City & Provincial Properties PLC
20-21 King’s Mews
Energy & Sustainability Statement

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1. Executive Summary

Low environmental impact will be key to the design of the proposed 20-21 King's Mews redevelopment. This energy and sustainability statement outlines the development's approach to sustainability, energy efficiency and renewable energy strategies in order to meet the sustainability targets set out by the London Borough of Camden and the Greater London Authority's (GLA) planning requirements. The building is located within a conservation area and therefore special consideration has been taken with regard to any roof mounted plant or equipment. The London Plan targets are not obligatory for minor developments, however, the targets as set out in Policy 5.2 of the London Plan and the steps of the Energy Hierarchy have been used as guidance for this strategy.

A number of sustainable and energy efficient measures included in the proposed design are listed below:

- The proposed strategy is to enhance the thermal insulation, air tightness and thermal bridging standards beyond the Part L standards, thereby reducing the space heating requirements to such an extent that they can be partly met passively by direct solar gains and the internal heat gains.
- A low air permeability of 3.0m^3/hr/m^2 for the residential elements will ensure heat losses through the buildings fabric will be minimised;
- The dwellings will be mechanically ventilated during winter months, with heat recovery to reduce incoming air heating demand;
- Natural ventilation during summer months will prevent overheating and the excessive use of cooling;
- Natural day lighting will improve occupant comfort and reduce the requirement for artificial lighting;
- All light fittings will be low energy fittings.

Investigation into the feasibility of connecting to a district energy network as per Policy 5.6 of the London Plan indicates that there are no networks within a viable connection distance to the development. Furthermore the small scale of the development and relative heating and electrical demands means that a Combined Heat and Power (CHP) unit is not appropriate.

In accordance with Policy 5.7 of the London Plan, an extensive range of low and zero carbon technologies have been considered in terms of providing a proportion of the development's energy demand. The limitations of the building's location within the Bloomsbury conservation area are such that rooftop equipment is not permissible and therefore these cannot be incorporated.

The proposed deign is achieving a 6% improvement over the 2013 Building Regulation CO_2 emission standards, as indicated in the adjacent table and graph.

Additional sustainable measures that feature in this development include:

- All insulation materials used within the proposed development will be selected to ensure they are CFC free both in manufacture and through their composition;
- Building materials where possible will be sourced locally to reduce transportation pollution & support the local economy;
- All timber will be purchased from responsible forest sources;
- Recycling facilities will be provided on site for construction and operational waste;
- Water use will be minimised by the specification of water efficient taps, shower heads, dual flush toilets and low water use appliances;
- Water metering will be installed to monitor and minimise wastage;
- The construction site will be managed in an environmentally sound manner in terms of resource use, storage, waste management, pollution.
- A Site Waste management Plan (SWMP) will be in produced for the works.

Regulated carbon dioxide savings from each stage of the Energy Hierarchy	Regulated Carbon dioxide savings	
	Tonnes CO_2 per annum	%
Savings from energy demand reduction	0.00	6%
Savings from CHP	0.00	0%
Savings from renewables	0.00	0%
Total Cumulative Savings	**0.00**	**6%**

Figure 1 Estimated CO_2 Emission Savings

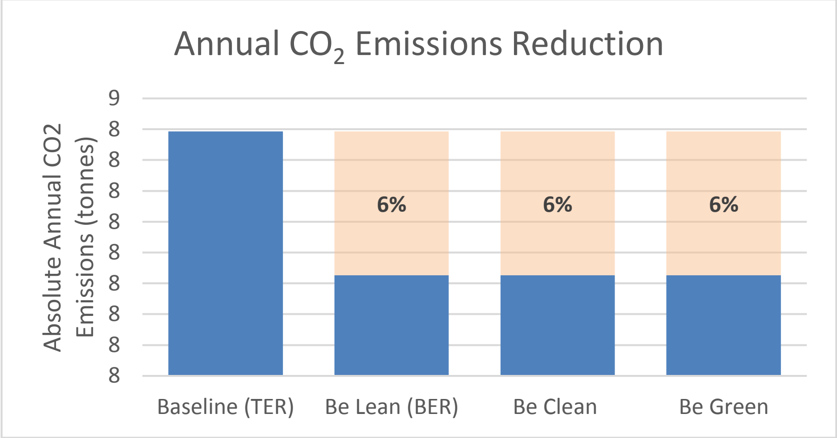

Figure 2 Site Wide Annual CO_2 Emissions

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2. Introduction

This Energy and Sustainability Statement has been prepared to accompany a planning application for the proposed 20-21 King's Mews redevelopment. It aims to meet the energy and climate change requirements of the London Borough of Camden and the Greater London Authority (GLA).

This report outlines the proposed sustainability and energy strategy for the proposed 20-21 King's Mews redevelopment. Each of the proposed initiatives has been assessed on the relative sustainability potential and suitability to the site.

The structure of this report is in accordance with the 'GLA's Guidance on preparing energy assessments' document, April 2015, which provides guidance on addressing the London Plan's energy hierarchy.

The principal objectives are to reduce the site's contribution to the cause of climate change by minimising the emissions of CO_2, by reducing the site's needs for energy and by providing some of the requirement by renewable/sustainable means. Issues such as water and waste, biodiversity, etc. have also been addressed in the present study. This statement will aim to address the aspirations of both the London Borough of Camden and the GLA despite being a minor development and not therefore obliged to explicitly meet the targets as set out in these policies.

The GLA London Plan and GLA Energy Hierarchy are considered to be the benchmark for local planning regulation. Together they provide a useful tool against which to undertake energy and sustainability assessment. They have been used in an advisory nature secondary to the requirements of the London Borough of Camden, to help incorporate a number of energy efficiency measures into the proposed development.

To guide and benchmark this process, the approach used in the Code for Sustainable Homes has been used to inform the sustainable features of the development.

Figure 3 Current Elevation

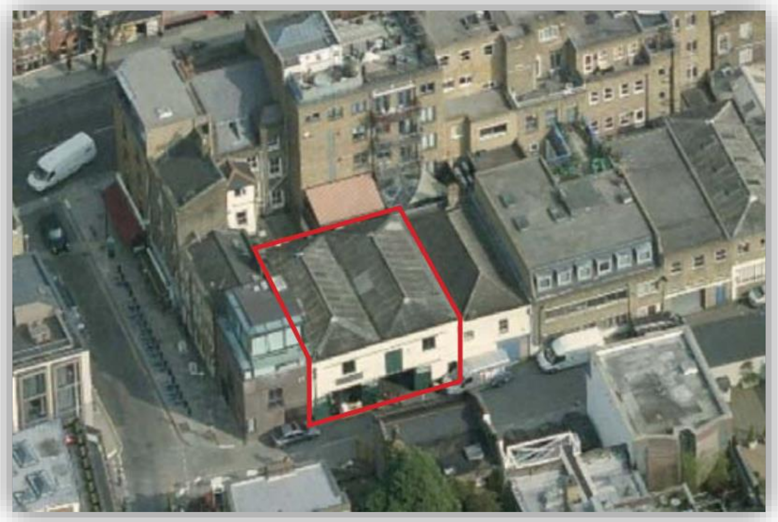

Figure 4 20-21 King's Mews Aerial View

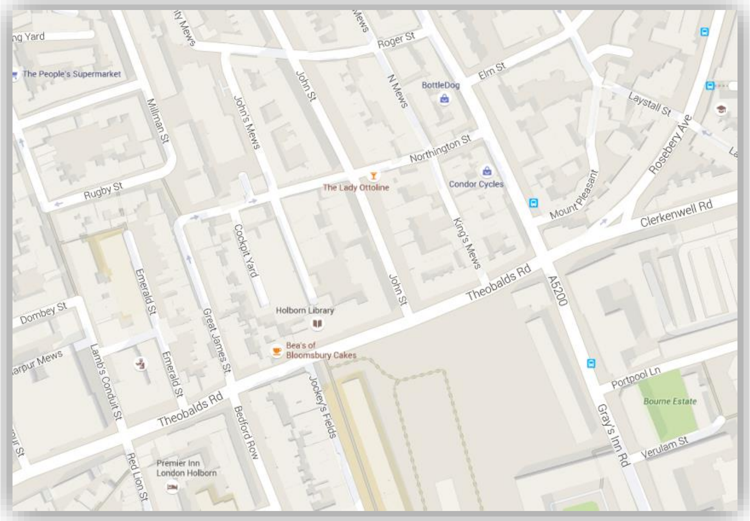

Figure 5 Site Plan

2.1 Outline Description of Development

The existing 2 storey building accommodates a garage on the ground floor with ancillary space on the first floor. There is currently no basement. The property is not listed but sits within the Bloomsbury conservation area.

The proposed works are outlined (but not limited to) below:

- Demolition of the internal existing structure and making good party walls and floors;
- Addition of various new elements in order to facilitate 7 new apartments;
- Proposed basement to be excavated to make room for the basement level of 2 duplex apartments;
- Second, first, ground and basement floors to be rearranged to accommodate 7 residential units of 2 bedrooms each and 2 bathrooms each, with the exception of Unit 3 which has 1 bathroom;
- Creation of windows and light wells to the basement areas.

The works will be assessed to be a new minor development and be assessed against Part L1a (dwellings) of the Building Regulations.

Floor	GIA (m^2)	No. of floors	No. of bedrooms	No. of bathrooms
Unit 1	95	2	2	2
Unit 2	102	2	2	2
Unit 3	65	1	2	1
Unit 4	65	1	2	2
Unit 5	64	1	2	2
Unit 6	62	1	2	2
Unit 7	61	1	2	2
Total	**514**	**4**		

Table 1 Building Area Schedule

3. Planning Policy

The National Planning Policy Framework (NPPF) was published in March 2012, which states a clear presumption in favour of sustainable development. The NPPF supports the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourages the reuse of existing resources, including conversion of existing buildings, and encourages the use of renewable resources.

The NPPF replaces PPS22 and in Section 10 outlines its energy and climate change policies. To support the move to a low carbon future, local planning authorities should:

- Plan for new development in locations and ways which reduce greenhouse gas emissions;
- Actively support energy efficiency improvements to existing buildings; and
- When setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

In determining planning applications, local planning authorities should expect new developments to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption;
- have a positive strategy to promote energy from renewable and low carbon sources;
- identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

The key focus of the NPPF is to support local and regional planning authorities.

3.1 The London Plan

The Greater London Authority (GLA) London Plan 2015 and the GLA's Guidance on Preparing Energy Assessments April 2015 document are considered to be the benchmark for local planning regulation. Together they provide a useful tool against which to undertake energy and sustainability assessments. For the purpose of this assessment they have been used in an advisory way secondary to the requirements of the London Borough of Camden, to help incorporate a number of energy efficiency measures into the proposed development.

The London Plan sets out a number of core policies for major developments with regards to reducing CO_2 emissions and providing energy in a sustainable manner.

As the proposed development is classified as a minor development, it is exempt from the following requirements. They have therefore been used in an advisory function and to guide the energy assessment.

Policy 5.2: Minimising Carbon Dioxide Emissions - requires that major developments achieve a 35% improvement over the 2013 Building Regulation CO_2 Emission Target.

Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

Policy 5.6: Decentralised Energy - requires all major developments to evaluate the feasibility of connecting to existing or proposed district heating networks and where no opportunity existing consider a site wide Combined Heat and Power (CHP) systems.

Policy 5.7: Renewable Energy - requires that all major developments seek to reduce their CO_2 emissions by at least 20% through the use of onsite renewable energy generation wherever feasible. Individual development proposals will also help to achieve these targets by applying the energy hierarchy in Policy 5.2.

3.2 London Borough of Camden

The London Borough of Camden set out their approach to sustainable development through their Core Strategy, Development Policies and Supplementary Planning Documents. Core Strategy Policy 13 sets out the overarching approach to sustainability in the Borough, with the aims of mitigating and adapting to climate change, promoting local energy generation, managing water resources and reducing carbon dioxide emissions.

The Development Policies provide further detail as to how the Core Strategy policies can be achieved. In this instance *"Development Policy 22 – Promoting Sustainable Design and Construction"* provides the details as to how the targets of CS13 will be meet and states:

"The council will require development to incorporate sustainable design and construction measures. Schemes must:

- Demonstrate how sustainable development principles, including relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and
- Incorporate green or brown roofs and green walls wherever suitable."

The council will promote and measure the sustainable design and construction by:

- Expecting non-domestic developments of 500sq m of floor space or above to achieve *"very good"* in BREEAM assessments and *"excellent"* from 2016 and encouraging zero carbon from 2019.

The council will require developments to be resilient to climate change by ensuring scheme include appropriate climate change adaption measures, such as:

- Summer shading and planting;
- Limiting run-off;
- Reducing water consumption;
- Reducing air pollution;
- No locating vulnerable uses in basements in floor-prone areas.

In addition to this policy, the Supplementary Planning Document *"Camden Planning Guidance 3 – Sustainability"* provides greater detail on the targets for developments and the approach that should be adopted in meeting these targets.

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4. Energy Strategy

The design has been developed to reduce the development's annual energy consumption, whilst providing energy in the most environmentally friendly manner to reduce its annual CO_2 footprint.

The initial focus is on passive building measures such as high levels of insulation and air tightness, followed by energy efficiency. In order to achieve this, a "Steps to Low Carbon" methodology has been applied to all new elements of the development.

4.1 Passive Design – 'Be Lean'

Substantial reductions in energy usage for the scheme will be achieved through the consideration of the passive elements of the design, together with improved occupant comfort. The aim is to optimise the passive building elements and hence reduce the energy consumption associated with the mechanical systems. This is balanced between a range of requirements and accounting for factors such as site constraints and acoustic considerations.

4.1.1 Passive Solar Design

Glazing types and window locations have been carefully considered, so that low angle winter solar gains and sun light are able to enter the space providing 'free' heating and lighting in winter. Solar gain is controlled in summer through solar coatings on the glazing to reduce the risk of 'overheating'.

The design of the living spaces have large areas of glazing to open up the building to the outside and allow light penetration, whilst in the bedroom areas the glazing areas have been reduced for privacy and reduced solar gains. The quantities of solar radiation entering the dwellings have been limited by the glazing specification, which will call for glass with high light transmission (70%), but limited solar transmission (60%).

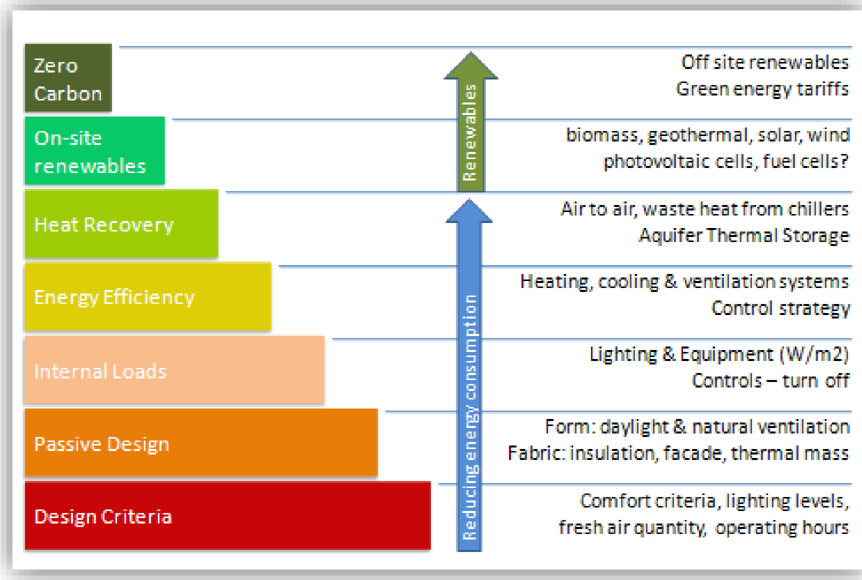

Figure 4 Steps to Low Carbon

Detail	Design	Regulations (L1a)
Ground floor average area weighted U-value	0.10W/m^{2}K	0.25W/m^{2}K
External wall average area weighted U-value	0.15W/m^{2}K	0.30W/m^{2}K
Roof average area weighted U-value	0.10W/m^{2}K	0.20W/m^{2}K
Window area weighted U-value (including frame)	1.40W/m^{2}K	2.00W/m^{2}K
Roof light area weighted U-value (including frame)	1.40W/m^{2}K	2.00W/m^{2}K
Window Visible Light Transmission (%)	60.0%	n/a
Roof Visible Light Transmission (%)	n/a	n/a
Glazing total solar transmission (G-value)	70.0%	n/a
External door average area weighted U-value	1.40W/m2K	2.0W/m2K
Thermal Bridging Y Value	Accredited Construction	n/a
Air permeability @ 50 Pascals	3.0m^3/hr/m^2	10m^3/hr/m^2

Figure 6 Residential Building Fabric

4.1.2 Building Envelope

Improving the thermal insulation standards beyond the minimum Building Regulation standards will help to reduce the annual CO_2 emissions associated with all of the building's heating and cooling systems, by limiting the heat loss through the building's fabric. All new thermal elements will therefore be specified to achieve an improvement over the minimum standards of the Building Regulations.

4.1.3 Thermal Bridging

Linear thermal bridge Ψ values, if not considered carefully, will have a high conductivity which will require a greater enhancement of the other elements of the building envelope to compensate. Where this is not possible, all architectural details will be in accordance with the enhanced construction details listed on the Energy Trust website or as an absolute minimum as per the requirements of Accredited Construction Details document.

Accredited Construction Details (ACD's) have been developed to assist the construction industry to comply with the performance standards in Part L of the Building Regulations. They focus on issues concerning insulation continuity and airtightness and suggest a common approach to design, construction and testing methodology, and general improvements of the process.

4.1.4 Air Permeability

An air pressure test will be carried out in order to determine the air leakage rates and take any remedial actions to improve it. An air leakage rate of 3m^3/hr/m^2 at 50Pa will be targeted for the development in comparison with the Building Regulation minimum standards for new dwellings of 10m^3/hr/m^2 at 50Pa. Good air tightness will be achieved by robust detailing of junctions and good building practices on site.

4.2 Energy Efficient Systems

After assessing the contribution of the passive elements to the overall energy balance, the aim is to further reduce CO_2 emissions by selecting efficient mechanical and electrical systems and efficient controls to manage the energy used during operation. On the basis of good practice the following principles will be adopted throughout the proposed development where possible:

4.2.1 Ventilation – Mechanically Ventilated

The development will be mechanically ventilated, with a high efficiency heat exchanger that will greatly reduce the heating load associated with incoming fresh air for space heating.

Historically, fresh air in dwellings was supplied through window openings and trickle vents, but as these are uncontrolled systems they result in large amounts of wasted heat. In order to minimise the heating load associated with the fresh air, a controlled Mechanical Ventilation with Heat Recovery (MVHR) system is proposed for each dwelling. MVHR uses the heat in the extract air to pre-warm the incoming air, thereby reducing the heating load. The design of an MVHR system will need to ensure that the fan powers are minimised and that the ductwork is insulated to avoid heat losses to unconditioned spaces.

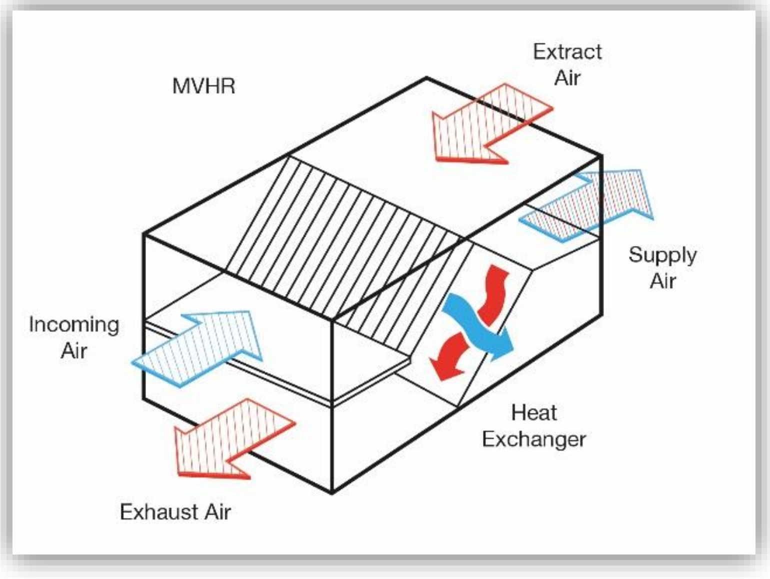

Figure 8 MVHR Unit with Plate Heat Exchanger

MVHR systems also work well in areas with local air quality concerns, as they can filter pollutants out of incoming air, improving the internal environment which is ideal for this central London location.

The MVHR system is designed to provide fresh air for the occupants NOT air condition the space. Therefore the dwellings will have openable windows to enable them to be naturally ventilated in summer to avoid the risk of overheating.

Comfort cooling will be provided as part of the mechanical ventilation system, allowing occupants the choice of natural ventilation (and associated cooling effects) or mechanical cooling at their discretion.

4.2.2 Eco-Labelled Goods

As lights and appliances account for about a third of the CO_2 emissions in developments where domestic appliances are installed, energy efficient units will be incorporated, including A and A+ rated appliances.

Figure 7 White Goods efficiency rating

4.2.3 Low-Energy Lighting

To reduce the energy consumption associated with artificial lighting, 100% of internal lighting fittings will be energy efficient with high luminaire efficacies in excess of 75 lumens/circuit Watt. The fixing must be permanently fitted to the ceiling or wall and can contain one or more lamps.

Furthermore, the development has been designed to maximise daylight into bedrooms and living rooms, reducing the requirement for artificial lighting. Light wells down to basement level promote natural daylighting into these spaces.

4.2.4 HVAC System Plant Efficiencies

The design team will specify all equipment and plant to exceed the minimum requirements of the domestic Building Services Compliance Guide. This provides guidance on the means of complying with the requirements of Part L1a of the Building Regulations for conventional space heating systems, hot water systems and cooling systems.

4.2.5 Controls

The heating systems will be appropriately zoned, allowing fast local response to changes in loads. Appropriate lighting controls, including timers, occupancy controls and dimming shall be specified where applicable for all internal lighting.

4.2.6 Energy Metering

Metering of the energy uses within the development will help the building users identify areas of increased consumption and highlight potential energy-saving measures for the future, hence reducing the associated annual CO_2 emissions from these systems. All electrical and gas supplies will be metered using smart meters to enable building users and tenant to be responsible for their own consumption and hence CO_2 emissions.

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5. Estimated Annual Energy Consumption

In accordance with the GLA and London Borough of Camden Policy, the estimated energy consumption for the development has been calculated. The estimated energy consumption for the development has been based on the National Calculation Methodology (NCM) using the approved Standard Assessment Procedure (SAP) software Elmhurst Energy 2012 for each dwelling.

The energy assessments have been carried out for the proposed scheme with the aforementioned passive and energy efficient measures. Connection to a district heating network, the use of a combined heat and power (CHP) unit and integrating low and zero carbon technologies (LZCs) have been explored later in this assessment as per the steps of the Energy Hierarchy.

5.1 Dwelling Annual Energy Consumption

The analysis indicates that the proposed dwellings are all performing significantly better than the minimum requirements of the Building Regulations and achieving improvements of between 4% and 8% dependant on the dwelling, with an area weighted improvement for the residential development of 6% based on the design parameters listed in Appendix A: Be Lean Modelled Parameters - Dwellings.

In order to strive towards the desired 35% reduction in annual CO_2 emissions a proportion of the development's energy requirements should be met by on-site energy generation and/or renewable energy technologies. As this is a minor development, these targets are being considered as guidance rather than explicit targets.

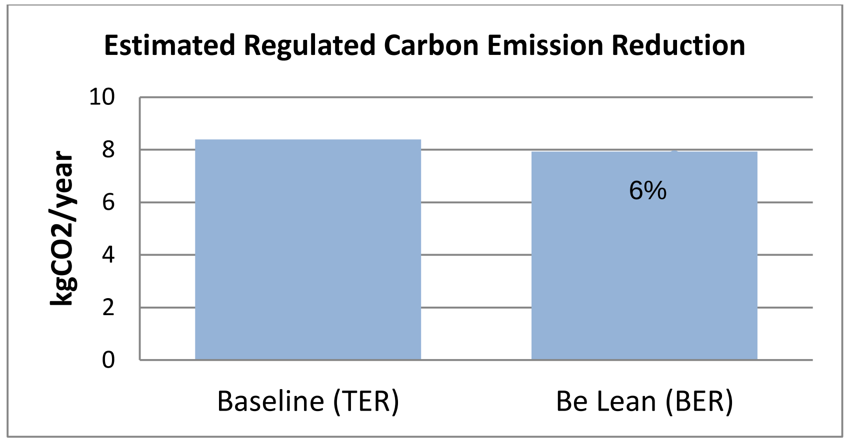

Figure 9 Estimated CO_2 Reduction

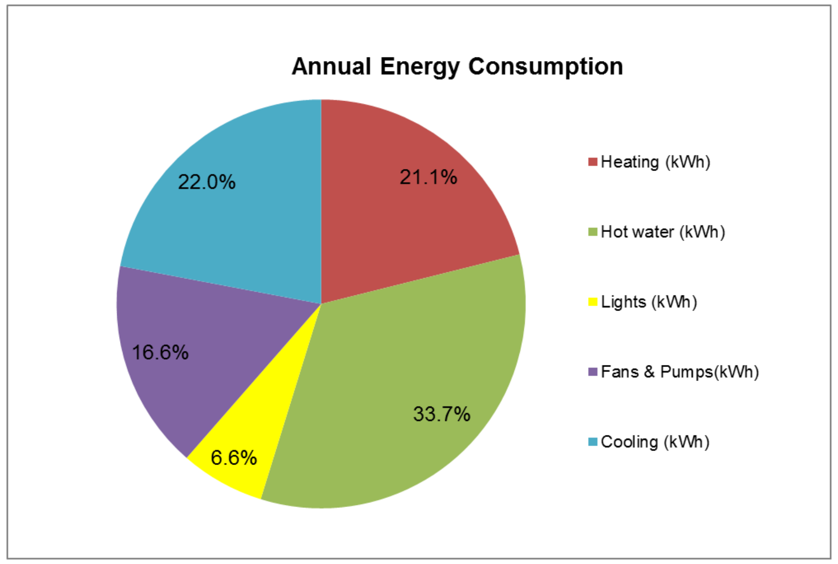

Figure 10 Energy Consumption from 'Being Lean'

Area Weighted Results	Be Lean	
	Absolute	%
Heating (kgCO2)	1514	13%
Hot water (kgCO2)	2415	21%
Lights (kgCO2)	1145	10%
Fans & Pumps(kgCO2)	2852	24%
Cooling (kgCO2)	3795	32%
Total Energy (kgCO2/m2)	11721	100%
DER ($kgCO_2$)	15.42	-
TER (kgCO2)	16	-

Figure 11 Area Weighted Results

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6. Decentralised Energy Networks

The feasibility of connecting to an existing or proposed district network has been investigated for the site at 20-21 King's Mews in accordance with Policy 5.6 of the London Plan.

The London Heat Map indicates that there are no existing district heat networks within close proximity to the site. Close proximity is deemed to be within 500m of the site, due to the cost involved in infrastructure amendments in order to facilitate connection. The mark up below indicates that the closest network is more than double that distance away. There is, however, a potential network to the South West of the site. However, as this development is minor it is not practical to connect to it. For this reason, district heating schemes are not considered feasible for this development.

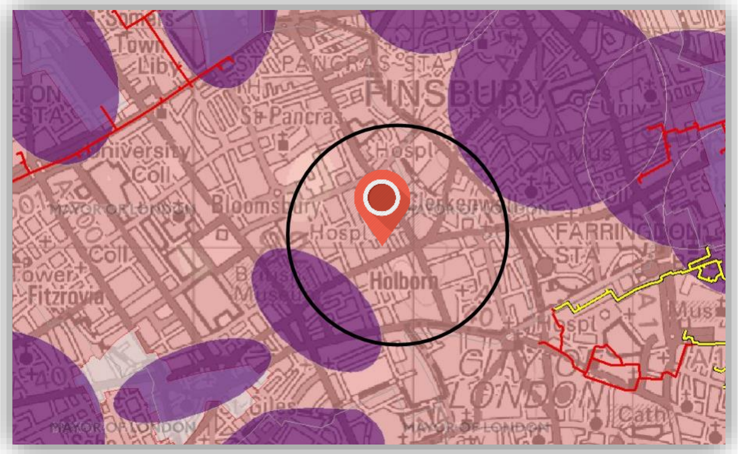

Figure 12 District Heating Networks in Proximity to the site (Yellow = installed, Red = proposed, Purple = potential)

Figure 13 Domestic and Commercial boilers (Red = Commercial, Black = Domestic)

7. Combined Heat & Power (CHP)

In accordance with the Mayor's Energy Hierarchy in Policy 5.6 the feasibility of a site wide CHP network has been investigated.

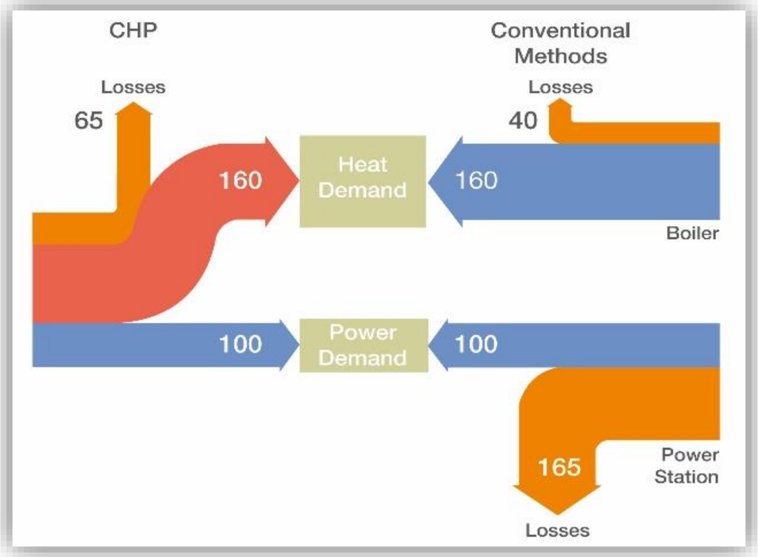

Figure 14 CHP Efficiency Diagram

CHP systems only work efficiently where there is a large and constant heating (space and water) demand. Given the limited size of the development and the high performance building fabric specified, the estimated heat demand is too low to support the use of an efficient CHP scheme. CHP is therefore not proposed for inclusion.

8. Low and Zero Carbon Energy Sources

Policy 5.7 of the London Plan requires that all major developments seek to reduce their CO_2 emissions by at least 20% through the use of onsite renewable energy generation wherever feasible. The following technologies have been investigated to determine the feasibility of delivering a reduction in the CO_2 emissions through renewables. As such, the advice to follow is just that, and is not required in order to meet planning requirements due to the fact the development is a minor one.

The feasibility of each of the energy sources listed has been assessed with regard to the potential contribution each could make to supply a proportion of the development's delivered energy requirement, whilst considering the technical, planning, land use and financial issues.

8.1 ASHP (Air Source Heat Pump)

Air source heat pumps exchange heat between the outside air and a building to provide space heating in winter and can also provide cooling in the summer months. The efficiency of these systems are inherently linked to the ambient air temperatures. Heat pumps supply more energy than they consume, by extracting heat from their surroundings. Heat pump systems can supply as much as 4kW of heat output for just 1kW of electrical energy input.

Typically there are two main types of air sourced heat pump systems, one which is refrigerant-based system (VRF) and one which is water based system (Air to water heat pumps). VRF systems transfer heat from one location another using a refrigerant. The volume or flow rate of refrigerant is accurately matched to the required heating or cooling loads thereby saving energy and providing more accurate control.

The analysis indicates that if the conventional heating and cooling system were replaced with a split VRF system then a further reduction in the development's annual CO_2 will be achieved. This saving is expected to be 10% based on installing VRF's with a seasonal cooling efficiency (SEER) of 4.0 and heating seasonal efficiency (SCoP) of 4.0.

The location of the development within a conservation area is restrictive with regard to rooftop equipment and therefore ASHPs will not therefore be proposed for inclusion in the design.

8.2 GSHP (Ground Source Heat Pumps)

Ground source heat pumps require either horizontal trenches or vertical boreholes to be excavated in order to accommodate piles or loops. As the proposed refurbishment is within an existing building with no grounds it would not be possible to install any ground coupled system and hence GSHP have be discounted from this assessment.

8.3 Biomass Boilers

Biomass in the form of logs, wood chips and wood pellets are classified as a renewable source of energy due to the fact that the carbon dioxide emitted when the biomass is burned has been taken out of the atmosphere by the growing plants. Even allowing for emissions of carbon dioxide in planting, harvesting, processing and transporting the fuel they will typically reduce net CO_2 emissions by over 90%.

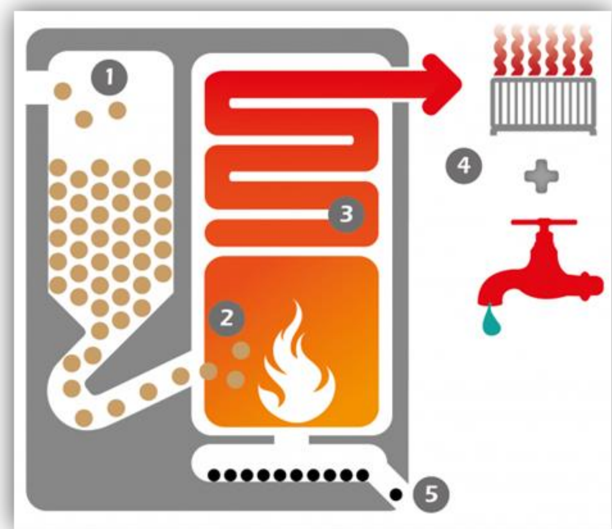

Figure 15 Biomass Boiler Process

As with conventional CHP, electrical generation is most effective when the base load is being met. A catalytic converter should be fitted to all units, in order to minimise the NOx, PM10 and other emissions, if the building is located in a high value ecological area.

Biomass boilers are not considered appropriate for this development due to potential adverse local air quality impacts.

8.4 Solar Thermal

Solar thermal collectors utilise solar radiation to heat water for use in buildings. The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30º from the horizontal.

Figure 16 Solar Thermal Collector Panel

Solar collectors are typically designed to meet a development's base heat load, associated with its domestic hot water requirements. For residential development these usually equates to 60-70% of the total DHW annual load, with the natural gas-fired boilers meeting the remainder of the load.

The development is located within a conservation area, therefore the feasibility of installing solar thermal collectors is not considered viable due to aesthetic constraints.

8.5 Photovoltaic Panels

Photovoltaic solar cells convert solar energy directly into electricity. The cells consist of two layers of silicon with a chemical layer between. The incoming solar energy charges the electrons held within the chemical. The energised electrons move through the cell into a wire creating an electrical current.

A study into the feasibility of onsite electric generation using south facing photovoltaic panels at 30º on the roof of the development to meet a proportion of the residential development's electricity demand has been undertaken and suggests that the electrical load would be suited to PV panels. A 50m^2 array with approximately 8.6kWp of installed power could provide up to 6960kWh per year – a possible emissions reduction for the residential dwellings of 9.5%.

The development, however, is located within the Bloomsbury conservation area where rooftop development is not acceptable. Therefore PV is not proposed for inclusion.

Figure 17 Roof Mounted Solar Photovoltaic Array

8.6 Wind Turbines

The output from wind turbines are highly sensitive to wind speed. Hence it is essential that turbines should be sited away from obstructions, with a clear exposure or fetch for the prevailing wind.

The urban location of the site coupled with the adjacent buildings will result in a turbulent flow regime across the site. This, coupled with the location of the development within a conservation area suggests that it is not proposed to include wind turbines as part of the development.

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9. Proposed Energy Strategy

Although the proposed development is not a major development, we have followed the Mayor's Energy Hierarchy and the London Borough of Camden's policy. The estimated energy consumption for the development has been based on the National Calculation Methodology (NCM) calculated with the approved software Elmhust Energy 2012.

9.1 Residential Energy Strategy

The analysis indicates that the proposed dwellings will perform better than the minimum requirements of the Building Regulations.

As this is a minor development it does not need to achieve the 35% London Plan target, however the proposed solutions follow the passive design and energy efficiency measures as set out in Policy 5.2 of the London Plan. The apartments will be insulated to high standards with accredited construction details ensuring heat losses are kept to a minimum. Mechanical Ventilation Heat Recovery (MVHR) in each flat will provide the spaces with minimum fresh air heating requirements whilst recovering heat from the stale exhaust air.

In accordance with Policy 5.7 of the London Plan, an extensive range of low and zero carbon technologies have been considered in terms of providing a proportion of the development's energy demand. The limitations of the building's location within the Bloomsbury conservation area are such that rooftop equipment is not permissible and therefore these cannot be incorporated.

The analysis indicates that the proposed dwellings are all performing significantly better than base case achieving an area weighted improvement of 6%.

An outline of the building fabric and fixed systems specified in the SAP assessment can be found in Appendix A: Modelled Parameters - Dwellings. The results of the energy strategy are shown adjacent.

9.1.1 Overall Energy Consumption

As an overall site, annual CO_2 emissions are reduced by 6% over the baseline which is a significant improvement over Part L 2013.

Regulated carbon dioxide savings from each stage of the Energy Hierarchy	Regulated Carbon dioxide savings	
	Tonnes CO_2 per annum	%
Savings from energy demand reduction	0.00	6%
Savings from CHP	0.00	0.00
Savings from renewables	0.00	0%
Total Cumulative Savings	**0.00**	**6%**

Figure 18 Estimated CO_2 Emission Savings

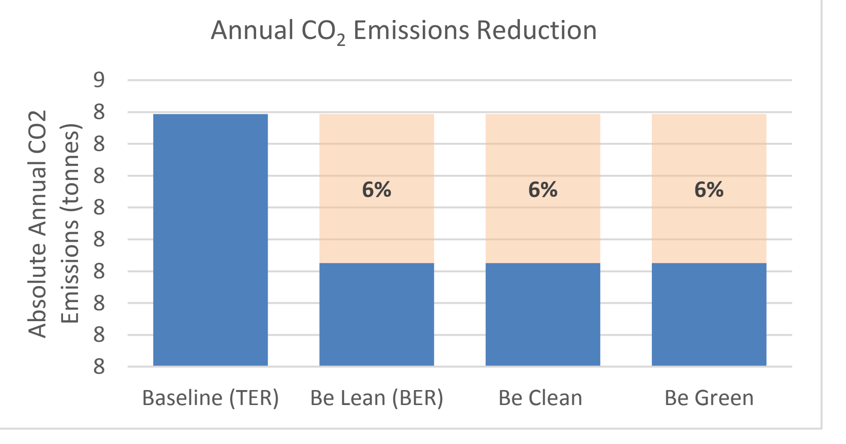


Figure 19 Site wide annual CO_2 emissions

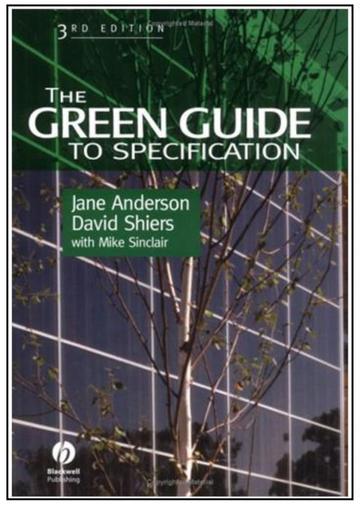
10. Materials

Building and construction activities worldwide consume 3 billion tons of raw material each year, which account for approximately 50% of total global consumption. Using green/sustainable building materials and products promotes conservation of dwindling non-renewable resources. In addition, integrating sustainable building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these source materials.

The aim for the proposed 20-21 King's Mews development will be for its overall environmental impact to be minimised through the specification of sustainable materials. As the proposed development is a refurbishment of an existing building, building elements should be reused where possible.

10.1 Environmental Impact of Materials

New materials with low overall environmental impact will be chosen and advice from the Green Guide to Specification will be taken into consideration for the selection. The Green Guide rates the environmental impact of different materials and components, taking into account factors like toxicity, ozone depletion, ease of recycling, waste disposal etc. Where viable, at least 80% (by area) of the new main elements in the building, fabric & building services insulation should be specified to achieve the best performing "A" and "A+" ratings from the Green Guide.



Environmental Issue
Climate Change*
Water extraction
Mineral extraction
Stratospheric ozone depletion*
Human toxicity
Ecotoxicity to freshwater
Higher level nuclear waste
Ecotoxicity to land
Waste disposal
Fossil fuel depletion
Eutrophication*
Photochemical ozone creation*
Acidification*

Figure 20 The 13 Environmental Issues assessed by the Green Guide

10.2 Sustainable Timber

All timber used for basic or finishing building elements in the scheme will be sourced from responsibly managed and sustainable forests or plantations. Such timber products are the only truly renewable construction material in common use and growing trees also absorb and fix CO_2. Forests can also provide the habitat for a wide variety of plant and animal life, preserving important ecology and promoting biodiversity.

10.3 Locally Sustainable Materials

A building that is truly sustainable must be constructed using locally sourced, sustainable materials i.e. materials that can be supplied without any adverse effect on the environment. Therefore, where practical, materials should be sourced from local suppliers, reducing the environmental impacts and CO_2 emissions associated with transportation to the site.

10.4 Recycled Materials

Scope for increased recycling will be incorporated by specifying recycled materials where possible and ensuring that even where new materials are used, as much as possible can be recycled at the end of the buildings' life.

Specifying materials with a high-recycled content is also another method of saving processing or manufacturing energy. The recycled content of a material can be described as either post-consumer or post-industrial to indicate at what point in the life cycle a material is reclaimed.

10.5 Ozone Depletion and Global Warming

CFCs and HCFCs, compounds commonly used in insulation materials and refrigerants, can cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. They also significantly increase global-warming if they leak into the atmosphere. Following the Montreal Protocol, production and use of CFCs is no longer permitted and EC regulations phased out HCFCs at the end of 2015. However, products that replace these gases are often still potent global warming contributors.

All insulation materials specified for the proposed scheme will have zero Ozone Depleting Potential and low Global Warming Potential, (GWP<5) in either manufacture or composition in line with the CfSH requirements. This will include insulation for building elements (roof, internal & external walls, floor) as well as insulation for hot water vessels and pipe or duct work.

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11. Water Conservation

Water consumption in the UK has risen by 70% over the last 30 years. Trying to meet the increasing demand by locating new sources of water supply is both expensive and damaging to the environment. Therefore, the design team have focused on reducing the demand for water and managing the existing resources.

11.1 Demand Reduction and Water Efficiency

The aim is to minimise internal and external potable water use within the development. Good water management can contribute to reducing the overall level of water consumption maintaining a vital resource and having environmental as well as cost benefits in the life-cycle of the building. The following water saving measures are being considered:

Dual Flush Cisterns on WC's - These units have the ability to provide a single flush of 4L and/or a full flush of 6L.

Flow Restrictors to Taps - Flow restrictors reduce the volume of water discharging from the tap. Spray taps have a similar effect and are recommended to reduce both hot and cold-water consumption. Low flow taps in one of the above forms will be installed in all areas.

Low Flow Showers - The average shower uses 15 litres of water a minute, by restricting the output of the showers in the development to a maximum of 9 litres/ min a 40% water saving can be achieved.

Water Meters - In 1995 approximately 33,200 million litres of water a day were extracted in England and Wales, this increased to 44,130 million litres/day in 2001, and much of this was for domestic water supply. To reduce this figure, accurate information on usage is required for management of a building's consumption. Water meters will be specified on the main supply to each dwelling.

12. Sustainable Urban Drainage

The site's drainage strategy will aim to reduce the impact of development on the natural drainage patterns, by retaining water on site by the incorporation Sustainable Urban Drainage techniques (SUDs).

As the site is currently completely impermeable with hard landscaping and building areas, the main aim for the development will be to improve the water retention of the site.

The Environment Agency's Flood Map indicates that the site is located within Flood Zone 1 and therefore there is a low risk of flooding on the site due to a great distance from the river Thames.

Figure 21 Flood Map for 20-21 King's Mews

As a minimum, the design will ensure that the peak rate of runoff into watercourses is no worse than the existing site's run off rate. This will comply with the Interim Code of Practice for Sustainable Urban Drainage Systems (SUDS) (CIRIA, 2004) or for at least the 1 year and 100 year return period events.

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13. Waste Management

Buildings and building sites produce a significant amount of waste annually. Most of the waste produced in the UK is disposed of in landfill sites and only a small percentage of it is recycled or reused.

13.1 Waste Targets

Under EU legislation the UK will have to ensure that less than a third of its waste is sent for burial in landfill sites by 2020. To achieve this target a number of measures are implemented, including landfill tax, aiming to discourage disposal of waste to landfill. Good waste management is a key component of sustainable development. Reducing waste is an important means of:

- Reducing unnecessary expenditure;
- Reducing the amount of natural resources used for production of new materials;
- Reducing energy for waste disposal;
- Reducing levels of contamination and pollution arising from waste disposal.

The proposed development will minimise the impact of waste in the environment where possible and fit-out designer for the commercial tenancies should be aware of these measures.

13.2 Demolition & Construction

During the construction phase a large amount of waste material will be generated through construction, demolition and land clearing procedures. In building construction, the primary waste products in descending percentages are: wood, asphalt/concrete/masonry, drywall, roofing, metals, and paper products.

Prior to commencement on site a Site Waste Management Plan (SWMP) that complies with the requirements of current legislation and CSH will be prepared. This plan will identify the local waste haulers and recyclers, determine the local salvage material market, identify and clearly label site spaces for various waste material storage and require a reporting system that will quantify the results and set targets. As a minimum the SWMP will contain:

a. The target benchmark for resource efficiency e.g. m^3 of waste per $100m^2$ or tonnes of waste per $100m^2$;
b. Procedures and commitments for minimising non-hazardous waste in line with the benchmark;
c. Procedures for minimising hazardous waste;
d. Procedures for monitoring, measuring and reporting hazardous and non-hazardous site waste;
e. Procedures for sorting, reusing and recycling construction waste into defined waste groups either on site or through a licensed external contractor;
f. The name or job title of the individual responsible for implementing the above.

As the proposed development is a redevelopment, there is limited opportunity for new material to make up foundations. Opportunities for introducing more reused or reusable materials/components will be explored during detailed design.

13.3 Waste Management & Reporting in Operation

The detailed design phases will identify the potential waste streams that the development will produce. As a minimum, plans will be formulated to handle the separation, collection, and storage of common recyclable materials such as paper, glass, plastics, and metals. The collection points will be easily accessible to all of the users.

The main aim will be to recycle as much waste as possible; this will be achieved by making sure that waste recycling facilities are strategically placed in convenient locations.

The space allocated for waste storage should be able to accommodate containers with at least the minimum volume recommended by British Standard 5906 (British Standards, 2005) based on a maximum collection frequency of once per week. This is 170 litres volume for a two bedroom dwelling.

Large integrated recycling bins with at least 3 containers for recyclable waste and one general waste will be considered for each dwelling similar to the image adjacent.

14. Environmental Management

14.1 Construction

Construction sites are responsible for significant impacts, especially at a local level. These arise from noise, potential sources of pollution and waste and other disturbances. Impacts such as increased energy and water use are also significant. Therefore attention is being given to site-related parameters with the aim to protect and enhance the existing site and its ecology.

The aim is to have a construction site managed in an environmentally sound manner in terms of resource use, storage, waste management, pollution and good neighbourliness. To achieve this, there will be a commitment to comply with the Considerate Constructors Scheme. As a minimum a score of greater than 35 of out 50 will be achieved with an aspiration to exceed 40, with no individual section achieving a score of less than 7.

Areas that can be taken into consideration in order to minimise the impact of the construction site on its surroundings and the global environment are as follows:

- Monitor, report and set targets for CO_2 or energy usage arising from site activities;
- Monitor, report and set targets for CO_2 or energy usage arising from transport to and from site;
- Monitor, report and set targets for water consumption arising from site activities;
- Monitor construction waste on site, sorting and recycling construction waste where applicable;
- Adopt best practice policies in respect of air and water pollution arising from site activities;
- Operates an Environmental Management System;
- Additionally, all timber used on site should be responsibly sourced.

15. Land Use and Ecology

The site is currently comprised of an existing building with no green spaces, with the entire site made up of hard standing. The proposed development involves a sedum roof, which is expected to improve the ecological value of the site.

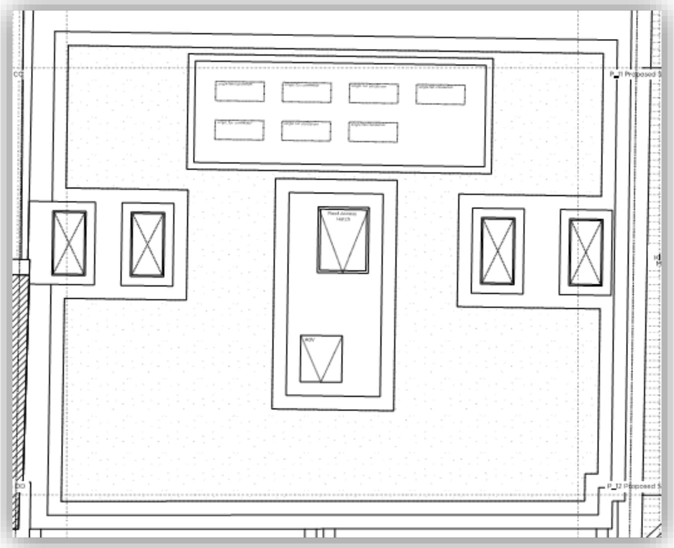


Figure 22 Proposed Sedum Roof

A check has been undertaken in order to establish whether the site lies within any conservations areas or historic parks or gardens. The check confirms that the building lies within the Bloomsbury conservation area.

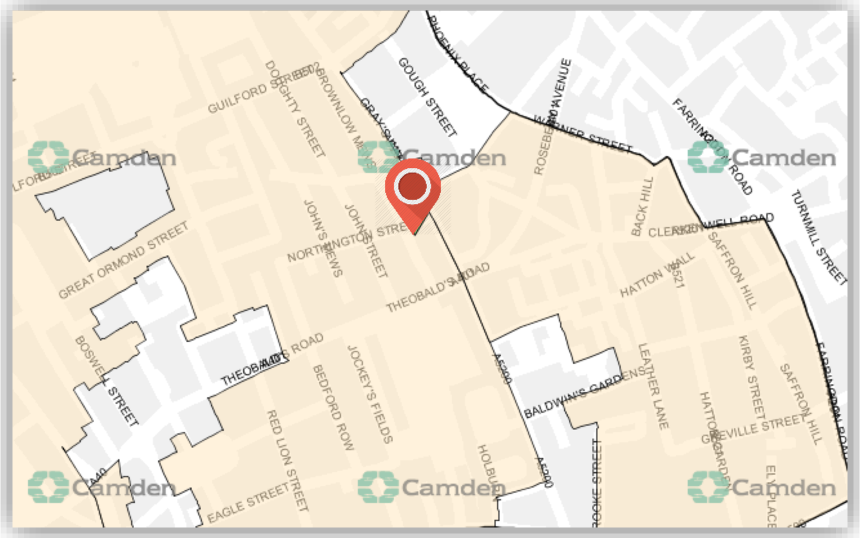


Figure 23 Conservation Area Check

16. Pollution

Global concern for environmental pollution has risen in recent years, as concentrations of harmful pollutants in the atmosphere are increasing. Buildings have the potential to create major pollution both from their construction and operation, largely through pollution to the air (dust emissions, NOx emissions, ozone depletion and global warming) but also through pollution to watercourses and ground water. The proposed development will aim to minimise the above impacts, both at the design stage and on-site.

16.1 Ozone Depletion

CFCs and HCFCs, compounds commonly used in insulation materials and refrigerants, can cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. They also significantly increase global-warming if they leak into the atmosphere. Following the Montreal Protocol, production and use of CFCs and HCFCs is no longer permitted. However, products that replace these gases are often still potent global warming contributors. Where refrigerants are used for air-conditioning and comfort cooling they will be CFC and HCFC-free.

16.2 Internal pollutants

Volatile organic compounds (VOCs) are emitted as gases (commonly referred to as offgassing) from certain solids or liquids. VOCs include a variety of chemicals, some of which are known to have short-term and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors.

VOCs are emitted by a wide array of products numbering in the thousands. Examples include: paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials, furnishings, adhesives, Urea-formaldehyde foam insulation (UFFI), pressed wood products (hardwood plywood wall panelling, particleboard, fibreboard) and furniture made with these pressed wood products.

'No' or 'low' VOC paints are available from most standard mainstream paint manufacturers. These 'eco-friendly' paints are made from organic plant sources and also powdered milk based products.

The design team will seek to select internal finishes and fittings with low or no emissions of VOCs and comply with European best practice levels as a minimum.

16.3 NOx emissions from boilers

Nitrous oxides (NOx) are emitted from the burning of fossil fuels and contribute to both acid rain and to global warming in the upper atmosphere. At ground level, they react to form ozone, a serious pollutant and irritant at low level. Burners in heating systems are a significant source of low-level NOx, while power stations (and therefore electric heating) are a significant source of NOx in the upper atmosphere.

The amount of NOx emissions varies between products. New gas boilers vary from 40 NOx/kWh to <70mg NOx/kWh (class 5). The proposed high efficiency gas-fired combination boilers will be specified to emit less than 50 NOx/kWh.

The City of Camden was declared an Air Quality Management Area (AQMA) in 1999 as the levels of NOx exceeded the National Air Quality Objectives. The Camden Air Quality Action Plan recommends that emissions standards for new boilers that meet the BREEAM requirements are targeted.

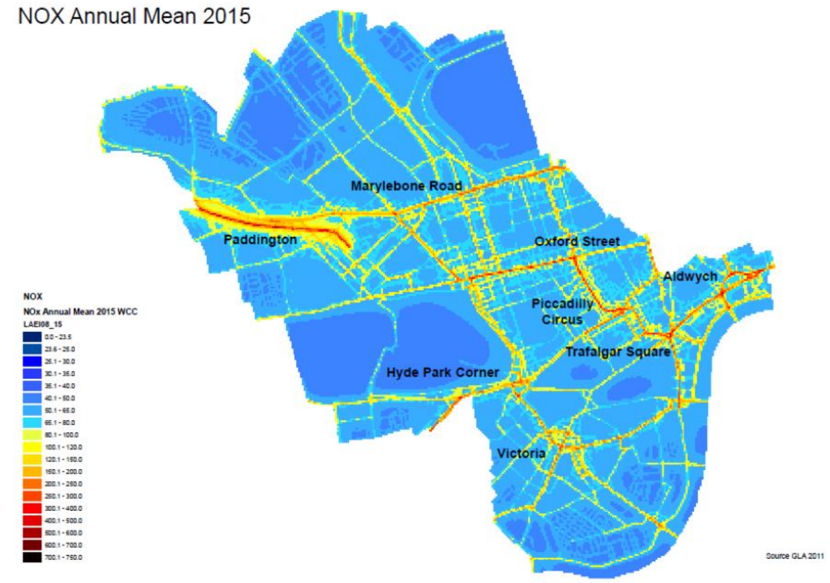


Figure 24 NO_X Levels in Mayfair

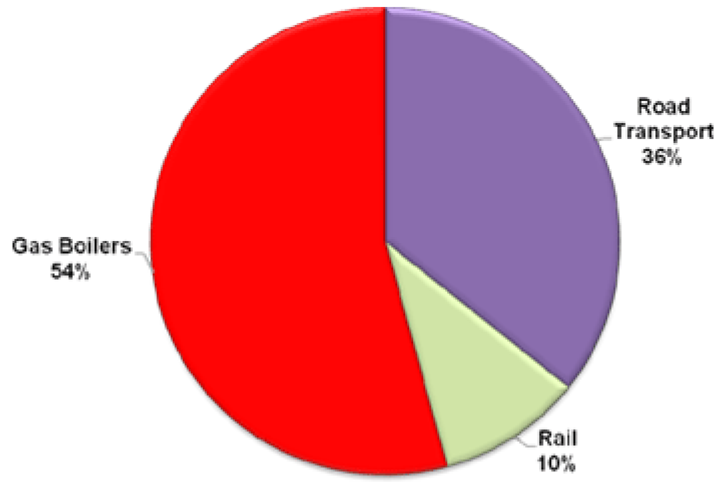


Figure 25 Breakdown of sources of NOx in the Borough of Camden (Source: London Borough of Camden)

17. Green Transport

The transport of people between buildings is the second largest source of CO_2 emissions in the UK after energy use in buildings and remains the main source of many local pollutants. Energy use and emissions from transport are growing at 4% per year, and at the same time, the effects of climate change are becoming more severe; there will be greater pressure to control CO_2 emissions from transport and sites without good access to public transport will be at much greater risk from these controls.

17.1 Site Location

20-21 King's Mews is located to the North of the City of London's business district and South of the King's Cross St Pancras area. The site has good public transport access to routes heading around and directly through the centre of London and out to other suburbs. As such it has excellent local and regional transport links within easy walking distance of the site.

Farringdon, Russell Square, Chancery Lane and Holborn underground stations are all within 800m walk of the site, located on various Underground lines, therefore offering connections to destinations throughout the city.

Thameslink and National Rail depart from Farringdon, with Crossrail scheduled to open within the next few years. National and international rail services depart Kings Cross and London St Pancras, 1.5km away.

The Public Transport Accessibility Level for the development is 6b, the highest rating possible, indicating that the site has excellent public transport links. This is also projected to increase as the development progresses due to the increase in people density in the area.

17.2 Cycling Facilities

A Santander cycle hire scheme stand is located 100m from the site at Northington Street and another further down Grays Inn Road at Wren Street.

17.3 Walk Score

The building has a Walk Score of 99: 'Walker's Paradise', which means that daily errands can be performed without the use of a car.

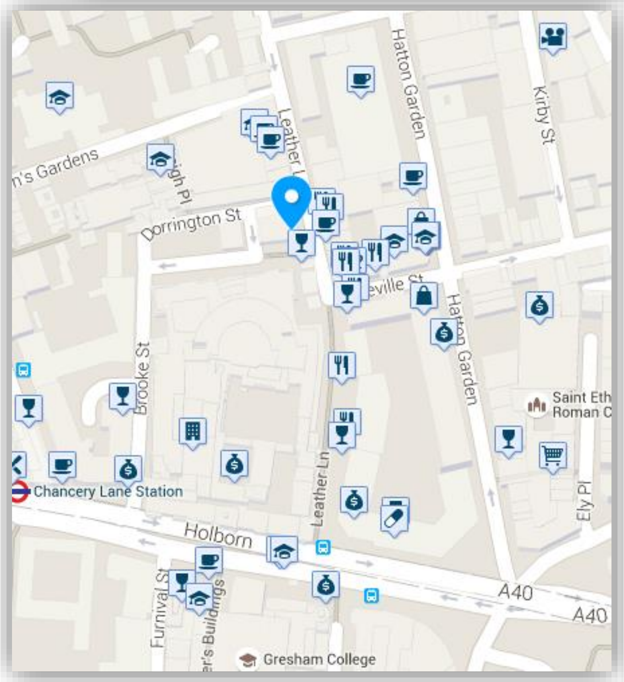
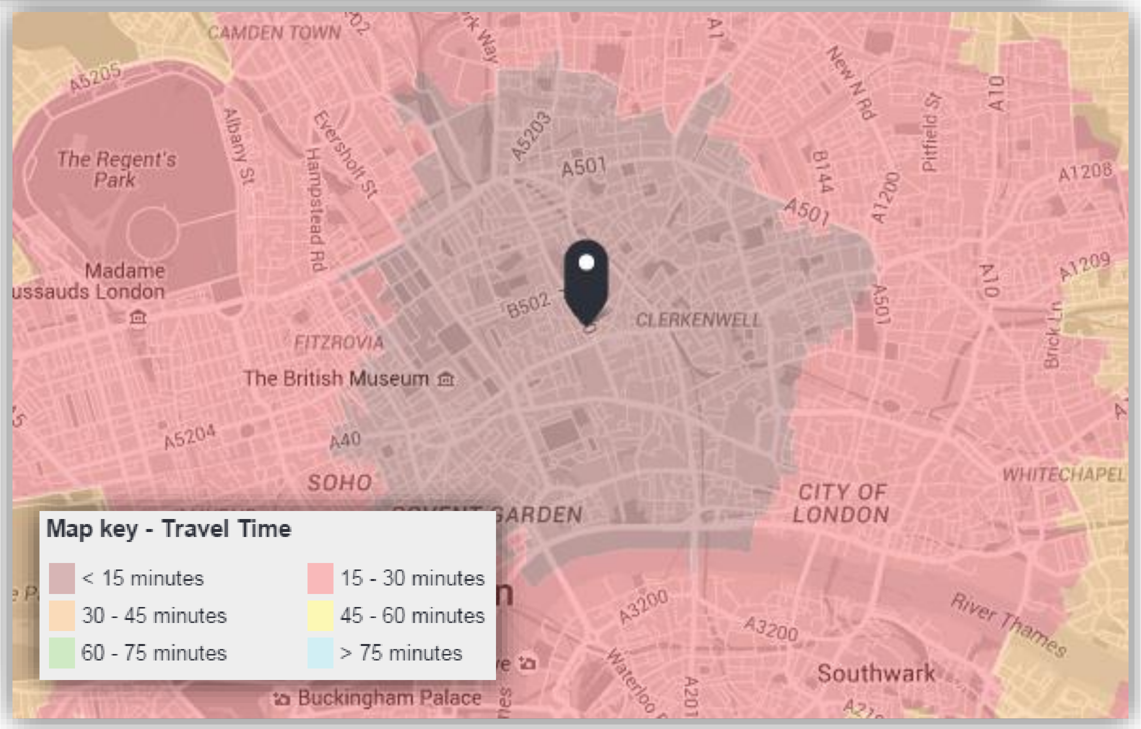


Figure 26 Walk Score Map



Appendix A: Modelled Parameters - Dwellings

Detail	Design	Regulations (L1a)
Ground floor average area weighted U-value	0.10W/m^{2}K	0.25W/m^{2}K
External wall average area weighted U-value	0.15W/m^{2}K	0.30W/m^{2}K
Roof average area weighted U-value	0.10W/m^{2}K	0.20W/m^{2}K
Window area weighted U-value (including frame)	1.40W/m^{2}K	2.00W/m^{2}K
Roof light area weighted U-value (including frame)	1.40W/m^{2}K	2.00W/m^{2}K
Window Visible Light Transmission (%)	60.0%	n/a
Roof Visible Light Transmission (%)	n/a	n/a
Glazing total solar transmission (G-value)	70.0%	n/a
External door average area weighted U-value	1.40W/m2K	2.0W/m2K
Thermal Bridging Y Value	Accredited Construction	n/a
Air permeability @ 50 Pascals	3.0m^3/hr/m^2	10m^3/hr/m^2

Figure 28 Building Fabric Performance

Detail	Be Lean	Be Green
Heating type	Individual Combi Boilers	Individual Combi Boilers
Heating fuel	Natural Gas	Natural Gas
Gross boiler seasonal efficiency / VRF efficiency	90.0%	90.0%
Heating Emitters	Radiators	Radiators
Boiler Compensator	Weather	Weather
Controls	Time and temperature zone control	Time and temperature zone control
Ventilation	MVHR 92% Efficiency	MVHR 92% efficiency
Extract SFP (W/L/s)	0.55	0.55
Ductwork	Semi-rigid	Semi-rigid
Hot water pipework insulated	Yes	Yes
Cooling Type	Split System	VRF
Cooling SEER	3.5	4.0
Low energy light fittings	100%	100%
Hot water daily usage	< 125 l/p/day	< 125 l/p/day
Hot Water System	Instantaneous Combi	Instantaneous Combi

Figure 29 Systems Performance