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Energy and Sustainability Strategy

179-181 High Street, Hampton Hill – Retail Areas
London Borough of Richmond-Upon-Thames

On behalf of
Clive Chapman Architects

25/05/2016
Job Ref: 5388

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Planning
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1.0 Introduction

1.0.1 This Energy and Sustainability Statement has been prepared by Metropolis Green to accompany the planning application submitted by Clive Chapman Architects to the London Borough of Richmond-Upon-Thames for the proposed 179 – 181 High Street, Hampton Hill.

1.0.2 The existing site, comprises four self-contained retail units at ground level, with three residential units on the first floor. The site is shown in Figure 1.

Figure 1 – Site Location

1.0.3 The proposed development, lies on the north side of the Hampton Hill High Street. It consists the redevelopment of the existing site to deliver, 10 No. residential units, 540 m^2 of retail space, soft landscaping and secure cycle storage spaces.

1.0.4 This Energy and Sustainability Strategy relates to the 540 m^2 retail area, it will be submitted in conjunction with the energy and sustainability strategies for the residential areas, prepared by Clive Chapman Architects.

1.0.5 As the development consist of 3 refurbished units and 7 new building units, to align with the residential application, the development is considered to be a minor development, as such it is not required to meet the London Plan sustainability and energy targets. However it will still be encouraged to meet all policies set by the London Borough of Richmond-Upon-Thames.

1.0.6 A BREEAM Pre-Assessment has been prepared by Metropolis Green, for the retail areas. The proposed development has achieved a BREEAM rating of 73.25%, scored 1.4 Credits under Ene 01 (out of 2 credits) and has met the necessary minimum mandatory criteria, and therefore achieves the required Excellent rating.

1.0.7 However, the nature of the development has caused some constraints in terms of BREEAM, which has meant that some of the more costly or onerous BREEAM credits have had to be targeted to obtain the Excellent rating; these credits would not normally be targeted for a development of this small size and type. As the proposed development is only just above the threshold for the Excellent rating as it is, we believe that reducing the BREEAM rating required to a Very Good level would be much more appropriate for the proposed development. Justification for this is provided in the 'BREEAM Pre-Assessment' section of this report, and a copy of the pre-assessment is included in Appendix A.

1.0.8 LBRUT require all residential developments of more than 1 unit, to provide a LBRUT Sustainability Construction Checklist (SCC) as part of the application. The SCC for the proposed development, has a score of 57.5.

1.0.9 This report should be read alongside other supplemental reports prepared by the design team for the planning application. Figures 2 and 3, show the detail at ground floor and front elevation of the proposed part refurbishment and part new build development.

Figure 2 – Ground Floor Plan

Figure 3 – High Street Elevation

Policy and Methodology

1.0.10 This section of the report has been prepared to ensure that the relevant national, regional and local energy policies can be achieved on by the proposed 179 – 181 High Street development.

1.0.11 As the proposed development, is considered to be a minor development, it is not required to achieve the London Plan's energy policies, however it is encouraged to relate to all LBRUT carbon reduction policies, including:

- LBRUT Policy DM SD 1, requires all new developments, to achieve a 35% carbon reduction against 2013 Building Regulations.
- LBRUT Policy CP2, encouragers all new developments, to reduce carbon emission by 20% from on-site renewable energy generation.
- LBRUT Policy DM SD 2, requires all new developments to connect to existing or planned decentralised energy networks.
- LBRUT Policy DM SD 4, requires all new developments to avoid and mitigate overheating and excessive heat generation.
- LBRUT Policy CP1: requires all non-residential developments, to achieve BREEAM Excellent.

1.0.12 This Energy Strategy has been prepared by following London Plan's recommended energy hierarchy: to minimise energy demand (Be Lean), supply of energy (Be Clean), and use of renewables (Be Green).

1.0.13 It assess the energy efficiency measures of the proposed 179 – 181 High Street and the low carbon options for supplying energy to the development before examining the potential for renewable energy technologies to reduce carbon emissions of the development.

1.0.14 All energy and carbon figures have been calculated using approved Simplified Building Energy Modelling (SBEM), used to demonstrate compliance with Approved Documents Part L2A 2013 edition, and BREEAM requirements. Sample BRUKL reports can be found in Appendix B of this report.

1.0.15 LBRUT promotes a 'regulated' energy approach to calculating the energy demand and carbon baseline of development. The baseline therefore includes the energy consumed in the operation of the space heating/cooling and hot water systems, ventilation and all internal lighting. Reported separately, are the carbon emissions from cooking and all electrical appliances which are not covered by the Building Regulations, this is called 'unregulated' energy.

2.0 Energy Strategy

2.0.1 This section outlines the methods to reduce the carbon emissions of the retail areas within the proposed 179 – 181 High Street development.

2.1 Energy Efficiency Measures (Be Lean)

2.1.1 Metropolis Green have worked with Clive Chapman Architects to determine the most efficient and feasible way to reduce the carbon emissions from the retail areas, using both passive and active design measures.

2.1.2 Improving the fabric and services efficiency is the most effective way of reducing carbon emissions as these measures will last the lifetime of the building. Reducing the CO_2 emissions in turn reduces the amount of low carbon and renewable energy technologies required to comply with regulations and policies, as well as lowering costs.

2.1.3 The thermal performance of the building fabric has been improved and is better than the limiting parameters set in Part L of the Building Regulations. These measures are summarised in Table 1 below.

Table 1 – Building Fabric Performance

Specification	Efficient Baseline
External Wall U-value	0.22
Ground Floor U-value	0.15
Roof U-value	0.18
Windows & Roof light U-values	1.5

2.1.4 In addition to the high thermal performance of the building fabric, passive and active design measures, have been adopted, discussed in Tables 3 and 4.

Table 2 – Passive Design Measures

Passive Design Measures	Specific Project Measures
Description of types of glazing/windows	High performing double glazed windows. G-values of 0.63
Optimise natural daylight	Large floor to ceiling windows optimise natural daylight
Optimise solar gain	Solar gains have been maximised during winter months through the windows. Low G-value windows will reduce excessive summer gains.
Optimise insulation	Insulation will be designed to achieve the specified high performing U-values.
Maximise insulation of heating infrastructure	To be provided accordingly throughout the heating pipework

Table 3 – Active Design Measures

Active Design Measures	Specific Project Measures
Thermal mass parameter	External walls: 129 kJ/m2.K Ground floor: 36 kJ/m2.K Flat roof / ceiling: 225 kJ/m2.K
Air Permeability	5 m3/h.m2
Domestic Hot Water System	Instant electric water heaters
Space Heating System	VRF system seasonal heating SCoP 5.5 (e.g. Mitsubishi High COP Y-series heat pumps), metering of energy with 'out of range' alarm
Space Cooling System	VRF system cooling EER of 7.5 (e.g. Mitsubishi High COP Y-series heat pumps), metering of energy with 'out of range' alarm
Ventilation System	MVHR with SFP of 1.2 W/l.s and heat exchange efficiency of 75%
Average luminaire efficiency (lm/W)	Lighting with average luminaire efficacy of 85 lm/cW (including display lighting), manual control, lighting energy metering with 'out of range' alarm

2.2 Overheating and Cooling

2.2.1 Through the application of passive design and low energy measures, the design team have worked to reduce the risk of summer overheating in line with the 'cooling hierarchy' and LBRUT Policy DM SD 4.

Minimising internal heat generation through energy efficient design

2.2.2 Detailed design of the heat distribution system will ensure that the pipe runs have been minimised to reduce heat loss.

2.2.3 The large floor to ceiling windows provide, natural light into the development and beneficial solar gains, in winter months.

2.2.4 Energy efficient lighting will be utilised throughout the building, to minimise energy demand and reduce internal heat gains.

Reducing the amount of heat entering the building in summer

2.2.5 As discussed above, the façade allows beneficial solar gains to reduce winter heating consumption, in addition to the low G-value windows, will limit the amount of excessive solar gains in summer months.

Use of thermal mass and high ceilings to manage the heat within the building

2.2.6 The thermal mass of the building fabric, has been optimised to moderate and average out internal temperatures, by not retaining excessive heat, therefore reducing the likelihood of overheating occurring.

Ventilation

2.2.7 Ventilation will be provide through Mechanical Ventilation with Heat Recovery (MVHR). At this early stage, the specification for the units are:

- 1.2 W/l.s and heat exchange efficiency of 75%

Comfort cooling

2.2.8 Additionally comfort cooling, will be supplied via an ASHP providing both space heating and cooling. This is to meet the comfort cooling demands of the retail units and also to meet market expectations. This system is outlined in more detail in Section 2.4.9.

Dynamic Simulation Modelling

2.2.9 The GLA's Sustainable Design and Construction SPD, Marc 2016 update, states that developments are required to undertake Dynamic Simulation Modelling (DSM) to demonstrate that the proposed development does not overheat in the summer months. As such, Metropolis Green have modelled selected occupied areas against CIBSE TM52 in line with the LP's cooling hierarchy to address thermal comfort, ventilation and CO2 concentrations.

2.2.10 The DSM results show that the retail areas, pass three of the CIBSE TM52 Criteria, therefore overheating is unlikely in the summer months. The full Thermal Comfort Report is shown in Appendix F

2.3 Heating Infrastructure Including CHP (Be Clean)

2.3.1 The next stage is to demonstrate that the proposed energy systems have been selected in accordance DM SD 4, using the following hierarchy:

1. Connection to existing or planned area wide, low carbon heat distribution networks;
2. Site wide heat networks;
3. Combined Heat and Power (CHP).

2.3.2 Related to point one and two above, London Boroughs have prepared borough wide heat maps, which feed into Boroughs' Local Plans and, where appropriate, neighbourhood plans. Where the borough heat map shows potential for a district heating network, more detailed energy master plans should be prepared by the local planning authority.

Connection to an Existing or Proposed Heat Network

2.3.3 An investigation of the area was undertaken using the London Heat Map tool to determine whether there are any opportunities to connect to existing heat

infrastructure. The London Heat Map (Figure 4), shows that there are no existing proposed heat networks within the area.

Figure 4 – London Heat Map

2.3.4 Guidance from the GLA[1] on preparing energy assessments notes that, *"it is not expected that small purely residential developments (for example less than 500 dwellings) include on-site CHP. Due to the small landlord electricity supplies, CHP installed to meet the base heat load would require the export of electricity to the grid. It is recognised that the administrative burden of managing CHP electricity sales at this small scale, where energy service companies (ESCOs) are generally not active, is too great for operators of residential developments to bear. If CHP is installed but does not operate because arrangements for CHP electricity sales are not concluded, the projected CO2 savings will not materialise.*

2.4 Renewable Energy

2.4.1 The approved London Plan renewable energy technologies have been appraised, examining the suitability of the site and potential for delivering CO_2 reductions, in line LBRUT's Policy CP2.

2.4.2 The London Plan approved renewable energy technologies include:

- Photovoltaics
- Solar Water systems
- Biomass Heating
- Ground Source Heat Pumps
- Air Source Heat Pumps

[1] Energy Planning, Greater London Authority guidance on preparing energy assessments (March 2016)

- Wind

2.4.3 The choice of technology will be dependent upon a range of factors including: orientation, height, window size, surrounding buildings and environment, site size and layout, geology, conservation and biodiversity.

2.4.4 The general feasibility of the technologies which were discounted are shown in Table 6.

Table 4 – Discounted Renewable Technologies

Renewable Technologies	Unfeasible due to:
Wind Turbines	Impact within an urban environment: • Size and appearance • Noise • Appropriate positioning • Unpredictable and varying wind speeds • Cost, and • Maintenance
Biomass Heating	Impact on the air quality of LBRUT. Transport and storage of biomass fuels.
Solar Thermal	Greater savings can be made through the PVs
Ground Source Heat Pumps (GSHP)	The installation of GSHP is one of the most costly options for this site, boreholes would need to be drilled to around a depth of 100m and the location of the scheme in such a central and historic location would preclude such infrastructure.

2.4.5 The appraisal has shown that ASHPs providing both space heating and cooling and 22 No. PV panels providing 7.32kWp, to be the most suitable renewable energy technology for the development.

Photovoltaics

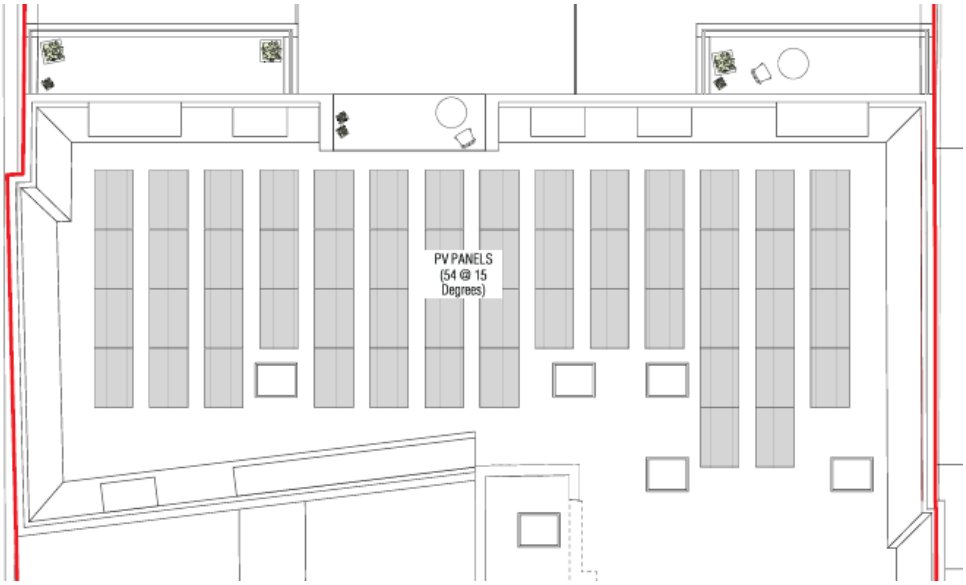
2.4.6 PV systems convert solar energy from both direct light and diffuse light, into electricity through semiconductor cells. PV systems require an inverter to convert the low voltage, direct current (DC) electricity produced by the array of panels into 230V 50/60Hz alternating current (AC).

2.4.7 For the purposes of the analysis, the Sunpower E20/333 has been used, however there are a number of products available which may be selected and as such the PV array is subject to change.

2.4.8 The area of PV is calculated to ensure that there is sufficient space for access to the panels required for maintenance. There is limited space for the panels due to the relatively small roof area. Additionally the lower roof areas, have been allocated for amenity space for the residents.

2.4.9 Nevertheless, 22 No. PV panels will be located on the roof, orientated South at an angle of 15° or as far as possible. An indicative layout of the PV array is illustrated in Figure 5 below.

Figure 5 – Proposed PV Layout



Air Source Heat Pump (ASHP)

2.4.10 As discussed previously, in addition to the incorporation of PV panels, ASHP units will be used to provide space heating and cooling, to help further reduce the carbon emissions of the proposed development.

2.4.11 The ASHP units will work in conjunction with the MVHR, to provide the retail areas, with space heating and cooling. The units will be located in an exposed external area in close proximity to the commercial spaces.

2.4.12 The ASHP selected for the analysis is the ASHP Mitsubishi Y-Series, which, has a Seasonal Coefficient of Performance (SCoP) of 5.5 or better, and (SEER) of 7.5 or better.

2.4.13 Table 5 demonstrates that carbon emissions results for the Renewables Baseline.

Table 5 – Renewable Baseline Emissions

Renewable Baseline	Retail Areas
Target CO_2 emission rate (TER) ($kgCO_2/yr$)	35
Building CO_2 emission rate (BER) ($kgCO_2/yr$)	22.2
Total % Improvement	35.6%

3.0 BREEAM Pre-Assessment

3.0.1 A BREEAM pre-assessment has been undertaken for the proposed development, as required by LBRUT Policy DM SD 1; all new non-residential developments over 100m^2 must achieve a BREEAM rating of 'Excellent' (70%).

3.0.2 The BREEAM scheme used is 2014 Non-Domestic Refurbishment and Fit-Out (NDRFO), which has four parts according to the level of refurbishment being undertaken: Part 1 is for fabric and structure; Part 2 is for core services; Part 3 is for local services; and Part 4 is for the internal design. The retail area of the proposed development is a shell only project, therefore the pre-assessment is a Part 1 scope.

3.0.3 The pre-assessment has achieved a BREEAM rating of 73.25%, has met the necessary minimum mandatory criteria, and therefore achieves the required Excellent rating.

3.0.4 However, the nature of the development has caused some constraints in terms of BREEAM, which has meant that some of the more costly or onerous BREEAM credits have had to be targeted to obtain the Excellent rating; these credits would not normally be targeted for a development of this small size and type. As the proposed development is only just above the threshold for the Excellent rating as it is, we believe that reducing the BREEAM rating required to a Very Good level would be much more appropriate for the proposed development.

3.0.5 For instance, the site's location and the fact that is a retail unit mean that only a number of credits can be targeted in terms of daylighting and view out (Hea 01) – glazing can only be provided at the front of the unit because buildings sit on either side, so areas at the back of the unit will not be able to meet the necessary criteria to achieve these credits. Similarly, credits relating to ventilation, potential for natural ventilation (both Hea 02) and free cooling (Ene 04) cannot be targeted because it is a retail, so will have a varied occupancy and will require mechanical ventilation.

3.0.6 The site's location has average transport links, so few credits have been achieved in terms of public transport accessibility (Tra 01), and the constrained site does not have sufficient space to be able to provide cycle storage spaces (10No. would be required) or cyclist facilities (showers, changing facilities, lockers, drying space), so credits cannot be targeted for Tra 03.

3.0.7 The site includes the extension of the existing buildings on site in order to provide sufficient space for a worth-while number of residential units above the retail space; this extension unfortunately removes the existing building's garden space which includes trees[2], so only a small number of the BREEAM ecology credits can be targeted. Additionally, removing green space and increasing areas of hardstanding reduces the amount of permeable surfaces at the development which help to mitigate surface water run-off, so there will

[2] It should be noted that the development does incorporate new features of ecological value in the form of a garden space, new trees, sedum roof, and habitat boxes.

be an increase in the volume of surface water run-off at the development and these credits cannot be targeted (Pol 03).

3.0.8 Onerous or costly credits that have been targeted to ensure that the Excellent rating can be achieved are as follows:

- Lifecycle and service life planning (Man 02) - an elemental life cycle cost (LCC) analysis and a component level LCC plan will need to be undertaken, which can be costly and unnecessary for a project of this size.
- The chosen Contractor will need to operate an environmental management system (EMS) and will need to achieve a high considerate constructors scheme (CCS) score, which can mean that only larger construction companies can be consulted and a larger construction fee will be applied. Additionally, the Contractor will need to record and report transport movements and impacts of construction materials and waste and appoint a construction stage sustainability champion (Man 03 credits).
- A thermographic survey, air tightness testing and a visual inspection will need to be undertaken at the post-construction stage to ensure the integrity of the building fabric, however, if defects are found during the site inspection, these must be rectified prior to building handover, which can delay the building completion date (Man 04).
- The Contractor will also have to ensure that operational infrastructure and resources are put in place to coordinate post-occupancy evaluation information at quarterly intervals for the first three years of the building's occupation, which could increase the Contractor's fees (Man 05 exemplary credit).
- High performing materials will need to be used for the construction of the project, so they will be more expensive (Mat 01). Furthermore, materials specified will have to have responsible sourcing certification that allows the project to achieve 54% of the points available for the Mat 03 credits.
- The Contractor will need to achieve a resource efficiency of less than 2.1m^3 or 0.4 tonnes of construction waste per 100m^2 (GIFA) during construction, which is very difficult to achieve (Wst 01 credits), and recycled or secondary aggregates will need to be used on site in-situ (Wst 02 credit), which can limit the construction methods of the project.
- A climate change adaption strategy/risk assessment for the structural and fabric resilience will need to be completed for the project (Wst 05), which is simply not necessary for a project of this small scale.

3.0.9 If the proposed development target rating were reduced to a Very Good score and these more difficult credits were removed from the assessment, a BREEAM score of 56.6% could be targeted. The benchmark for a Very Good rating is 55%, so some of these credits would still need to be targeted to ensure that the assessment has a sufficient "buffer" to ensure that a Very Good rating is achieved at the end of the project (the best credits to target to allow a buffer

are the materials credits, as these have a higher weighting in the assessment than all the other credits; generally, a good buffer at this stage in a development is approximately 5% above the required rating, i.e. 60% in this case).

3.0.10 Areas where the proposed development has performed well in terms of BREEAM, due to the design team's careful stipulation of sustainable features and thinking during the design process (regardless of the more difficult credits above), are as follows:

- The building has a high energy efficiency due to the selection of low u-value building fabric materials and low energy-consuming services (Ene 01).
- Low carbon and renewable energy generation technologies have been utilised (Ene 04).
- The health and wellbeing of building users has been paramount in the designs, ensuring user thermal and acoustic comfort (Hea 04 or Hea 05, respectively).
- The security of the building has also been accounted for in the designs (Hea 06).
- The design team have included sufficient operational waste space for the retail unknit, to encourage recycling of the building's waste streams (Wst 03).
- Although existing ecological area will be lost, the design team have ensured that enhancement measures have been included into the designs by incorporating garden space, new trees, sedum roof, and habitat boxes (LE 04).
- The chosen development site is in Flood Zone 1, so has a low risk if flooding (Pol 03).

3.0.11 In conclusion, the BREEAM 2014 NDRFO pre-assessment for the proposed development currently demonstrates that an Excellent rating can be achieved, however it will be very challenging to accomplish due to the constraints detailed above; therefore we recommend that the proposed development should target a reduced rating of Very Good, as this is a much more appropriate rating for the size and type of the development.

3.0.12 A copy of the full BREEAM NDRFO pre-assessment for the project is included in Appendix A of this Energy strategy.

4.0 Conclusion

4.0.1 This Energy and Sustainability Strategy demonstrates that the proposed retail areas of the 179 – 181 High Street development in the London Borough of Richmond-Upon-Thames meets the energy policies set out in the Core Strategy.

4.0.2 Table 8 shows that a total 35.6% improvement can be achieved, by introducing:

- Passive and active demand reduction measures;
- MVHR with SFP of 1.2 W/l.s and heat exchange efficiency of 75%;
- ASHP providing both space heating and cooling; and
- 22 No. PV panels providing 7.32kWp.

4.0.3 The BREEAM Pre-Assessment prepared by Metropolis Green, demonstrates that the retail areas, of the proposed 179 – 181 High Street development, can achieve a BREEAM 'Excellent' rating with a score of 73.25%; however it is recommended that the proposed development should target a reduced rating of Very Good, as this is a much more appropriate rating for this size and type of development

Table 6 - Regulated Carbon Emissions Reduction

	Retail Areas
Target CO_2 emission rate (TER) ($kgCO_2/yr$)	35
Building CO_2 emission rate (BER) ($kgCO_2/yr$)	22.2
Total % Improvement	35.6%

Glossary

Building Emissions Rate (BER) or Dwelling Emission Rate (DER) - the actual building/dwelling CO2 emission rate. It is expressed in terms of the mass of CO2 emitted per year per square metre of the total useful floor area of the building (kg/m2/year). In order to comply with Part L of the Building Regulations, the BER/DER must be less than the TER (see below).

Combined Heat and Power (CHP) - defined as the simultaneous generation of heat and power in a single process.

Communal heating - a general term for a shared heating system where heat is supplied to multiple dwellings and/or non-domestic buildings using pipes containing hot water.

Energy assessment – an energy assessment is a document which explains how the London Plan targets for CO2 reduction will be met for a particular development within the context of the energy hierarchy.

Individual gas boiler – a gas boiler is installed in a dwelling or a non-domestic building to provide the property with heat. In this case natural gas (rather than hot water) is piped to the property.

Kilowatt (kW) – One thousand watts. A watt is a measure of power.

Megawatt (MW) – One million watts. A watt is a measure of power.

Part L of the Building Regulations – Approved documents L1A and L2A of the Building Regulations relate to the conservation of fuel and power in new dwellings and new buildings other than dwellings respectively.

Regulated CO_2 emissions – The CO2 emissions arising from energy used by fixed building services, as defined in Approved Document Part L of the Building Regulations. These include fixed systems for lighting, heating, hot water, air conditioning and mechanical ventilation.

Simplified Building Energy Model (SBEM) - a computer program that provides an analysis of a building's energy consumption. The purpose of the software is to produce consistent and reliable evaluations of energy use in non-domestic buildings for Building Regulations compliance.

Site heat network – a set of flow and return pipes circulating hot water to the apartment blocks (and apartments contained therein) and non-domestic buildings on a development.

Standard Assessment Procedure (SAP) - a methodology for assessing and comparing the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin Building Regulations and other policy initiatives

Target CO2 Emission Rate (TER) - the minimum energy performance requirement for a new dwelling/building. It is expressed in terms of the mass of CO2 emitted per year per square metre of the total useful floor area of the building (kg/m2/year).

Appendix A – BREEAM Pre-Assessment

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BREEAM 2014 NDRFO – Pre-Assessment

179-181 High Street, Hampton Hill
London Borough of Richmond-upon-Thames

On behalf of
Clive Chapman Architects

27/05/2016
Job Ref: 5388

Produced By	Position	Date
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Approved By	Position	Date
Miranda Pennington	Director	27/05/2016

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Planning
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Renewable Energy
Sustainable Development

1.0 Introduction

Project Name	179-181 High Street, Hampton Hill
BREEAM Version	BREEAM 2014 Non-Dom RFO
Applicable Assessment Parts	Part 1 Assessment (Fabric and Structure; Shell Only)
Assessment Stage	Pre-Assessment Stage
Lead Assessor	Fenja Scarisbrick Jones of Metropolis Green Ltd.
Assessor Support	Kate Chesterfield of Metropolis Green Ltd.
Client (Architect)	Clive Chapman Architects
Target Rating	Excellent (70%)
Current Score	73.25 %

2.0 BREEAM Credit Summary

	Credits available	Credits achieved	% Credits achieved	Weighting	Category score
Management	19.0	19.0	100.00%	18.32%	18.32%
Health and Wellbeing	13.0	7.0	53.84%	14.96%	8.05%
Energy	4.0	2.4	60.00%	3.88%	2.33%
Transport	9.0	4.0	44.44%	10.12%	4.50%
Water	0.0	0.0	0.00%	0.00%	0.00%
Materials	11.0	10.0	90.90%	21.09%	19.17%
Waste	11.0	10.0	90.90%	11.60%	10.54%
Land Use and Ecology	4.0	2.0	50.00%	13.50%	6.75%
Pollution	5.0	2.0	40.00%	6.49%	2.59%
Innovation	10.0	1.0	10.00%	10.00%	1.00%
Total	**88.0**	**57.4**	**65.22%**	**-**	**73.25%**
Rating	**-**	**-**	**-**	**-**	**Excellent**

3.0 Site Details

These details are used for filtering the assessment in BREEAM Non-Domestic Refurbishment and Fit Out Pre-Assessment submission page, so only targets applicable to the project are made available.

Site Name	179-181 High Street, Hampton Hill
Site Address	179-181 High Street, Hampton Hill, Middlesex, London Borough of Richmond-Upon-Thames, TW12 1NL
Scope of the Assessment	Fabric and structure: Yes Core Services: No Local Services: No Interior Design: No

Is the project a change of use?	No
Are transportation systems specified or present within the refurbishment or fit-out zone? (lifts, escalators, moving walks)	No
Are there laboratories present and if so what % of total building area do they represent	No laboratories present
Laboratory containment area	No laboratories present
Is cold storage specified or present within the refurbishment or fit-out zone?	No
Are soft landscaped areas within the scope of refurbishment or fit-out zone?	No
If the asset undergoing refurbishment or fit-out is part of a larger building, is the cooling generation plant centralised or localised?	N/A
If the asset undergoing refurbishment or fit-out is part of a larger building, is the heating generation plant centralised or localised?	N/A
Is Wat01 within the scope of the assessment in accordance with Table 42?	No
What is the building type?	Retail
If Industrial, does the building have office areas?	N/A
Does the building have any unregulated water demands? e.g. irrigation, car washing, or other process related water use	No
Does the building have unregulated energy demands from significantly contributing systems?	No
Is the project a simple building?	No
Does the building have external lighting within the scope of works?	No
Does the building have any existing or newly specified externally mounted plant?	No
If undertaking a Part 4 assessment, is there any equipment specified that requires commissioning (see Man04 CN13)	N/A
Historic building (listed building or building in a conservation area?	No

4.0 Mandatory Minimum Standards

In addition performance against the minimum standards (required for the specified target rating) under each scenario is summarised below;

Issue	**Targeted**
Man 03 - Responsible construction practices	Yes
Man 04 - Commissioning and handover	Yes
Ene 01 - Reduction of energy use and carbon emissions	Yes
Mat 03 - Responsible Sourcing of Materials	Yes
Wst 03 - Operational Waste	Yes

If the required minimum standards are not met then the target rating will not be achieved regardless of overall score.

5.0 Credits and Comments Table

		Available	Targeted	Comments
Management				
Man 01	Project brief and design	4	4	**Stakeholder Consultation (Project Delivery) - 1 Credit** Credit targeted – Project delivery requires the design team to establish their roles and responsibilities throughout the project by the concept design stage - a Project Execution Plan is typically used to satisfy this credit. **Stakeholder Consultation (Third Party) - 1 Credit** Credit targeted – third party stakeholders of the project (e.g. intended building users) are consulted by the concept design stage and their contributions are incorporated into the buildings design. **Sustainability Champion (Design) - 1 Credit** Credit targeted – a BREEAM Accredited Professional is appointed during the feasibility stage as a sustainability Champion to set BREEAM performance targets for the project. These targets must be formally agreed client and the project design team no later than the concept design stage. **Sustainability Champion (Monitoring Progress) - 1 Credit** Credit targeted – a BREEAM Accredited Professional is appointed to monitor progress against the agreed BREEAM performance targets throughout the design process and formally reports this to the client and design team. The first Sustainability Champion credit (above) must be achieved in order to target this credit.
Man 02	Life cycle cost and service life planning	4	4	**Elemental Life Cycle Cost (LCC) - 2 Credits** Credits targeted – an elemental life cycle cost (LCC) analysis must be undertaken for the project by the concept design stage, which provides typical cost benchmarks for key elements, comparative cost modelling or approximate estimates. It is expressed as cost per square metre of gross internal floor area and presented for elemental analysis. **Component Level LCC Plan - 1 Credit** Credit targeted – a component level LCC plan must be developed by the end of the technical design stage in line with PD 156865:2008. This involves cost planning specification choices of systems, elements or component levels during design development; the environment of the building and other local conditions must also be identified. The three credits above would not normally be targeted for a project of this size, however in order to obtain an Excellent rating, some of the more costly and onerous credits needed to be targeted. **Capital Cost Reporting - 1 Credit** Credit targeted – predicted and final capital costs of project must be reported to the BRE in £/m2. This is a very simple credit to achieve.
Man 03	Responsible construction practices	6	6	**Timber Pre-Requisite** Credit targeted – All timber and timber-based products used on the project must be 'Legally harvested and traded timber'. This a mandatory minimum standard required to achieve a BREEAM rating. **Environmental Management – 1 Credit** Credit targeted – The Principal Contractor must operate an environmental management system (EMS) covering their main operations (e.g. ISO 14001). **Sustainability Champion (Construction) – 1 Credit** Credit targeted – a Sustainability Champion (this could be a BREEAM AP or a member of the construction team who has been certified by the BRE Site Sustainability Manager Membership Scheme) is appointed to monitor the project and ensure that the BREEAM sustainability performance/criteria are met. **Considerate Construction – Up to 2 Credits** Credits targeted – This requires the project to be registered with the considerate constructors' scheme and a CCS score between 35 and 39 must be achieved, with at least 7 points scored in each section. **Monitoring of Construction Site Impacts (Energy & Water) – 1 Credit**

				Credit targeted – a member of the construction team monitors, records and reports the energy and water consumption resulting from all on-site refurbishment and fit out processes throughout the project. **Monitoring of Construction Site Impacts (Transport of Construction Materials and Waste) – 1 Credit** Credit targeted – a member of the construction team monitors, records and reports the transport movements and impacts of construction materials and waste.
Man 04	Commissioning and handover	3	3	**Commissioning and Testing Schedule and Responsibilities – 1 Credit** Credit targeted – Commissioning and testing schedule to be produced to ensure a smooth commissioning process, complying with relevant building standards. **Testing and Inspecting Building Fabric – 1 Credit** Credit targeted – this requires a thermographic survey, air tightness testing and a visual inspection to be undertaken on the project (at appropriate times in its refurbishment) to ensure the integrity of the building fabric, including continuity of insulation, avoidance of thermal bridging and air leakage paths. If defects are found during the site inspection, thermographic survey and air tightness testing, these must be rectified prior to building handover, which can delay the building completion date. **Handover – 1 Credit** Credit targeted – Building user guides and a training schedule must be produced prior to project handover for the building occupants and premises managers.
Man 05	Aftercare	2	2	**Aftercare Support – 1 Credit** Credit targeted – Resources, training, support, etc. are be made available to the building users up to 12 months after occupation by the Contractor. **Post Occupancy Evaluation – 1 Credit + Exemplary level credit (accounted for in the innovation section)** Credit targeted – A post occupancy evaluation (POE) is undertaken one year after building occupation to gain performance feedback from building users, and (exemplary level criteria) operational infrastructure and resources are put in place to coordinate POE information at quarterly intervals for the first three years of building occupation. As stated previously, the exemplary credit would not normally be targeted for a project of this size and type (shell only), however in order to obtain an Excellent rating, some of the more costly and onerous credits needed to be targeted.
Management Credit Total:		**19**	**19**	
Management Weighting total:		**18.32%**	**18.32%**	

Health and Wellbeing				
Hea 01	Visual Comfort	5	2	**Daylighting – Up to 3 Credits** One credit targeted – this credit requires a daylighting analysis to be undertaken which demonstrates either of the following: • Method 1: o At least 17.5% of the sales area must have a point daylight factor of 2% or more o At least 40% of all the other occupied areas must have an average daylight factor of 2% and a uniformity ratio of at least 0.3. • Method 2: o Daylighting provision, averaged over all relevant spaces has improved after refurbishment and fit out by at least 15% and there is a minimum glazing to floor area ratio of 5% glass to floor area ratio for side windows (2.5% for roof lights) Only one credit has been targeted for this issue, as the building only has glazing at the front due to its orientation and the fact that it is a retail unit. It is unlikely that more credits will be achievable, but the results of the daylighting analysis would be the only way of demonstrating this. **View Out – Up to 2 Credits** Credits not targeted – All occupied areas of the building must be within 7m of a wall with a window providing an adequate view out, which is not achieved in the proposed development.
Hea 02	Indoor Air Quality	3	1	**Indoor Air Quality (IAQ) plan– 1 Credit** Credit targeted – an indoor air quality plan must be produced and implemented which minimises indoor air pollution during the design, construction and occupation of the building through building design and specification/installation decisions. **Ventilation – Up to 1 Credit** Credit not targeted – this requires building extracts and intakes to be over 10m apart and intakes to be over 20m from sources of external pollution (e.g. a road), which is unlikely to be achievable in the proposed development. **Adaptability – Potential for Natural Ventilation – Up to 1 Credit** Credit not targeted – this requires the building to be capable of utilising a natural ventilation strategy, which is unlikely to be achievable in the proposed development.
Hea 04	Thermal comfort	2	2	**Thermal Modelling – 1 Credit** Credit targeted – thermal modelling must be undertaken using software in accordance with CIBSE AM11 to provide full dynamic thermal analysis. This is to demonstrate that the summer and winter operative temperature ranges in occupied spaces are appropriate and that overheating will not occur. **Adaptability – for a Projected Climate Change Scenario – 1 Credit** Credit targeted – the thermal modelling and analysis above demonstrates that the project has accounted for a projected climate change environment.
Hea 05	Acoustic Performance	2	2	**Acoustic Performance – 2 Credits** Credits targeted – the proposed development must meet relevant acoustic performance standards and testing requirements, i.e. sound insulation and indoor ambient noise levels, as defined by a suitably qualified Acoustician.
Hea 06	Safety and Security	1	1	**Security of Site and Building – 1 Credit** Credit targeted – a suitably qualified Security Consultant (SQSS) must undertake a Security Needs Assessment for the building and develop a set of recommendations/solutions which will be implemented in the building's design.
Health & Wellbeing Credit Total:		**13**	**7**	
Health & Wellbeing Weighting Total:		**14.96%**	**8.05%**	

Energy				
Ene 01	Reduction of energy use and carbon emissions	2	1.4	**Energy Performance – Up to 2 Credits (using Option 2)** 1.4 Credits targeted – using option 2: elemental level energy model with information currently available, the energy strategy for the project achieves 1.4 of 2 credits. The energy strategy uses passive and active design measures, mechanical ventilation with heat recovery, air source heat pumps and 22No. PV panels.
Ene 04	Low carbon design	2	1	**Passive Design Analysis – 1 Credit** Credit targeted – a passive design analysis has been undertaken in the Energy Strategy, to demonstrate measures incorporated in the building to reduce the demand for energy consuming building services.; passive design solutions include: o High performing double glazed windows o Optimising daylight and therefore solar gains o Insulation with high performing u-values **Free Cooling – 1 Credit** Credit not targeted – it is unlikely that free cooling strategies will be able to be implemented in the design of the building.
Energy Credit Total:		**4**	**2.4**	
Energy Weighting Total:		**3.88%**	**2.33%**	

Transport				
Tra 01	Public Transport Accessibility	5	2	**Public Transport Accessibility – Up to 5 Credits** 2 Credits targeted – the development has an accessibility index of 5.91 (as calculated using TfL WebCAT software) which, when put into the BREEAM 2014 NDFRO Tra 01 calculator, demonstrates that 2 credits can be achieved for the development.
Tra 02	Proximity to amenities	1	1	**Proximity to amenities – 1 Credit** Credit targeted – the proposed development is defined as building type 1 in the BREEAM Tra 02 issue, so must be within a 500m proximity of at least 2 of the following: o an appropriate food outlet, o a place to access cash, o access to a recreation/leisure facility for fitness/sports Both an appropriate food outlet and a cash point are located at the Tesco supermarket next door to the development, therefore the Tra 02 credit can be achieved for the development.
Tra 03	Cyclist facilities	2	0	**Cycle Storage – 1 Credit** Credit not targeted – cycle storage facilities have not been provided for the non-domestic part of the development. **Cyclist Facilities – 1 Credit** Credit not targeted – the cycle storage credit must be achievable in order to target this credit.
Tra 05	Travel Plan	1	1	**Travel Plan – 1 Credit** Credit targeted – a BREEAM compliant travel plan will be undertaken for the proposed development and submitted with the planning application.
Transport Credit Total:		**9**	**4**	
Transport Weighting Total:		**10.12%**	**4.50%**	

Materials				
Mat 01	Life Cycle Impacts	4	4	**Life Cycle Impacts – Up to 4 Credits (Mat 01 Option 2 chosen)** 4 Credits targeted – this issue requires an elemental assessment of environmental performance information (EPI) to be undertaken for the materials used in the fabric and structure of the development (both re-used and new materials); credits are awarded based on the calculated number of Mat 01 points achievable based on the percentage of each element that is

				• re-used in situ • re-used in situ with minor repairs • specified with robust EPI To achieve 4 credits, at least 75% of the available Mat 01 credits must be achieved. This number of credits would not normally be targeted for a project of this size and type (shell only), however in order to obtain an Excellent rating, a large number of credits needed to be targeted because Materials credits have a high weighting, so are worth more in the assessment. Mat 01 Option 1 could also be used to calculate the number of credits, however this can be a more onerous task, as this requires a life cycle assessment (LCA) be undertaken for building elements. The number of credits available using this method is 6, so the credit weightings will differ.
Mat 03	Responsible Sourcing of Materials	4	4	**Timber Pre-Requisite** Targeted – all timber and timber-based products used on the project must be legally harvested and traded timber; this is a mandatory minimum requirement for achieving any level of BREEAM certification. **Sustainable Procurement Plan - 1 Credit** Credit targeted – the Principal Contractor must source materials for the project in accordance with a documented sustainable procurement plan. **Responsible Sourcing of Materials - Up to 3 Credits** 3 Credits targeted – the Principal Contractor must source materials which have certification demonstrating that they are responsibly procured/produced. Each of the applicable specified materials comprising the main elements of the building are assigned a 'responsible sourcing tier level' according to the certification that can be associated with that material (e.g. material may be certified under BES6001, have an EMS, or be recycled, etc.). Each tier level then has a certain number of points associated to it; the number of BREEAM credits achievable for this credit is calculated using a BREEAM Mat 03 tool, which determines the % of available points all the materials score according to the certification available. To achieve 3 credits, at least 54% of the available BREEAM Mat 03 responsible sourcing of materials points must be achieved. Again, normally this number of credits would not normally be targeted for a project of this size and type (shell only), however in order to obtain an Excellent rating, a large number of credits needed to be targeted because Materials credits have a high weighting, so are worth more in the assessment.
Mat 04	Insulation	1	1	**Insulation – 1 credit** Credit targeted – all new insulation specified for use within the project (both building fabric and building services) must have an insulation index ($=\frac{volume\ of\ insulation[m^3]}{Thermal\ conductivity[W/m.K]}$) of at least 2.5, and should have a high Green Guide to Specification rating (A+ or A).

Mat 05	Designing for durability and resilience	1	1	**Designing for durability and resilience**
				Credit targeted – the building must be analysed to determine any exposed or vulnerable building elements, and protective measures must be incorporated to protect them, e.g.:
				• Vulnerable areas:
				  ○ Entrances, stairwells, common areas
				  ○ Materials that are exposed to the elements which could undergo degradation from environmental factors and biological/polluting agents.
				• Protective measures:
				  ○ external bollards, push plates, durable floor finishes, railings
				  ○ robust material coatings/finishes, using materials less prone to degradation

Mat 06	Material efficiency	1	0	**Material Efficiency – 1 Credit** Credit not targeted – this is a particularly onerous credit, so has not been targeted.
Materials Total:		**11**	**10**	
Materials Weighting Total:		**21.09%**	**19.17%**	

Waste				
Wst 01	Construction Waste Management	7	6	**Pre-Refurbishment Audit – 1 credit** Credit targeted – a pre-refurbishment audit is undertaken on the site prior to the concept design stage to guide the design, determine any materials that can be reused and to set targets for waste management. **Re-use and Direct Recycling of Materials – Up to 2 Credits** 1 Credit targeted – 50%* of the waste materials (applicable as identified in table 64 of the BREEAM NDFRO Manual) on site are re-used on-site or off-site or are sent back to the manufacturer for closed loop recycling. **Construction Resource Efficiency – Up to 3 Credits** 3 Credits targeted – the contractor will need to demonstrate a resource efficiency of less than 2.1m^3 or 0.4 tonnes of construction waste per 100m^2 (GIFA), and complete a BREEAM compliant resource management plan. **Diversion of Resources from Landfill - 1 Credit** Credit targeted – the following percentages of non-hazardous construction, demolition and excavation waste generated by the project must be diverted from landfill: Non-demolition: 70 % by volume (80% by tonnage) Demolition: 80% by volume (90% by tonnage). Waste materials will also be sorted into separate key waste groups according to the waste streams generated by the scope of works.
Wst 02	Recycled Aggregates	1	1	**Recycled Aggregates – 1 Credit** Credit targeted – recognise and encourage the use of recycled and secondary aggregates and re-use of aggregates in-situ. This credit would not normally be targeted for a project of this size and type (shell only), however in order to obtain an Excellent rating, some of the more costly and onerous credits needed to be targeted.
Wst 03	Operational Waste	1	1	**Operational Waste – 1 Credit** Credit targeted – dedicated storage facilities will be provided for the building's operational recyclable waste streams; the minimum storage space provision should be at least 2m^2 per 1000m^2 of net floor area (for buildings under 5000m^2; rounded up to the nearest 1000m^2).
Wst 05	Adaptation to Climate Change	1	1	**Adaptation to Climate Change – 1 Credit** Credit targeted – a climate change adaptation strategy/risk assessment for structural and fabric resilience must be completed by the end of the concept design stage. This credit would not normally be targeted for a project of this size and type (shell only), however in order to obtain an Excellent rating, some of the more costly and onerous credits needed to be targeted.
Wst 06	Functional adaptability	1	1	**Functional Adaptability – 1 Credit** Credit targeted – a building-specific, BREEAM-compliant functional adaption study is undertaken for the development by the concept design stage.
Waste Credit Total:		**11**	**10**	
Waste Weighting Total:		**11.60%**	**10.54%**	

Land Use and Ecology				
LE 02	Protection of Ecological Features	1	0	**Protection of Ecological Features – 1 Credit** Credit not targeted – the development is removing areas of garden, including trees, so this credit cannot be achieved.
LE 04	Ecological Enhancement	1	1	**Ecological Enhancement – 1 Credit** Credit targeted – an ecology report has been undertaken for the site by a suitably qualified Ecologist and they have made recommendations for site as follows: • Installation of habitat boxes for birds/bats. • Invertebrate improvements such as log piles, nesting tubes. • New refuge for reptiles. • Landscape proposals to include native fruiting/flowering species.
LE 05	Long Term Impact on Biodiversity	2	1	**Long Term Impact on Biodiversity – Up to 2 Credits** 1 Credit targeted – a suitably qualified Ecologist has been appointed prior to commencement of on-site activities and they will confirm that all relevant UK and EU legislation relating to the protection and enhancement of ecology will be complied with for the site-wide development. A landscape and habitat management plan will be compiled for the site, covering at least the first 5 years after project completion and will be handed over to the building owner for use by the grounds maintenance staff. To achieve 2 credits, at least 4 of the following applicable additional measures must be incorporated to improve the site's long term impact on biodiversity: • Contractor appoints a Biodiversity Champion to ensure detrimental impacts on site biodiversity are minimised during construction, in line with the Ecologist recommendations. • Contractor trains site workforce on how to protect ecology during the project, in line with Ecologist recommendations. • New ecologically valuable habitat is created at the site. • Where flora/fauna habitats exist on site, the Contractor programmes site works to minimise the impact on wildlife. As flora/fauna habitats do exist on the current site and these are being removed, only 1 credit can be targeted for this issue, and at least 2 of the other measures must be undertaken to achieve the credit.
Ecology Credit Total:		**4**	**2**	
Ecology Weighting Total:		**13.50%**	**6.75%**	

Pollution				
Pol 03	Surface Water Run Off	5	2	**Flood Risk Management – Up to 2 Credits** 2 Credits targeted – the site is in flood zone 1, therefore has a low risk of flooding. **Surface Water Run-Off – Up to 2 Credits** No credits targeted – the existing site has a garden at the back which is being removed by the proposed development (extension), therefore the area of impermeable surfaces at the site will increase, so these credits cannot be achieved. **Minimising Watercourse Pollution – 1 Credit** Credit not targeted – this requires SUDs to be incorporated into the proposed development.
Pollution Credit Total:		**5**	**2**	
Pollution Weighting Total:		**6.49%**	**2.59%**	

Exemplary and Innovation Credits				
Man 05	Aftercare	1	1	**Post Occupancy Evaluation – 1 Exemplary level credit** Credit targeted – Operational infrastructure and resources are put in place to coordinate POE information at quarterly intervals for the first three years of the building's occupation.

				As stated previously, this credit would not normally be targeted for a project of this size and type (shell only), however in order to obtain an Excellent rating, some of the more costly and onerous credits needed to be targeted.
Innovation Credit Total:		**10**	**1**	
Innovation Weighting Total:		**-**	**1%**	
OVERALL SCORE TOTALS:			**73.25%**	

Appendix B - Policy Context

B.1 National Policy

B.1.1 Sustainable development is a core principle underpinning planning, and has a key role to play in the creation of sustainable communities. In order to ensure the implementation of sustainable development and to determine the targets and standards to be met by the proposed development, it is necessary to review the relevant national, regional and local planning policies with respect to sustainability and the site's location. A summary of the planning policy context for the site and proposed development is provided below.

B.1.2 The National Planning Policy Framework (NPPF) was published in March 2012 and sets out the Government's planning policies for England, and how these policies are expected to be applied. The policies in the document, taken as a whole, constitute the Government's view of what sustainable development in England means in practice for the planning system.

B.1.3 Fundamentally for the proposed development, paragraph 7 of the NPPF states that:

> There are 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:
>
> - **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; and
> - **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.

B.1.4 Paragraph 14 of the NPPF states that:

> At the heart of the National Planning Policy Framework 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

B.1.5 The NPPF outlines a set of core land-use planning principles that should underpin both plan-making and decision-taking, three of which are particularly relevant to this Sustainability Statement. Under paragraph 17, these principles are that planning should:

- support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy);
- contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser environmental value, where consistent with other policies in this Framework; and
- encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value.

B.1.6 Design is addressed in section 7 of the NPPF, and paragraph 56 states:

> The Government attaches great importance to the design of the built environment. Good design is a key aspect of sustainable development, is indivisible from good planning, and should contribute positively to making places better for people.

B.1.7 Meeting the challenge of climate change is addressed in section 10 of the NPPF, and paragraph 93 notes that planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development.

B.1.8 Further to the above, paragraphs 95 and 96 state:

To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;

- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

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

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

B.1.9 Conserving and enhancing the natural environment is addressed in section 11 of the NPPF, and excerpts from paragraph 109 state that the planning system should contribute to and enhance the natural and local environment by:

- minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures; and
- preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.

B.1.10 Paragraph 118 notes that when determining planning applications, local planning authorities should aim to conserve and enhance biodiversity by encouraging opportunities to incorporate biodiversity in and around developments.

B.1.11 Noise is addressed under paragraph 123 which notes that Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development; and
- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions.

B.1.12 Additionally, paragraph 125 notes that by encouraging good design, planning policies and decisions should limit the impact of light pollution from artificial light on local amenity.

B.2 Regional Policy

B.2.1 The London Plan was published in July 2011 and is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London to 2031. The policies relevant to this report are found in Chapter 5 (and to a lesser extent in Chapter 7) of the London Plan.

B.2.2 The London Plan applies to Major Development only, therefore the local policies take precedence.

B.3 Local Policy

London Borough of Richmond-Upon-Thames Core Strategy, April 2009

B.3.1 Policies in the London Borough of Richmond-Upon-Thames' Local Plan relating to sustainability and the proposed development are contained within the following documents: the Core Strategy (April 2009), Development Management Plan (November 2011) and various Supplementary Planning Documents.

London Borough of Richmond-Upon-Thames' Core Strategy, April 2009

Core Strategy Policy CP1: Sustainable Development

A. The policy seeks to maximise the effective use of resources including land, water and energy, and assist in reducing any long term adverse environmental impacts of development. Development will be required to conform to the Sustainable Construction checklist, including the requirement to meet the Code for Sustainable Homes level 3 (for new homes), Ecohomes "excellent" (for conversions) or BREEAM "excellent" (for other types of development). This requirement will be adjusted in future years through subsequent DPDs, to take into account the then prevailing standards in the Code for Sustainable Homes and any other National Guidance, and ensure that these standards are met or exceeded.

The following principles will be promoted:

B. Appropriate location of land uses: Facilities and services should be provided at the appropriate level locally, taking account of the network of town centres identified in policy CP8. Higher density residential and mixed use developments to be in town centres, near to public transport to reduce the need to travel by car.

C. Making best use of land: The use of existing and proposed new facilities should be maximised through management initiatives, such as co-location or dual use. Redevelopment of sites should normally only take place where there can be an increase in the number of housing units and/or quantity of commercial floorspace.

D. Reducing environmental impact: The environmental benefits of retaining and, where appropriate, refurbishing existing buildings, should be compared against redevelopment. Development should seek to minimise the use of open land for development and seek to maintain

the natural vegetation, especially trees, where possible. Local environmental impacts of development with respect to factors such as noise, air quality and contamination should be minimised.

E. Environmental gain to compensate for any environmental cost of development will be sought.

Core Strategy Policy CP2: Reducing Carbon Emissions

A. The Borough will reduce its carbon dioxide emissions by requiring measures that minimise energy consumption in new development and promoting these measures in existing development, particularly in its own buildings.

B. The Council will require the evaluation, development and use of decentralised energy in appropriate development.

C. The Council will increase the use of renewable energy by requiring all new development to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation unless it can be demonstrated that such provision is not feasible, and by promoting its use in existing development.

Core Strategy Policy CP3: Climate Change – Adapting to the Effects

A. Development will need to be designed to take account of the impacts of climate change over its lifetime, including:

- Water conservation and drainage
- The need for Summer cooling
- Risk of subsidence
- Flood risk from the River Thames and its tributaries.

B. Development in areas of high flood risk will be restricted, in accordance with PPS25, and using the Environment Agency's Catchment Flood Management Plan, Borough's Strategic Flood Risk Assessment and site level assessments to determine risk.

Core Strategy Policy CP4: Biodiversity

A. The Borough's biodiversity including the SSSIs and Other Sites of Nature Importance will be safeguarded and enhanced. Biodiversity enhancements will be encouraged particularly in areas of deficiency (parts of Whitton, Hampton, Teddington, Twickenham and South Kew), in areas of new development and along wildlife corridors and green chains such as the River Thames and River Crane corridors.

B. Weighted priority in terms of their importance will be afforded to protected species and priority species and habitats in the UK, Regional and Richmond upon Thames Biodiversity Action Plans.

Core Strategy Policy CP5: Sustainable Travel

A. The need for travel will be reduced by the provision of employment, shops and services at the most appropriate level locally, within the

network of town centres identified in CP 8. To implement this policy the Council will:

- Protect and enhance local facilities and employment to reduce the need to travel.
- Require developments which would generate significant amounts of travel to be located on sites well served by public transport.

In promoting safe, sustainable and accessible transport modes such as walking, cycling and public transport, in association with its partners the Council will seek to:

B. Land for transport:

- Safeguard land for existing and proposed transport functions.
- Reflect the above priorities in the allocation of road spaces as part of the Parallel Initiatives Programme

C. Cycling and Walking:

- Give priority to pedestrians, including those with disabilities, particularly in Richmond town centre and the district and local shopping centres.
- Provide and promote a well-designed bicycle and walking network across the Borough (the Strategic Walks network, Richmond Borough Cycle Network and London Cycle Network Plus), and improve conditions for cyclists and pedestrians elsewhere.
- Prioritise the needs of pedestrians and cyclists in the design of new developments including links to existing networks and requiring the provision of adequate cycle parking.
- Investigate the possibility of a footbridge across the Thames between Ham and Twickenham for pedestrians and cyclists.

D. Public Transport:

- Improve provision for buses particularly in Richmond and Twickenham town centres, and seek to improve bus services within River Crane Corridor through the implementation of development proposals.
- Achieve integration and convenient interchange facilities at all the borough's stations.
- Seek improvements to orbital public transport including rail access to Heathrow.
- Improve walking, cycling and public transport in areas less well served by public transport, including some of the areas of relative deprivation.

E. Congestion and Pollution:

- Undertake traffic management measures to reduce the impact of traffic particularly in Richmond town centre, the district and local centres, residential areas and streets unsuitable for through traffic.

F. Car parking and Travel:

- Require new car free housing in Richmond and Twickenham town centres and in other areas where there is good public transport and elsewhere have regard to maximum parking standards.

- Require car share facilities and car clubs in appropriate new developments and encourage the use of low emission motor vehicles in order to reduce congestion and pollution.
- Discourage commuter parking particularly by giving priority to residents' needs. Limit any further expansion of parking in town and local centres and manage parking controls to help maintain the vitality and viability of the centres, including the evening economy.

G. Sustainable Travel:

- Encourage major employers and schools to develop Green Travel Plans and require these where appropriate with planning applications.
- Require all major developments to submit a Transport Assessment based on TfL's Best Practice Guidance.
- Encourage efficient, safe and sustainable freight transport.
- Encourage river transport through the retention and support for new transport infrastructure.

H. The Council will support measures to minimise the impacts of Heathrow, particularly on traffic and noise on the Borough and will oppose changes that increase local impacts. Specifically it will seek the support of BAA, the Government and relevant statutory authorities for the following measures:

i. maintenance of the 480,000 limit on total air transport movements;

ii. maintenance of the current system of segregated mode;

iii. maintenance of the current noise preferential routes;

iv. the discontinuation of night flights;

v. restrictions of the use of private cars and improvements to public transport including a southern rail link.

Core Strategy Policy CP6: Waste

This Borough supports the objectives of sustainable waste management and will:

A. Maximise self-sufficiency in waste management capacity (in line with London Plan target of 85% self-sufficiency within London by 2020).

B. Seek to minimise waste creation, increase household recycling and composting rates to at least 40% by 2010, 50% by 2020, address waste as a resource and look to disposal as the last option, in line with the waste hierarchy.

C. Work with its partners in the West London Waste Authority to prepare a Joint Waste Plan, which will identify locations suitable for waste management facilities to meet The London Plan consolidated with Alterations since 2004 apportionment and other requirements.

D. Safeguard and improve existing waste sites at Craneford Way, Twickenham and Townmead Road, Kew unless compensatory provision is made.

E. Monitor changes in the stock of waste management facilities, waste arisings, and the amount of waste recycled, recovered and going for disposal.

London Borough of Richmond-Upon-Thames' Development Management Plan, Adopted November 2011

Policy DM SD 1: Sustainable Construction

All development in terms of materials, design, landscaping, standard of construction and operation should include measures capable of mitigating and adapting to climate change to meet future needs.

New buildings should be flexible to respond to future social, technological and economic needs by conforming to the Borough's Sustainable Construction Checklist SPD.

New homes will be required to meet or exceed requirements of the Code for Sustainable Homes Level 3.

They also must achieve a minimum 25 per cent reduction in carbon dioxide emissions over Building Regulations (2010) in line with best practice from 2010 to 2013, 40 per cent improvement from 2013 to 2016, and 'zero carbon' standards (as designed in future legislation) from 2016. It is expected that efficiency measures will be prioritised as a means towards meeting these targets. These requirements may be adjusted in future years to take into account the then prevailing standards and any other national guidance to ensure the standards are met or exceeded.

New non-residential buildings over 100sqm will be required to meet the relevant BREEAM 'excellent' standards.

Policy DM SD 2: Renewable Energy and Decentralised Energy Networks

New development will be required to conform with the Sustainable Construction Checklist SPD and:

A. Maximise opportunities for the micro-generation of renewable energy. Some form of low carbon renewable and/or de-centralised energy will be expected in all new development, and

B. Developments of 1 dwelling unit or more, or 100sqm of non-residential floor space or more will be required to reduce their total carbon dioxide emissions by following a hierarchy that first requires an efficient design to minimise the amount of energy used, secondly, by using low carbon technologies and finally, where feasible and viable, including a contribution from renewable sources.

C. Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where there is no over-riding adverse local impact.

D. All new development will be required to connect to existing or planned decentralised energy networks where one exists. In all major developments and large Proposals Sites identified in the (forthcoming) Site Allocations DPD, provision should be made for

future connection to a local energy network should one become available.

Policy DM SD 4: Adapting to Higher Temperatures and Need for Cooling

All new developments, in their layout, design, construction, materials, landscaping and operation, are required to take into account and adapt to higher temperatures, avoid and mitigate overheating and excessive heat generation to counteract the urban heat island effect, and meet the need for cooling.

All new development proposals should reduce reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1. minimise internal heat generation through energy efficient design
2. reduce the amount of heat entering a building in summer through shading, reducing solar reflectance, fenestration, insulation and green roofs and walls
3. manage the heat within the building through exposed internal thermal mass and high ceilings
4. passive ventilation
5. mechanical ventilation
6. active cooling systems (ensuring they are the lowest carbon options).

Opportunities to adapt existing buildings, places and spaces to manage higher temperatures should be maximised and will be supported.

Policy DM SD 5: Living Roofs

Living roofs should be incorporated into new developments where technically feasible and subject to considerations of visual impact. The onus is on the applicant/developer for proposals with roof plate areas of 100sqm or more to provide evidence and justification if a living roof cannot be incorporated. The aim should be to use at least 70% of any potential roof plate area as a living roof.

The use of living roofs in smaller developments, renovations, conversions and extensions is encouraged and supported.

Policy DM SD 6: Flood Risk

Development will be guided to areas of lower risk by applying the Sequential Test as set out in paragraph 3.1.35 of the Development Management Plan document. Unacceptable developments and land uses will be restricted in line with PPS25 and as outlined below. Developments and Flood Risk Assessments must consider all sources of flooding and the likely impacts of climate change. Where a Flood Risk Assessment is

required and in addition to the Environment Agency's normal floodplain compensation requirement, attenuation areas to alleviate fluvial and/or surface water flooding must be considered where there is an opportunity. The onus is on the applicant/developer for proposals on sites of 10 dwellings or 1000sqm of non-residential development or more to provide evidence and justification if attenuation areas cannot be used. In areas at risk of flooding, all proposals on sites of 10 dwellings or 1000sqm of non-residential development or more are required to submit a Flood Warning and Evacuation Plan.

Flood Zone 3b – The functional floodplain as identified in the Borough's Strategic Flood Risk Assessment will be protected by not permitting any form of development on undeveloped sites unless it:

- is for water-compatible development;
- is for essential utility infrastructure which has to be located in a flood risk area and no alternative locations are available and it can be demonstrated that the development would be safe, without increasing flood risk elsewhere and where possible would reduce flood risk overall.

Redevelopment of existing developed sites will only be supported if there is no land use intensification and a net flood risk reduction; the restoration of the functional floodplain to its original function will be supported. Proposals for the change of use or conversion to a use with a higher vulnerability classification will not be permitted. Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units will not be permitted.

A Flood Risk Assessment is required for all development proposals meeting the Flood Zone 3b definition.

Flood Zone 3a – Land uses are restricted to water compatible, less and more vulnerable development. Highly vulnerable developments will not be permitted. Self-contained residential basements and bedrooms at basement level will not be permitted. All basements, basement extensions and basement conversions must have internal access to a higher floor and flood resistant and resilient design techniques must be adopted.

A Flood Risk Assessment is required for all development proposals meeting the Flood Zone 3a definition.

Flood Zone 2 – No land use restrictions. Self-contained residential basements and bedrooms at basement level will not be permitted. All basements, basement extensions and basement conversions must have internal access to a higher floor and flood resistant and resilient design techniques must be adopted.

A Flood Risk Assessment is required for all development proposals meeting the Flood Zone 2 definition, unless the proposal is for a change of use from water compatible to less vulnerable.

Flood Zone 1 – No land use restrictions.

A Flood Risk Assessment is required for development proposals meeting the Flood Zone 1 definition that are greater than 1 hectare. Also required for all other development proposals where there is evidence of a risk from

other sources of flooding, including surface water, ground water and sewer flooding.

Policy DM SD 7: Sustainable Drainage

All development proposals are required to follow the drainage hierarchy when disposing of surface water and must utilise Sustainable Drainage Systems (SuDS) wherever practical. Any discharge should be reduced to greenfield run-off rates wherever feasible.

When discharging surface water to a public sewer, developers will be required to provide evidence that capacity exists in the public sewerage network to serve their development.

Policy DM SD 9: Protecting Water Resources and Infrastructure

The borough's water resources and supplies will be protected by resisting development proposals that would pose an unacceptable threat to surface water and groundwater quantity and quality. This includes pollution caused by water run-off from developments into nearby waterways.

New developments must achieve a high standard of water efficiency by:

1. meeting the minimum mandatory target for water consumption as set out in the Code for Sustainable Homes, or
2. meeting a minimum of 2 credits on water consumption for other types of developments (BREEAM "excellent"), or
3. meeting a minimum of 3 credits on water consumption for conversions (EcoHomes "excellent"), and
4. utilising rainwater harvesting for all external water uses to reduce the consumption of potable water wherever possible.

The above requirements may be adjusted in future years to take into account the then prevailing standards and any other national guidance to ensure that these standards are met or exceeded.

New developments should also consider the following:

1. utilising rainwater harvesting and greywater recycling for all non-potable uses to reduce the consumption of potable water wherever possible, and
2. designing of landscaping to minimise water demand.

Proposals that seek to increase water availability or protect and improve the quality of rivers or groundwater will be encouraged.

The development or expansion of water supply or waste water facilities will normally be permitted, either where needed to serve existing or proposed new development, or in the interests of long term water supply and waste water management, provided that the need for such facilities outweighs any adverse land use or environmental impact.

The Council will support in principle the implementation of the Thames Tunnel project.

Where rivers have been classified by the Environment Agency as having 'poor' status (currently the River Crane, the Beverley Brook and the River Thames, upstream of Teddington), any development affecting such rivers is encouraged to improve the water quality in these areas.

Policy DM OS 5: Biodiversity and New Development

All new development will be expected to preserve and where possible enhance existing habitats including river corridors and biodiversity features, including trees.

All developments will be required to enhance existing and incorporate new biodiversity features and habitats into the design of buildings themselves as well as in appropriate design and landscaping schemes of new developments with the aim to attract wildlife and promote biodiversity, where possible.

When designing new habitats and biodiversity features, consideration should be given to the use of native species as well as the adaptability to the likely effects of climate change.

New habitats and biodiversity features should make a positive contribution to and should be integrated and linked to the wider green and blue infrastructure network, including de-culverting rivers, where possible.

London Borough of Richmond-upon-Thames Refuse and Recycling Requirements Supplementary Planning Document (SPD), Adopted April 2015

B.3.2 Clause 2.1 of the LBRUT Refuse and Recycling SPD states that:

when considering the amount of storage space needed for any particular development, the following requirements will help to calculate the volume of waste generated. They should only be taken as a guide since individual developments may need specific storage requirements:

2.6m2 waste storage should be provided for every 1,000m2 gross floorspace. Note: 50% of this capacity should be retained for the storage of separated waste for recycling.

London Borough of Richmond-upon-Thames Sustainable Construction Checklist Supplementary Planning Document (SPD), Adopted August 2011

B.3.3 The London Borough of Richmond-upon-Thames requires a Sustainable Construction Checklist (SCC) to be completed for all new non-residential developments providing a floor area greater than or equal to 100m2.

B.4 BREEAM

B.4.1 BREEAM is the world's leading and most widely used environmental assessment method for buildings. It sets the standard for best practice in sustainable design and is used to describe a building's environmental performance.

B.4.2 BREEAM is a performance based assessment method and certification scheme for new buildings. The primary aim of BREEAM New Construction 2011 is to mitigate the life cycle impacts of new buildings on the environment in a robust and cost effective manner.

B.4.3 The BREEAM scheme can be used to assess the environmental life cycle impacts of new non-domestic buildings at the design and construction stages. 'New Construction' is defined as development that results in a new standalone structure, or new extension to an existing structure, which will come into operation/use for the first time upon completion of the works.

B.4.4 BREEAM credits are also awarded in 9 categories (plus an additional Innovation category) of sustainable design according to performance. These credits are then added together to produce a single overall score on a scale of Pass, Good, Very Good, Excellent and Outstanding, dependent on the total score received from achieving credits across the various categories. There are minimum standards that must be achieved in order to meet the higher rating levels under BREEAM. For more detail, please refer to the BREEAM 2011 New Construction Technical Manual.

B.4.5 A scheme can be assessed at Design Stage (DS) - leading to an Interim BREEAM Certificate and/or at the Post Construction Stage (PCS) – leading to a Final BREEAM Certificate.

Appendix C – Sample BRUKL Reports

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Proposed retail space

As designed

Date: Wed May 25 11:50:23 2016

Administrative information

Building Details

Address: 179-181 High Street, Hampton Hill, Richmond, TW12 1NL

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.d.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.2.0

BRUKL compliance check version: v5.2.d.2

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Ondrej Gajdos

Telephone number: 02080995978

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	35
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	35
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	22.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	0Ground - Retail Unit_W_45
Floor	0.25	0.15	0.15	0Ground - Retail Unit_S_2
Roof	0.25	0.18	0.18	0Ground - Retail Unit_R_19
Windows***, roof windows, and rooflights	2.2	1.5	1.5	0Ground - Retail Unit_G_64
Personnel doors	2.2	1.8	1.8	0Ground - Retail Unit_D_55
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

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Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs.
Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Split

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.5	7.5	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
0Ground - Retail Unit	-	-	-	1.2	-	-	-	-	-	0.75	0.5

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
0Ground - Retail Unit	-	85	85	4999

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0Ground - Retail Unit	NO (-62.1%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

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Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	483.1	483.1
External area [m²]	805.5	805.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	194.03	306.27
Average U-value [W/m²K]	0.24	0.38
Alpha value* [%]	23.22	17.17

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.27	1.57
Cooling	9.32	14.17
Auxiliary	5.63	3.78
Lighting	37.81	48.46
Hot water	1.7	1.96
Equipment*	20.26	20.26
TOTAL**	54.72	69.93

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	11.86	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	193.31	197.31
Primary energy* [kWh/m²]	168	205.62
Total emissions [kg/m²]	22.2	35

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	5.3	188	0.3	9.3	5.6	5.4	5.61	5.5	7.5
	Notional	13.7	183.6	1.6	14.2	3.8	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

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Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.22	0Ground - Retail Unit_W_45
Floor	0.2	0.15	0Ground - Retail Unit_S_2
Roof	0.15	0.18	0Ground - Retail Unit_R_19
Windows, roof windows, and rooflights	1.5	1.5	0Ground - Retail Unit_G_64
Personnel doors	1.5	1.8	0Ground - Retail Unit_D_55
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

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Appendix D – Renewable Technology Appraisal

D.1 Wind Turbines

D.1.1 Wind is one of the most cost-effective methods or generating renewable electricity. However wind is more suited to low density areas where there is more space necessary for maintenance, less turbulent wind patterns, and they are less likely to be the cause of noise and vibration to nearby properties. High density areas are not ideal with current wind turbine technology.

D.1.2 Installation of wind turbines is neither feasible nor suitable for 179 – 181 High Street. There are a number of concerns with wind turbines in an urban environment including; visual impact, noise, cost, maintenance and space. Although calculations for the modelled systems indicate that wind systems contribute to carbon reductions, it must be noted that under dense urban environments the energy outputs generated by wind turbines can be quite unpredictable. This is mainly due to the neighbouring buildings acting as obstructions causing turbulence to the incoming wind flow. The site would need to be evaluated appropriately (over a period of 12 months) using wind speed monitoring & recording devices in order to give an accurate prediction in terms of energy output derived by the real wind speed measurements recorded on site.

D.1.3 In addition to these concerns, the actual energy output of any turbines installed is likely to be much lower than the modelled outputs due to turbulence created in the urban environment.

D.1.4 Wind turbines have a long lifetime with relatively little maintenance required, and when considering life cycle costs, even with the feed in tariff and energy savings considered they have a longer payback time than other renewable technologies.

D.1.5 Therefore, wind turbines have been determined to be unsuitable for the development at 179 – 181 High Street.

D.2 Biomass Heating

D.2.1 Wood is the most commonly used form of biomass fuel, and can either be burned in solid fuel boilers for central heating applications, or for raising steam for power generation in large installations.

D.2.2 Typically, biomass installations are sized to meet a base heat load with peak load and load variations to be met from gas-fired boilers. Biomass boilers operate most efficiently and are therefore most cost effective when working continuously at full load, they do not respond well to rapidly fluctuating demand. When assessing the feasibility of a biomass installation, storage space and biomass delivery requirements need to be taken into account.

D.2.3 Although the calculations typically show that a biomass boiler could provide a higher level of carbon reductions than gas boilers, the main operational concerns are raised in relation to air quality, storage capacity and logistics of parking for delivery of wood pellets/chips etc.

D.2.4 Air quality is another major concern with biomass heating due to NOx (Nitrogen Oxides) and Particulate Matter (PM10) emissions.

D.2.5 The entire LBRUT is designated as an Air Quality Management Area (AQMA), with current technology, biomass fuelled boiler may negatively impact on air quality which is deemed inappropriate in an Air Quality Management Area unless abatement technology can provide sufficient mitigation.

D.2.6 Biomass systems also require space for storage and delivery of fuel. Additionally, fuel delivery carries implications for parking, increased emissions and pressure from transport. In the context of the current layout, there is insufficient space able to be allocated for the biomass storage facility.

D.2.7 When considering life cycle costs, there are higher maintenance requirements than other forms of renewable energy, fuel costs are predicted to rise and the value of net lettable space required for storage must be considered.

D.2.8 When considering noise impact, the impact of fuel deliveries must be considered, otherwise, the impact is similar to conventional plant.

D.2.9 Therefore, it is determined that a biomass heating solution cannot be practically implemented and is not suitable for the development at Canterbury Crescent.

D.3 Solar Thermal

D.3.1 Solar Thermal hot water heating systems harvest energy from the sun to heat water. The solar heating collectors are generally positioned on the roof of a building, they can also be wall mounted, although with reduced efficiency. A fluid within the panels, heats up by absorbing solar radiation. The fluid is then used to heat up new water which is stored in a separate water cylinder.

D.3.2 As an alternative to PVs, implementing Solar Hot Water (SHW) can deliver carbon saving to new hot water generation for space heating as well as for new hot water production.

D.3.3 Greater savings can be made through the PV panels.

D.4 Ground Source Heat Pump (GSHP)

D.4.1 In the UK, soil temperatures stay at a constant temperature of around 11-12°C, throughout the year. Ground source heat pumps take this low temperature energy and concentrate it into more useful, higher temperatures, to provide space heating and water heating. The process is similar to that used in refrigerators. A fluid is circulated through pipes in the ground absorbing the heat from the soil, the fluid is passed through a heat exchanger in the pump which extracts the heat from the fluid and increases it via a compression cycle. This is then used to provide heating and heat new hot water.

D.4.2 It has been determined that connection to existing or installation of new Ground Source Heat Pump plant is not a feasible option for the 179 – 181 High Street scheme.

D.4.3 The geology at the site has been analysed and accessed; in principle the deposits underlying the site could be suitable for an open loop GSHP system but the viability of this option, would be dependent on the thermal demand to make it cost effective. The installation of GSHP is one of the most costly options for this site, boreholes would need to be drilled to around 100m depth.

D.4.4 Additionally a further detailed analysis of conflicts with existing systems, ground conditions and soil conductivity would be required before determining whether or not the required levels of carbon savings could be achieved and in order to assess the potential for hydraulic connectivity.

D.4.5 Land use, plant space and physical security for the ground collectors and the heat pump units also need to be taken into consideration. For horizontal collector systems, a potentially large area is required for the collector pipework. This area should be free of trees which will cause problems for installation of the pipework. It can be beneath the building but it is most effective in an open area. For borehole or vertical collectors, land requirements are reduced but still significant as the boreholes must be a minimum of five metres apart. Due to the large area required for boreholes exterior to the buildings, construction programme impact and cost impact a GSHP is not considered to be a feasible option for the site.

D.4.6 Noise impact of heat pumps is considered to be negligible although concerns have been raised where older systems are poorly maintained and become noisy.

D.4.7 Taking all of these considerations into account, it is judged that GSHP is not a suitable or affordable technology for 179 – 181 High Street.