

# Planning Statement

## Sustainability Statement

### Barrie House

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**Date of current issue:**  
21/09/2018

**Issue number:** 3

**Our reference:**  
2787-Barrie House-Sustainability Statement-  
1809-21ns.docx

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# Executive Summary

## Sustainability Statement

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#### Executive summary

The proposed Barrie House development, located at 29 St Edmund's Terrace, in the London Borough of Camden, comprises the extension of the existing Barrie House development, to provide 9 new residential units over a 4 to 5-storey development (including 1 basement storey), with a total net internal area of approximately 720m<sup>2</sup>.

The scheme will target a reduction in carbon emissions of 19% beyond Part L of Building Regulations 2013, in compliance with The London Plan Policy 5.2, and demonstrate the required level of sustainability in its design, construction and operation.

This Sustainability Statement will be provided as evidence to the local authority of the actions being taken to demonstrate the development's holistic approach to sustainable design and construction. It provides a summary of the contribution that the design will make to creating a more sustainable development, drawing on information provided by specialist consultants and design reports and identifying key features intrinsic to achieving low carbon homes.

Key sustainability features within the development will include:

- A 21.6% reduction over Part L of Building Regulations 2013 following the energy hierarchy as required by the National Policy Planning Framework (NPPF).
- More than 10% reduction in carbon emissions over Part L of Building Regulations 2013 through the use of renewables.
- A water consumption target of 105 litres/person/day through implementation of water efficiency and reuse measures.
- A sustainable materials procurement policy and an efficient waste strategy on site including at least 85% of waste to be diverted from landfill.
- The inclusion of sustainable transport options such as cycle storage and a home office to allow the occupants to work from home.
- Protection and enhancement of ecology on site and the appropriate actions to ensure protected species.
- An emphasis on local supply and labour to encourage employment opportunities and to offer a diverse, self-sustaining environment.

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#### Key sustainability measures:

In summary, the key measures incorporated to meet planning requirements and to achieve a low carbon development address the following key areas of sustainable design and construction:

- **Energy and CO<sub>2</sub>**
  - **Materials and Waste**
  - **Water Management**
  - **Biodiversity and People**
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# Introduction

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#### Sustainability introduction

The design team has significant experience in delivering schemes that are considered highly sustainable, either through application of formal green building rating systems, such as BREEAM as well as applying benchmarks from standards such as Passivhaus Design, and adopting precedents from industry exemplar sustainable developments.

In addition, to reflect the holistic nature of the scheme and to demonstrate the commitment of sustainable development to the London Borough of Camden, the scheme will target a stringent goal to reduce carbon emissions by at least 19.0% (over Part L of Building Regulations 2013), equivalent to Level 4 of Code for Sustainable Homes.

The scheme will also demonstrate its commitment to sustainable development in the following areas:

- Economic** Provision of additional housing in an area of need, and the use of local labour to boost employment.
- Social** Community engagement during development design to ensure the building matches the needs of the local populous. Alleviating fuel poverty in the region as well as the shortfall in new, quality build households is also addressed.
- Ecological** Improvement of foraging sites for bats and birds through introduction of carefully selected planting within the sites and adequate protection of protected and priority species.

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#### Description of development

The proposed Barrie House development, located at 29 St Edmund's Terrace, in the London Borough of Camden, comprises the extension of the existing Barrie House development, to provide 9 new residential units over a 4 to 5-storey development (including 1 basement storey), with a total net internal area of approximately 720m<sup>2</sup>.

The aspiration for the scheme is to significantly improve the existing site and its immediate environment by providing an efficient and inclusive development, which meets the policy recommendations of the London Borough of Camden.

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# Policy Context

## Sustainability Statement

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#### National context: The 2008 Climate Change Act

The UK Government is committed to reducing the UK's carbon emissions by 80% over 1990 levels through the Climate Change Act 2008. Achieving truly sustainable design and construction and forwarding the green agenda within the construction industry across the UK is inherent to meeting these emission targets. This development aims to do both of these.

To help monitor carbon reductions and to plot progress being made for future plans and investments in the UK's low-carbon economy, intermediary targets have been established. The UK is currently in the second of four established carbon budgets, in which a 29% in CO<sub>2</sub> emissions is required by the end of 2017 to ensure that the UK remains on course for meeting the 80% reduction by 2050.

Concurrent with reducing CO<sub>2</sub> emissions by 80% by 2050 is the European Climate Change Policy targets. It sets the objective of ensuring 20% of energy consumption is generated from renewable sources by 2020 whilst also reducing Europe's carbon footprint by 20%. Ensuring a fabric first approach with consideration to renewable energy production fits both the climate change act and the European Commission's 2020 targets for reducing greenhouse gas (GHG) emissions.

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# Policy Context

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#### Local context: Camden Core Strategy 2010

The London Borough of Camden's Local Development Framework (LDF) is a portfolio of documents which together provide a comprehensive local policy framework for the city. The lead document in the LDF, the Camden Core Strategy (CS), includes strategic policies to manage the borough and deliver Camden's future sustainable development.

The CS sets out the vision for the London Borough of Camden, including the following statement relevant to this sustainability statement:

*'Camden will be a low carbon, low waste borough that is an exemplar in terms of sustainable design and transport and will have taken the significant opportunities to expand the use of local heating and power systems... Camden will have a safe and healthy population. Crime and the fear of crime will be reduced and health inequalities across the borough significantly lessened. Walking and cycling will be easier and safer, our already excellent public transport system will be improved, and congestion and high levels of pollution will continue to be reduced.'*

The following CS strategic objectives are relevant to this sustainability statement:

1. To make sure that development in Camden achieves high environmental standards and is designed to adapt to, and reduce the effect of, climate change.
2. To promote high quality, sustainable design and physical works to improve our places and streets and preserve and enhance the unique character of Camden and the distinctiveness of our many conservation areas and our other historic and valued buildings, spaces and places.
3. To reduce the environmental impact of transport in the borough and make Camden a better place to walk and cycle.
4. To reduce, and better plan for and manage, Camden's waste, including by working with our partner boroughs in the North London Waste Authority area.
5. To promote and protect the high levels of amenity and quality of life that make Camden such a popular place to live.
6. To support improvements to the health and well-being of Camden's population and tackle the borough's existing health inequalities.
7. To reduce congestion and pollution in the borough by encouraging more walking and cycling and less motor traffic, and to support and promote new and improved transport links, at King's Cross, St Pancras, Euston, Tottenham Court Road, West Hampstead and elsewhere.

#### **CS Policy 13 Tackling climate change through promoting higher environmental standards**

CS Policy 13 sets out the strategic policy for reducing the effects of and adapting to climate change, encouraging local energy generation and addressing water and surface water flooding. Specific and relevant policy requirements addressed by the development are:

- Minimisation of car travel demand by strategic location of developments;

*(continued on next page...)*

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# Policy Context

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#### Local context: Camden Core Strategy 2010 (continued)

- Efficient use of land and design of buildings to withstand climate change;
- Minimising carbon emissions from developments by implementing the energy hierarchy; 'Be Lean, Be Clean, Be Green';
- Implementation of and connection to local energy networks where feasible;
- Efficient use of water, protection of drainage infrastructure and flood risk mitigation, where required.

#### Camden Development Policies 2010-2025

The Camden Development Policies sets out the detailed planning policies that applications for planning permission are assessed against to achieve the vision and objectives of the CS. The following policies for sustainability are considered in this statement:

##### DP Policy 22 Promoting sustainable design and construction

DP Policy 22 outlines the requirements for incorporating all aspects of sustainability in design and construction. The following specific requirements are provided:

- Use of applicable assessment methodologies, including BREEAM 'Excellent' rating for new non-domestic developments over 500m<sup>2</sup> of internal floor area and standards relating to the Code for Sustainable Homes (CfSH), subsequently withdrawn by the Government. The proposed development is a domestic, new construction type development, therefore there is no applicable BREEAM assessment for the scheme. The CfSH is not now accessible for new schemes, however, certain key requirements including those related to energy, water and waste are transcribed and addressed by this statement;
- Climate change adaptation and resilience measures must be incorporated in new developments, including summer shading and planting, limiting water runoff, reducing water consumption and reducing air pollution. These measures are addressed in their respective sections of this statement.
- Green/brown roofs should be incorporated where suitable. Green/brown roofs are not deemed to be suitable for this scheme, based on the space constraints of the site and the small-scale nature of the scheme not resulting in the economies of scale required for these measures to be effective.

##### DP Policy 23 Water

The Council requires developments to reduce water consumption, the pressure on the combined sewer network and the risk of flooding. The proposed development addresses the following policy requirements:

- Reduction of water consumption through water-efficient sanitaryware fittings and equipment;
- The amount and rate of runoff will not increase as a result of the proposed development, as the impermeable area will not increase from that of the existing site;
- Space constraints of the development mean that there is no viable space to implement a rainwater harvesting system.

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#### Camden Planning Guidance 3 Sustainability

The Camden Planning Guidance (CPG) 3 Sustainability supports the policies in the LDF and forms a supplementary planning document (SPD) for planning decisions. The CPG and additional guidance it provides on interpretation of the LDF sustainability policies is considered in this sustainability statement.

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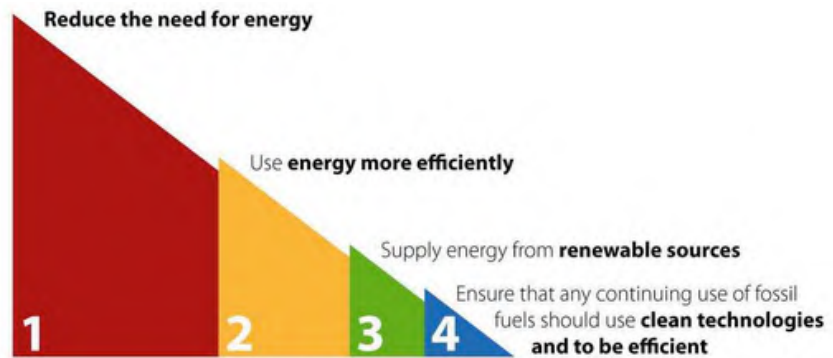
# Energy and CO<sub>2</sub> Sustainability Statement Barrie House

## Energy strategy

An energy strategy for the development has been undertaken. The following is a summary of their findings in accordance with the energy hierarchy and policy requirements.

## The energy hierarchy

The proposed scheme has followed the energy hierarchy that is illustrated below:



This methodology widely used in accordance with meeting the Sustainable Design and Construction Supplementary Planning Guidance (SPG), has been adopted for the scheme using a 'Lean', 'Clean', and Green' approach in addressing the London Borough of Camden's policy. A summary of the savings in carbon emissions are shown below:

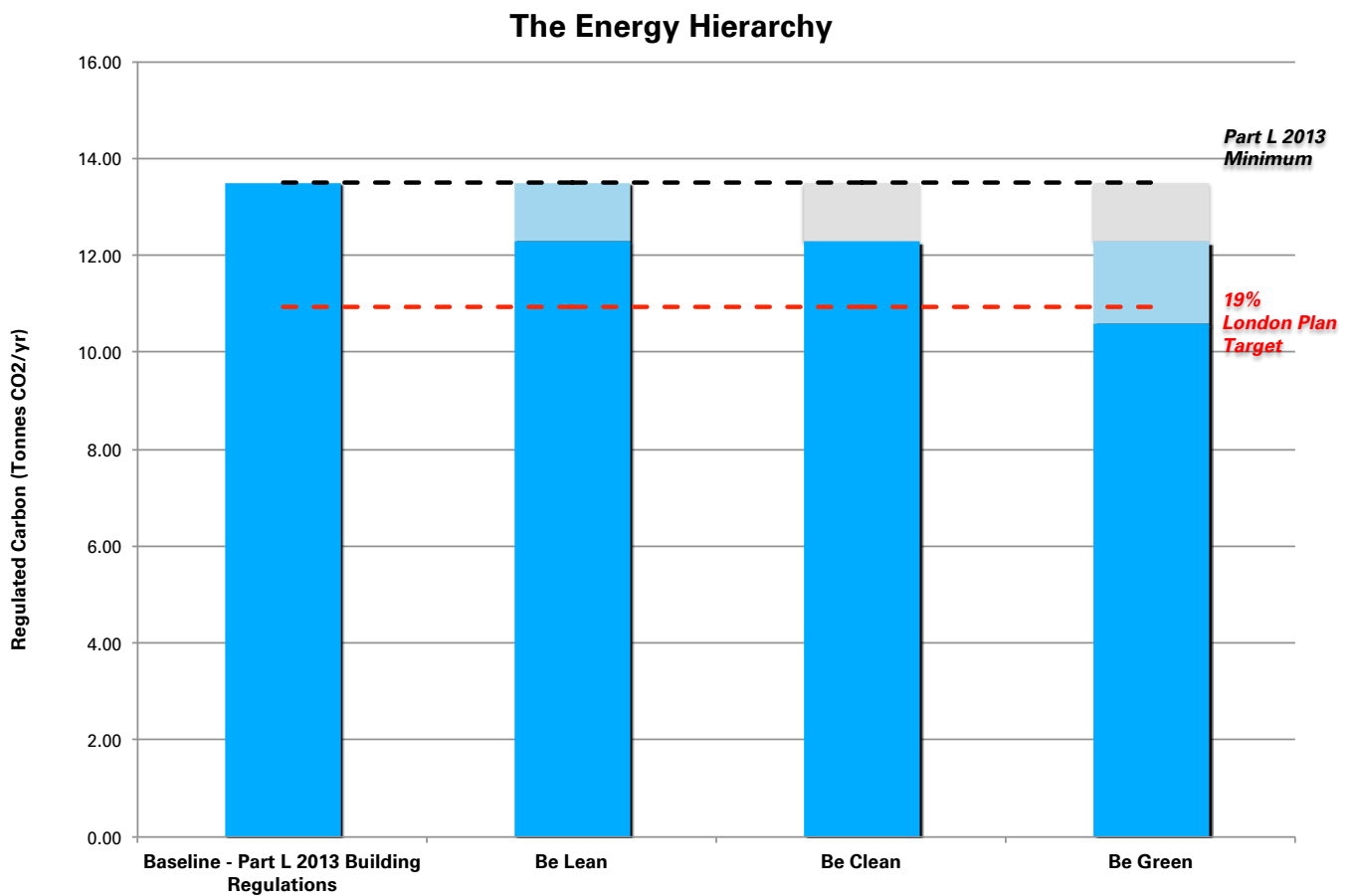
GLA's Energy Hierarchy – Regulated Carbon Emissions				
	Baseline:	Be Lean:	Be Clean:	Be Green:
CO <sub>2</sub> emissions (Tonnes CO <sub>2</sub> /yr)	13.50	12.28	-	10.59
CO <sub>2</sub> emissions saving (Tonnes CO <sub>2</sub> /yr)	-	1.22	-	1.69
% saving over the previous stage	-	9.0	-	12.5
Total CO <sub>2</sub> emissions saving (Tonnes CO <sub>2</sub> /yr)		2.91		
<b>21.6% of total carbon emissions savings over Part L of the Building Regulations 2013 achieved.</b>				

# Energy and CO<sub>2</sub> Sustainability Statement Barrie House

**GLA's Energy Hierarchy – Regulated Carbon Emissions**

A graphical illustration of how the scheme performs in relation to Building Regulations and the Energy Hierarchy is shown below.

Figure



**Summary**

As demonstrated above the development will reduce carbon emissions by 9.0% from the fabric energy efficiency measures described in the 'Be Lean' section, and will reduce total carbon emissions by 21.6% over Building Regulations with the further inclusion of low and zero carbon technologies (photovoltaic panel system).



# Materials and Waste Sustainability Statement Barrie House

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## Materials and waste introduction

Sustainable material sourcing and waste management will be considered throughout the life of the building to ensure the scheme's environmental footprint is minimised as far as possible. The scheme will also ensure low embodied carbon throughout the procurement, transport and construction of building materials, together with end of life emissions.

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## Materials selection and sourcing

The design team has confirmed that efforts will be made to reuse materials where feasible, and that where required, new materials will be responsibly sourced. New construction materials will be selected, where feasible, with a low environmental impact. In addition, the project will aim for at least 10% of new materials to come from recycled or reused sources. Minimum standards apply to new timber, which must be sourced in accordance with the UK Government's Timber Procurement Policy.

In addition, basic building and finishing elements will be sustainably procured and sourced from local suppliers and manufacturers within 50 miles of the development to prioritise and encourage growth in economic activity within the London Borough of Camden. In addition, all timber will be FSC / PEFC certified, all concrete will be BES 6001 certified and any other material will be ISO 14001 certified for both key processes and supply chain / extraction processes.

The Green Guide for Specification<sup>1</sup> is a reference tool, providing guidance on the relative environmental impacts for a range of different building elemental specifications, based on Life Cycle Assessment and the Environmental Profile Methodology. The design team will reference the Green Guide to Specification to help specify materials with a low environmental impact, where feasible.

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## Embodied carbon analysis

The development considers a number of opportunities to cut embodied carbon, they are as follows:

- A materials efficiency strategy will be followed throughout the design, procurement and construction stages of development, to ensure the scheme produces less waste on site. For example, adjustment of some sizes will be made to minimise offcuts of materials, and some bespoke materials will be developed off-site.
- The development has been designed to be efficient in terms of the amount of materials used to construct the dwelling.
- Materials will be procured from the local area where possible, to reduce carbon through transportation.
- Materials and products with a higher recycled content will be procured where feasible, as these have a low embodied carbon.
- Consideration has been made to use of timber as a low embodied carbon alternative to steel and concrete where possible.
- The design team has confirmed the Waste and Resources Action Programme (WRAP) guidance 'cutting embodied carbon in construction projects' will be followed.

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<sup>1</sup> Building Research Establishment (BRE) Green Guide to Specification; <https://www.bre.co.uk/greenguide/>

# Materials and Waste

## Sustainability Statement

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#### Waste management (construction waste)

The design team will promote resource efficiency through effective and appropriate management of demolition and construction site waste.

In line with the waste hierarchy, during the construction phase, the preferred approach should be:

- The use of reclaimed materials;
- The use of materials with higher levels of recycled content; and
- The use of new materials

For demolition, the following should be

- Prioritising the on site reuse of demolition materials;
- Recycle materials on site recycling, then off site recycling; and
- The least preferred option – disposal to landfill.

A site waste management plan will be developed for the site which adopts target best practice benchmarks for resource efficiency, details procedures and commitments to minimise non-hazardous and hazardous waste at the design stage and monitors/measures waste production on site.

The site waste management plan will also include procedures and commitments to sort and divert waste from landfill through the following:

- Re-use on site;
- Salvage/reclaim for re-use off-site;
- Return to supplier via a 'take-back' scheme;
- Recovery and recycling using an approved waste management contractor; and
- Compost.

In addition, the design team has committed to diverting at least 85% by volume (90% by weight) of non-hazardous non-demolition waste generated by the project to be diverted from landfill.

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#### Waste management (operational waste)

Dedicated internal and external waste storage and recycling facilities for end users are proposed to encourage recycling. The storage space will provide inclusive access and usability. The London Borough of Camden operates a weekly front-of-property recycling collection service.

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# Water Management Sustainability Statement Barrie House

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## Water management introduction

The development proposal recognises the need to create a scheme that is efficient and adaptable to future climatic scenarios.

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## Water conservation

The design team is committed to achieve a significant reduction in water use for the development over typical performance, equating to a water consumption target of 105 litres per person per day for the residential dwellings.

Water consumption will be reduced through the use of water efficient components for all specified water-consuming components (including low-flow showerheads and taps, dual flush toilets and low water consuming washing machines and dishwashers), water meters for each dwelling, water recycling systems where appropriate and flow control devices that regulate the supply of water to each facility according to demand.

A permanent automated water leak detection system that alerts the building occupants to a major water leak on the mains water supply within the building and between the building and the utilities water meter will be installed.

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# Water Management Sustainability Statement Barrie House

## Flood risk and sustainable drainage systems (SuDS)

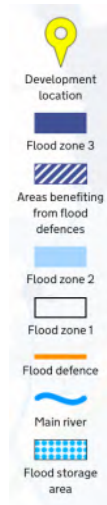
The Barrie House development is located within Flood Zone 1 of the Environment Agency's Flood Map for Planning. This is defined as an area with little or no risk to flooding where the annual probability of river, tidal and coastal flooding (with defences where they exist) is <math><0.1\%</math> i.e. less than 1 in 1000 years (see map below).

The proposed development will have a net neutral impact on the impermeable area of ground at the site, as the proposed extension will be located on the existing hardstanding car park area and the loss of the small grassed area within the existing access road at the front of the site will be reprovided by new soft landscaping and planting areas surrounding the development.

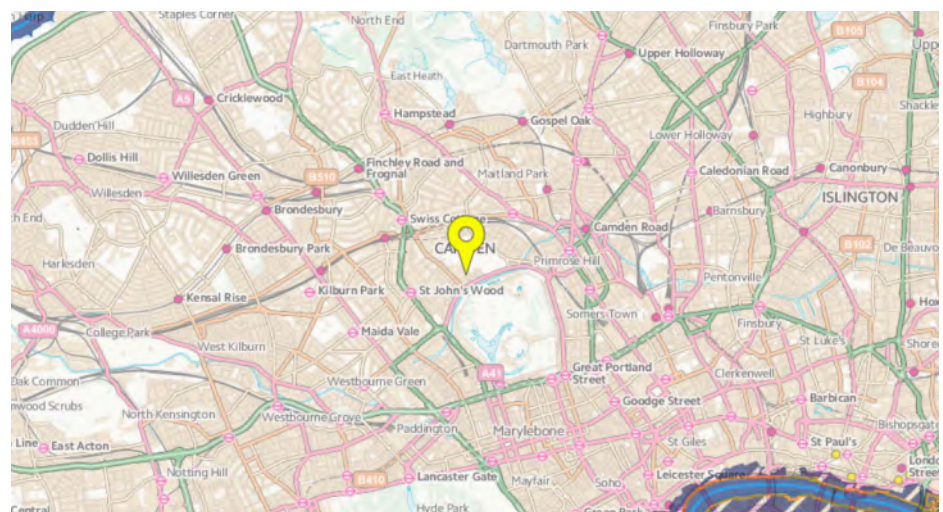
Sustainable drainage systems (SuDS) will be introduced as part of the development, which will include:

- Green roof to be installed on new flat roof areas (see Appendix A);
- Raised planters along the north-west perimeter of the new building, surrounding private gardens and screening bin stores, will act as bioretention systems, slowing down runoff and attenuating surface water, before gradual infiltration to the groundwater system;
- Permeable block paving forming the pedestrian pathways and building entrances will also encourage infiltration for surface water and will incorporate subsurface filtration materials to filter potential pollution from parked cars to the groundwater system;
- Additional planting and soft landscaping, as per the scheme's landscape proposals, will provide further functions for interception, retention and infiltration.

## Flood map



Flood map<sup>2</sup> showing location of the Barrie House development within Flood Zone 1:



<sup>2</sup> UK Government, Flood map for planning; <https://flood-map-for-planning.service.gov.uk/>

# Biodiversity and People Sustainability Statement Barrie House

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## Biodiversity

The proposed development will promote the protection of any existing ecological features from damage during site demolition and the completion of the construction works.

The design team is committed to help protect and enhance biodiversity on site, including implementing the following where applicable:

- Any affected trees and shrubs cleared out of bird breeding season (March-August).
- Trees located outside of scope of works fully protected during construction in accordance with British Standard 5837:2012.
- New planting to include insect and bird attracting species.
- Bat and bird protection in line with best practice.
- Provision of bat and bird boxes.

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## Land use and ecology

The proposed development will incur no negative change in ecological value and a suitably qualified ecologist will provide early design stage advice on:

- How to improve the ecological value of the site.
- Confirm that all relevant UK and EU legislation relating to protection and enhancement of ecology has been complied with during the design and construction process.
- Produce a landscape and habitat management plan to cover at least the first five years after project completion, if applicable.

### Ecology protection and enhancement

The design team are committed to help protect and enhance biodiversity on site.

New planting is proposed for the development, including new trees, hedges and shrubs, as per the scheme's landscape proposal. This new planting will include insect attracting species (such as african lily *Agapanthus africanus* and woodland sage *Salvia nemorosa*) and bird attracting species (such as wild cherry *Prunus avium*).

Bat and bird nesting boxes will be considered for inclusion. The design team is also considering bee bricks to provide nesting opportunities in this nest-limited urban environment.

### Arboricultural management and protection

The design team are committed to help protect trees on and adjacent to the site that may be affected by works for the proposed development.

An Arboricultural Implication Assessment and Arboricultural Method Statement will be prepared for the development. This will address the protection of trees in the vicinity of the development, providing recommendations for mitigation of development impacts, where applicable.

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# Biodiversity and People Sustainability Statement Barrie House

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## Construction environmental management

Environmental impacts of the construction works will be mitigated as far as possible. This will include the incorporation of the following:

- Contractor following environmental management system processes (under ISO14001), including the development of a construction environmental management plan (CEMP) specific to the sites;
- Training and site induction of all site operatives;
- Monitoring of energy, water and transport to and from site during construction;
- Management of waste on site and minimisation of air pollution;
- Emissions of dust and exhaust gases will be controlled through mitigation measures detailed in a site-specific dust management plan agreed with the London Borough of Camden;
- Following best practice pollution guidance from the Environment Agency;
- Ensuring all site timber is responsibly sourced in line with the UK Government's Timber Procurement Policy.

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## Considerate Constructors



The scheme will be registered under the Considerate Constructors Scheme (CCS) and is targeting at least 35 out of 50 points, including 7 points within each section of the scheme. The CCS scheme aims to recognise and encourage construction sites that are managed in an environmentally and socially considerate, responsible and accountable manner.

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## Occupant wellbeing

The development has been designed to ensure the wellbeing of occupants in terms of levels of fresh air, thermal comfort and reduction of overheating, access to natural light, good lighting levels internally and externally, acoustic performance and access to safe drinking water.

The building services strategy has been carefully considered in order to balance the need for energy-smart, low carbon technologies with the need for adequate and controllable ventilation, heating and cooling.

The design team will specify all low volatile organic compounds (VOC) finishing products, including adhesives, sealants and paints. All composite wood products will contain no added urea formaldehyde.

Thermal modelling, in line with CIBSE AM11 guidelines and Building Bulletin 101, will be undertaken for the development using full dynamic thermal analysis software. Summer and winter operative temperature ranges in occupied spaces will be in accordance with the criteria set out in CIBSE Guide A Environmental design.

The building will comply with the requirements set out in Section 7 of BS 8233:2014 for:

- Sound insulation
- Indoor ambient noise level

Overall, the development will promote health, wellbeing and community engagement within the local community.

# Biodiversity and People Sustainability Statement Barrie House

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## Sustainable transport

The Barrie Road development has a public transport accessibility level (PTAL) rating of 1b. It is located within 300 metres (approximately a 4 minute walk) of two bus stops used by services travelling in opposite directions, providing a frequent service in peak hours. St John's Wood Underground Station is approximately a 14 minute walk and South Hampstead Overground Station is approximately a 20 minute walk from the development.

The development will be supported by a site-specific travel plan. The travel plan will set out the transport strategy for the development, which includes the provision of approximately 22 cycle storage spaces between the residential dwellings, located securely in the basement storey of the development.

Approximately 10 car parking spaces will be provided as part of the development proposals, which presents a net neutral change from the existing car parking provision on the site.

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## Accessibility and security

Design proposals have taken into consideration external and internal accessibility. This includes cyclist and pedestrian access to the site. Creating a secure but fully accessible development is a key part of the development. To ensure this is achieved, the design team will adopt where feasible, the key principles of "Secured by Design" within all elements of the scheme.

Home offices will be accommodated for within the residential dwellings, by provision of adequately sized, ventilated and lit spaces for desks and power and data points for equipment, in order for the occupant to work from home and reduce the need for road transport.

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# Conclusions

## Sustainability Statement

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#### Conclusions

This Sustainability Statement has responded to the London Borough of Camden's Planning Policy requirements.

In summary the scheme will adopt the following sustainable features:

- A 21.6% reduction over Part L of Building Regulations 2013 following the energy hierarchy as required by the National Policy Planning Framework (NPPF);
  - More than 10% reduction in carbon emissions over Part L of Building Regulations 2013 through the use of renewables;
  - Develop a scheme that is efficient and adaptable to future climatic scenarios with a water consumption target of 105 litres/person/day through implementation of water efficiency and reuse measures;
  - A sustainable materials procurement policy and an efficient waste strategy on site including at least 85% of waste to be diverted from landfill;
  - The inclusion of sustainable transport options including provision of cycle storage and home office space to allow the occupants to work from home;
  - Protection and enhancement of ecology on site through planting and species-specific measures, along with appropriate actions to ensure protected species;
  - Be located in a low flood risk zone and incorporate sustainable drainage measures (SuDS) to improve surface water runoff for the development;
  - An emphasis on local supply and labour to encourage employment opportunities and to offer a diverse, self-sustaining environment;
  - Follow best practice policies in terms of air, water and ground pollution and appoint a contractor who will register for the Considerate Constructors Scheme.
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# Appendix A: Green Roof Recommendations

## Sustainability Statement

### Barrie House

#### Viability of space for green roofs

The current development proposals have been assessed for their suitability for the implementation of green roofs. The viable roof areas of the development are shown in Figure A-1. In total, there is deemed to be up to approximately 123m<sup>2</sup> of viable area for green roofs, apportioned as follows:

- Up to approximately 83m<sup>2</sup> on the north roof area (note that approximately 19m<sup>2</sup> of solar photovoltaic (PV) panels will be installed on this area as well as an acoustic enclosure of approximately 14m<sup>2</sup> in area).
- Approximately 50m<sup>2</sup> on the south roof area.

The viable roof areas are accessible for maintenance only and will not be used as accessible amenity space for building users.

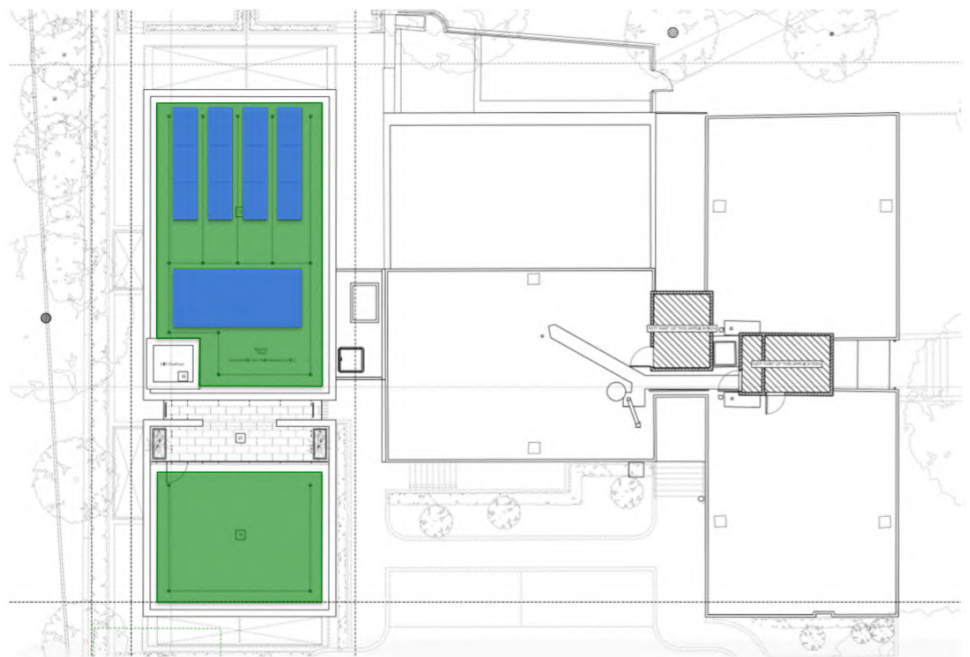


Figure A-1: Potential green roof areas (marked green) and areas with areas required for building plant infrastructure (marked blue)

# Appendix A: Green Roof Recommendations

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#### Categorisation of green roof systems

In a general sense, a green roof system comprises of several materials, which are layered to achieve the desired functions (for example vegetative cover and drainage characteristics).

Types of green roof systems can be divided into the following main categories:

- Extensive systems – can be subdivided into four categories:
  - Extensive sedum / wildflower blanket – a lightweight pre-grown ‘sedum / wildflower blanket’ installed over a substrate base with a depth of around 80mm, which can support a limited range of hardy plants;
  - Extensive plug-planted – an extensive living roof with a minimum substrate depth of 80mm can be plug planted with a high diversity of different herbs, wildflowers, grasses and sedum species. Native plug plant species can be chosen to suit local ecological needs, aesthetic preference for plant height and further increase the biodiversity of the living roof; and
  - Extensive seeded – an alternative option is to include an extensive living roof (80-150mm) seeded with a high diversity blend of stonecrop, wildflower and herb species to give the appearance of a wild grass and flower meadow.
  - Extensive ‘biodiverse’ – this category includes the ‘brown roof’ system, which is not purposely planted, but an appropriate growing medium is selected and installed to allow indigenous plant species to inhabit the roof. The substrate depth of a ‘biodiverse’ roof may vary across the roof area, to promote a diversity of both shallow and deep-rooted plants.
- Semi-intensive – an intermediate type, containing characteristics of both extensive and intensive roofs. Semi-intensive roofs typically require a substrate depth of 100-200mm and facilitate a wider range of plants than a typical extensive green roof. The maintenance requirements will be dependent on the plant species installed.
- Intensive – often known as roof gardens, these usually have deeper substrates (and therefore higher loadings on the building structure) and can support a wide variety of planting. Intensive roofs usually require more frequent and intensive maintenance, in comparison to other green roof types and are typically easily accessible for maintenance.

The characteristics of each category of green roof systems and their suitability for the development have been evaluated, in accordance with the SuDS Manual (CIRIA, 2015) and the Green Roof Code of Best Practice<sup>3</sup> (GRO, 2014). Table A-1 provides an overview of the systems considered.

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<sup>3</sup> The GRO Green Roof Code – Green Roof Code of Best Practice for the UK 2014

# Appendix A: Green Roof Recommendations

## Sustainability Statement

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**Table A-1:** Suitability and characteristics of green roof systems

Green roof type	Substrate depth	Maintenance requirements	Advantages	Disadvantages	Suitability
Extensive sedum/wildflower blanket	20-80mm	Minimal to none, suitable for inaccessible areas Irrigation only during plant establishment	Lightweight Can be installed on inaccessible roof areas, almost no maintenance required No irrigation Can be installed on roofs with slope up to 1 in 3 Relatively inexpensive	Only simple sedum/moss communities/limited wildflowers supported, low biodiversity Shallow depth of substrate to provide attenuation and low transpiration Provides little runoff retention Limited insulation provision	High
Extensive plug-planted	20-80mm	Minimal to none, infrequent access required Irrigation only during plant establishment	Lightweight Can be installed on inaccessible roof areas, almost no maintenance required No irrigation Relatively inexpensive	Shallow depth of substrate to provide attenuation and low transpiration Provides little runoff retention Limited insulation provision	High
Extensive seeded	80-150mm	Low, infrequent access required Irrigation only during plant establishment	Lightweight Low maintenance requirement No irrigation with selected species	Provides runoff retention, but not as much as intensive	Medium
Extensive 'biodiverse'	80-150mm	Low, some infrequent access required Irrigation may be required after plant establishment	Lightweight Supports indigenous plant species No irrigation	Provides runoff retention, but not as much as intensive Greater loading on roof structure Takes time for plant species to establish	Medium
Semi-intensive	100-200mm	Low to medium, dependent on selection of plant species Irrigation	Allow variety of grasses, small shrubs, flowering plants to be supported	Irrigation system likely to be required Higher capital and maintenance costs	Low
Intensive	>200mm	Medium to high, frequent access required	Allows range of plants, up to medium-sized shrubs to be planted Accessible as garden or amenity space	Greatest loading on roof structure Highest capital and maintenance costs Irrigation system required (demand for energy, water and materials)	Low

# Appendix A: Green Roof Recommendations

## Sustainability Statement

### Barrie House

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#### Green roof system selection recommendations

Green roof system types have been evaluated for their suitability for the development (Table A-1). It has been deemed that the following system types would be most appropriate for the proposed development:

- Extensive sedum/wildflower blanket green roof; or
- Extensive plug-planted green roof.

#### System recommendations

It is recommended that either of the above options be implemented for the proposed green roof area. With regards to optimising the impact on runoff quantity management and performance as a successful SuDS component, the following specific recommendations are made:

- Substrate depth should be maximised, within the limitations of the extensive green roof system. It is recommended that a depth of substrate of up to 80mm should be used for the green roof areas. The system must be verified by a structural engineer with regards to the structural capacity of the building to withstand the imposed loads, including the saturated weight of the system, other imposed loads (including maintenance loadings and snow cover) and the load-bearing capacity of the underlying roof deck and structure.
- Long-term plant coverage should be maximised through either of the sedum/flower blanket or plug-planted green roof types, to maximise the evapotranspiration performance of the green roof.

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#### Green roof design considerations

The successful design and implementation of a green roof requires collaboration between the design and project team, including the following:

- Design – Architect / Landscape Architect, Structural Engineer, Drainage Engineer, Ecologist;
  - Construction – Principal Contractor, Specialist Green Roof Installer; and
  - Management and maintenance – Building Owner / Tenant, Facilities Management.
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# Appendix A: Green Roof Recommendations

## Sustainability Statement

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#### Green roof design considerations (continued)

##### Materials

The following materials layers / types must be considered for the green roof system:

- Waterproof membrane – the waterproofing layer must be robust and would typically be one of the following materials; reinforced polyvinyl chloride, synthetic rubber, thermoplastic polyolefins, high density polyethylene, modified asphalts and hypalon. The waterproofing layer must be root resistant, adequately protected from temperature changes and mechanical damage, and anchored to the roof to resist wind uplift forces. It is highly recommended that the membrane is tested electronically for leaks before the covering elements are installed, as repairs are difficult once the green roof is completed.
- Root barrier – the waterproof membrane manufacturer should be consulted to determine whether a separate, dedicated root barrier membrane is required.
- Drainage and geotextile filter layer – the function of the drainage layer is to drain excess water from the roof and it can provide some attenuation capacity and / or retain water for plants to draw upon when rainfall is low. The drainage layer is typically comprised of a geocomposite / geocellular drainage system, along a shallow layer of gravel or pebbles at a width of between approximately 300-400mm from the edge of the roof system. The performance specification of the system should be in accordance with BS EN 13252:2001 'Geotextiles and geotextile-related products. Characteristics required for use in drainage systems'.
- Soil or growing medium – the depth and type of the soil medium should be selected based on the type of vegetation to be supported and required performance characteristics for volume control. Typically a minimum substrate depth of approximately 80mm is suitable to support plants within an extensive system, but a depth of up to 150mm is recommended (where feasible).

##### Planting

The potential planting types for recommended green roof systems are:

- Seeding – seeds can be hand or machine planted, and will require weeding, erosion control and watering for initial establishment.
- Self-seeding – the initial 'plug-planted roof' can be left to self-colonise initially.

##### Construction

The Green Roof Code of Best Practice (GRO, 2014) provides a guide for the construction and installation of green roof systems. Key areas for consideration are:

- Correct application and testing of the waterproof membrane.
- Temporary ballasting of individual components may be required and must be considered during construction, to prevent uplift due to wind.
- The growing medium should be protected from over-compaction during construction.
- Safe access is required during construction, along with adequate safety provision for all areas beneath the roof, in accordance with all best-practice construction guidance, including the Construction (Design and Management) Regulations (CDM) 2015.