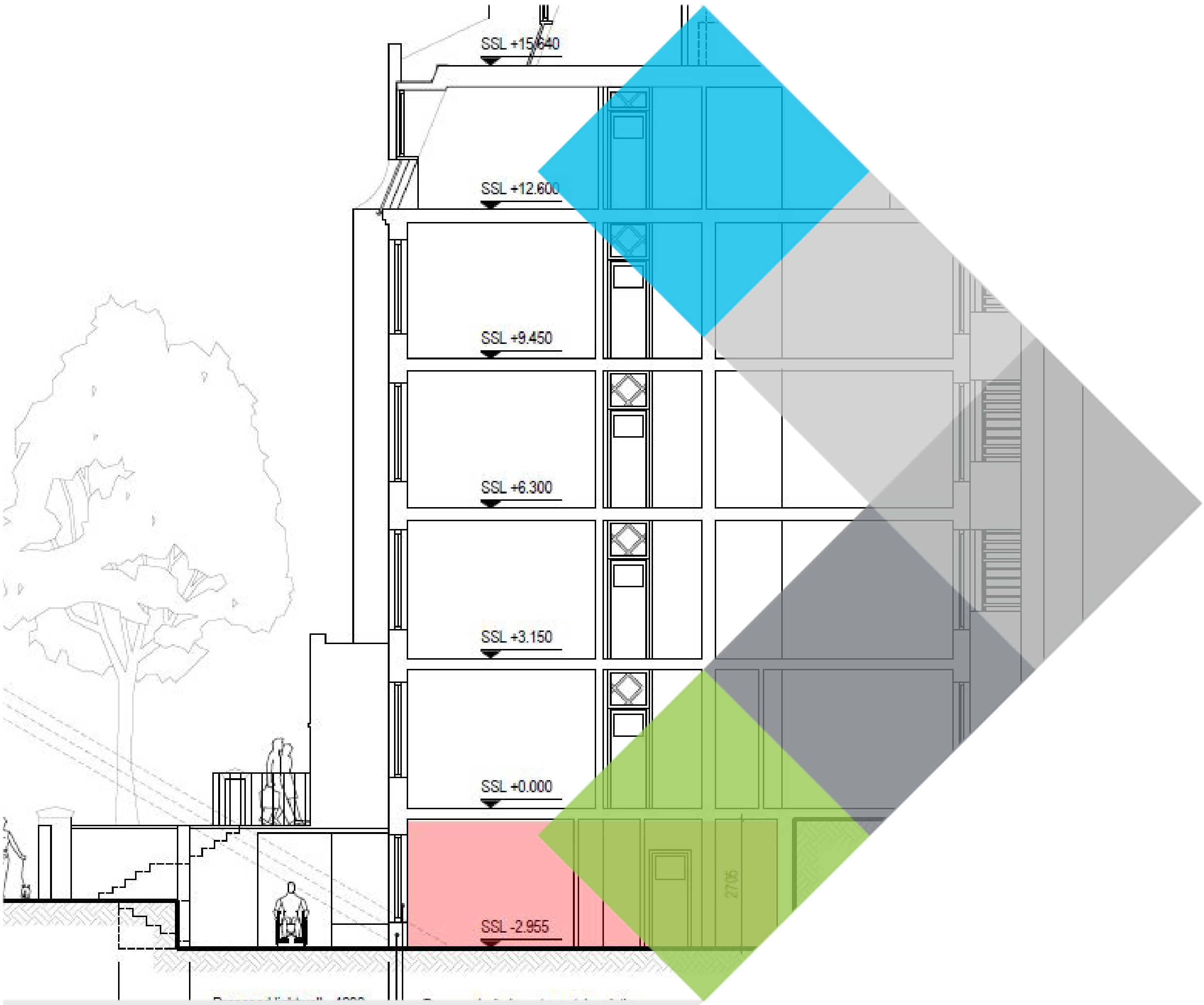

Sustainability Statement

Ornan Court Limited

Ornan Court, Belsize Park

Final

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ABOUT HODKINSON CONSULTANCY

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry and tailor teams to suit each individual project.

We are able to advise at all stages of projects from planning applications to handover.

Our emphasis is to provide innovative and cost effective solutions that respond to increasing demands for quality and construction efficiency.

This report has been prepared by Hodkinson Consultancy using all reasonable skill, care and diligence and using evidence supplied by the design team, client and where relevant through desktop research.

Hodkinson Consultancy can accept no responsibility for misinformation or inaccurate information supplied by any third party as part of this assessment.

Executive Summary

The purpose of this Sustainability Statement is to demonstrate that the proposed development at Ornan Court by Ornan Court Limited in the London Borough of Camden is considered sustainable, as measured against relevant local, regional and national planning policies.

The development proposes the development of two wheelchair accessible lower group apartments in Ornan Court, on Ornan Road in Belsize Park. Through the incorporation of sustainable design and construction methods, energy and water saving measures, waste reduction techniques as well as measures to enhance the ecological value of the site, a good quality and sustainable development is proposed.

The key sustainability features outlined in this Sustainability Statement are listed below:

- A 5.81% reduction in CO_2 emissions is to be achieved through the use of energy efficiency measures;
- Water efficiency measures and devices will be installed in the homes to target a maximum daily water usage of 105 litres/person/day in accordance with the London Plan and the tighter Building Regulations optional requirement;
- Recycling facilities will be provided for domestic and construction related waste;
- The use of sustainable transport modes will be encouraged, and the site benefits from very good connections to a range of surrounding transport services;
- The dwellings will be designed to meet Building Regulation Part M 4(3) Category 3 requirements (wheelchair user dwellings), ensuring they are accessible and can be used by all;
- 100% of the proposed development will be on an existing site. Developing under-used sites is supported by the NPPF;
- Where practical, building materials will be sourced locally to reduce transportation pollution and support the local economy. All timber will be purchased from responsible forest sources. Materials will be selected based on their environmental impact, with preference given to high rated materials from the BRE Green Guide to Specification where possible; and
- Construction site impacts will be minimised and monitored where possible.

CONTENTS

1. INTRODUCTION

1.1 This Sustainability Statement has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development. This statement sets out the sustainable design and construction measures included in the planning application for the proposed development at Ornan Court in the London Borough of Camden.

1.2 The formulation of the Sustainability Strategy for the proposed development has been developed in response to several key priorities, including:

> To achieve a viable reduction in CO_2 emissions with an affordable, deliverable and technically appropriate strategy;

> To address all national, regional and local planning policies and requirements;

> To provide high quality homes that are adaptable to future changes in climate;

> To minimise the negative impact on the proposed development on both the local and wider climate and environment;

> To achieve high levels of sustainable design and construction;

> To minimise emissions of pollutants such as oxides of nitrogen and particulate matter; and

> To create a pleasant, safe and friendly living environment that will be flexible to its residents' needs.

Sustainable Development

1.3 Resolution 42/187 of the United Nations General Assembly defined sustainable development as:

'Meeting the needs of the present without compromising the ability of future generations to meet their own needs.'

1.4 The National Planning Policy Framework (NPPF) and Planning Practice Guidance define three dimensions to sustainable development: economic, social and environmental. These dimensions give rise to the need for the planning system to perform a number of roles. The NPPF and Planning Practice Guidance define these roles as follows:

> **An Economic Role**: Contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time

to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure.

> **A Social Role**: Supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high quality built environment, with accessible local services that reflect the community's needs and support its health, social and cultural well-being.

> **An Environmental Role**: Contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.

The Strategy

1.5 In preparing this Sustainability Statement we have worked with the applicant to produce a strategy which recognises the economic, social and environmental roles of the planning system to achieve a sustainable form of development which is both policy compliant and deliverable. In preparing the strategy we have focussed on ensuring that the development is:

Economically Sustainable

> The provision of short term employment opportunities for the local population during construction;

> The provision of transport choice and options to those that live within and visit the development.

Socially Sustainable

> Effective and appropriate consultation of relevant stakeholders to inform the design of the proposed development;

> A inclusive housing mix which is beneficial to the needs of the area;

> Ensuring that the development is accessible to all;

> Incorporating measures to reduce and design out crime;

> Committing to considerate construction practices.

Environmentally Sustainable

> Integrating energy efficiency into the design of the development;

> Incorporating water efficiency measures to reduce consumption;

> Recognising the need to adapt to climate change;

> Sourcing materials in a sustainable way;

> Managing waste through measures to reduce, reuse and recycle.

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2. DEVELOPMENT OVERVIEW

Site Location

2.1 The application site is located on the junction of Ornan Road and Haverstock Hill in the London Borough of Camden. The site is the lower ground floor of the existing Ornan Court apartment block.

Figure 1: Site Location - © OpenStreetMap Contributors. Go to www.openstreetmap.org/copyright

Proposed Development

2.2 The proposed development consists of the development of 2x two-bed wheelchair accessible lower ground apartments in the existing Ornan Court apartment blocks.

3. RELEVANT PLANNING POLICY

3.1 The following planning policies and requirements have led the sustainable design of the proposed development.

National Policy: The NPPF

3.2 The National Planning Policy Framework (NPPF) was published on 27 March 2012. This document sets the overarching policies for development in England and states that:

"At the heart of the NPPF is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking.

For decision-taking this means:

- *Approving development proposals that accord with the development plan without delay; and*
- *Where the development plan is absent, silent or relevant policies are out-of-date, granting permission unless:*
  - *Any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or*
  - *Specific policies in this Framework indicate development should be restricted*."

3.3 The NPPF states that there are three dimensions to sustainable development; economic, social and environmental. It addresses the key areas in relation to achieving sustainable development, including the following:

- Building a strong, competitive economy;
- Ensuring the vitality of town centres;
- Promoting sustainable transport;
- Delivering a wide choice of high quality homes;
- Requiring good design;
- Promoting healthy communities;
- Meeting the challenge of climate change and flooding;

> Conserving and enhancing the natural environment; and

> Facilitating the sustainable use of materials.

3.4 Paragraph 95 of the NPPF states that:

"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."*

3.5 The document also makes it clear that the delivery of a wide choice of well-designed high quality homes is central to delivering sustainable development.

Regional Policy: The London Plan

3.6 **The London Plan** sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20 – 25 years.

3.7 On 10 March 2015, the Mayor adopted the Further Alterations to the London Plan (FALP). Additionally, on 14 March 2016, the Mayor adopted the Minor Amendments to the London Plan (MALP). From these dates respectively, the FALP and MALP are operative as formal alterations to the London Plan and form part of the development plan for Greater London. Where the London Plan is referenced within this document, this comprises the FALP and MALP as published.

3.8 The following outlines key policies set out in the London Plan which are relevant to the Proposed Development and this Sustainability Statement.

3.9 **Policy 3.8 – Housing Choice** requires that ninety percent of new housing meets Building Regulation requirement M4 (2) 'accessible and adaptable dwellings' and ten percent meets Building Regulation requirements M4 (3) 'wheelchair user dwellings'.

3.10 **Policy 5.2 – Minimising Carbon Dioxide Emissions** requires that all residential and non-residential major development between 2013 – 2016 achieve a 40% improvement on 2010 Building Regulations. The London Plan Sustainable Design and Construction SPG (2014) updates this target stating that the Mayor will adopt a carbon dioxide improvement target beyond Part L 2013 of 35%.

3.11 **Policy 5.3 – Sustainable Design and Construction** states that the highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments. Major development should meet the minimum standards outlined in the

London Plan Supplementary Planning Guidance and this should be clearly demonstrated. The standards include the following sustainable design principles (summarised):

> Minimising CO_2 emissions;

> Avoiding internal overheating and contributing to the urban heat island effect;

> Efficient use of natural resources (including water);

> Minimising pollution (including noise, air and urban run-off);

> Minimising the generation of waste and maximising reuse and recycling;

> Avoiding impacts from natural hazards (including flooding);

> Ensuring developments are comfortable and secure for users;

> Securing sustainable procurement of materials, using local suppliers where feasible; and

> Promoting and protecting biodiversity and green infrastructure.

3.12 **Policy 5.9 – Overheating and Cooling** seeks to reduce the impact of the urban heat island effect, reduce potential overheating and reduce reliance on air conditioning systems.

3.13 **Policy 5.10 – Urban Greening** encourages new planting in the public realm (including streets, squares and plazas) and green infrastructure, to contribute to the adaptation to, and mitigation of, the effects of climate change.

3.14 **Policy 5.12 – Flood Risk Management** states that new developments must comply with the flood risk assessment and management requirements, and will be required to pass the Exceptions Test addressing flood resilient design and emergency planning.

3.15 **Policy 5.13 – Sustainable Drainage** requires that developments should use sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible.

3.16 **Policy 5.15 – Water Use and Supplies** requires that development should minimise the use of mains water by incorporating water saving measures and equipment and that residential development is designed so that mains water consumption meets a target of 105 litres/person/day or less (reflecting the optional requirement in Part G).

3.17 **Policy 7.3 – Designing Out Crime** requires that development should reduce the opportunities for criminal behaviour and contribute to a sense of security without being overbearing or intimidating.

Housing Supplementary Planning Guidance

3.18 The **London Plan Housing Supplementary Planning Guidance** was adopted in April 2016.

3.19 Updated to reflect the FALP and MALP, Part 2 'Quality' of the document now reflects the Government's preferred approach to housing standards and the new technical national space standards.

Sustainable Design and Construction Supplementary Planning Guidance

3.20 The **London Plan Supplementary Planning Guidance – Sustainable Design and Construction (2014)** was adopted in April 2014.

3.21 The report states that the guidance in this document is intended to:

> Provide detail on how to implement the sustainable design and construction and wider environmental sustainability policies in the London Plan;

> Provide guidance on how to develop more detailed local policies on sustainable design and construction;

> Provide best practice guidance on how to meet the sustainability targets set out in the London Plan;

> Provide examples of how to implement sustainability measures within developments.

3.22 The SPG provides guidance on:

> Energy efficient design;

> Meeting carbon dioxide reduction targets;

> Decentralised energy;

> How to off-set carbon dioxide where the targets set out in the London Plan are not met;

> Retro-fitting measures;

> Support for monitoring energy use during occupation;

> An introduction to resilience and demand side response;

> Air quality neutral;

> Resilience to flooding;

> Urban greening;

> Pollution control;

> Basements policy and developments; and

> Local food growing.

3.23 Each section of the Supplementary Planning Guidance sets out the Mayor's priorities for the particular topic area, which the Mayor seeks developers to address in all development proposals. Some sections also contain best practice ambitions, which the Mayor strongly encourages be delivered in appropriate developments. To support these approaches, the Supplementary Planning Guidance includes detailed guidance for boroughs and developers, signposts to further information and best practice examples.

Local Policy: London Borough of Camden

Camden Local Plan

3.24 The **Camden Local Plan** was adopted in July 2017 to replace the Core Strategy and Development Policies planning documents adopted in 2010. Policies that are considered pertinent to this development include:

3.25 **Policy A5: Basements –** In determining proposals for basements and other underground development the Council will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability in the form of a Basement Impact Assessment and where appropriate, a Basement Construction Plan. The Council will only permit basement development where it is demonstrated to its satisfaction that the proposal will not cause harm to:

> Neighbouring properties;

> The structural, ground or water conditions of the area;

> The character and amenity of the area;

> The architectural character of the building; and

> The significance of heritage assets.

3.26 **Policy CC1: Climate change mitigation** – The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. The Council will:

> Promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

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

> Support and encourage sensitive energy efficiency improvements to existing buildings; and

> Expect all developments to optimise resource efficiency.

3.27 **Policy CC2: Adapting to climate change –** All development should adopt appropriate climate change adaption measures such as:

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

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

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

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

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

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

> Encourage new build residential development to use the Home Quality Mark and Passivhaus design standards; and

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

3.28 **Policy CC3: Water and flooding** – The council will require the development to incorporate water efficiency measures; consider the impact of development in areas at risk of flooding; and utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off where feasible.

3.29 **Policy CC4: Air Quality** – Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.

3.30 **Policy T1: Prioritising walking, cycling and public transport** – Developments must provide accessible, secure cycle parking facilities exceeding minimum standards outlined within the London Plan (Table 6.3).

Summary

3.31 While a sustainable development is proposed in line with the London Plan and Camden policies, a BREEAM Domestic Refurbishment rating is not targeted here. This is compliant with Camden Policy CC2 (as noted above) which only requires BREEAM for development of 5 or more dwellings and/or development exceeding 500sqm floorspace.

4. ENERGY & CO_2 CONSERVATION

Introduction

4.1 This section sets out the energy strategy proposed for the dwellings at the Ornan Court development, along with the resultant CO_2 reduction delivered from this strategy.

4.2 Following discussions with the Planning Officer for the development it has been agreed that the CO_2 reduction set out in Camden's Councils Local Plan CC1 & CC2 of a 19% reduction would not be achievable due to the constraints and scale of this Basement site. However the developer is committed to improve CO_2 emissions beyond Building Regulation Part L 2013 standards. This will be achieved through a considered design strategy through, prioritising a fabric first approach and installation of energy efficient technologies where appropriate.

4.3 Due to the space constraints of this site it has also been agreed that the application of Renewable Technologies (CPG3) is not viable for the proposed basement dwellings. A feasibility assessment is included later within this strategy document.

4.4 The potential for further CO_2 reductions is restricted at the proposed Ornan Court development due to:

- The proposed fabric U-Values take into account the similar basement construction types. Due to the restraints on horizontal space basement wall thickness are limited. The proposed values consider the installation of an energy efficient building fabric whilst proposing realistic values that can be physically achieved onsite;

- The dwellings have a single elevation to the front of the development. The installation of any renewable technology (such as ASHP) is unsuitable as this would reduce access space to the development;

- Solar PV is unsuitable onsite as roof access is unavailable to these apartments.

4.5 A reduction in CO_2 emissions will be achieved through the use of the London Plan Energy. DER/TER worksheets from the SAP calculations carried out are included in **Appendix A.**

Be Lean Measures

4.6 The dwellings will be built to an energy efficient design, achieving fabric heat losses better than the minimum requirements of Part L. Table 1 below, details the proposed Building Fabric Target.

Table 1: Proposed Building Fabric Target Improvements

Construction Element	Description	Target Heat Loss
External Basement Walls	Concrete Insulated Basement Walls (ie) Externally insulated Concrete Walls	0.17W/m²K
External Walls to Light-well: Front Elevation	Block Cavity Wall Construction Full Fill insulation	0.21W/m²K
Corridor Walls	Block Cavity Wall Construction Full Fill Insulation	0.18 W/m²K
Party Walls	Fully Filled and Sealed	0.00 W/m²K
Basement Floor	Internally Insulated Basement Slab	0.14 W/m²K
Upper Intermediate Party Floor Between Dwellings	Space between new and existing dwellings	0.00 W/m²K
Glazing	Double Glazed Soft (low-E) Argon Filled U-PVC Windows	1.30 W/m²K
Apartment Entrance Door	U-PVC Solid Front Door	1.40 W/m²K
Thermal Bridges	Accredited Construction Details to front facing and corridor elevations. All other junctions considered default for basement construction.	

Ventilation

4.7 All dwellings will include efficient intermittent or continuous extract ventilation, providing direct ventilation to the kitchen and wet rooms in each property.

4.8 To avoid problems associated with the build-up of pollutants and humidity levels whilst avoiding excessive heat loss, ventilation will be designed to meet the requirements of Parts L & F the building regulations.

4.9 All homes will benefit from openable windows allowing natural convective ventilation and night purging should the occupant desire.

4.10 The properties should be designed to meet an air permeability of 4.0 $m^3/(m^2.h)$.

Lighting

4.11 All lighting will be dedicated energy efficient fittings with appropriate controls.

4.12 Any external and security lighting will be adequately controlled using PIR sensors, daylight cut-off sensors or time switches.

Energy Efficient White Goods

4.13 Where provided by the client, energy efficient white goods will meet the following specification and energy efficient ratings under the EU Energy Efficiency Labelling Scheme:

> Fridges, freezers and fridge-freezers: A+ rating.

> Washing machines and dishwashers: A rating.

> Tumble dryers and washer-dryers: B rating.

Heating

4.14 Each dwelling will be fitted an energy efficient Combination Gas Boiler ~89%, which will deliver space heating and domestic hot water to each property.

4.15 Energy efficient boiler & radiator controls (Time Temperature Zone Control) will be fitted to allow the future residents optimum control of their heating temperatures.

Waste Water Heat Recovery

4.16 To meet compliance with Part L 2013 Building Regulations, the properties at Ornan Court will be required to incorporate waste water heat recovery WWHR units into the properties. For the purposes of this assessment our SAP calculations have assumed 1 WWHR installed to the main bathroom and another installed to the shower room within each property.

Be Clean Measures

4.17 No decentralised energy or local heat networks are available for connection at the Ornan Court Site.

Be Green Measures

4.18 The Energy Hierarchy requires use to consider the use of renewable technologies as part of the proposed design. However due to the space constraints onsite it has been deemed unviable to incorporate renewable technologies into this development, a range of technologies have been assessed and the reasons for why they are unsuitable is given below.

Biomass Boiler

4.19 Biomass boilers generate heat on a renewable basis as they are run on biomass fuel which is virtually carbon neutral. A biomass boiler would require a central plant room and heat distribution network and would therefore be liable to the high capital and running costs noted for district heating and CHP. This option is unsuitable for the proposed site.

Air and Ground Source Heat Pumps (ASHPs and GSHPs)

4.20 Whilst reducing energy usage significantly, heat pumps replace gas as the heating fuel with electricity, which is more carbon intensive. The result of this is that heat pumps do not enable sufficient reductions of CO_2 emissions for policy compliance. Electricity is also a more expensive fuel than gas, so energy bills are not necessarily reduced by heat pumps as much as by other technologies.

4.21 GSHPs are able to provide substantial reductions in energy usage. However, GSHPs require costly ground excavation works to bury the coils – boreholes would be required at the site due to the high space requirements of ground coils. There is no ground space available for the installation of a GSHP at the proposed Ornan Court development, they have therefore been deemed as unsuitable for this development

4.22 Air Source Heat Pumps are a more economical alternative to GSHPs as they do not require ground works. However, the performance of ASHPs can be lower than for GSHPs so therefore the reductions in CO_2 are correspondingly low. As there is little wall space available on the front elevation for the installation of such units. It has therefore been concluded that ASHP's are not an appropriate technology for the proposed development.

Wind Turbines

4.23 Small rooftop wind turbines are designed to generate electricity from the wind for use within each dwelling.

4.24 The proposed dwellings have no ownership over roof access within the Ornan Court Tenement Block. The installation of a wind turbine would not be suitable due to access and maintaining issue along with impacting of the aesthetic of the local area. It has therefore been concluded that wind turbines are not a suitable technology for the proposed development.

Solar Thermal Panels

4.25 Solar thermal panels use the sun's energy to generate hot water for each dwelling. Due to the seasonality of solar radiation, solar thermal panels can provide up to ~60% of a dwelling's hot water demand, with the remainder being provided as top-up by the conventional gas boiler. They are a robust technology that provides substantial benefits to residents in terms of 'free' energy.

4.26 Solar thermal panels are generally installed on the roofs of dwellings, with panels facing as close to south as possible to maximise their efficiency.

4.27 Due to issues around ownership rights, roof access and unavailable roof space Solar Thermal Panels are not considered a viable option for this development.

Renewable Technology - Photovoltaic (PV) Panels

4.28 PV panels generate electricity from solar radiation. The generating potential of PV panels is not dependent on development demand, but only on available roof space for installation and ensuring that they are not overshadowed. For this reason it has been concluded that PV panels are the most appropriate renewable energy technology for the new build dwellings.

4.29 It has been concluded that the installation of solar PV panels would be unsuitable for this development due to issues around ownership rights, roof access and available roof space Solar Thermal Panels are not considered a viable option for this development.

Summary

4.30 The use of any renewable technology at the Ornan Court site is severely restricted. The physical installation of the above technologies is unviable due to the space restrictions on the front elevation of the basement dwellings coupled with the small roof area space and small amount of amenity space available to the proposed dwellings.

Results

CO_2 Emissions

4.31 In line with the requirement of CC1 of Camden Councils Local Plan the London Plan Energy Hierarchy methodology has been used to achieve a CO_2 emissions reduction for the proposed Ornan Court development.

4.32 Table 2 below presents the predicted CO_2 emissions for the development.

Table 2 : CO_2 Reduction

	Carbon dioxide emissions (tCO_2.a)	% Reduction at each stage
Baseline	3.2	-
Lean	3.0	5.81%
Clean	3.0	0%
Green	3.0	0%
Total Savings	**0.2**	**5.81%**

4.33 The Ornan Court site will achieve a **5.81%** reduction in CO_2 for Regulated and Total emissions respectively. Figure 2 shows the CO_2 reduction of the proposed Ornan Court development over the Part L 2013 baseline.

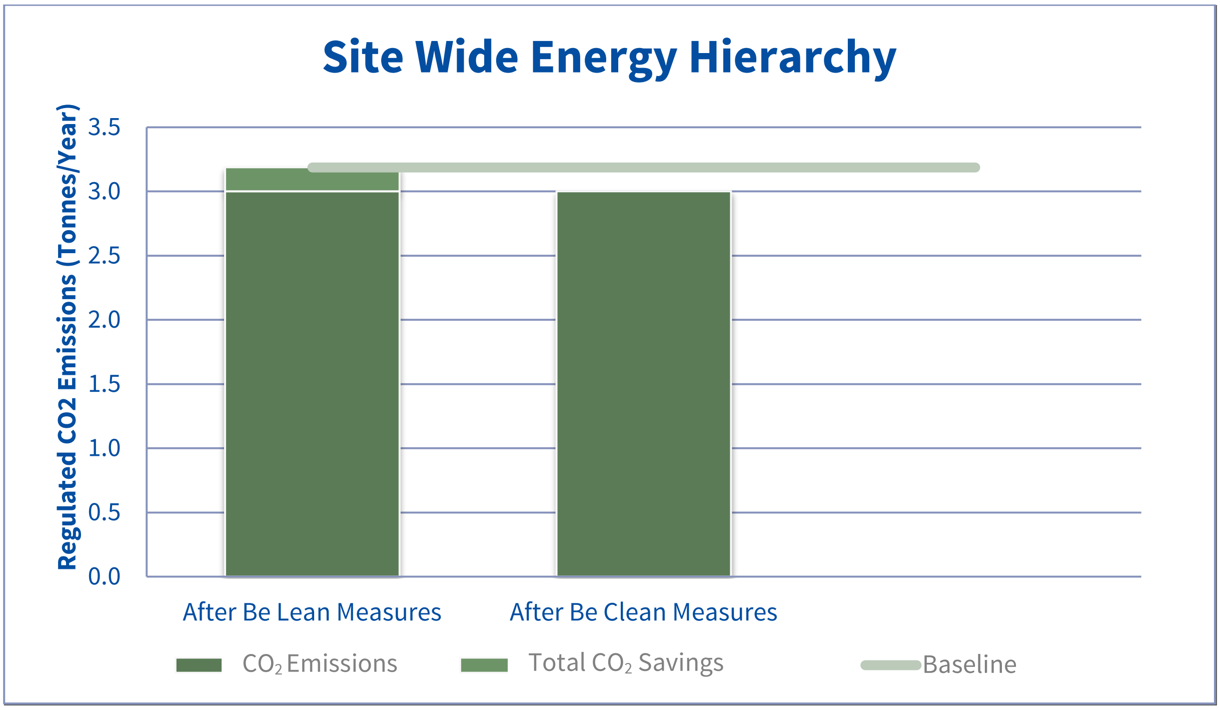

Figure 2: CO_2 reduction of the proposed Ornan Court development over the Part L 2013 baseline.

Fabric Energy Efficiency

4.34 The proposed energy efficient design of the dwellings will result in an improvement in Fabric Energy Efficiency of 5.8% above Part L 2013 target. Table 3 below outlines the Fabric Energy Efficiency for each dwelling.

Table 3: Fabric Energy Efficiency			
Unit Description	**Dwelling Fabric Energy Efficiency (kWh/ m^2/year)**	**Target Fabric Energy Efficiency (kWh/ m^2/year)**	**Fabric Energy Efficiency Improvement**
Basement Unit 1	47.8	50.9	6.1%
Basement Unit 2	52.2	53.8	3.0%
Total	**50.0**	**52.4**	**4.5%**

5. WATER REDUCTION

Internal Water Efficiency

5.1 Water conservation is at the core of sustainable development. Every person in the UK uses approximately 150 litres of water per day which has continued to rise by 1% since 1930. Water is a finite resource and during times of drought supplies can run low. Many natural ecosystems in the United Kingdom can suffer as a result of water abstraction.

5.2 Reducing water consumption will not only help to preserve our water sources but will save energy. As much as 25% of a household's energy consumption is used for heating water. As such, internal water consumption will be significantly reduced through the use of practical and hygienic water saving measures in accordance with the London Plan Policy 5.15.

Residential Water Use

5.3 All new dwellings will target a minimum water efficiency standard of **105 litres/person/day** in accordance with the above planning policy and the optional tighter Building Regulations Approved Document G requirement (110 litres/person/day). An evaluation of the proposed fixtures and fittings will be undertaken during the detailed design however an illustrative strategy to achieve this water target is set out in Table 4 below and the Water Efficiency Calculator in **Appendix B.**

Table 4: Residential Sanitaryware

Installation Type	Water Capacity/Flow Rate
WC	6/4 litres dual flush
Bath	160 litres capacity to overflow
Shower	8 litres/minute flow rate
Kitchen tap	5 litres/minute flow rate
Basin tap	4 litres/minute flow rate
Washing machine	8.17 litres/kg
Dishwasher	1.25 litres/place setting

6. MATERIAL SELECTION

Environmental Impact

6.1 New building materials will be selected, where possible, to ensure that they minimise environmental impact and have low embodied energy – from manufacture, transportation and operational stages, through to eventual demolition and disposal.

6.2 All insulation materials will have an Ozone Depleting Potential (ODP) of zero and a Global Warming Potential (GWP) of less than 5. In addition, all decorative paints and varnishes will meet the relevant standards in order to reduce the emission levels of volatile organic compounds (VOCs).

Local and Responsible Sourcing

6.3 In accordance with London Plan Policy 5.3, preference will be given to the use of locally sourced materials and local suppliers, where viable. This will benefit the local economy as well as having environmental benefits through reduced transportation.

6.4 Major materials will be responsibly and legally sourced from manufacturers with environmental management systems and chain of custody certificates, where appropriate.

6.5 Timber used on the site, including timber used in the construction phase, such as hoarding, fencing and scaffolding, will be sourced from sustainable sources (e.g. PEFC and FSC) where possible.

7. POLLUTION

7.1 The London Plan and London Borough of Camden policy seeks to ensure new development proposals do not unacceptably increase pollution.

7.2 Potential pollution sources will therefore be carefully managed from construction through to and during building occupation, and measures to reduce pollution have been incorporated into the proposed development.

Building Materials

7.3 The building materials within the proposed development will all meet the following criteria:

- Use traditional and/or long-established materials that do not emit pollutants;
- Use materials that are stable, durable and appropriate;
- Do not use materials that contain heavy metals, biocides or known toxins such as lead or asbestos;
- Make sure that mineral and other fibres are completely encapsulated;
- Use low or nil-formaldehyde-emitting materials;
- Minimise the use of paints, using organic, water-based or mineral paints wherever practicable;
- Avoid timber preservatives; and
- Avoid harmful cleaning agents, solvents and smoke from open fires.

Air Quality

7.4 An Air Quality Assessment has been prepared by Air Quality Consultants Ltd in support of the application. This has demonstrated that due to the small nature of the development and the lack of additional car parking, the impact of the development on existing air quality has been deemed not significant.

7.5 In terms of air quality for future residents, there is a slight risk of exceedences of the annual mean nitrogen dioxide objective at the façade facing Haverstock Hill. However, as there are no windows on this façade and as it is set well back from the road the overall impacts are not deemed to be significant.

7.6 The Applicant will ensure all plant and machinery is readily accessible to facilitate regular maintenance and inspection. All plant and machinery will be subject to a regular service agreement to maintain operational efficiency and to minimise emissions.

7.7 Where applicable, dwellings will be installed with high efficiency, low NO_x boilers.

Noise

7.8 In terms of construction traffic, this will be minimised by restricting deliveries and arrival times in order to manage potential impacts on existing and future occupants. Work will be limited to appropriate hours to be agreed with the Council, and suppressors will be used to reduce noise from machinery.

8. CLIMATE CHANGE ADAPTATION

8.1 The London Plan SPG discusses how developments should incorporate climate change adaptation taking into account overheating, the urban heat island effect and flood risk.

8.2 In accordance with the London Plan and London Borough of Camden policy DP22, the ability to adapt to climate change has been incorporated into the design of the proposed development.

Overheating

8.3 Minimising the risk of summer overheating is important so as to ensure that homes are adapted to climate change and remain comfortable to occupy in the future. The Applicant commits to ensuring that all dwellings will not have a high risk of summer overheating and will adopt appropriate measures to ensure this is delivered.

8.4 In line with the Cooling Hierarchy within London Plan Policy 5.9, it is proposed to reduce the need for active cooling as far as possible. Both homes will therefore be subject to measures to minimise the risk of summer overheating to an acceptable level. In the first instance, this will be done through the specification of open-able windows to provide natural ventilation and night purging. This will help to will reduce the build-up of heat within homes.

Flood Risk & Drainage

8.5 In accordance with the London Plan Sustainable Design and Construction SPG, flood risk within the context of the proposed development has been considered. According to the Environment Agency Flood Map for Planning, the site is located within Flood Zone 1 and is therefore at low risk of flooding.

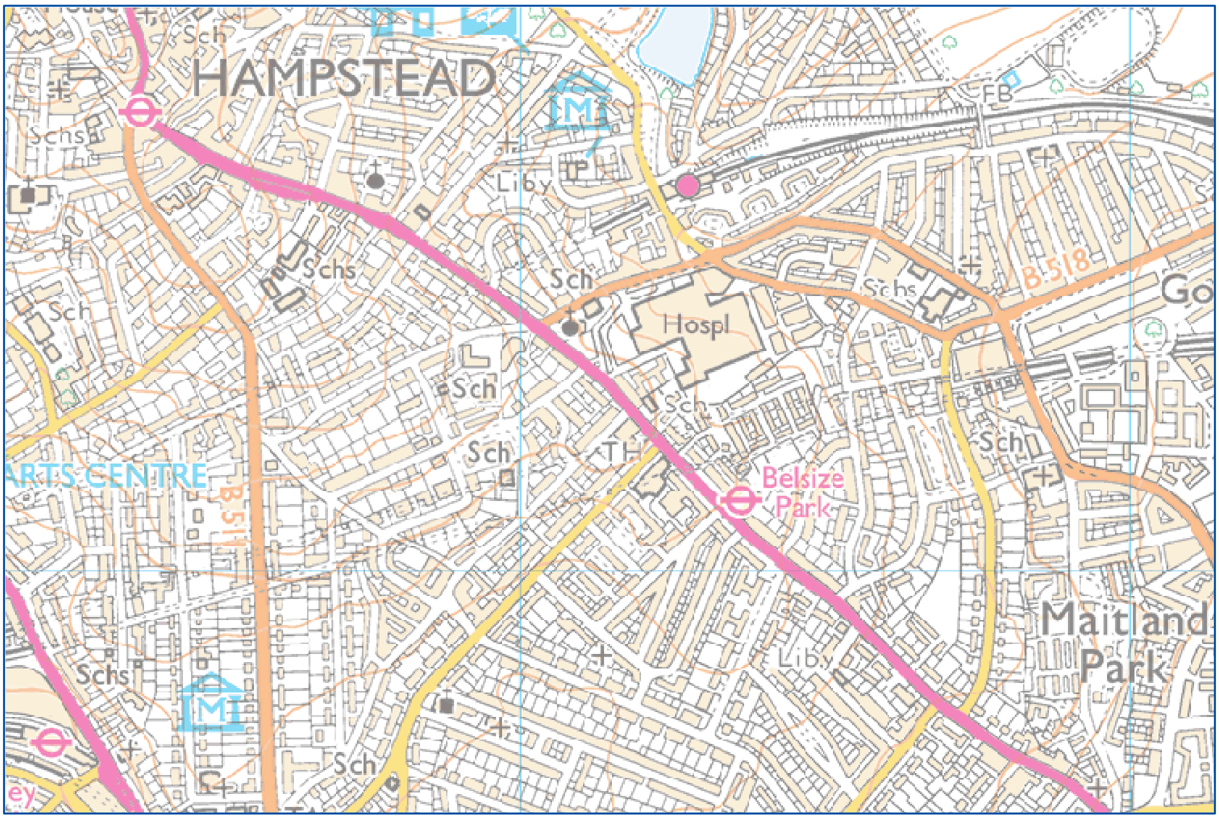

Figure 3: Environment Agency Flood Map for Planning – www.environment-agency.gov.uk

9. WASTE MANAGEMENT

Household Waste

9.1 Adequate internal storage containers for household recycling will be provided within the dwellings to encourage sustainable recycling habits by the occupants.

9.2 External storage for waste and recycling will be provided for the new dwellings. Space for external waste storage will also be provided to work with the London Borough of Camden waste collection service.

9.3 Home User Guides can also be provided to the occupants of the new dwellings which will provide advice and information on the most effective means and methods to recycle and minimise waste.

Construction Waste

9.4 Construction waste is a key element to be considered in achieving a reduction in all waste and has been considered as part of this proposed.

9.5 It is estimated that some 40% of all waste is construction related. It has also been shown on a number of housing sites that as soon as the issue of waste starts to be addressed, significant improvements follow quickly across the site. There are two key elements to be considered:

> Appropriate construction methods and effective management;

> Re-use/recycling of materials on site.

9.6 The amount of waste materials arising from construction can be reduced by introducing regular audits to monitor and control site activities more closely, for example reviewing materials ordering and site practices to prevent damage and cross-contamination. Attention to the quantity of materials purchased and the way that these are offloaded, labelled and stored, can significantly reduce the amount of materials wasted. Wherever possible, the use of packaging and non-returnable pallets should be avoided, or they should be recycled or reused.

9.7 A Site Waste Management Plan (SWMP) will be implemented which will result in various benefits for the development, which include:

> Better control of risks relating to the materials and waste on the site;

> 'Good housekeeping' of waste and improved site safety;

> Demonstrating compliance with the legislative framework;

> A mechanism for demonstrating how waste is managed and minimised and how associated costs are controlled;

> A tool to aid compliance with various environmental management systems e.g. ISO14001;

> Compliance with contractual requirements from public and private sector clients; and

> A system to help make cost savings by better managing the supply chain of materials, and their storage, handling, recovery and eventual disposal.

9.8 Recycling of materials from the construction waste stream can provide valuable construction materials and relieves the existing pressure on landfill sites. By maximising the value extracted from these materials, and extending their life in this way, the demand for such materials from new sources is reduced and there is likely to be a long-term beneficial impact on the conservation of mineral resources such as primary aggregate.

10.BUILDING QUALITY

Daylight & Sunlight

10.1 Daylighting will be maximised throughout the development and where appropriate, solar control glazing will be installed to reduce solar gains.

10.2 Hodkinson Consultancy has undertaken an internal daylight assessment of the development proposals. This study has concluded that all the proposed rooms will achieve the Average Daylight Factor as recommended by the British Standard 8206.

Accessibility & Building Regulations Part M

10.3 The Applicant's commitment to inclusivity will ensure that the proposed development is scaled appropriately so as to respond to the needs of all its users. The Applicant will endeavour to incorporate the requirements of the Equality Act (2010) into their design, making reasonable adjustments to enable disabled access, regularly reviewing whether the buildings are accessible and effective, and providing necessary design adjustments where it is practical to do so.

10.4 The Minor Alterations to the London Plan requires 90% of new housing to meet Building Regulation requirement M4 (2) and 10% of new housing to meet Building Regulation requirement M4 (3). The new Building Regulations Part M4 (2) 'accessible and adaptable dwellings' is broadly equivalent to Lifetime Homes standards; Part M4 (3) 'wheelchair user dwellings' is broadly equivalent to London Wheelchair Housing Standards.

10.5 These standards are intended to ensure accessible and adaptable accommodation for everyone; young families, older people, individuals with a temporary or permanent physical impairment, and allow residents to stay in their home despite developing disabilities.

10.6 Both of the proposed dwelling will meet Building Regulation M4(3). This will ensure that the highest standards of accessibility are achieved, for example:

- Approach route to be safe and convenient for everyone and be step-free;
- Principle living area is within the entrance storey;
- Wheelchair accessible entrances which are sheltered and adequately lit;
- Accessible communal stairs and lifts;
- Doorways and hallways with clear opening widths;
- Adequate circulation space;
- Entrance level living space, bedspace, WC and shower drainage;
- Potential for ceiling hoists between a bedroom and bathroom;
- Wheelchair accessible bathrooms; and
- Accessible locations of service controls and window handles.

Home Office

10.7 It is anticipated that the homes will have provisions for a home office where this can be achieved. Encouraging people to live and work in the same locality is central to the sustainability agenda as it reduces the need to travel and creates more lively and vibrant communities.

10.8 It is anticipated that each room which is suitable for use as a home office will have provision of double electrical sockets, a broadband enabled telephone point, good ventilation (preferably through an openable window), good daylighting and sufficient room for a desk and either a filing cabinet or a bookshelf.

11. TRANSPORT

Sustainable Transport Strategy

11.1 Sustainable transport links are central to the sustainability debate. They provide a positive contribution to environmental, societal and economic sustainability of the places they serve.

11.2 The site is well located within close proximity to a number of transport links which include the following:

> **Belsize Park Underground station** within approximately 350metres, providing Northern Line services to Morden and Edgware;

> **Hampstead Heath Overground station** within approximately 606metres, providing direct links to Stratford and Clapham Junction.

11.3 **A range of bus services** also pass close to the site, including the C11, 268, 168, 46 and the 24.

11.4 The very good level of access to public transport is reflected in the Public Transport Accessibility Level (PTAL) rating of 5 which shows a very good level of accessibility to public transport services.

HODKINSON

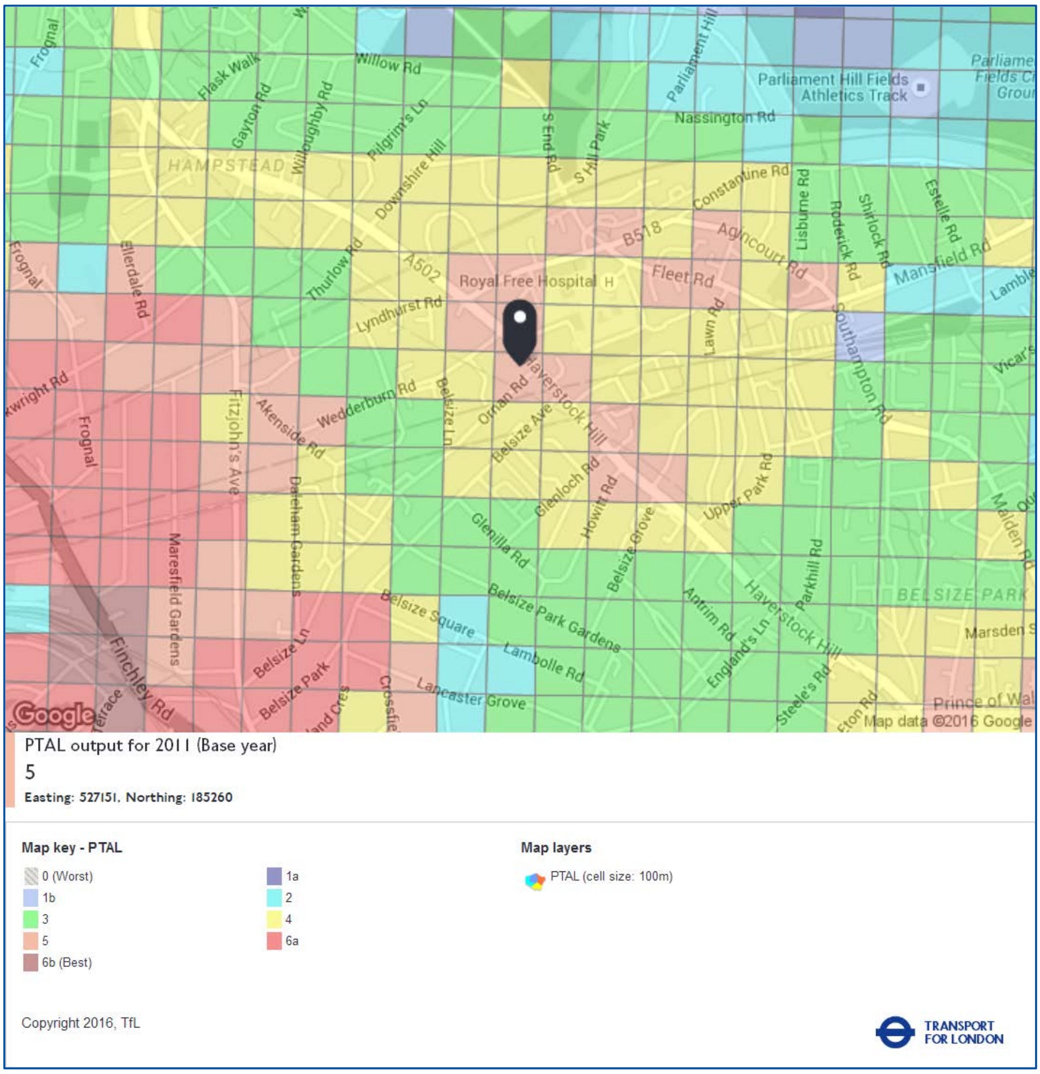

Figure 4: PTAL Map - www.tfl.gov.uk

11.5 The location of the site is therefore considered to be sustainable in terms of its transport links and accessibility.

Working from Home

11.6 As discussed in the previous chapter, the concept of working from home will be promoted by the provision of internal services and infrastructure, enabling the potential for home offices to be established in each dwelling. This will contribute to the vibrancy of this scheme, whilst offering additional environmental benefits in terms of potential reduced demand for transportation.

12. SUSTAINABLE CONSTRUCTION

12.1 Sustainable construction is described as involving the prudent use of existing and new resources and the efficient management of the construction process. This includes the following measures:

> Reducing waste during construction and demolition and sorting waste on site where practical;

> Reducing the risk of statutory nuisance to neighbouring properties as much as possible through effective site management;

> Controlling dust and emissions from demolition and construction; and

> Complying with protected species legislation.

Considerate Constructors Scheme

12.2 The development site will be registered with the Considerate Constructors Scheme. This is designed to encourage environmentally and socially considerate ways of working, to reduce any adverse impacts arising from the construction process. As commonly known, the Considerate Constructors Scheme aims are as follows:

> Enhancing the appearance;

> Respecting the community;

> Protecting the environment;

> Securing everyone's safety;

> Caring for the workforce.

12.3 The site will target *'Beyond Best Practice'* certification, achieving a score of between 35 out of 50, with all of the five sections scoring at least seven points.

Monitoring Construction Site Impacts

12.4 During the construction processes, control procedures will be put in place to minimise noise and dust pollution and roads will be kept clean. The management systems will generally comprise procedures and working methods that are approved by the development team together with commercial arrangements to ensure compliance.

12.5 Further to the above, additional measures will be adopted to minimise the impact on the local area during construction. This will include the limiting of air and water pollution in accordance with best practice principles, as well as the recording, monitoring and displaying of energy and water use from site activities during construction.

In terms of construction traffic, this will be minimised by restricting deliveries and arrival times in order to manage potential impacts on existing and future occupants. Work will be limited to appropriate hours to be agreed with the Council, and suppressors will be used to reduce noise from machinery.

13.CONCLUSION

13.1 The issue of sustainable development has been considered throughout the design of the proposed development at Ornan Court by Ornan Court Limited in the London Borough of Camden. In particular, the incorporation of sustainable design and construction methods, energy and water saving measures, waste reduction techniques as well as measures to enhance the ecological value of the site, a good quality and sustainable development is proposed.

13.2 The key sustainability features outlined in this Sustainability Statement are listed below:

> A 5.81% reduction in CO2 emissions is to be achieved through the use of energy efficiency measures;

> Water efficiency measures and devices will be installed in the homes to target a maximum daily water usage of 105 litres/person/day in accordance with the London Plan and the tighter Building Regulations optional requirement;

> Recycling facilities will be provided for domestic and construction related waste;

> The use of sustainable transport modes will be encouraged, and the site benefits from very good connections to a range of surrounding transport services;

> The dwellings will be designed to meet Building Regulation Part M 4(3) Category 3 requirements (wheelchair user dwellings), ensuring they are accessible and can be used by all;

> 100% of the proposed development will be on an existing site. Developing under-used sites is supported by the NPPF;

> Where practical, building materials will be sourced locally to reduce transportation pollution and support the local economy. All timber will be purchased from responsible forest sources. Materials will be selected based on their environmental impact, with preference given to high rated materials from the BRE Green Guide to Specification where possible; and

> Construction site impacts will be minimised and monitored where possible.

14. APPENDICES

Appendix A
DER/TER Worksheets

Appendix B
Water Efficiency Calculator

APPENDIX A

DER and TER Worksheet

DER Worksheet
Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Christopher Forster	Assessor number	10150
Client		Last modified	20/09/2017
Address	1 1 Ornan Court, Camden		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		85.60	(1a)	x	2.72	(2a)	=	232.83	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	85.60	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			232.83	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	0	x 10 =	0	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	0	÷ (5) =	0.00	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.20	(18)
Number of sides on which the dwelling is sheltered		3	(19)
Shelter factor	1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.16	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
c) whole house extract ventilation or positive input ventilation from outside	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Window			10.52	x	1.24	=	13.00			(27)
Door			1.89	x	1.40	=	2.65			(26)
Basement floor			85.60	x	0.14	=	11.98			(28)
External wall			71.23	x	0.17	=	12.11			(29a)
External wall			19.45	x	0.21	=	4.08			(29a)
External wall			22.19	x	0.18	=	3.99			(29a)
Party wall			9.79	x	0.00	=	0.00			(32)
Total area of external elements ∑A, m²			210.88							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	47.82	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K		250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		18.63	(36)
Total fabric heat loss	(33) + (36) =	66.44	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	38.42	38.42	38.42	38.42	38.42	38.42	38.42	38.42	38.42	38.42	38.42	38.42	(38)
Heat transfer coefficient, W/K (37)m + (38)m	104.86	104.86	104.86	104.86	104.86	104.86	104.86	104.86	104.86	104.86	104.86	104.86	
Average = ∑(39)1...12/12 =												104.86	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	
Average = ∑(40)1...12/12 =												1.23	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.56	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	95.01	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	104.52	100.71	96.91	93.11	89.31	85.51	85.51	89.31	93.11	96.91	100.71	104.52	
∑(44)1...12 =												1140.17	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	154.99	135.56	139.88	121.95	117.02	100.98	93.57	107.37	108.66	126.63	138.22	150.10	
∑(45)1...12 =												1494.94	(45)
Distribution loss 0.15 x (45)m	23.25	20.33	20.98	18.29	17.55	15.15	14.04	16.11	16.30	18.99	20.73	22.52	(46)
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month from Table 3a, 3b or 3c	3.05	2.75	3.05	2.95	3.05	2.95	3.05	3.05	2.95	3.05	2.95	3.05	(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

158.04	138.31	142.93	124.90	120.06	103.93	96.62	110.42	111.60	129.67	141.17	153.15	(62)

Solar DHW input calculated using Appendix G or Appendix H

-18.72	-16.47	-16.81	-13.84	-12.85	-10.60	-8.97	-10.86	-11.18	-13.82	-16.00	-18.10	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

139.32	121.84	126.12	111.07	107.22	93.33	87.64	99.56	100.42	115.86	125.17	135.05

∑(64)1...12 = 1362.58 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

52.30	45.76	47.27	41.29	39.67	34.31	31.87	36.46	36.86	42.87	46.70	50.67	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.71	20.17	16.41	12.42	9.28	7.84	8.47	11.01	14.78	18.76	21.90	23.34	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.75	233.14	227.11	214.26	198.05	182.81	172.63	170.23	176.26	189.11	205.33	220.57	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	(71)
Water heating gains (Table 5)	70.29	68.10	63.54	57.34	53.32	47.66	42.84	49.01	51.20	57.61	64.86	68.11	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	388.16	385.82	371.46	348.43	325.06	302.71	288.34	294.66	306.65	329.90	356.49	376.42	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthEast	0.77	x	10.52	x	36.79	x 0.9 x	0.63	x	0.70	=	118.29	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains in watts ∑(74)m...(82)m	118.29	201.50	275.70	341.60	382.63	379.86	366.22	335.62	298.52	222.70	141.69	101.23	(83)
Total gains - internal and solar (73)m + (83)m	506.45	587.32	647.16	690.04	707.68	682.57	654.57	630.28	605.17	552.59	498.18	477.66	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	1.00	0.99	0.97	0.93	0.82	0.66	0.70	0.89	0.98	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	19.65	19.81	20.05	20.35	20.66	20.88	20.97	20.96	20.80	20.41	19.96	19.61	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	19.90	(88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.99	0.96	0.90	0.73	0.52	0.56	0.83	0.97	0.99	1.00	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.11	18.33	18.68	19.13	19.54	19.81	19.89	19.88	19.73	19.20	18.56	18.05	(90)

Living area fraction — Living area ÷ (4) = 0.27 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.53	18.73	19.05	19.46	19.84	20.10	20.18	20.17	20.02	19.53	18.94	18.47	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.38	18.58	18.90	19.31	19.69	19.95	20.03	20.02	19.87	19.38	18.79	18.32	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	1.00	0.99	0.98	0.96	0.89	0.74	0.53	0.58	0.83	0.96	0.99	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m	504.44	582.43	635.38	659.51	629.07	503.34	350.09	365.63	500.44	532.26	494.15	476.20	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	1475.96	1434.60	1300.65	1091.40	838.29	561.08	359.65	379.80	605.12	920.60	1225.50	1480.53	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	722.81	572.66	494.96	310.96	155.66	0.00	0.00	0.00	0.00	288.92	526.57	747.22	

∑(98)1...5, 10...12 = 3819.76 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) 44.62 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)		0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =	1.00	(202)
Fraction of space heat from main system 2		0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] =	1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)		90.50	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month	798.68	632.77	546.91	343.60	172.00	0.00	0.00	0.00	0.00	319.25	581.85	825.66

∑(211)1...5, 10...12 = 4220.73 (211)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Efficiency of water heater	89.97	89.92	89.83	89.64	89.17	87.30	87.30	87.30	87.30	89.56	89.87	90.00	(217)
Water heating fuel, kWh/month	154.85	135.49	140.39	123.91	120.24	106.90	100.39	114.04	115.03	129.36	139.28	150.07	

∑(219a)1...12 = 1529.97 (219)

Annual totals

Space heating fuel - main system 1	4220.73	
Water heating fuel	1529.97	
Electricity for pumps, fans and electric keep-hot (Table 4f)		
mechanical ventilation fans - balanced, extract or positive input from outside	67.75	(230a)
central heating pump or water pump within warm air heating unit	30.00	(230c)

boiler flue fan			45.00		(230e)
Total electricity for the above, kWh/year				142.75	(231)
Electricity for lighting (Appendix L)				401.12	(232)
Total delivered energy for all uses			(211)...(221) + (231) + (232)...(237b) =	6294.56	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	4220.73	x	3.48	x 0.01 =	146.88	(240)
Water heating	1529.97	x	3.48	x 0.01 =	53.24	(247)
Pumps and fans	142.75	x	13.19	x 0.01 =	18.83	(249)
Electricity for lighting	401.12	x	13.19	x 0.01 =	52.91	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	391.86	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.26	(257)
SAP value	82.42	
SAP rating (section 13)	82	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	4220.73	x	0.216	=	911.68	(261)
Water heating	1529.97	x	0.216	=	330.47	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1242.15	(265)
Pumps and fans	142.75	x	0.519	=	74.09	(267)
Electricity for lighting	401.12	x	0.519	=	208.18	(268)
Total CO_2, kg/year				(265)...(271) =	1524.42	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	17.81	(273)
EI value					84.36	
EI rating (section 14)					84	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	4220.73	x	1.22	=	5149.29	(261)
Water heating	1529.97	x	1.22	=	1866.56	(264)
Space and water heating			(261) + (262) + (263) + (264) =		7015.85	(265)
Pumps and fans	142.75	x	3.07	=	438.23	(267)
Electricity for lighting	401.12	x	3.07	=	1231.43	(268)
Primary energy kWh/year					8685.52	(272)
Dwelling primary energy rate kWh/m2/year					101.47	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Christopher Forster	Assessor number	10150
Client		Last modified	20/09/2017
Address	1 1 Ornan Court, Camden		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		85.60	(1a)	x	2.72	(2a)	=	232.83	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	85.60	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			232.83	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	3	x 10 =	30	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	30	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.38	(18)
Number of sides on which the dwelling is sheltered		3	(19)
Shelter factor	1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.29	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.34	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
d) natural ventilation or whole house positive input ventilation from loft	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Window			10.52	x	1.33	=	13.95			(27)
Door			1.89	x	1.00	=	1.89			(26)
Basement floor			85.60	x	0.13	=	11.13			(28)
External wall			112.87	x	0.18	=	20.32			(29a)
Party wall			9.79	x	0.00	=	0.00			(32)
Total area of external elements ∑A, m²			210.88							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	47.28	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K		250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		9.88	(36)
Total fabric heat loss	(33) + (36) =	57.16	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	43.80	43.59	43.39	42.42	42.24	41.41	41.41	41.25	41.73	42.24	42.61	42.99	(38)
Heat transfer coefficient, W/K (37)m + (38)m	100.96	100.75	100.54	99.58	99.40	98.56	98.56	98.41	98.89	99.40	99.77	100.15	
Average = ∑(39)1...12/12 =												99.58	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.18	1.18	1.17	1.16	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.17	
Average = ∑(40)1...12/12 =												1.16	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.56	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	95.01	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	104.52	100.71	96.91	93.11	89.31	85.51	85.51	89.31	93.11	96.91	100.71	104.52	
∑(44)1...12 =												1140.17	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	154.99	135.56	139.88	121.95	117.02	100.98	93.57	107.37	108.66	126.63	138.22	150.10	
∑(45)1...12 =												1494.94	(45)
Distribution loss 0.15 x (45)m	23.25	20.33	20.98	18.29	17.55	15.15	14.04	16.11	16.30	18.99	20.73	22.52	(46)
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month from Table 3a, 3b or 3c	50.96	46.03	49.39	45.92	45.51	42.17	43.58	45.51	45.92	49.39	49.32	50.96	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	205.95	181.59	189.27	167.87	162.53	143.15	137.15	152.89	154.57	176.01	187.54	201.06	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

205.95	181.59	189.27	167.87	162.53	143.15	137.15	152.89	154.57	176.01	187.54	201.06	

∑(64)1...12 = 2059.58 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

64.27	56.58	58.86	52.03	50.29	44.12	42.01	47.08	47.61	54.45	58.29	62.65	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	128.03	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.71	20.17	16.41	12.42	9.28	7.84	8.47	11.01	14.78	18.76	21.90	23.34	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.75	233.14	227.11	214.26	198.05	182.81	172.63	170.23	176.26	189.11	205.33	220.57	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	35.80	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	-102.42	(71)
Water heating gains (Table 5)	86.39	84.20	79.11	72.26	67.59	61.27	56.46	63.28	66.12	73.19	80.96	84.21	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	404.26	401.92	387.03	363.35	339.33	316.33	301.96	308.93	321.57	345.47	372.59	392.52	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthEast	0.77	x	10.52	x	36.79	x 0.9 x	0.63	x	0.70	=	118.29	(77)

Solar gains in watts ∑(74)m...(82)m

118.29	201.50	275.70	341.60	382.63	379.86	366.22	335.62	298.52	222.70	141.69	101.23	(83)

Total gains - internal and solar (73)m + (83)m

522.55	603.42	662.73	704.96	721.95	696.19	668.19	644.55	620.10	568.17	514.28	493.76	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	1.00	0.99	0.97	0.92	0.79	0.62	0.66	0.87	0.98	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	19.73	19.88	20.12	20.43	20.71	20.91	20.98	20.97	20.84	20.48	20.04	19.70	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)	19.94	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)
Utilisation factor for gains for rest of dwelling n2,m	1.00	0.99	0.98	0.96	0.88	0.70	0.49	0.53	0.80	0.96	0.99	1.00	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.25	18.47	18.82	19.27	19.66	19.90	19.95	19.95	19.83	19.34	18.71	18.21	(90)

Living area fraction — Living area ÷ (4) = 0.27 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.65	18.86	19.17	19.58	19.94	20.17	20.23	20.23	20.10	19.65	19.07	18.61	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.65	18.86	19.17	19.58	19.94	20.17	20.23	20.23	20.10	19.65	19.07	18.61	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
	1.00	0.99	0.98	0.95	0.88	0.72	0.52	0.57	0.81	0.96	0.99	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m													
	520.34	598.08	649.90	671.45	635.99	502.74	350.33	365.51	505.22	545.53	509.81	492.16	(95)
Monthly average external temperature from Table U1													
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]													
	1448.48	1406.05	1274.35	1063.77	819.28	549.07	357.71	376.42	593.50	899.28	1194.45	1443.31	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m													
	690.54	542.96	464.59	282.47	136.37	0.00	0.00	0.00	0.00	263.19	492.94	707.65	

∑(98)1...5, 10...12 = 3580.72 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) 41.83 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)		0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =	1.00	(202)
Fraction of space heat from main system 2		0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] =	1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)		93.40	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month												
	739.33	581.33	497.42	302.43	146.01	0.00	0.00	0.00	0.00	281.79	527.77	757.66

∑(211)1...5, 10...12 = 3833.75 (211)

Water heating

Efficiency of water heater

87.86	87.64	87.22	86.35	84.61	80.30	80.30	80.30	80.30	86.06	87.37	87.95	(217)

Water heating fuel, kWh/month

234.41	207.20	216.99	194.41	192.09	178.27	170.79	190.39	192.50	204.52	214.65	228.60

∑(219a)1...12 = 2424.81 (219)

Annual totals

Space heating fuel - main system 1		3833.75	
Water heating fuel		2424.81	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)
Electricity for lighting (Appendix L)		401.12	(232)

Total delivered energy for all uses				(211)...(221) + (231) + (232)...(237b) =	6734.68	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3833.75	x	3.48	x 0.01 =	133.41	(240)
Water heating	2424.81	x	3.48	x 0.01 =	84.38	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	401.12	x	13.19	x 0.01 =	52.91	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	400.60	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.29	(257)
SAP value	82.03	
SAP rating (section 13)	82	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	3833.75	x	0.216	=	828.09	(261)
Water heating	2424.81	x	0.216	=	523.76	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1351.85	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	401.12	x	0.519	=	208.18	(268)
Total CO_2, kg/year				(265)...(271) =	1598.95	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	18.68	(273)
EI value					83.59	
EI rating (section 14)					84	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3833.75	x	1.22	=	4677.18	(261)
Water heating	2424.81	x	1.22	=	2958.27	(264)
Space and water heating				(261) + (262) + (263) + (264) =	7635.45	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	401.12	x	3.07	=	1231.43	(268)
Primary energy kWh/year					9097.13	(272)
Dwelling primary energy rate kWh/m2/year					106.27	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Christopher Forster	Assessor number	10150
Client		Last modified	20/09/2017
Address	2 2 Ornan Court, Camden		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		88.29	(1a)	x	2.72	(2a)	=	240.15	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	88.29	(4)						
Dwelling volume							(3a) + (3b) + (3c) + (3d)...(3n) =	240.15	(5)

2. Ventilation rate

				m³ per hour	
Number of chimneys		0	x 40 =	0	(6a)
Number of open flues		0	x 20 =	0	(6b)
Number of intermittent fans		0	x 10 =	0	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fires		0	x 40 =	0	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	0	÷ (5) =	0.00	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.20	(18)
Number of sides on which the dwelling is sheltered		3	(19)
Shelter factor	1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.16	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

c) whole house extract ventilation or positive input ventilation from outside

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(24c)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(24c)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Window			10.52	x	1.24	=	13.00			(27)
Door			1.89	x	1.40	=	2.65			(26)
Basement floor			88.29	x	0.14	=	12.36			(28)
External wall			63.43	x	0.17	=	10.78			(29a)
External wall			17.30	x	0.21	=	3.63			(29a)
External wall			22.19	x	0.18	=	3.99			(29a)
Party wall			9.79	x	0.00	=	0.00			(32)
Total area of external elements ∑A, m²			203.62							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	46.42	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K		250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		14.75	(36)
Total fabric heat loss	(33) + (36) =	61.17	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	39.62	39.62	39.62	39.62	39.62	39.62	39.62	39.62	39.62	39.62	39.62	39.62	(38)
Heat transfer coefficient, W/K (37)m + (38)m	100.79	100.79	100.79	100.79	100.79	100.79	100.79	100.79	100.79	100.79	100.79	100.79	
Average = ∑(39)1...12/12 =												100.79	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	
Average = ∑(40)1...12/12 =												1.14	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.60	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	95.99	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	105.59	101.75	97.91	94.07	90.23	86.39	86.39	90.23	94.07	97.91	101.75	105.59	
∑(44)1...12 =												1151.85	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	156.58	136.95	141.32	123.20	118.22	102.01	94.53	108.47	109.77	127.93	139.64	151.64	
∑(45)1...12 =												1510.26	(45)
Distribution loss 0.15 x (45)m	23.49	20.54	21.20	18.48	17.73	15.30	14.18	16.27	16.47	19.19	20.95	22.75	(46)
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month from Table 3a, 3b or 3c	3.05	2.75	3.05	2.95	3.05	2.95	3.05	3.05	2.95	3.05	2.95	3.05	(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

159.63	139.70	144.36	126.15	121.26	104.96	97.58	111.52	112.72	130.97	142.59	154.69	(62)

Solar DHW input calculated using Appendix G or Appendix H

-18.98	-16.70	-17.04	-14.02	-13.02	-10.74	-9.09	-11.01	-11.33	-14.01	-16.22	-18.34	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

140.65	123.00	127.32	112.13	108.24	94.22	88.48	100.51	101.39	116.97	126.37	136.34

∑(64)1...12 = 1375.61 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

52.82	46.22	47.75	41.70	40.07	34.66	32.19	36.83	37.24	43.30	47.17	51.18	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.38	20.77	16.89	12.79	9.56	8.07	8.72	11.33	15.21	19.31	22.54	24.03	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	235.90	238.34	232.18	219.04	202.47	186.89	176.48	174.03	180.20	193.33	209.91	225.49	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	(71)
Water heating gains (Table 5)	71.00	68.78	64.18	57.92	53.86	48.13	43.27	49.50	51.72	58.19	65.51	68.79	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	395.30	392.92	378.27	354.77	330.90	308.11	293.49	299.89	312.15	335.86	362.98	383.33	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthEast	0.77	x	10.52	x	36.79	x 0.9 x	0.63	x	0.70	=	118.29	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains in watts ∑(74)m...(82)m	118.29	201.50	275.70	341.60	382.63	379.86	366.22	335.62	298.52	222.70	141.69	101.23	(83)
Total gains - internal and solar (73)m + (83)m	513.59	594.42	653.97	696.38	713.53	687.97	659.71	635.51	610.67	558.56	504.67	484.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	1.00	0.99	0.97	0.93	0.81	0.64	0.68	0.88	0.98	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	19.75	19.90	20.13	20.42	20.70	20.90	20.98	20.97	20.83	20.47	20.04	19.71	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	0.99	0.99	0.96	0.89	0.72	0.51	0.55	0.82	0.97	0.99	1.00	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.30	18.52	18.86	19.27	19.66	19.90	19.96	19.95	19.83	19.34	18.73	18.24	(90)

Living area fraction — Living area ÷ (4) = 0.25 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.67	18.87	19.18	19.57	19.93	20.15	20.22	20.21	20.08	19.63	19.06	18.62	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.52	18.72	19.03	19.42	19.78	20.00	20.07	20.06	19.93	19.48	18.91	18.47	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	1.00	0.99	0.98	0.96	0.88	0.72	0.52	0.56	0.82	0.96	0.99	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m	511.75	589.79	642.43	665.37	631.20	498.60	342.68	358.70	499.90	537.98	500.86	483.25	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	1433.40	1393.08	1263.00	1059.87	813.99	544.60	349.44	368.99	587.90	894.61	1190.50	1437.87	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	685.70	539.81	461.70	284.05	135.99	0.00	0.00	0.00	0.00	265.34	496.54	710.24	

∑(98)1...5, 10...12 = 3579.37 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 40.54 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)		0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =	1.00	(202)
Fraction of space heat from main system 2		0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] =	1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)		90.50	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month	757.68	596.47	510.17	313.86	150.27	0.00	0.00	0.00	0.00	293.19	548.67	784.79

∑(211)1...5, 10...12 = 3955.10 (211)

Water heating

Efficiency of water heater	89.94	89.89	89.79	89.57	89.05	87.30	87.30	87.30	87.30	89.50	89.83	89.97	(217)
Water heating fuel, kWh/month	156.38	136.84	141.80	125.18	121.55	107.92	101.35	115.13	116.14	130.69	140.67	151.55	

∑(219a)1...12 = 1545.20 (219)

Annual totals

Space heating fuel - main system 1		3955.10
Water heating fuel		1545.20

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside	69.88	(230a)
central heating pump or water pump within warm air heating unit	30.00	(230c)

boiler flue fan			45.00		(230e)
Total electricity for the above, kWh/year				144.88	(231)
Electricity for lighting (Appendix L)				412.89	(232)
Total delivered energy for all uses			(211)...(221) + (231) + (232)...(237b) =	6058.07	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3955.10	x	3.48	x 0.01 =	137.64	(240)
Water heating	1545.20	x	3.48	x 0.01 =	53.77	(247)
Pumps and fans	144.88	x	13.19	x 0.01 =	19.11	(249)
Electricity for lighting	412.89	x	13.19	x 0.01 =	54.46	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	384.98	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.21	(257)
SAP value	83.08	
SAP rating (section 13)	83	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	3955.10	x	0.216	=	854.30	(261)
Water heating	1545.20	x	0.216	=	333.76	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1188.06	(265)
Pumps and fans	144.88	x	0.519	=	75.19	(267)
Electricity for lighting	412.89	x	0.519	=	214.29	(268)
Total CO_2, kg/year				(265)...(271) =	1477.55	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	16.74	(273)
EI value					85.15	
EI rating (section 14)					85	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3955.10	x	1.22	=	4825.22	(261)
Water heating	1545.20	x	1.22	=	1885.14	(264)
Space and water heating				(261) + (262) + (263) + (264) =	6710.37	(265)
Pumps and fans	144.88	x	3.07	=	444.77	(267)
Electricity for lighting	412.89	x	3.07	=	1267.57	(268)
Primary energy kWh/year					8422.71	(272)
Dwelling primary energy rate kWh/m2/year					95.40	(273)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Christopher Forster	Assessor number	10150
Client		Last modified	20/09/2017
Address	2 2 Ornan Court, Camden		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		88.29	(1a)	x	2.72	(2a)	=	240.15	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	88.29	(4)						
Dwelling volume							(3a) + (3b) + (3c) + (3d)...(3n) =	240.15	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	3	x 10 =	30	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	30	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.37	(18)
Number of sides on which the dwelling is sheltered		3	(19)
Shelter factor	1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.29	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
d) natural ventilation or whole house positive input ventilation from loft	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Window			10.52	x	1.33	=	13.95			(27)
Door			1.89	x	1.00	=	1.89			(26)
Basement floor			88.29	x	0.13	=	11.48			(28)
External wall			102.92	x	0.18	=	18.53			(29a)
Party wall			9.79	x	0.00	=	0.00			(32)
Total area of external elements ∑A, m²			203.62							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	45.84	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K		250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		8.74	(36)
Total fabric heat loss	(33) + (36) =	54.58	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	45.06	44.85	44.64	43.67	43.49	42.64	42.64	42.49	42.97	43.49	43.86	44.24	(38)
Heat transfer coefficient, W/K (37)m + (38)m	99.64	99.43	99.23	98.25	98.07	97.22	97.22	97.07	97.55	98.07	98.44	98.82	
Average = ∑(39)1...12/12 =												98.25	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.13	1.13	1.12	1.11	1.11	1.10	1.10	1.10	1.10	1.11	1.11	1.12	
Average = ∑(40)1...12/12 =												1.11	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	2.60	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	95.99	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	105.59	101.75	97.91	94.07	90.23	86.39	86.39	90.23	94.07	97.91	101.75	105.59	
∑(44)1...12 =												1151.85	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	156.58	136.95	141.32	123.20	118.22	102.01	94.53	108.47	109.77	127.93	139.64	151.64	
∑(45)1...12 =												1510.26	(45)
Distribution loss 0.15 x (45)m	23.49	20.54	21.20	18.48	17.73	15.30	14.18	16.27	16.47	19.19	20.95	22.75	(46)
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month from Table 3a, 3b or 3c	50.96	46.03	49.89	46.39	45.98	42.60	44.02	45.98	46.39	49.89	49.32	50.96	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	207.54	182.97	191.21	169.59	164.20	144.61	138.55	154.45	156.16	177.82	188.96	202.60	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

207.54	182.97	191.21	169.59	164.20	144.61	138.55	154.45	156.16	177.82	188.96	202.60	

∑(64)1...12 = 2078.67 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

64.80	57.04	59.46	52.56	50.80	44.57	42.44	47.56	48.10	55.01	58.76	63.16	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	130.08	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.38	20.77	16.89	12.79	9.56	8.07	8.72	11.33	15.21	19.31	22.54	24.03	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	235.90	238.34	232.18	219.04	202.47	186.89	176.48	174.03	180.20	193.33	209.91	225.49	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	36.01	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	-104.06	(71)
Water heating gains (Table 5)	87.10	84.88	79.92	73.00	68.28	61.90	57.04	63.93	66.80	73.94	81.61	84.89	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	411.40	409.02	394.01	369.86	345.33	321.88	307.26	314.31	327.23	351.60	379.08	399.43	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthEast	0.77	x	10.52	x	36.79	x 0.9 x	0.63	x	0.70	=	118.29	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains in watts ∑(74)m...(82)m	118.29	201.50	275.70	341.60	382.63	379.86	366.22	335.62	298.52	222.70	141.69	101.23	(83)
Total gains - internal and solar (73)m + (83)m	529.69	610.52	669.71	711.46	727.95	701.74	673.48	649.93	625.76	574.30	520.77	500.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	1.00	0.99	0.97	0.92	0.78	0.61	0.65	0.87	0.98	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	19.79	19.94	20.17	20.47	20.74	20.92	20.98	20.98	20.86	20.51	20.09	19.76	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)	19.98	19.98	19.98	19.99	19.99	20.00	20.00	20.00	20.00	19.99	19.99	19.99	(88)
Utilisation factor for gains for rest of dwelling n2,m	1.00	0.99	0.99	0.96	0.88	0.70	0.48	0.53	0.80	0.97	0.99	1.00	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.36	18.58	18.92	19.35	19.72	19.94	19.99	19.99	19.88	19.42	18.81	18.32	(90)

Living area fraction — Living area ÷ (4) = 0.25 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.72	18.93	19.24	19.63	19.98	20.19	20.24	20.24	20.13	19.69	19.14	18.69	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.72	18.93	19.24	19.63	19.98	20.19	20.24	20.24	20.13	19.69	19.14	18.69	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	1.00	0.99	0.98	0.95	0.88	0.72	0.52	0.56	0.81	0.96	0.99	1.00	(94)
Useful gains, ηmGm, W (94)m x (84)m	527.64	605.45	657.26	678.15	640.59	502.95	348.32	363.81	507.76	551.78	516.52	499.19	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	1437.18	1394.80	1263.94	1054.68	812.02	543.82	354.37	372.89	588.21	891.87	1184.83	1431.83	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	676.70	530.44	451.37	271.10	127.55	0.00	0.00	0.00	0.00	253.03	481.18	693.88	

∑(98)1...5, 10...12 = 3485.25 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) 39.48 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)		0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =	1.00	(202)
Fraction of space heat from main system 2		0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] =	1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)		93.40	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month	724.52	567.92	483.26	290.26	136.56	0.00	0.00	0.00	0.00	270.91	515.18	742.91

∑(211)1...5, 10...12 = 3731.53 (211)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Efficiency of water heater	87.81	87.57	87.14	86.23	84.42	80.30	80.30	80.30	80.30	85.94	87.30	87.90	(217)
Water heating fuel, kWh/month	236.36	208.93	219.43	196.68	194.49	180.09	172.54	192.35	194.47	206.91	216.43	230.49	

∑(219a)1...12 = 2449.18 (219)

Annual totals

Space heating fuel - main system 1		3731.53	
Water heating fuel		2449.18	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)
Electricity for lighting (Appendix L)		412.89	(232)

Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	6668.61	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3731.53	x	3.48	x 0.01 =	129.86	(240)
Water heating	2449.18	x	3.48	x 0.01 =	85.23	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	412.89	x	13.19	x 0.01 =	54.46	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	399.44	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.26	(257)
SAP value	82.44	
SAP rating (section 13)	82	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	3731.53	x	0.216	=	806.01	(261)
Water heating	2449.18	x	0.216	=	529.02	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1335.03	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	412.89	x	0.519	=	214.29	(268)
Total CO_2, kg/year				(265)...(271) =	1588.25	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	17.99	(273)
EI value					84.03	
EI rating (section 14)					84	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3731.53	x	1.22	=	4552.47	(261)
Water heating	2449.18	x	1.22	=	2988.00	(264)
Space and water heating				(261) + (262) + (263) + (264) =	7540.48	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	412.89	x	3.07	=	1267.57	(268)
Primary energy kWh/year					9038.30	(272)
Dwelling primary energy rate kWh/m2/year					102.37	(273)

APPENDIX B

Water Efficiency Calculator

Water Efficiency Calculator (Internal: 105 litres/person/day)
Ornan Court

	Internal Water Consumption			
Installation Type	**Unit of Measure**	**Capacity / Flow Rate**	**Litres/person/day**	**Notes**
WC	Full Flush Volume (Litres)	**6**	8.76	Low flush WCs will be installed to reduce the volume of water consumed during flushing. All WCs will have dual flush cisterns which will provide both part (4L) and full (6L) flushes.
	Part Flush Volume (Litres)	**4**	11.84	
Bath	Capacity (Litres to overflow)	**150**	16.50	All baths will have reduced capacities of 150 litres (excluding displacement). The bath taps are not included in this calculation as they are already incorporated into the use factor for the baths.
Shower	Flow Rate (Litres/min)	**8**	34.96	Shower flow rates will be reduced to 8 litres/minute using flow restrictors fixed to the shower heads. These contain precision-made holes or filters to restrict water flow and reduce the outlet flow and pressure.
Kitchen Tap	Flow Rate (Litres/min)	**4**	12.12	Kitchen taps will be reduced to 4 litres/minute using flow restrictors which will be fitted within the console of the tap or in the pipework.
Basin Tap	Flow Rate (Litres/min)	**3**	6.32	All taps (excluding kitchen taps) will be reduced to 3 litres/minute using flow restrictors. Where multiple taps are to be provided the average flow rate will be used.
Washing Machine	Water Consumption (Litres/kg)	**8.17**	17.16	Water efficient washing machines or washer-dryers will be specified. The make and model numbers of the appliances are unknown at this stage therefore a default figure of 8.17 litres/kg has been assumed.
Dishwasher	Water Consumption (Litres/place setting)	**1.25**	4.50	All dishwashers will be water efficient. The make and models numbers are unknown therefore a default figure of 1.25 litres/place setting has been assumed at this stage.
		Net Internal Water Consumption (Litres/person/day)	**112.2**	
		Normalisation Factor	**0.91**	
		Total Water Consumption (Litres/person/day)	**102.10**	The internal water consumption target of ≤105 litres/person/day will be achieved.