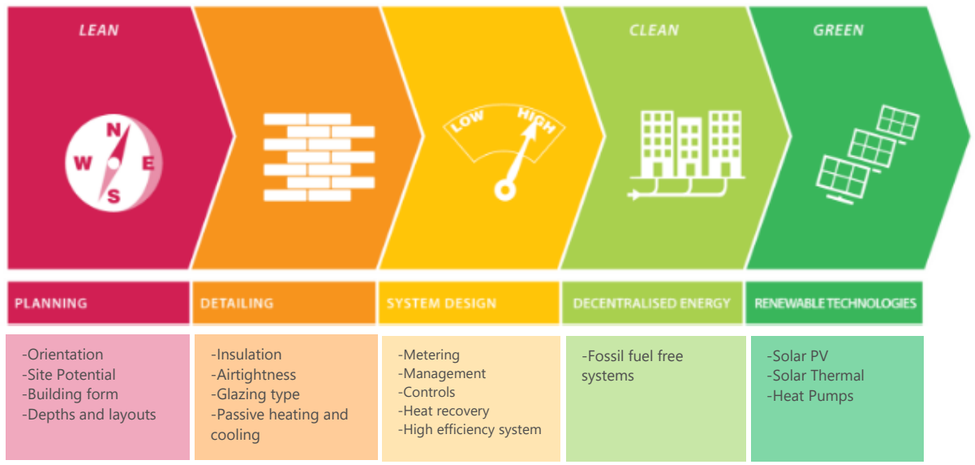


Figure 5—1 Lean, Clean, Green principles in line with adopted and upcoming draft Cherwell Local Plan

A decentralised, all electric heating and cooling strategy will be adopted to serve both residential and non-residential buildings. An 'all-electric' approach would achieve net zero-carbon emissions from operational energy use when used in conjunction with on and off-site renewable electricity sources.

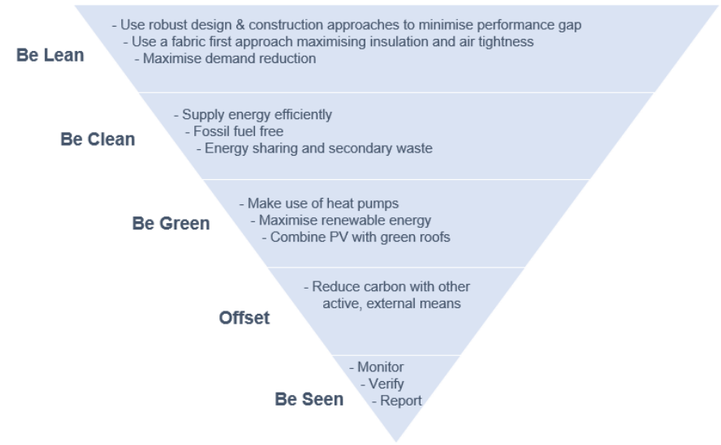


Figure 5—2 Energy hierarchy applied for the Proposed Development

5.2 Benchmark Study – Domestic Areas

A benchmarking study of similar typologies (based on performances from typical Studios / 1Beds, 2 Beds, 3 Beds, 4+Beds Flats and Houses) has been undertaken in line with the energy hierarchy: Lean, Clean, Green, Seen to estimate the performance of the residential units of the Proposed Development against the local and regional requirements.

The latest methodology of Standard Assessment Procedure (SAP 10.2) was followed, with the online Design SAP 10 by Elmhurst Energy used to assess the energy and fabric performance of the assumed 1,800 residential units of the Proposed Development.

A summary of modelling assumptions and intentions of the project is included within the following table:

Table 5—1 Summary of modelling assumptions through the energy hierarchy – domestic buildings

	Model assumptions and inclusions
Baseline – Building Regulations Notional Development (as generated by Part L software)	Building Emission Rate / Target Emission Rate (BER / TER) is modelled as a reference 'compliant' building, with the following features: Domestic Areas: - Notional fabric and glazing areas - Heat generation via individual gas boilers with performance matching the notional
Lean - Energy efficiency measures applied	Improved energy efficient model, with the following features: **-Fabric-first approach in line with Passivhaus principles** aiming for improved U-values, low air permeability and reduced linear thermal bridging. **-Energy efficiency measures** as required to aim for a Part L Fabric Energy Efficiency metric of no more than 15- 20kWh/m^2/year (based on draft Local Plan 2040). -All showers connected to a **WWHR system.** **-Mechanical Ventilation** via **MVHRs** **-Low Energy Lighting**
Clean – Supply Energy Efficiently	- A site wide district heating network not proposed due to low density of heat demand. Heat networks can demonstrate benefits where heat is generated centrally with highly efficient plant and distributed to buildings within the vicinity. However, distribution losses in these systems are typically very high and, for a low-density development such as Begbroke, are likely to entirely outweigh any benefit that would be realised from generating heat centrally. Heat networks can be beneficial where there is a source of waste heat present which can be uplifted at greater efficiency than generating heat locally. The operational benefits of a network would need to be weighed up against adverse impacts, such as network losses, efficiency, and ease of expansion.

	-Heating generated from localised heat pumps with high efficiency (benefits from ASHPs accounted within this stage for separate benefits via PVs on Be Green).
Green -Renewable Energy Technology	-Maximised renewable energy via PVs -Smart energy management systems.
Be Seen	Post-construction monitoring, verification and reporting

5.3 Baseline CO_2 Emissions

For the domestic areas of the Proposed Development, the baseline CO_2 emissions have been estimated based on the benchmarking study modelling, following the assumptions set out in Table 5—1.

The baseline (i.e. target) CO_2 emissions of the Site (TER) are derived from the models with the final proposed building specification (Be Green Stage), which includes low carbon and renewable energy sources.

5.3.1 Baseline Unregulated Carbon Emissions

Domestic Unregulated emissions from the use of electrical appliances and cooking are estimated in SAP methodology as outlined in Appendix L of The Government's Standard Assessment Procedure for Energy Rating of Dwellings (SAP 10.2). They are based on the treated floor area and are assumed not to change between each stage of the energy hierarchy.

It's worth noting that the Proposed Development will aim to follow high sustainability credentials such as net-zero carbon commitments in line with UK Green Building Council (UKGBC), considering both regulated and unregulated emissions.

Table 5—2 Estimated sitewide unregulated carbon emissions using 10.2 carbon factors – domestic buildings

Typology	Unregulated Carbon Emissions	
	Tonnes CO_2/year	kg CO_2/m^2/year
Domestic - Sitewide	944.9	6.1

5.3.2 Baseline Regulated Carbon Emissions

The table below summarises the predicted baseline carbon dioxide emissions for the domestic areas of the Proposed Development in line with Part L 2021:

Table 5—3 'Baseline' predicted carbon emissions (using SAP 10.2) – domestic buildings

Typology	Baseline Regulated Carbon Emissions	
	kg CO_2/year	Tonnes CO_2/year
Domestic - Sitewide	1,814,800.6	1814.8

5.4 Energy Demand Reduction– "Lean"

5.4.1 Passive Design

This section discusses the passive design measures and intentions for the residential areas of the Proposed Development, aiming to reduce energy and cooling demands through energy efficiency measures alone and meet the required fabric energy efficiency targets.

In order to provide healthy and comfortable homes, it is imperative to minimise heating and cooling demands as much as possible through a fabric-first approach at first. All buildings on the illustrative masterplan should be designed following Passivhaus principles (as encouraged also by Cherwell Residential Design Guide SPD) to enable improved performance and drive a reduction in the performance gap.

As a first step, efforts have been taken to optimise the design of all dwellings at an illustrative masterplan level. As shown in Figure 5—3 below, key principles relevant to building orientation, spacing, road layout, landscaping/wind buffer, building form factors and Passivhaus principles have been set out:

- Where possible, dwellings are oriented up to 30° due south to enable optimum annual solar gains.
- Where possible, roads are aligned to support southern orientation of dwellings, as well as to enable access but promote pedestrian and cyclist priority.
- Street planting and areas of landscaping/tree cover to mitigate effects of wind, noise, sun exposure and air quality.
- Ample spacing is allowed between dwellings to prevent overshadowing.
- A low form factor and compact envelope is proposed throughout to minimise heat loss.
- The majority of dwellings have openings/facades on opposite sides for increased ventilation and maintenance of adequate internal comfort temperatures.

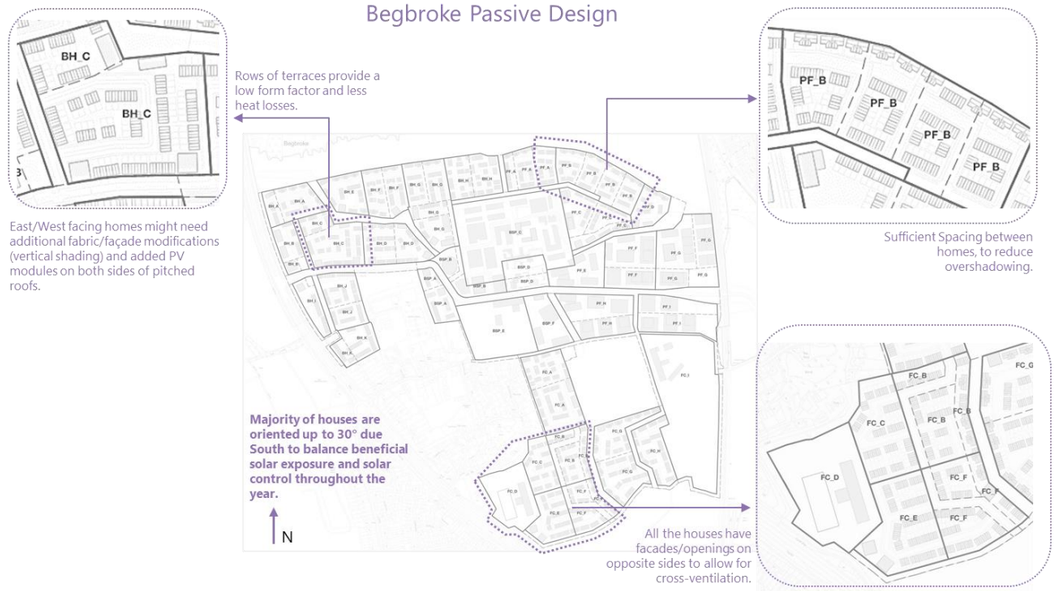


Figure 5—3 Optimised early Begbroke Innovation District site layout implementing passive design principles

Several fabric and services improvements would be incorporated to provide energy-efficient homes. Measures such as best practice u-values, along with ambitious low air-permeability rates and commitments to reduced thermal bridging across junctions are proposed to reduce the heat losses throughout the building envelope. A reasonable window to wall area ratio will be maintained while for all the residential units highly efficient mechanical ventilation with heat recovery systems (MVHRs), wastewater heat recovery systems to recover heat energy from all showers along with 100% energy efficient lighting are proposed.

The recommended fabric and building services specifications are summarised in the following tables and compared with the reference building requirements from Part L 2021. These proposed values have been used to estimate the energy demand and subsequent carbon emissions reduction of the "Be Lean" stage of the hierarchy.

5.4.2 Lean Fabric and System Improvement

Table 5—4 Proposed Fabric Performance for Domestic areas of Begbroke Innovation District

Building Element	Begbroke Innovation District – Domestic areas	Notional Building Part L1 2021
External Wall U-value	0.13 W/m^{2}K	0.18 W/m^{2}K
Floor U-value	0.1 W/m^{2}K	0.13 W/m^{2}K
Roof U-value	0.1 W/m^{2}K	0.11 W/m^{2}K
Glazing U-value	0.7 W/m^{2}K	1.20 W/m^{2}K
g-value	0.6	0.63
Air Permeability	1 m^3/m^{2}hr	5 m^3/m^{2}hr
Thermal Bridging	Aiming for Passivhaus principles wherever possible. Current study assumed a combination of default and proposed independently assessed psi-values for each junctions.	Reference values of psi for junctions (or y value= 0.05 if lengths not specified)

The proposed building services used in SAP modelling (10.2) and following Part L1 compliance are set out in Table 5—5.

Table 5—5 Proposed Domestic Building Services Specification

Element	Value	Notes
Ventilation Specific Fan Power (SFP)	0.62 W/L/s 0.62 W/L/s 0.66 W/L/s	Values provided are from SAP Product Characteristics Database (PCDB) for Kitchen +1 wet rooms, Kitchen +2 wet rooms, Kitchen +3 wet rooms (equivalent system to Nuaire MRXBOXAB-ECO4)
Waste Water Heat Recovery System (WWHR)	10 l / min	Connected to a system such as Recoup.
Lighting	100 %	Energy efficient lighting to be specified, Minimised LEL fittings with appropriate controls.

5.4.3 "Lean" Carbon Emissions

The table below presents the predicted baseline and lean regulated carbon dioxide emissions in line with Part L 21:

Table 5—6 Predicted Lean carbon emissions for the domestic areas of the Proposed Development (using SAP 10.2 carbon factors)

Typology	Baseline Regulated Carbon Emissions		Lean Regulated Carbon Emissions		
	kg CO_2/year	Tonnes CO_2/year	kg CO_2/year	Tonnes CO_2/year	% Improvement over Baseline
Domestic - Sitewide	1,814,800.6	1814.8	1,379,039.5	1,379.0	24.0%

5.4.4 Fabric Energy Efficiency Standards

In line with the Part L 21 criteria for the minimum fabric energy efficiency standards, it is expected that the proposed energy efficiency measures would enable compliance with the target fabric energy efficiency rates set by the notional building with a buffer of about 29.9% overall:

Table 5—7 Predicted Sitewide Fabric Energy Efficiency Rate in line with Part L 21 – Domestic buildings

	DFEE (kWh/m^2/yr)	TFEE (kWh/m^2/yr)	Improvement (%)
Domestic - Sitewide	27.2	38.8	29.9%

5.5 Heating Infrastructure – "Be Clean"

The strategy for the Begbroke Innovation District recognises that an all-electric servicing strategy as a suitable approach to achieve compliance with the emerging Future Homes Standard and Future Building Standards. Investigations have concluded that the density of the Proposed Development is not conducive to the effective or efficient deployment of a sitewide heat network. However, opportunities for energy sharing and recovering, electric batteries and other forms of energy storage, alongside demand management, will be explored to add resilience to the strategy and reduce the carbon emissions, by diversifying energy demand away from peak times and maximising the proportion of any renewably generated energy which is consumed on-site. Research has shown that the carbon intensity of electricity varies by 32% throughout the day on average and over 50% on the coldest winter days. Energy storage enables the demand during highest carbon periods to be avoided, meaningfully reducing carbon emissions. These options are not yet included in the energy modelling so there is no reduction in emissions at the Be Clean stage.

Air source heat pumps	Ground and Water source heat pump	Electric Boilers	Gas Boilers	Centralised system	Electric panel heaters and electric DHW	Solar PV	Solar Thermal	Heat Recovery
Air source heat pumps extracts energy from the air at efficiency COPs up to 3.0, 2.4 and 4.0 for heating, hot water and cooling. This will substantially reduce the carbon emissions for the proposed developments.	GSHPs and WSHPS operate in much the same way as ASHPs, using water as the source of energy. Typically have higher efficiencies but they come with more complex requirements as well as large spatial requirements.	Electric boiler are considered as green technology due to grid decarbonisation. However, they have low efficiency when compared with ASHPs and GSHPs. They incur high utility bills for future users.	Although there is no gas boiler 'ban' in 2025, but regulations such that fossil fuel heating will not achieve compliance, therefore, gas boilers will not be considered for proposed development.	Heat networks can demonstrate benefits where heat is generated centrally with highly efficient plant linked to nearby waste heat sources and distributed to buildings within the vicinity. If heat offtake opportunity arises within vicinity of the masterplan, the centralised system could be investigated further.	Similar to electric boiler, they have low efficiency when compared with ASHP and GSHP. They incur high utility bills for future users.	PV panels can be used to generate electricity from the sun. This energy can be exported back to the National Grid or directly used on site when there is demand. Rooftop PV opportunities has been explored for the masterplan. The masterplan or nearby fields have potential for ground mounted PV.	Solar thermal panels can be used to meet a proportion of a building's thermal demand renewably. However, PV systems are much simpler and require minimal maintenance, unlike solar thermal systems which are complex and require regularly inspection.	Maximising heat recovery across the site where possible. This includes the base and enhanced ventilation systems with heat recovery as well as utilising heat recovery heat pumps where possible.

Figure 5—4 Technology appraisal for the Proposed Development

Figure 5—4 sets out the technologies considered for the Proposed Development. Air source heat pumps, Solar PV and heat recovery systems are the confirmed technologies. Gas boilers and electric panels are discounted. The remaining technologies will be further considered during the next stage of the design.

5.5.1 "Clean" Carbon Emissions

The table below presents the predicted baseline and clean regulated carbon dioxide emissions in line with Part L 21:

Table 5—8 Predicted Clean carbon emissions for the domestic areas of the Proposed Development (using SAP 10.2 carbon factors)

Typology	Baseline Regulated Carbon Emissions		Clean Regulated Carbon Emissions		
	kg CO_2/year	Tonnes CO_2/year	kg CO_2/year	Tonnes CO_2/year	% Improvement over Baseline
Domestic - Sitewide	1,814,800.6	1,814.8	539,887.9	539.9	70.3%

5.6 Renewable Energy – "Be Green"

5.6.1 Photovoltaic Panels (PV Study)

The opportunity for on-site photovoltaic generation has been assessed in accordance with OUD's sustainability and carbon targets. Rooftop mounted panels offer the potential for renewable generation without occupying any of the Site's undeveloped ground area, which has important ecological and urban greening uses. A high level study of available roof is presented in table below. This is an initial estimate and subject to change during later stages of design.

Table 5—9 High level rooftop PV study – domestic buildings

Total roof area (m^2)	Available roof area for PV (m^2)	Total roof space PV utilisation	Installed PV capacity (MW)	Annual generation (GWh)
216,000	95,000	44%	18.9	19.2

5.6.2 "Green" Carbon Emissions

The table below presents the predicted baseline and green regulated carbon dioxide emissions in line with Part L 21:

Table 5—10 Predicted Green carbon emissions for the domestic areas of the Proposed Development (using SAP 10.2 carbon factors)

Typology	Baseline Regulated Carbon Emissions		Green Regulated Carbon Emissions		
	kg CO_2/year	Tonnes CO_2/year	kg CO_2/year	Tonnes CO_2/year	% Improvement over Baseline
Domestic - Sitewide	1,814,800.6	1814.8	270,139.1	270.1	85.1%

5.6.3 "Green" Predicted Energy Demand

The table below summarises the predicted green energy demand of the Proposed Development:

Table 5—11 Predicted Green energy demands for the residential units of the Proposed Development (based on indicative sample houses)

Typology	Green Energy Demand (kWh/ year)					
	Space heating	Hot Water	Cooling	Auxiliary	Lighting	Unregulated Energy
Domestic - Sitewide	315,893	3,214,410	0.0	420,014	368,518	6,947,999

5.6.4 Energy Hierarchy Conclusions

The Lean, Clean, Green and Seen analysis results have been collated in the format required for the outline planning submission. The following sections illustrate the carbon emissions savings of the domestic areas of the Proposed Development (based on the benchmarking study that uses the illustrative masterplan) following the energy hierarchy.

Through following a fabric-first approach (following Passivhaus principles) and energy efficiency measures resulting in increased demand reduction, connecting to highly efficient localised (houses) or centralised heat pumps (flats) along with maximising opportunities for roof-mounted Solar PV Panels, the residential units of the Proposed Development could achieve an on-site 85.1% reduction in CO_2 emissions over Part L 2021 baseline figures.

The residential units are estimated to achieve a reduction of approximately 70% before the additional benefits of the PV panels, therefore meeting and substantially exceeding the draft target of 63% outlined within Core Policy 39 of Cherwell District Council draft Local Plan 2040.

Any remaining regulated carbon emissions would need to be offset either through a cash in lieu payment to Cherwell District Council or through alternative proposed and agreed off-site measures.

Finally, as the applicant has high sustainability ambitions for a net-zero development including both regulated and unregulated emissions, an indicative estimation of the offset payment related to the unregulated emissions is presented in Table 5—12.

Table 5—12 Predicted Carbon Dioxide Emissions savings and off-set payments for the Proposed Development in line with Part L 21 (regulated emissions) – domestic buildings

	Total Regulated Emissions	CO_2 savings	Percentage savings
	(Tonnes CO_2 / year)	(Tonnes CO_2 / year)	(%)
Part L 2021 baseline	1814.8	-	-
Be Lean	1379.0	435.8	24.0%
Be Clean (ASHPs)	539.9	839.2	46.2%
Be Green (Solar PVs)	270.1	269.7	14.9%
Total Savings	-	1,544.7	**85.1%**
		CO_2 savings for off-set payment (Tonnes CO_2)	
Cumulative savings for off-set (30 years)	-	8,104	-
Cash in-lieu contribution (£)*	-	**£769,897**	-

*Carbon price is based on a figure of £95 per tonne of carbon dioxide unless confirmed otherwise with the Local Planning Authority of Cherwell. All figures presented are subject to change as part of ongoing energy strategy development.

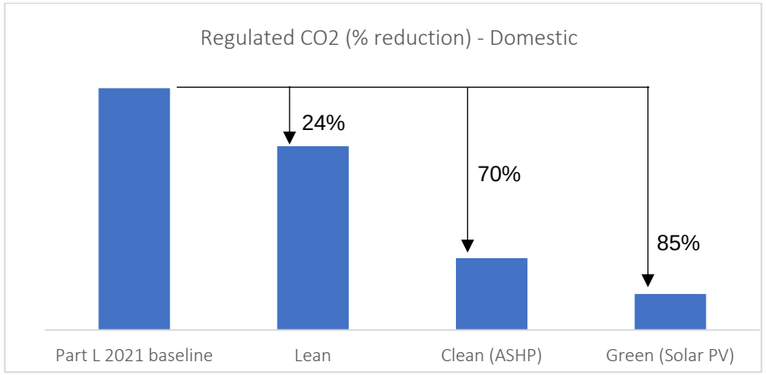


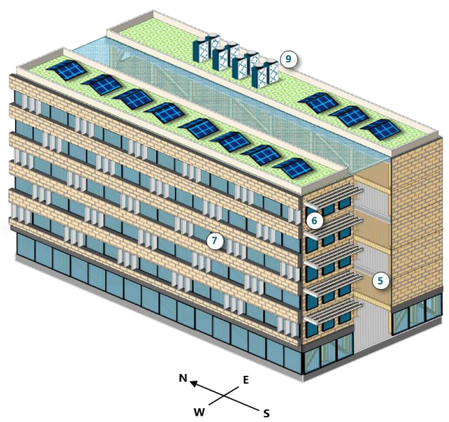
Figure 5—5 Predicted regulated CO_2 emissions reductions of the domestic units

Table 5—13 Predicted Unregulated Carbon Dioxide Emissions and off-set payment for a net-zero development – domestic buildings

Unregulated Residential Carbon Dioxide Emissions (1,800 Dwellings)	
Total tonnes CO2 per annum	945
Cash in-lieu contribution (£) for unregulated for 30 years, based on 95	2,693,044

5.7 Non-domestic design principles

At the time of writing this planning statement the detailed area schedule for non-domestic buildings is not yet confirmed so a benchmark study could not be carried out in a similar way to the residential buildings. It is worth noting however that a similar methodology in line with the energy hierarchy as described in the previous sections would be followed for the non-residential areas of the Proposed Development. Illustrative principles are given below.



- Fabric U-values meeting and/or bettering Part L 2021
- Passivhaus design principles to reduce performance gap
- Reduced glazing areas on southern elevations
- Shading to minimise unwanted solar gains
- Dual aspect spaces with atriums where feasible
- Maximise natural light - light sensors along perimeters
- Use of natural and/or mixed mode ventilation where feasible
- Heat pumps for heating and cooling and separate DHW systems – depending upon demand
- Avoid systems with high refrigerant usage
- Larger ducts/pipes & reduce distribution wherever possible. Reducing fan/pump power and system losses
- Systems zoned and controlled by space use
- Roof top renewable energy (solar photovoltaics)

Figure 5—6 Non-domestic design principles

5.8 Energy strategy commitments

Table 5—14 Summary of Energy commitments

Ambitions	
• Residential buildings to achieve ~85% improvement on Part L (2021) baseline. • 'Lean' – improve energy efficiency through passive design and energy efficiency measures • 'Clean' – supply energy efficiently • 'Green' – maximise renewable energy generation • Design buildings to Passivhaus standard, addressing RIBA 2030 and LETI guidance	
Passive Measure (Lean)	**Suggested Design Response**
Orientation	• Occupied spaces to the northern or southern side of buildings to avoid overheating from low angle solar gains during summer months. • Buildings to self-shelter from prevailing winds to reduce infiltration losses.
Massing and form	• Reducing/efficient form factor (e.g. terraces) to minimise heat loss.
Passive solar design	• Reasonable window to wall area ratio will be maintained for all the residential units.
Shading	• Spacing between buildings to avoid overshadowing.
Daylighting	• Maximise daylight entering the building and drive natural ventilation systems by positioning intakes and out-takes suitably to windward and leeward sides.
Microclimate	• Planting in the public realm (streets, green spaces etc.) provide shade and evaporative cooling, reducing the heat island effect and sheltering from sun and wind.
Minimising heat loss	• Best practice u-values, ambitious low air-permeability rates and commitments to reduced thermal bridging across junctions to reduce heat losses.
Improved air tightness	• All buildings will be designed following Passivhaus principles (as encouraged also by Cherwell Residential Design Guide SPD).
Natural ventilation	• Highly efficient mechanical ventilation with heat recovery systems (MVHRs),
Heat recovery	• Wastewater heat recovery systems to recover heat energy from all showers.
Active Measure (Clean)	**Suggested Design Response**
Heating infrastructure	• All electric infrastructure (no gas) in alignment with Future Homes Standard. • Air source heat pumps (ASHP) • Localised heat recovery networks, where appropriate.
Carbon emissions reduction	• Opportunities for energy sharing and recovering, electric batteries and other forms of energy storage, alongside demand management, will be explored to reduce reliance on energy grid at more carbon-intensive times of day.
Active Measure (Green)	**Suggested Design Response**
Renewable energy	• Rooftop solar PV. • Gas boilers and electric panel heaters discounted.
Carbon emissions reduction	• 100% energy efficient lighting.
Active Measure (Seen)	**Suggested Design Response**
Remaining regulated emissions	• Any remaining regulated carbon emissions to be offset either through a cash in lieu payment to Cherwell District Council or through alternative proposed and agreed off-site measures.
Monitoring and reporting	• Monitor, verify and report post-construction.

6 Summary

6.1 Overview

The sustainability vision for Begbroke Innovation District focuses on a regenerative development which creates positive outcomes for people and planet. Begbroke Innovation District aspires to be a global exemplar of sustainable development which brings people closer to nature.

Building upon OUD's vision for sustainable places, this sustainability statement sets out how the Proposed Development responds to local and national policy. It is structured around twelve sustainability objectives drawing on best practice from the Building with Nature, WELL Community and BREEAM Infrastructure standards as follows:

- Embodied Carbon
- Operational Carbon
- Circular Economy
- Ecology
- Transport
- Flooding
- SuDS
- Water
- Waste
- Air Quality
- Noise
- Certifications

A number of sustainability commitments have been embedded which provide a solid baseline for delivering against the sustainability aspirations for Begbroke Innovation District and OUD. A number of key commitments are summarised as follows, with remaining opportunities and aspirations outlined for further review at the next stage:

Table 6—1 Summary of key commitments

Summary of Key Commitments
• Deliver Net Zero buildings in operation. • Achieve a minimum BREEAM rating of Very Good for non-residential buildings, while targeting Excellent with a pathway to Outstanding. • Achieve a minimum Biodiversity Net Gain of 10%, with an aspiration to go further. • Manage surface water on-site via sustainable methods, limiting runoff to greenfield rates. • Limit water use to 110 l/p/d. • Achieve ~85% improvement on Part L (2021) baseline. • Maximise renewable energy generation. • A circular approach to materials, with an aspiration to obtain ~20% of materials via circular sourcing. • A circular approach to waste, with an aspiration to divert all non-hazardous waste from landfill and ability to reuse ~80% of on-site construction materials. • A circular approach to water, with rainwater capture and reuse. • Implement sustainable travel, prioritising the pedestrian and cyclist where 'the car takes a back seat'. • Promote climate resilience by building capacity into the development to respond to future climate change, overheating and weather extremes with flood modelling to account for 26% and 41% climate change scenarios and 1 in 100 year flood events.

Based on the above, it can be concluded that proposals for Begbroke Innovation District demonstrate a clear strategy to addressing climate change mitigation throughout the whole life of the development, minimising its vulnerability to climate change impacts and implementing regenerative principles to create positive outcomes for people and planet.

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