

Energy & Sustainability Statement

Dukesbridge House, Reading

Prepared for Lipman Properties
01st July 2020



envision

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EXECUTIVE SUMMARY

1. This Energy & Sustainability Statement has been prepared by Envision on behalf of Lipman Properties (the applicant), and is submitted to support a planning application for the roof and side extensions to existing building at Dukesbridge House to provide a residential-led scheme with associated landscaping, public realm improvements, alterations to the existing vehicular access and car parking and provision of cycle parking and waste storage.
2. The primary purpose of this document to explain how the scheme can meet with Reading Borough Council's energy and sustainability policies, along with the requirements of Part L1a of Building Regulations 2013 (with 2016 amendments).
3. Envision have undertaken a review of the relevant policies and worked with the design team to determine and agree the relevance and approach that should be taken to fulfil each policy.

Summary of Energy Strategy

4. This report illustrates how the scheme complies with the nationally recognised "*Energy Hierarchy*" and follows passive and efficiency improvements before the application of any Low or Zero Carbon (LZC) sources.
5. Envision has produced Part L1A compliant SAP calculations and Part L2a compliant SBEMs in order to determine the energy and CO₂ emissions for the proposed development, which have been calculated using SAP 10 emission factors.
6. To reduce the energy consumption of the development and to assist in achieving a Building Regulation Part L 2013 compliant development, the following design measures are recommended and will need to be incorporated into the detailed design;
 - Building fabric construction U-values significantly improved compared with standard Building Regulations U-values;
 - Reduced Air Permeability, lower than standard Buildings Regulations, and in accordance with prospective development building occupiers;
 - High efficiency LED lighting utilizing low-energy control systems such as daylight dimming and occupancy sensing;
 - Mechanical Ventilation Heat Recovery (MVHR) to all apartments.
 - High-efficient communal Air-Source Heat Pumps providing efficient space and water heating to the residential portion;
 - High-efficient Air-Source Heat Pumps providing efficient heating, cooling and hot water to the A1/A3 & D2 use;
 - HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values.

7. The figures used as the basis for this assessment are discussed further in Section 4 of this report.

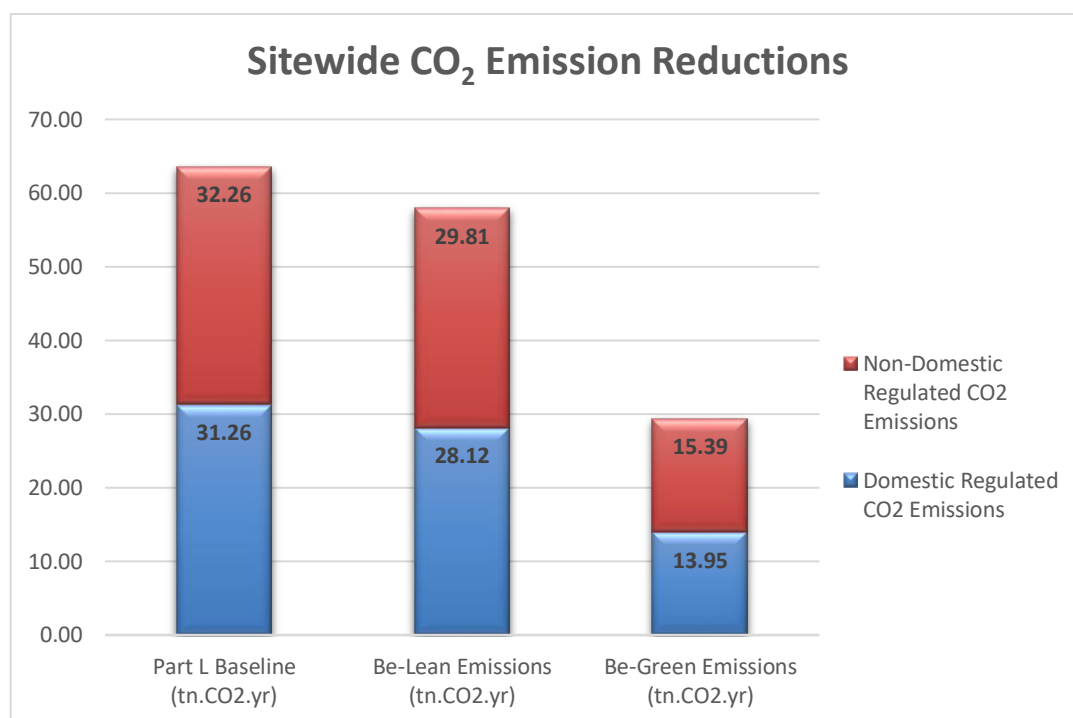
Carbon Savings Predicted

8. The regulated site-wide baseline for the development (Part L 2013 compliant using SAP 10 carbon factors) has been calculated as being **63.52 tonnes.CO₂.year**.
9. The site-wide CO₂ emissions following reductions at the 'Be-Lean' Stage, i.e. energy-efficient stage, have been calculated at **57.93 tonnes.CO₂.year**. This represents a **8.80%** reduction in carbon emissions beyond the Part L 2013 compliant baseline;
10. At the 'Be-Clean' stage, district heating and communal heating solutions were assessed for their viability on site. Analysis showed that owing to the development's location, size and servicing strategy, neither were viable for inclusion. Therefore, there are no CO₂ or Energy Demand savings to be shown at this stage.
11. The 'Be-Green' stage, i.e. on-site renewables/low carbon technology accounted for the proposed installation of:
 - VRF Air-Source Heat Pumps (ASHP), with low refrigerant charge, and high efficiency inverter driven compressors, providing heating and cooling to the A1/A3 D2 use;
 - Heat pumps providing hot water to the D2 use, which will require further analysis at the detail-design stage; and
 - High-efficient communal Air-Source Heat Pumps providing efficient space and water heating to the residential portion.
12. The site-wide CO₂ emissions following reductions at the 'Be-Green' Stage, i.e. on-site renewables/low carbon technology, have been calculated at **28.59 tonnes.CO₂.year**.
13. Therefore, in total the development reduces CO₂ emissions by **34.18 tonnes.CO₂.year**, equal to a **53.81%** saving beyond the Part L 2013 baseline (using SAP 10 emission factors), thereby complying with Reading Borough Council energy policies with regards to minimum CO₂ emission reductions for major residential and non-residential developments.
14. Only residential areas are required to achieve the 'zero-carbon homes' target and subject to the Reading Borough Council carbon offset payment.
15. In order to bring the residential carbon savings up to 100%, the remaining residential carbon emissions are to be offset through a carbon offset payment. As detailed below, the carbon offset payment, priced at £60 per tonne of CO₂ per year (over 30 years) to be paid via a S106 to Reading Borough Council is **£25,110**.

Table A.1 – Residential Carbon Offset Payment

Site Total	
Annual offset (residential areas only)	13.95 Tonnes.CO ₂
Offset Payment	£25,110

Fig A.1 – Final Site-Wide CO₂ reductions Chart



Summary of Sustainability Strategy

16. The scheme will deliver a series of sustainability measures which are compatible with RBC's requirements for sustainable design and construction:
- A high-quality residential development, incorporating high levels of natural light, sustainable transport options and low-carbon heating solutions;
 - SuDs strategy to achieve a 50% reduction in peak discharge rates in comparison with the existing regime;
 - Sustainable material selections with timber to be procured with Forest Stewardship Council accreditation;
 - Incorporation of climate adaptation measures, including permeable paving, green roof(s) and passive building design including MVHR;
 - Responsible construction practices during site construction, including a pre-demolition audit and a site waste management plan;
 - Amenity space for all residents.

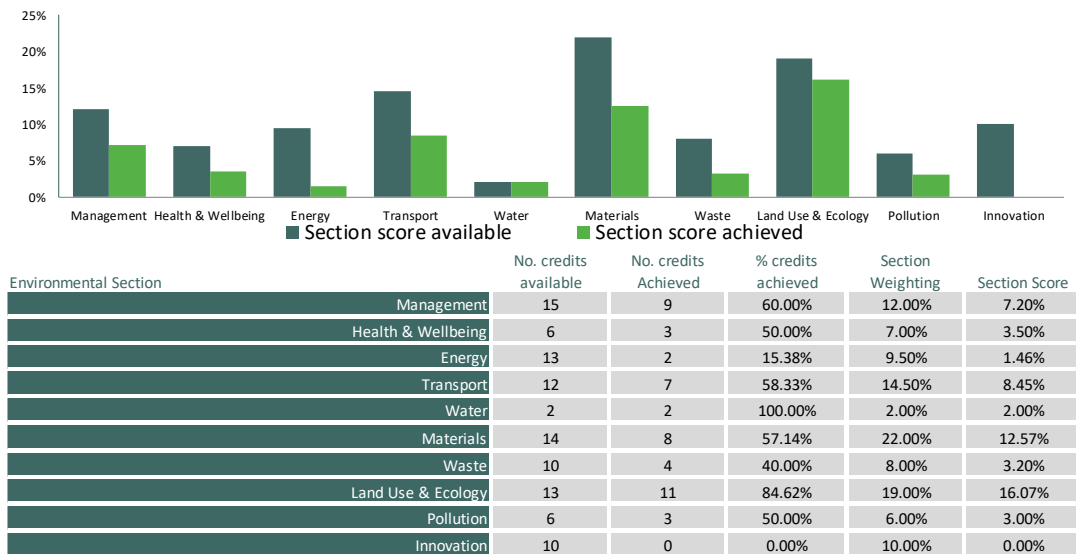
Summary of BREEAM Review

17. A BREEAM predictive assessment has been undertaken to consider the possible performance of the development against BREEAM. The non-domestic elements of the scheme are below 1000 m² and therefore it is considered that a BREEAM Very Good rating would be an acceptable target to apply. The BREEAM predictive assessments identify that the development aligns to a Very Good rating, albeit that due to the small size of the commercial uses, and the varying use classes proposed multiple separate BREEAM assessment would be required, which is considered to be overly onerous. In this case it is recommended that just the Gym (D2 use) is subject to a BREEAM assessment, which would be undertaken against the shell only criteria. This would avoid the duplication of costs associated with undertaking multiple BREEAM assessments, but the principles of BREEAM are applied to all non-domestic elements proposes. Further details on BREEAM is provided in Appendix 4.

Overall Building Performance

Building name	Dukesbridge House (D2 Use)
BREEAM rating	Very Good
Total Score	57.40%
Min. standards level achieved	Very Good level

Building Performance by Environment Section



1 INTRODUCTION

- 1.1 Envision is a dynamic building services, energy and sustainability consultancy, dedicated to providing strategic and technical advice to clients through all phases of planning and development.
- 1.2 We have been appointed by Lipman Properties (the applicant), to prepare an Energy and Sustainability Statement to support a planning application for the roof and side extensions to existing building at Dukesbridge House to provide a residential-led scheme with associated landscaping, public realm improvements, alterations to the existing vehicular access and car parking and provision of cycle parking and waste storage.

Scope

- 1.3 This Energy and Sustainability Statement provides information on the predicted carbon emissions of the development and includes an analysis of the potential contribution that renewable and low carbon technologies could contribute towards reducing the energy and associated CO₂ emissions for the scheme.
- 1.4 This Energy and Sustainability Statement sets the parameters of detailed design, but remains at a strategic level. The calculations in this document are an indication of system size and carbon emissions based on guidance documents, approved software and practical experience. They are not design calculations but establish the viability and feasibility of various technologies for the proposed development.
- 1.5 This statement is structured as follows:
- Section 2 provides a description of the site and the development proposals;
 - Section 3 provides a description of the main sustainability & energy policies relevant to the application;
 - Section 4 provides an energy assessment, structured against the requirements of the energy policies examined in Section 3;
 - Section 5 provides a sustainability statement, structured against the requirements of the sustainability policies examined in Section 3;
 - Section 6 provides a concluding summary;

2 CONTEXT AND PROPOSALS

Location & Existing Situation

- 2.1 The Site is located at 23 Duke Street, Reading, RG1 4SA. The site is referred to in this application as Riverside Central, and is comprised of existing commercial buildings (Dukesbridge House and Dukesbridge Chambers) along with a car park to the north of Dukesbridge House and east of Dukesbridge Chambers. The site is bounded by residential and office buildings from the west, east and north sides with the river on the south.
- 2.2 The planning boundary includes Dukesbridge House and excludes Dukesbridge Chambers. Dukesbridge House has a consented Permitted Development which was approved in June 2019 (Application No: 190602) which permitted the change of use of building from Class B1(a)(offices) to C3 (dwelling houses) to comprise 77 residential units has been granted.

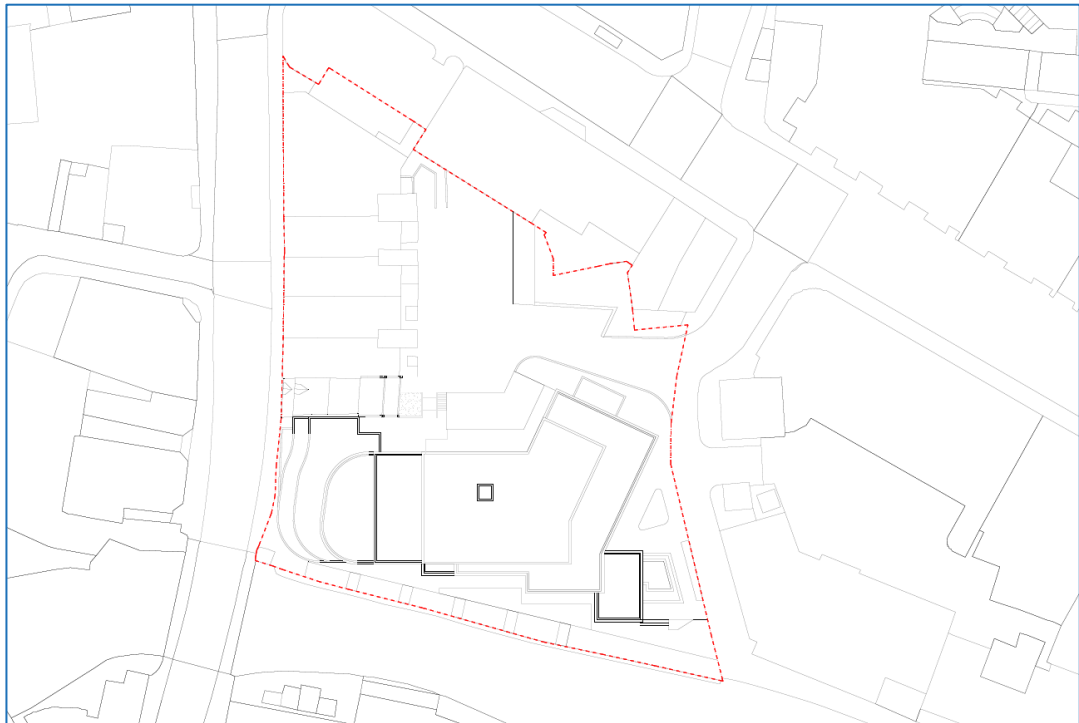


Figure 2.1 – Site Location (image courtesy of Emre Arolat Architecture)

The Proposed Development

- 2.3 The proposal is for a roof and side extensions to existing building at Dukesbridge House to provide a residential-led scheme with associated landscaping, public realm improvements, alterations to the existing vehicular access and car parking and provision of cycle parking and waste storage. The scheme comprises:
1. 34 dwellings;
 2. 1 no. D2 use;
 3. 3 no. A1/A2/A3/A4/A5 uses.



Figure 2.2 – Typical Floor (image courtesy of Emre Arolat Architecture)

3 ENERGY & SUSTAINABILITY POLICY CONTEXT

- 3.1 A key mechanism for delivering the principles of low-carbon development lies within the UK planning system, which is implemented through national guidance along with regional and local planning policies. A review of all the relevant policy documents was undertaken in order to gain an understanding of the guiding policies for energy, CO₂ reductions and sustainable design.

National Planning Policy Framework

- 3.2 The revised National Planning Policy Framework (NPPF) was published on 24th July 2018 and updated in February 2019. It sets out the framework for all planning policy in England and how these are expected to be applied. The NPPF sets out a presumption in favour of sustainable development, and the need to support economic growth through the planning system.
- 3.3 Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives:
- an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
 - a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
 - an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.
- 3.4 Planning plays a key role in helping shape places to 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. The NPPF does not include detailed measures on sustainable design codes and standards to apply, although expects that when setting any local requirement for a building's sustainability, local planning authorities should do so in a way consistent with the national technical standards.

Reading Borough Council Planning

3.5 The most relevant policies which need to be considered when assessing the scheme's compliance to sustainability policy are those provided within local development documents. Reading Borough Council (RBC) is currently working to two primary documents relating to energy, CO₂ reductions and sustainability:

1. Reading Borough Local Plan (Adopted November 2019);
2. Sustainable Design & Construction SPD (Adopted December 2019).
3. Reading Climate Emergency Strategy 2020-25 (Draft published March 2020)

3.6 The policies and guidance pertinent to the energy and sustainability of new-build development from the aforementioned policy documents are as follows:

Policy CC2: Sustainable Construction and Design (Local Plan)

3.7 This policy requires proposals for new development, including the construction of new buildings to comply with the following;

1. The design of buildings and site layouts must use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and take account of the effects of climate change;
2. All minor non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Very Good' standard as a minimum;
3. All non-residential development or conversions to residential should incorporate water conservation measures so that predicted per capita consumption does not exceed the appropriate levels set out in the applicable BREEAM standard. Both residential and nonresidential development should include recycling greywater and rainwater harvesting where systems are energy and cost effective.

Policy CC3: Adaptation to Climate Change (Local Plan)

3.8 This policy requires proposals for new development to incorporate measures to adapt to climate change including;

1. New buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements;
2. Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example by including measures such as solar shading, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, etc.
3. Use of trees and other planting, where appropriate as part of a landscape scheme, to provide shading of amenity areas, buildings and streets and to help to connect habitat, designed with native plants that are carefully selected, managed and adaptable to meet the predicted changed climatic conditions; and

4. All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change

Policy CC4: Decentralised Energy (Local Plan)

- 3.9 Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq m shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.

Policy CC5: Waste Minimisation & Storage (Local Plan)

- 3.10 Development should demonstrate measures to minimise the generation of waste in the construction, use and life of buildings and promote more sustainable approaches to waste management, including the reuse and recycling of construction waste and the promotion of layouts and designs that provide adequate, well-designed space to facilitate waste storage, reuse, recycling and composting.

Policy EN18: Flooding & Sustainable Drainage Systems (Local Plan)

- 3.11 Development will be directed to areas at lowest risk of flooding in the first instance, following the Sequential and Exceptions Test set out in the NPPF, and taking into account the effects of climate change. It will consider flooding from all sources, including fluvial, surface water, groundwater and sewer flooding. Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.
- 3.12 All major developments must incorporate sustainable drainage systems (SuDS) as appropriate and in line with the Government's Technical Standards.

Policy H5: Standards for New Housing (Local Plan)¹

- 3.13 New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable:
 1. All new build housing will be built to the higher water efficiency standard under Regulation 36(3) of the Building Regulations;
 2. All major new-build residential development should be designed to achieve zero carbon homes.²

¹ This is the primary policy against which the Energy Statement will be structured.

² Zero Carbon Homes as defined in Sustainable Design & Construction SPD: In achieving Zero Carbon Homes for major residential developments, the preference is that new build residential of ten or more dwellings will achieve true carbon neutral development on-site. If this is not achievable, it must achieve a minimum of 35% improvement in regulated emissions over the Target Emissions Rate in the 2013 Building Regulations, plus a Section 106 contribution of £1,800 per remaining tonne towards carbon offsetting within the Borough (calculated as £60/ tonne over a 30 year period).

Sustainable Design Checklist (Sustainable Design & Construction SPD)

- 3.14 For major applications, a Sustainability Statement based on a sustainability checklist should be submitted at the submission stage. The two sustainable design and construction checklists (domestic & non-domestic) are based on the BREEAM standards but are not a complete repetition of these requirements. They are intended to help provide pointers as to the type of considerations that the development should be taking into account in order to achieve relevant standards of the BREEAM and/or Zero Carbon Homes and thereby comply with policies CC2-CC5, EN18 and H5.³

³ The sustainability checklist forms the structure of the sustainability statement.

4 ENERGY STATEMENT

4.1 An effective Energy Statement should follow the *Energy Hierarchy*, that is;

1. 'Be-Lean' (minimise energy demand through passive and active measures);
2. 'Be-Clean' (select the most energy-efficient heating and cooling infrastructure) and;
3. 'Be Green' (show intelligent use of renewable energy and technologies).

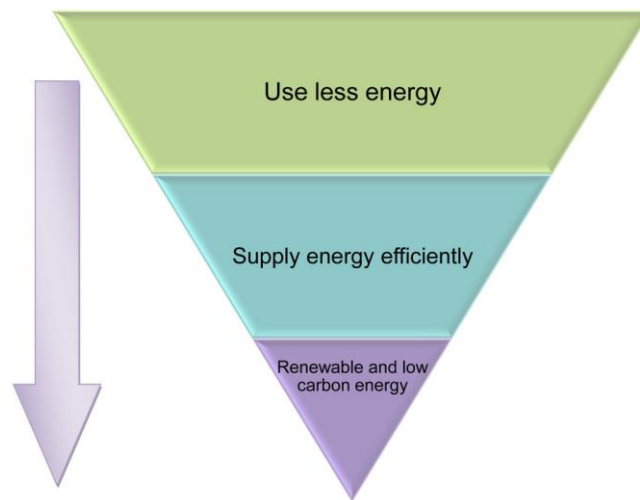


Fig 4.1 - 'Energy Hierarchy'

4.2 An Energy Statement should also clearly identify the operational carbon footprint of the development after each stage of the energy hierarchy, including both regulated emissions and those emissions associated with uses not covered by Building Regulations.

Policy Requirements

- 4.3 Reading Borough Council (RBC) Local Plan Policy H5(c) sets a 'zero carbon' target for major residential development. The 'Zero Carbon Homes' requires the residential element of the application to achieve at least a **35 per cent reduction** in regulated carbon dioxide emissions (beyond Part L1A 2013) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to RBC to be ring fenced to secure delivery of carbon dioxide savings elsewhere.
- 4.4 There is no zero-carbon target for the non-domestic element of the scheme.
- 4.5 In line with Section 3.34 of the RBC Sustainable Construction & Design SPD, the predicted CO₂ emissions and energy demand presented in this report have been calculated using **SAP 10 figures**. The GLA 'Carbon Emission Reporting Spreadsheet', which is suggested as a useful tool for SAP 10 conversion, has been provided in Appendix II.
- 4.6 Compliance with Part L1a and L2a of Building Regulations is provided via the BRUKLs and SAP worksheets in Appendix V to VIII.

Domestic Modelling Methodology

- 4.7 In accordance with NCM guidance, the appropriate methodology for calculating the energy performance of the new-build apartments is “The Government’s Standard Assessment Procedure for Energy Rating of Dwellings”. This procedure was undertaken using Stroma FSAP 2012 version 1.0.4.26 which is a Department of Communities and Local Government (DCLG) approved methodology and software for undertaking SAP assessments.
- 4.8 For the purposes of this assessment, the following apartment typologies were selected for analysis:

Table 4.1 – Apartment Typologies

Apartment Type	Primary Orientation
1B-MF (N)	North
1B-MF (S)	South
1B-MF (E-W)	East/West
2B-MF (N)	North
2B-MF (S)	South
2B-MF (E-W)	East/West
3B-MF (E-W)	East/West
1B-TF (N)	North
1B-TF (S)	South
1B-TF (E-W)	East/West
2B-TF (S)	South
2B-TF (E-W)	East/West
3b-Duplex	Dual
1B-Duplex	Dual

- 4.9 As detailed in the table above, in order to provide a level of analysis reflecting the various orientations of the scheme, apartments were selected from each elevation.

Non-Domestic Modelling Methodology

- 4.10 The appropriate methodology for calculating the energy performance of the non-domestic portion is through a Simplified Building Energy Model (SBEM). The SBEM was produced using DesignBuilder software version 6.1.0.006, which is a DCLG approved software and methodology for undertaking SBEM.
- 4.11 For the purposes of this assessment, the non-domestic portion of the development was split into 2 no. SBEM models comprising the following areas were modelled:
1. A1 & A3 Units;
 2. D2 Use.
- 4.12 As each unit is being brought forward on a shell basis, indicative retail, customer seating, gym, office, WC, and store zones were modelled in each unit.

Establishing the Target Emission Rate (TER)

- 4.13 The total emissions savings calculated in this report for the new-build development are expressed against a Building Regulation 2013 Target Emission Rate. This is the Baseline against which the measures implemented must show an improvement.
- 4.14 The Target Emission Rates for the development have been established using DCLG approved methodology and software.
- 4.15 The calculated carbon emissions and total energy demand for the Target Emission Rate are illustrated below. The calculated figure demonstrates a Part L1A & L2A Building Regulations 2013 compliant model – arrived at using SAP 10 carbon factors.

Table 4.2 – Target CO₂ emissions for Domestic Portion (SAP 10 Performance)

Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)		
	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions
Baseline: Part L1a 2013 of the Building Regulations Compliant Development	31.26	13

Table 4.3 – Target CO₂ emissions for Non-Domestic Portion (SAP 10 Performance)

Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)		
	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions
Baseline: Part L2a 2013 of the Building Regulations Compliant Development	32.26	44

Table 4.4 – Target CO₂ emissions for Site

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	63.52		

- 4.16 The site-wide figure of **63.52 tonnes.CO₂.yr**, calculated using SAP 10 emissions factors, is the target that must be reached and improved upon by the proposals in this Energy Assessment in order to comply with Building Regulations Part L1a 2013 and RBC Policy CC2, CC3 and H5(c). This will be achieved through the implementation of fabric efficiency, energy-reduction and carbon-saving measures as outlined in the ensuing sections.

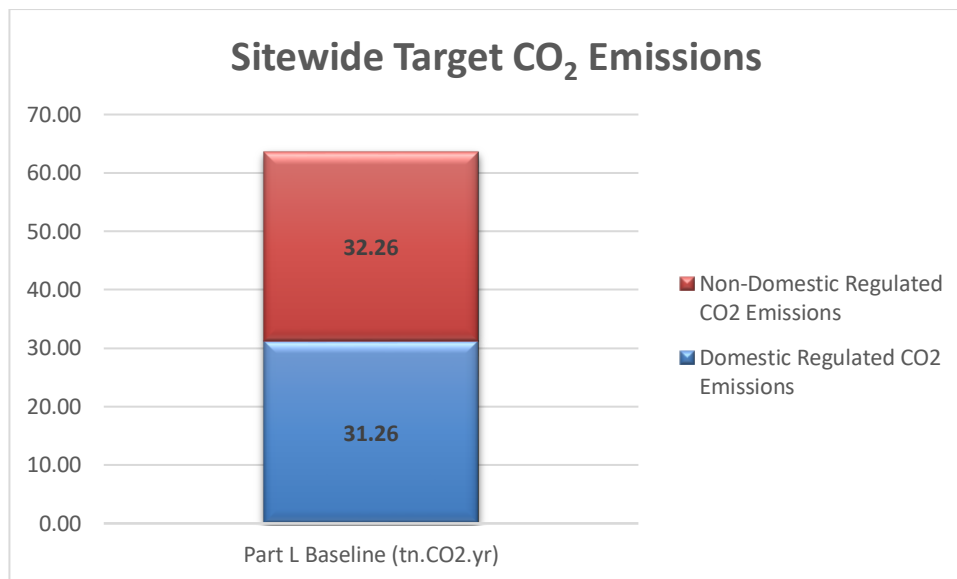


Fig 4.2 – Target CO₂ emissions for New-Build

Applying the Energy Hierarchy: Stage 1 – Be Lean

- 4.17 Best practice low carbon design seeks a ‘fabric first’ approach to reducing the carbon footprint of the built environment. This is achieved through buildings using less energy by improving u-values, air-tightness and lighting efficiency amongst others. This is the first step to consider in reducing a building’s carbon emissions before the efficient delivery of power, heat or renewables are considered by a design-team.

Fabric Efficiency

- 4.18 U-Values are used to measure how effective elements of a building’s fabric are as insulators. That is, how effective they are at preventing heat from transmitting between the inside and the outside of a building. The lower the U-value of an element of a building’s fabric, the more slowly heat is able to transmit through it, and so the better it performs as an insulator. Very broadly, the better (i.e. lower) the U-value of a buildings fabric, the less energy is required to maintain comfortable conditions inside the building.
- 4.19 The table below details the u-values for the new-build apartments and commercial units:

Table 4.5 Proposed U-Values

Elements	Residential New-Build U-Values – W/m ² K	Commercial New-Build U-Values – W/m ² K	Comment
External Wall	0.14	0.17	
Wall to Unheated Corridor	0.16	-	Corridors assumed as unheated
Exposed Floor	0.12	0.12	
Flat Roof	0.11	0.11	
Standard Window Units	1.2 (g-value 0.5 & frame factor of 0.85)	1.3 (g-value 0.45 and LT value 0.68)	-
External Solid Doors	2.2	1.4	Includes doors to unheated corridors.
Party Walls	0	0	Assumed as fully-filled cavity with effective edge sealing and insulation in line with layers in abutting elements.

Commentary on Glazing Technology

- 4.20 In order to reduce the effects of solar gain and the resultant risk of overheating, low g-values have been specified and must be specified at detail-design.

Air Permeability

- 4.21 The designed Air Permeability Rate (APR) has been set at 3 m³/h.m² @ 50Pa for the domestic and 4 m³/h.m² @ 50Pa for the non-domestic portions.

Lighting: Domestic

- 4.1 The SAP calculation software used for assessing the development does not allow for the specification of lighting elements. However, it is assumed that the light fittings across all residential apartments (refurbished and new-build) be specified as LED, low-energy with local manual switching and if appropriate, occupancy sensing.

Lighting: Non-Domestic

- 4.22 This energy demand will be limited by the application of more efficient lighting, photocell and use of LED lighting throughout. The following lighting design requirements are therefore stipulated;

Table 4.6 – Non-Residential Lighting Datasheet

Lighting zone	Luminaire Lumens / Circuit Watt	Light Output Ratio	Photocell Dimming (Parasitic Power – W/m ²)	Occupancy Sensing – On/Off (Parasitic Power – w/m ²)
Fitness/Gym Areas	100	1	No	No
BOH (WC/Changing/Store)	100	1	No	Yes (0.3 W/m ²)
A1/A3 Customer Areas	100	1	No	No

Space & Water Heating – Residential

- 4.23 In line with the 'Energy Hierarchy' (which requires savings at the Be-Lean stage to be from energy efficiency alone and not from renewable heating sources), the heating system for each dwelling at 'Be-Lean' stage has been assumed as a communal gas-fired heating system, with the efficiency in line with the notional building boiler efficiency (93.5%).
- 4.24 Each dwelling will be provided with domestic hot water storage as follows:
1. 1-Bed Flats: 150 litre cylinder with 1.19 kwh/day heat loss;
 2. 2 & 3 Bed Flats: 250 litre cylinder with 1.67 kwh/day heat loss.
- 4.25 The SAP assessment assumes the pipework will be fully insulated and the water heating will be timed separately.

- 4.26 It is assumed that all heating systems will be controlled via suitable arrangement of plumbing and electrical services and will use a delayed start thermostat, with boiler interlock.

Space & Water Heating: Non-Residential

- 4.27 In accordance with the 'Energy Hierarchy' (which requires savings at the Be-Lean stage to be from energy efficiency alone and not from renewable heating sources), the 'Be-Lean' stage heating system serving all areas in the non-domestic uses has been assumed as a dual-system with the heating specified as a 91% efficient gas-fired boiler with cooling efficiencies entered as per the inputs detailed in the 'Be-Green' section.
- 4.28 In the A1 & A3 uses, the hot water system is assumed to be an instantaneous electric point-of-use water heater, input as gas-fired at Be-Lean stage.
- 4.29 In the D2 uses, the 'Be-Lean' stage hot water system is assumed to be a 91% gas-fired boiler with the hot water storage vessel to have a standing loss of 1.9 kWh/day.

Ventilation Strategy – Residential

- 4.30 The ventilation strategy has been designed to meet with occupant requirements across the varied unit sizes in the development, whilst maintaining the energy efficiency needed to lower carbon emissions. A balanced whole-house mechanical ventilation system with heat recovery is proposed for every new-build dwelling as follows;
1. 1-Bed Flats: *Nuair MRXBOX95AB-WM1* (or similar);
 2. 2 & 3 Bed Flats: *Nuair MRXBOX95-WM2* (or similar).
- 4.31 Heat recovery should be given considered during detailed design for pandemic situations. Heat recovery can provide a route for transfer of disease between exhaust air and fresh air intakes. CIBSE guidance should be consulted during the design stage.
- 4.32 Careful consideration should be given to intake and exhaust locations so as to prevent short circuiting of air supplies.

Ventilation Strategy: Non-Residential

- 4.33 The ventilation strategy in the non-residential areas has been designed to meet with occupant and client requirements across the varied activity zones in the development, whilst maintaining the energy efficiency needed to lower carbon emissions. The following strategy is proposed:

Table 4.7 – Summary of Non-Residential Ventilation Strategy

Ventilation Zone	System	Specific Fan Power	Heat Recovery (Efficiency)
Customer Seating/Office/Gym/Changing	Air-Handling Unit	1.4	Yes (72.5%)
WCs (A1 & A3)	Extract Fan (Remote from Zone)	0.4	No
WCs (D2)	Extract Fan (Remote from Zone)	0.4	No

Be Lean Stage – Domestic CO₂ Reductions

- 4.34 The following tables and graphs represent the lean stage improvements for the domestic portion of the development over the Target Emission Rate:

Table 4.8 – Be-Lean CO₂ emissions for Domestic Portion (SAP 10 performance)

Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)		
	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions
Be-Lean CO₂ Emissions	28.12	13
Reduction over Part L Baseline	3.14	
% Reduction over Part L Baseline	10.04%	

Be Lean Stage – Non-Domestic CO₂ Reductions

- 4.35 The following tables and graphs represent the lean stage improvements for the non-domestic portion of the development over the Target Emission Rate:

Table 4.9– Be-Lean CO₂ emissions for Non-Domestic Portion

Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)		
	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions
Be-Lean CO₂ Emissions	29.81	44
Reduction over Part L Baseline	2.45	
% Reduction over Part L Baseline	7.60%	

Be Lean Stage – Sitewide CO₂ Reductions

- 4.36 The following tables and graphs represent the lean stage improvements for the whole development over the Target Emission Rate;

Table 4.10 – Site-wide Be-Lean CO₂ emissions

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	63.52		
Be-Lean	57.93	5.59	8.80%

- 4.37 As detailed above, the measures as taken at ‘Be-Lean’ stage would result in a **8.80%** reduction in site-wide regulated CO₂ emissions over the Part L 2013 Target Emission Rate (calculated using SAP 10 figures).

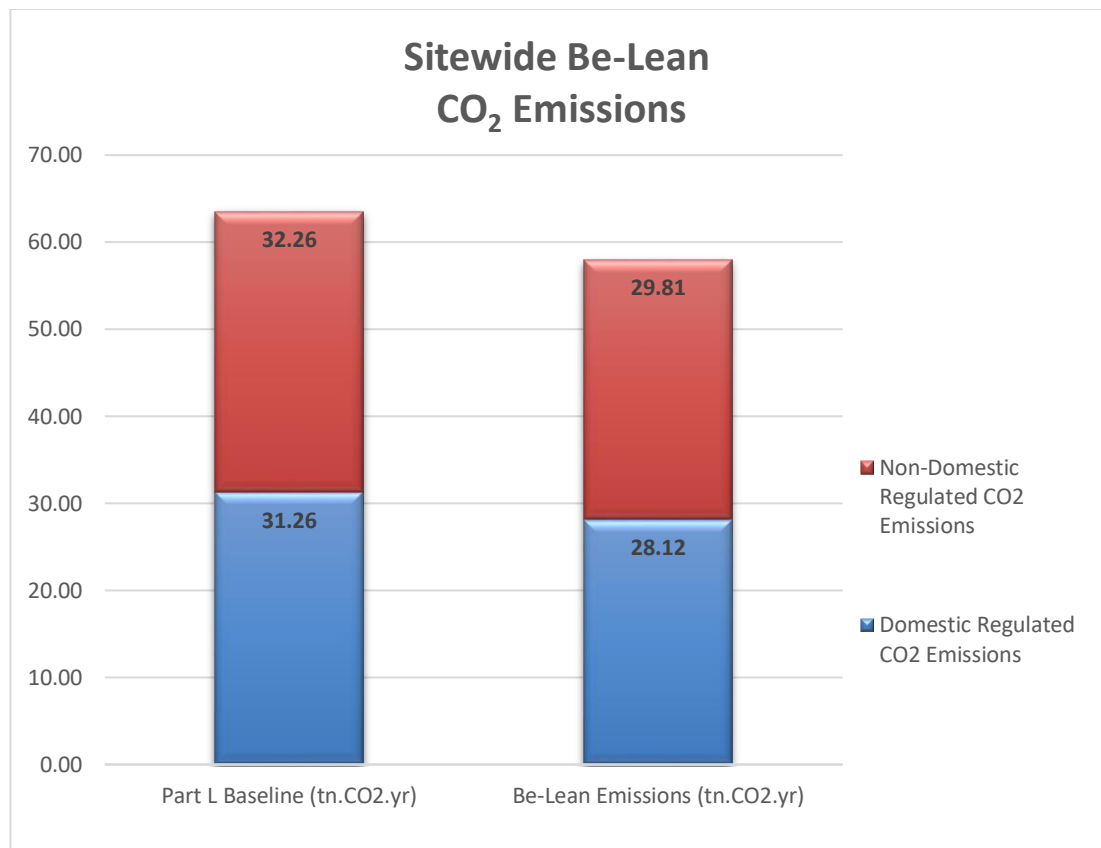


Fig 4.2 – Be-Lean CO₂ emissions for Development

Applying the Energy Hierarchy: Stage 2 – Be Clean

- 4.38 Policy CC4 Of the Reading Borough Council Local Plan requires any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq m to consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.
- 4.39 In addition, if there is existing decentralised energy provision present within the vicinity of an application site, further developments of 10 dwellings or more or non-residential development of 1,000 sq m or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.

Connection to existing heating or cooling networks

- 4.40 A desktop study undertaken on the area surrounding the site at Dukesbridge House shows there are no existing nor planned heat networks within vicinity of the site. The council has instructed Element Energy to undertake a detailed technical and economic assessment of decentralised energy opportunities in Reading. This study identified four heat network clusters, located around central Reading. As the proposed development site is outside of these cluster areas, it is envisaged that there is limited potential for connection.



Fig 4.4 – Decentralised Energy High Priority Areas (Taken from RBC SPD 2019)

Site wide CHP network

- 4.41 Small-medium residential-led developments (e.g. containing fewer than 500 apartments) are generally not viable for CHP installation. At this scale, it is generally not economic to install CHP in residential led, and where CHP is installed it tends to have lower electrical efficiencies. Due to the small landlord electricity demand, CHP installed to meet the base heat load would require the export of electricity to the grid.
- 4.42 In addition, the administrative burden of managing CHP electricity sales at this small scale where energy service companies (ESCOs) are generally not active, and the low unit price

available for small volumes of exported CHP electricity, means it is generally uneconomic for developers to pursue. This can lead to CHP being installed but not operated. For these reasons the use of CHP is discounted for this application, instead the installation of high-efficiency gas-fired boilers is being pursued.

Future Connection to District Heating

- 4.43 Opportunities have been considered during design development to provide a connection at boundary. However, the design will not include any connection to boundary to provide linkage to a decentralised energy network.
- 4.44 Given that no DH networks are available within the vicinity of the site, it is suggested that a capped connection at boundary or other similar infrastructure is unnecessary. Indeed this is not a requirement for development which sits outside a high priority area.
- 4.45 In addition, it is noted that by pursuing an all-electric scheme, the development is future-proofed for falling CO₂ emissions as the National Grid continues to decarbonize. Therefore a future connection to a DH network would not necessarily result in the scheme having lower CO₂ emissions than an all-electric scheme.

Applying the Energy Hierarchy: Stage 3 – Be Green

- 4.46 An analysis of low carbon/renewable technologies was undertaken to determine which would be suitable for application in a development of this size and nature. This analysis has been appended to this document in Appendix I.
- 4.47 During the design-development period for this scheme, multiple low carbon/renewable systems were examined for both their feasibility and ability to lower carbon emissions insofar as possible. As per the analysis contained in Appendix 1, the renewable systems deemed to be the most viable for the development are;
1. **Communal Air Source Heat Pump** providing efficient space and water heating to all apartments on site’;
 2. **VRF Air-Source Heat Pumps (ASHP)**, with low refrigerant charge, and high efficiency inverter driven compressors, providing heating and cooling to the A1/A3 & D2 uses;
 3. **Air Source Heat Pump** providing efficient water heating to the D2 Gym.
- 4.48 In order to ensure the safety and security of the Electricity Networks, depending on the size, type and location of the installation, the developer will be required to submit an ‘application form for the installation of low carbon technologies’ to the local distribution network operator (DNO) at completion of the development and installation of the heat pumps.
- 4.49 During detail design, consideration will be required to ensure adequate space and appropriate location of the external condensers for the heat pump systems.

Low-Carbon/Renewable Technology System 1 – Communal Air Source Heat Pumps to Residential Units

- 4.50 In order to maximise CO₂ reductions, the development will be heated by a Mitsubishi Ecodan system⁴ (with a minimum SCOP of 3.19) which will condition the dwelling through underfloor heating or radiators.
- 4.51 The external condensers for the Ecodan system will be located on the roof of the development, with the exact size to be determined at detail-design.
- 4.52 The domestic hot water supply for the residential units will be provided by the aforementioned Mitsubishi Ecodan system via a hot water cylinder in each dwelling with the hot water pipework to be fully insulated. The cylinders for each dwelling will be allocated as follows:
1. 1-Bed Flats: *150 litre cylinder with 1.19 kwh/day heat loss;*
 2. 2 & 3 Bed Flats: *250 litre cylinder with 1.67 kwh/day heat loss.*

⁴ Or similar and approved.

Accounting for direct electric hot water provision

- 4.53 The efficient generation of domestic hot water (DHW) by heat pumps for sanitary purposes can be challenging. The main issue revolves around the need for DHW to be distributed so it reaches a temperature of at least 50°C to all outlets within 1 minute, requiring storage at a temperature of at least 60°C. This is a strict requirement set out by the Health & Safety Executive in the Legionnaire's disease Technical Guidance Part 2: The Control of Legionella bacteria in hot and cold-water systems.
- 4.54 Heat pumps work most efficiently when the temperature difference between the heat source and the hot water being produced does not exceed 30-40°C, a temperature range well suited to producing low temperature hot water for space heating. The temperature difference associated with generating DHW is particularly sensitive to both source temperature and DHW system architecture and is usually higher than this optimal range in the UK climate – this can lead to a significant drop in overall system efficiency if a heat pump provides 100% of hot water demand.
- 4.55 Therefore, in an energy strategy specifying large communal air-source heat pump installations it is prudent to account for the direct electric immersion that will likely be provided to bring the DHW provision up to at least 60°C, thereby allowing the heat pump to operate at optimal efficiencies. Typically, a 100% efficient direct electric top-up would account for 20% of total DHW demand.
- 4.56 SAP does not readily (nor accurately) allow for a DHW system that has 80% of demand met by communal air-source heat pumps, and 20% by a direct electric immersion. Therefore, to ensure accurate results, the assessor has manually calculated total electrical consumption for DHW by taking 80% of DHW demand and calculating associated consumption with a 319% efficient heat pump. The remaining 20% of DHW demand has been met with a 100% efficient direct electric immersion.
- 4.57 This has resulted in the Be-Green SAP 2012 BER columns in the GLA's reporting sheet not matching (as the calculated actual BER is higher than the one calculated in SAP).
- 4.58 The operation of the electrical immersion should be set so that the cylinder is brought up to the required storage temperature at least twice a day.

Low-Carbon/Renewable Technology System 2 – Air-Source Heat Pumps to Commercial Uses

- 4.59 The second low-carbon/renewable energy proposed for the commercial and industrial units is an air-source heat pump (ASHP). ASHPs with the following specifications have been assumed for each commercial unit:
- The proposed ASHP for the commercial units is a conventional VRF air source heat pump system.
 - Cooling plant will have a minimum Energy Efficiency Ratio (EER) of 3.24 and SEER of 7.34.
 - The ASHP will have a minimum COP of 4.92 for heating.

- HVAC system controls installed will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values as well as local time and temperature control.

Low-Carbon/Renewable Technology System 3 – Air-Source Heat Pumps to D2 Gym for Hot Water

- 4.60 It is proposed that the hot water in the D2 gym will be provided via a heat pump with a minimum COP of 2.8 and hot water storage as per the details laid out in the 'Be-Lean' section.⁵

Be Green Stage – Domestic CO₂ Reductions

- 4.61 The following tables and graphs represent the green stage improvements for the domestic portion of the development over the Target Emission Rate;

Table 4.11 – Be-Green CO₂ emissions for Domestic Portion

Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)		
	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions
Be-Green CO₂ Emissions	13.95	13
Reduction over Part L Baseline	17.31	
% Reduction over Part L Baseline	55.37%	

⁵ D2 uses have a high hot water demand and operators traditionally utilise gas-fired and/or direct electric systems for hot water production to meet this demand. Heat pumps are not yet widely used for hot water generation in D2 uses as they generally have longer recovery times alongside potential concerns over pasteurisation due to the lower hot water delivery temperature. These issues will be further addressed at detailed design and during the Agreement for Lease (AFL) negotiations.

Be Green Stage – Non-Domestic CO₂ Reductions

- 4.62 The following tables and graphs represent the green stage improvements for the non-domestic portion of the development over the Target Emission Rate;

Table 4.12 – Be-Green CO₂ emissions for Non-Domestic Portion

Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)		
	Regulated CO ₂ Emissions	Unregulated CO ₂ Emissions
Be-Green CO₂ Emissions	15.93	44
Reduction over Part L Baseline	16.87	
% Reduction over Part L Baseline	52.29%	

Be Green Stage – Sitewide CO₂ Reductions

- 4.63 The following tables and graphs represent the green stage improvements for the whole development over the Target Emission Rate;

Table 4.13 – Site-wide Be-Lean CO₂ emissions

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	63.52		
Be-Lean	57.93	5.59	8.80%
Be-Gren	29.34	58.59	45.01%

- 4.64 As detailed above, the measures as taken at 'Be-Lean' stage would result in a **45.01%** reduction in site-wide regulated CO₂ emissions over the Be-Lean Stage, through the use of renewables.

Final Residential CO₂ Reduction Charts & Carbon Offset Payment

- 4.65 In accordance with the Reading Borough Council Policy H5(2) and the Sustainable Design & Construction SPD, major *residential* development is expected to achieve a minimum of 35% improvement in regulated emissions over the Target Emissions Rate in the 2013 Building Regulations, plus a Section 106 contribution of £1,800 per remaining tonne towards carbon offsetting within the Borough (calculated as £60/ tonne over a 30 year period).
- 4.66 The table below details the carbon emission reductions for the residential portion of the development, alongside the calculated carbon offset payment.

Table 4.14– Final New-Build Residential CO₂ reductions

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	31.26	13
After energy demand reduction	28.12	13
After heat network / CHP	-	-
After renewable energy	13.95	13
	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	3.14	10.04%
Savings from heat network / CHP	-	-
Savings from renewable energy	14.17	45.34%
Cumulative on-site savings	17.31	55.37%
Annual Savings from off-set payment	13.95	-
(Tonnes CO₂)		
Cumulative savings for off-set payment (over 30 Years)	418.50	-
Carbon offset Payment (£60 per tonne)	£25,110	

- 4.67 In order to bring the residential carbon savings up to 100%, the remaining residential carbon emissions are to be offset through a carbon offset payment. As detailed above, the carbon offset payment, priced at £60 per tonne of CO₂ per year (over 30 years) to be paid via a S106 to Reading Borough Council is **£25,110.00**

Final Site-Wide CO₂ Reduction Charts

- 4.68 The final carbon emissions and predicted savings are presented below for the entire development comprising all domestic and non-domestic uses.

Table 4.15– Final New-Build Residential CO₂ reductions

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	63.52	57
After energy demand reduction	57.93	57
After heat network / CHP	-	-
After renewable energy	29.34	57
	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	5.59	8.80%
Savings from heat network / CHP	n/a	n/a
Savings from renewable energy	28.59	45.01%
Cumulative on-site savings	34.18	53.81%

- 4.69 As detailed above the cumulative on-site savings for the new-build domestic and non-domestic uses equate to a total on-site saving of 53.81% below a Part L baseline, calculated using SAP 10 emission factors.

5 SUSTAINABILITY STATEMENT

5.1 This section provides an account of the sustainability benefits of the proposed development, and how relevant policy will be addressed in the development proposals. The section is structured against the Sustainability Checklist as detailed in Appendix 1 of the Reading Borough Council (RBC) Sustainable Design & Construction SPD, thereby demonstrating compliance with policies CC2-CC5, EN18 and H5 of the RBC local plan.

Residential Sustainability Checklist

Table 5.1 – Sustainability Checklist (Residential)

Energy & CO ₂ Reduction	
<i>Aim: To conserve energy, in particular carbon dioxide emissions and maximise the use of energy efficient techniques.</i>	
Criteria	Design & Construction Commitments
How has the development been designed to optimise the use of the energy from the sun and limit heat losses?	The building predominantly faces towards the south-east which provides generous exposure to the sun throughout the day. These solar gains help to reduce the energy demand from space heating systems. Heat losses have been limited through a highly insulated fabric and low air permeability, with specified values below the upper limit values as detailed in Part L1a of Building Regulations.
How has the development been designed to optimise natural daylighting, energy efficient lighting, external lighting and natural ventilation?	The building predominantly faces towards the south-east which provides generous exposure to the sun throughout the day, providing a high level of natural light. The balance between natural light, solar gain and overheating is struck by specifying the glazing with a g-value of 0.45, which reduces <i>excessive</i> solar gain (and resultant overheating risk) whilst still allowing adequate levels of natural light. All developments will be specified with aLED lighting and internal temperatures will be modulated through the use of openable windows, promoting natural ventilation. A Mechanical Ventilation Heat Recovery (MVHR) system will provide an adequate level of background ventilation, whilst reducing overall space heating demand.

How will the design of the building make efficient use of energy? (e.g. use of thermally massive materials, levels of insulation, energy efficient white goods and use of green/brown roofs etc.).	The development will be specified with a highly insulated fabric and low air permeability, resulting in a high level of fabric energy efficiency. A green roof has been specified, reducing surface water run-off whilst also reducing the impact to the surrounds from the urban heat island effect. It is not expected the developer will provide white goods to the units, but homeowners will be provided details on energy efficiency and choosing white goods through the Home User Guide.
Has local energy generation from renewables and/or decentralised energy been considered as part of the scheme?	Renewable energy generation will be provided in the form of communal air-source heat-pumps, which will provide high-efficiency space and water heating to each dwelling on site.
How have cycle storage facilities been considered?	17 cycle parking spaces (9 stands) will be provided as part of the development in secure and sheltered and secure space. The level of provision is in accordance with the standards set out in RBC's adopted Revised Parking Standards and Design (2011).
Does the development meet the requirements of policies H5? Is this clearly illustrated?	Section 4 of this report contains an Energy Assessment detailing how the development fully accords with the requirements of Policy H5.
Is a Section 106 contribution required? If so, what amount?	As detailed in Section 4 of this report, the Energy Assessment has identified a £25,110 carbon offset payment to be secured via Section 106 for payment to Reading Borough Council.

Water

Aim: To improve efficiency in the use of water, conserve water resources and minimise vulnerability to flooding.

Criteria	Design & Construction Commitments
How will the development incorporate the use of water saving devices to achieve the higher water efficiency standard under Regulation 36(3) of the Building Regulations?	Policy H5 includes the requirement for new residential development to meet the higher water efficiency standard under Regulation 36(3) of the Building Regulations? As part of this, the council requires the consideration of grey water, and rainwater harvesting systems. The table below illustrates the various fittings-based water consumption levels to achieve various water efficiency scenarios. In this case, the Scenario 1, 3 or 4 specification demonstrate consumption of less than 110 litres/person/day. This is an example of the specification to be followed by the scheme at Dukesbridge House.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Strategy, Code level	Fittings-based, Code level 3/4	Fittings-based, Code level 3/4	Fittings-based, Code level 3/4	Fittings-based, Code level 3/4	Fittings-based, Code level 5/6	Recycling-based, Code level 5/6
WC	4 (single flush)	4/2.6 (dual flush)	5/3 (dual flush)	6/4 (dual-flush toilet)	4/2.6 (dual flush)	6 (supplied by greywater)
Taps (excluding kitchen taps)	4	5	4	4	1.6	3
Bath	180	155	180	180	155	155
Shower	8	8	8	8	6	7
Kitchen sink taps	6	8	6	6	3	4
Washing machine	8.17 (not supplied)	8.17 (not supplied)	8.17 (not supplied)	6.14 (supplied)	6.14	8.17 (not supplied)
Dishwasher	1.25 (not supplied)	1.25 (not supplied)	1.25 (not supplied)	1.25 (not supplied)	0.67	1.25 (not supplied)
Water Recycling	0 (not supplied)	0 (not supplied)	0 (not supplied)	0 (not supplied)	0 (not supplied)	26.52 (greywater supplying toilet)
Predicted per capita consumption (Code)	104.65	99.81	103.28	103.43	79.99	79.84

How will the development incorporate recycling rainwater and reduce the use of potable water?	There is limited external landscaped amenity area that would benefit from a rainwater harvesting system. Instead, the proposed drainage strategy will limit surface water discharge through the use of a green roof system with a connection to the existing surface water drainage network.
Has the collection, treatment and re-use of grey water been considered? If so, how will these facilities be incorporated within the development?	Greywater harvesting was not considered for use within the development as its application in a development of this nature would be feasible - the dual plumbing and infrastructure required in an apartment block constructed above an existing building would cause excessive engineering and cost challenges.

Materials

Aim: To retain local character and promote the use of materials with a low environmental impact.

Criteria	Design & Construction Commitments
How will the selected materials help retain local character, ensure long life and ensure a low environmental impact, including consideration of embodied energy?	Maximising the sustainability of all the materials used in the build will be an important factor from the outset. The development will be designed and constructed as to maximise the sustainability of materials. The client will ensure the following standards are met in the development: 1. At least 90% of timber and timber products are to be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) scheme; 2. No construction or insulation materials are to be used which will release toxins into the internal and external environment, including those that deplete stratospheric ozone.

Surface Water Run-Off

Aim: To reduce flooding, pollution and other environmental damage.

Criteria	Design & Construction Commitments
How has the development considered flooding and pollution?	A Flood Risk Assessment has been prepared with this application which confirms: 1. The Environment Agency (EA) Flood Zone map shows the site lies within Flood Zone 1 'Low Probability' (as defined in NPPF Planning Practice Guidance (PPG) 'Flood Risk and Coastal Change' Table 1) 2. As proposed 'more vulnerable' development in Flood Zone 1, development is appropriate in principle and requires consideration of peak river flow climate change allowances of +25%. Given the proximity of the River Kennet, the +35% climate change allowance scenario has also been considered to address residual risk.

	3. EA modelled flood data has confirmed that the site lies outside of the 1 in 100 annual probability +25% allowance for climate change 'design flood event' and the equivalent +35% allowance scenario. Since the site is within the Flood Zone at lowest probability of flooding, the Sequential Test is de facto passed.
Has the design considered the use of sustainable drainage systems (SuDS) and how will they be incorporated within the development?	Although there is expected to be no increase in impermeable surface from the development, the SuDS strategy has been designed for incorporation into the development as follows: • Surface water discharge will be limited through the use of a green roof system with a connection to the existing surface water drainage network. This will ensure that there is a 50% reduction in peak discharge rates in comparison with the existing regime.
Does the development meet the requirements of policy EN18?	As detailed above, the Sequential Test been de facto passed, and a SuDs strategy is being implemented, the development is therefore deemed to meet the requirements of Policy EN18.
Waste <i>Aim: To minimise the production of waste and maximise re-use and recycling.</i>	
Criteria	Design & Construction Commitments
How will the development minimise waste sent to landfill?	Residential waste storage space would take account of the requirement of BS5906:2005. This requires that suitable refuse and recycling space provision is allocated for the residential apartments in a centralised waste store. The necessary provision is as follows: • 100 litres for first bed/1 bed; • 70 litres for each bedroom after that. In accordance with storage requirements in BS5906:2005, 50% of this quantity of waste arisings should be for recyclable waste and 75% of the quantity should

	be for general municipal waste. This over provision of storage capacity will ensure that sufficient space is always allocated to cater for waste volumes. For each portion of the development adequate storage for refuse and recycling has been provided in accessible locations and sufficient space will be provided in each collection location/area for refuse vehicles to manoeuvre so that they can enter and exit in forward gear. Homeowners will be provided details on how to recycle and minimise waste in the Home User Guide.
How will the development make the maximum use of construction and demolition waste?	A site waste management strategy will be prepared for the construction phase of the development, which identifies measures to minimise construction waste, and maximise the use of demolition and construction waste.
How will the development make maximum use of re-used and recycled materials?	A pre-demolition audit will be undertaken to review the opportunities for reusing and recycling of existing materials. Construction materials will be procured from 'responsible sources' as specified by BRE, including suppliers certified to ISO14001/BES6001.
How will provision be made for the storage and recycling of waste for all users of the site?	As detailed under Criterion 1 of this section , residential waste storage space would take account of the requirement of BS5906:2005. This requires that suitable refuse and recycling space provision is allocated for the residential apartments in a centralised waste store. The necessary provision is as follows: • 100 litres for first bed/1 bed; • 70 litres for each bedroom after that. In accordance with storage requirements in BS5906:2005, 50% of this quantity of waste arisings should be for recyclable waste and 75% of the quantity should be for general municipal waste. This over provision of storage capacity will ensure that sufficient space is always allocated to cater for waste volumes.

Pollution	
<i>Aim: To minimise damage to the environment through air, ground/surface water, land, noise or light pollution.</i>	
Criteria	Design & Construction Commitments
What measures have been incorporated to ensure that noise and light pollution will be minimised through the development?	Any new development can potentially lead to detrimental environmental effects; as is the nature of construction. These potential effects have been considered during the planning stages of this proposal. The development is not of the scale that would require an Environmental Impact Assessment (EIA), however the measures as outlined in this section, and subsequently implemented, will ensure that any potential impacts can be appropriately controlled in order to demonstrate compliance with Local Plan Policy EN16: Pollution & Water Resources. Noise A Noise Impact Assessment has been submitted with this application, which will set limits that will be met when specifying the external heat pump condensers. In addition, the inclusion of Mechanical Ventilation Heat Recovery (MVHR) will allow fresh air to be provided without the need to open windows, reducing the impact of external noise on internal occupants. External Lighting The development's lighting strategy will ensure that it does not have adverse effects at night-time. Although a detailed lighting design scheme for the site that ensures light pollution is minimised has not yet been undertaken the following measure are expected to be incorporated: • External lighting will be designed in compliance with Table 1 and accompanying notes of ILE Guidance Note for reduction of obtrusive light;

	All non-safety/security lighting will be automatically switched off between 2300hrs and 0700hrs.
What measures have been incorporated to reduce nitrogen oxide emissions and reduce the global warming potential of insulants?	As detailed under the 'Management' section, no construction or insulation materials are to be used which will release toxins into the internal and external environment, including those that deplete stratospheric ozone. With regards to nitrogen oxide emissions (NOx), no on-site fossil combustion will occur as the servicing strategy is fully electrified with the use of heat pumps, therefore no NOx emissions are expected.
What measures have been incorporated to reduce the release of pollution into the atmosphere?	As detailed in the Energy Assessment presented in Section 4, the scheme will have no on-site fossil fuel combustion.
Health & Well-being <i>Aim: To improve the quality of life in homes through good daylighting, improved sound insulation, provision of outdoor space with good accessibility.</i>	
Criteria	Design & Construction Commitments
How has the development been designed to maximise natural lighting, reduce the likelihood of noise complaints, incorporate private outdoor space and ensure the layout of the development can be easily adapted to meet the needs of future occupants?	The building predominantly faces towards the south-east which provides generous exposure to the sun throughout the day, providing a high level of natural light. On northern elevations, large apertures will ensure adequate levels of natural light are maintained. The development will be constructed in accordance with Part E of Building Regulations, reducing the impact of noise between apartments. The inclusion of Mechanical Ventilation Heat Recovery (MVHR) will allow fresh air to be provided without the need to open windows, reducing the impact of external noise on internal occupants. Every unit has their own private amenity space. Some have inset balconies providing privacy with the use of the facade modules, where some have large private terraces that have formed from the shape and design of the building with its stepping back on each floor as a response to the nature of the site.

Management	
<i>Aim: To manage the site in an environmentally and socially considerate manner.</i>	
Criteria	Design & Construction Commitments
What measures have been taken to ensure the construction of the site is managed in an environmentally and socially considerate manner, mitigating environmental impacts?	It is not considered that the construction phase will yield an adverse level of disturbance, particularly given the surrounding land uses, although various measures adopted by the contractor will ensure that any potential disturbance is minimised. The principal contractor will be required to deliver high standards of sustainable construction, which will be achieved through the following: • Registering the site against the Considerate Constructors Scheme; • Managing the construction site to reduce environmental effects, this will include adopting best practice measures to protect water and air quality, monitoring water and energy use from construction activities.
How has the development been designed to ensure people feel safe and secure?	The development will provide a secure, gated car and cycle parking area. Access to the apartments will be via a secure lobby entrance with only residents having access. The development is also situated in a prominent, built-up area of Reading providing good levels of oversight and external lighting.
Ecology	
<i>Aim: To retain, protect and enhance wildlife habitats and natural features.</i>	
Criteria	Design & Construction Commitments
How have the wildlife habitats and natural features on and adjacent to the site been considered and how will they be retained, protected and enhanced?	The development itself does not distinct ecological value, however the site is located directly adjacent to the River Kennet. Due protection will be given to any wildlife habitats and natural features within the river boundary during construction.

Non-Residential Sustainability Checklist

Table 5.2 – Sustainability Checklist (Non-Residential)

Management <i>Aim: To recognise and encourage environmentally and socially considerate development.</i>	
Criteria	Design & Construction Commitments
Will guidance for the non-technical building user be provided so they can understand and operate the building efficiently and understand how the design reduced the overall environmental impact of the building and raise environmental awareness?	The proposed commercial uses will be taken forward on a speculative basis and assessed as shell only. The aftercare credits in BREEAM under Shell Only do not include requirements for building user guides, which generally focus on the building controls. Details will be provided in the O&M manuals and health and safety files regarding building performance.
What consideration has been given to resource use, energy consumption and pollution in terms of the construction site impacts?	The principal contractor will be required to deliver high standards of sustainable construction, which will be achieved through the following: • Registering the site against the Considerate Constructors Scheme; • Managing the construction site to reduce environmental effects, this will include adopting best practice measures to protect water and air quality, monitoring water and energy use from construction activities.
Will site investigation and appropriate remedial action be undertaken?	Yes, the site has been subject to a Phase 1 environmental review.
Will the community and stakeholders be involved in the design process encouraging flexibly designed buildings which cater for shared use with the local community?	The commercial spaces are designed to be flexible and could be taken by a range of operators. The scheme design has been informed through liaison with commercial letting agents.
How has the building been designed to reduce the opportunity for and the fear of crime?	The proposed development includes a mix of uses and introduces a greater level of activity into the site, including provision of natural surveillance.
What consideration has been given to the maintenance of the building?	A maintenance strategy will be developed post planning.

Health & Wellbeing

Aim: To ensure a good quality amenity level is afforded to occupants of buildings

Criteria	Design & Construction Commitments
How has the development been designed to ensure users have sufficient daylight, an external view, adequate and appropriate lighting, ventilation, air quality and drinking water?	The commercial aspects include A1 – A5 and D2 uses. The requirements for these vary depending on uses. The scheme addresses these where relevant through the BREEAM requirements. The scheme is taken forward as shell only, and therefore many of these considerations are relevant to the fit out.

Energy & CO₂ Reduction

Aim: To conserve energy, in particular carbon dioxide emissions and maximise the use of energy efficient techniques.

Criteria	Design & Construction Commitments
How has the building been designed to minimise CO₂ emissions associated with their operational energy consumption?	The building will be designed to a high degree of thermal performance and low air permeability, which will help to reduce energy demand and associated emissions from space heating. Heat losses have been limited through a highly insulated fabric and low air permeability, with specified values below the upper limit values as detailed in Part L2a of Building Regulations.
How has the development been designed to optimise the use of the energy from the sun, natural daylighting and controlled natural ventilation?	The building predominantly faces towards the south-east which provides generous exposure to the sun throughout the day. These solar gains help to reduce the energy demand from space heating systems.
How has the development been designed to optimise natural daylighting, energy efficient lighting, external lighting and natural ventilation?	The building predominantly faces towards the south-east which provides generous exposure to the sun throughout the day, providing a high level of natural light. The balance between natural light, solar gain and overheating is struck by specifying the glazing with a g-value of 0.45, which reduces excessive solar gain (and resultant overheating risk) whilst still allowing adequate levels of natural light. The commercial units are expected to include active cooling to regulate internal conditions in accordance with market demands.

How will the design of the building make efficient use of energy? (e.g. use of thermally massive materials, levels of insulation, energy efficient white goods and use of green/brown roofs etc.).	The development will be specified with a highly insulated fabric and low air permeability, resulting in a high level of fabric energy efficiency. A green roof has been specified, reducing surface water run-off whilst also reducing the impact to the surrounds from the urban heat island effect.
Have renewable energy sources or decentralised energy been considered for this development and if so, how would they be incorporated within the development?	The commercial units will be fitted out by the tenants in accordance with a design brief which follows the principles established by this statement. Renewable energy generation will be provided in the form of air-source heat-pumps, which will provide high-efficiency space heating, with the option of cooling. Hot water is expected to be generated by point of use / direct electric systems, working in tandem with the heat pumps.
Transport	
<i>Aim: To reduce the need to travel through appropriately located development.</i>	
Criteria	Design & Construction Commitments
How has the design and layout incorporated measures to reduce the need to travel, especially by car, and promote alternative and sustainable modes of transport such as walking, cycling and the use of public transport?	The planning application is submitted with a transport statement and Travel Plan which explains the approach taken to promote sustainable forms of transport.
How have deliveries and the manoeuvring of delivery vehicles been considered?	The units are not expected to have high servicing demands. Further details on the delivery requirements are set out in the Transport Statement.
Water	
<i>Aim: To improve efficiency in the use of water, conserve water resources and minimise vulnerability to flooding.</i>	
Criteria	Design & Construction Commitments
How will the development incorporate the use of water saving devices to achieve a maximum consumption of 5.5 cubic m per year per person for office developments? (or the most appropriate benchmark for other types of development).	The scheme is being brought forward on a shell only basis, with water consuming fittings being the responsibility of the developer. The scheme proposes a D2 Gym and A class retail, which has varying requirements for water demand. The Gym will be the highest demand, with an expectation for showers and washroom facilities. The tenants will be required through a fit out specification to install water efficient equipment, not exceeding targets laid out by BREEAM Excellent (25% reduction from a notional baseline).

Will the development and access to and from it such as roads and paths be located away from areas of potential flooding?	Safe access to and from the site is a matter which has been addressed within the Flood Risk Assessment.
How will the development incorporate harvesting and re-use of rainwater?	There is limited external landscaped amenity area that would benefit from a rainwater harvesting system. Instead, the proposed drainage strategy will limit surface water discharge through the use of a green roof system with a connection to the existing surface water drainage network.
Does this development meet the requirements of EN18?	EN18 directs development away from areas that are liable to flood. In areas of lower risk, development may move forward if it passes the exception test in the NPPF. It also requires major developments to incorporate Sustainable Drainage Systems (SuDS). The scheme demonstrates alignment with this policy.
Materials <i>Aim: To retain local character and promote the use of materials with a low environmental impact.</i>	
Criteria	Design & Construction Commitments
How will the selected materials help retain local character, ensure long life and ensure a low environmental impact?	Maximising the sustainability of all the materials used in the build will be an important factor from the outset. The development will be designed and constructed as to maximise the sustainability of materials. The client will ensure the following standards are met in the development: • All timber and timber products are to be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) scheme; • No construction or insulation materials are to be used which will release toxins into the internal and external environment, including those that deplete stratospheric ozone.

What consideration has been given to reusing materials in-situ, responsibly sourcing materials and re-using existing structures?	
Waste <i>Aim: To minimise the production of waste and maximise re-use and recycling.</i>	
Criteria	Design & Construction Commitments
Has an audit of the materials present on the site been conducted with an assessment of the extent to which materials could be re-used?	A pre demolition audit will be undertaken prior to demolition works to consider what options exist to recover materials.
How will the development make the maximum use of construction, demolition waste and recycled materials?	A site waste management strategy will be prepared for the construction phase of the development, which identifies measures to minimise construction waste, and maximise the use of demolition and construction waste.
How will provision be made for the storage and recycling of waste for all users of the site?	Commercial waste storage space would take account of the requirement for BREEAM, including for provision of suitable space for separate general and recyclable waste streams. BREEAM requires 2m² of waste storage to be provided for a development of this size. Depending on the retail uses, waste composting should also be considered by provision of points for washdown. This will depend on tenant requirements.
Land Use & Ecology <i>Aim: To retain, protect and enhance wildlife habitats and natural features.</i>	
Criteria	Design & Construction Commitments
How have the wildlife habitats and natural features on and adjacent to the site been considered and how will they be retained, protected and enhanced?	The development itself does not distinct ecological value, however the site is located directly adjacent to the River Kennet. Due protection will be given to any wildlife habitats and natural features within the river boundary during construction.
What consideration has been given to not using previously undeveloped land?	The site is located on previously developed land.

What consideration has been given to the removal of contamination from the land?	Any contamination identified will be treated appropriately and remediation will take place where necessary.
Pollution <i>Aim: To minimise damage to the environment through air, ground/surface water, land, noise or light pollution.</i>	
Criteria	Design & Construction Commitments
What measures have been incorporated to ensure that noise and light pollution will be minimised through the development?	Any new development can potentially lead to detrimental environmental effects; as is the nature of construction. These potential effects have been considered during the planning stages of this proposal. The development is not of the scale that would require an Environmental Impact Assessment (EIA), however the measures as outlined in this section, and subsequently implemented, will ensure that any potential impacts can be appropriately controlled in order to demonstrate compliance with Local Plan Policy EN16: Pollution & Water Resources. Noise A Noise Impact Assessment has been submitted with this application, which will set limits that will be met when specifying the external condensers. External Lighting The development's lighting strategy will ensure that it does not have adverse effects at night-time. Although a detailed lighting design scheme for the site that ensures light pollution is minimised has not yet been undertaken the following measure are expected to be incorporated: • External lighting will be designed in compliance with Table 1 and accompanying notes of ILE Guidance Note for reduction of obtrusive light;

	All non-safety/security lighting will be automatically switched off between 2300hrs and 0700hrs.
What consideration has been given to reducing refrigerants and minimising nitrogen oxide emissions?	As detailed under the 'Management' section, no construction or insulation materials are to be used which will release toxins into the internal and external environment, including those that deplete stratospheric ozone. With regards to nitrogen oxide emissions (NOx), no on-site fossil combustion will occur as the servicing strategy is fully electrified with the use of heat pumps, therefore no NOx emissions are expected.
What measures have been incorporated to reduce the release of pollution into the atmosphere?	As detailed in the Energy Assessment presented in Section 4, the scheme will make there will be no on-site fossil combustion.
Land Use & Ecology <i>Aim: To retain, protect and enhance wildlife habitats and natural features.</i>	
Criteria	Design & Construction Commitments
How have the wildlife habitats and natural features on and adjacent to the site been considered and how will they be retained, protected and enhanced?	The development itself does not distinct ecological value, however the site is located directly adjacent to the River Kennet. Due protection will be given to any wildlife habitats and natural features within the river boundary during construction.

6 CONCLUSION

- 6.1 This Energy & Sustainability Statement has been prepared by Envision on behalf of Lipman Properties (the applicant), and is submitted to support a planning application for the roof and side extensions to existing building at Dukesbridge House to provide a residential-led scheme with associated landscaping, public realm improvements, alterations to the existing vehicular access and car parking and provision of cycle parking and waste storage.
- 6.2 To minimise energy consumption by the development and to ensure compliance with Reading Borough Council (RBC) Local Plan Policy H5, the following design measures are proposed:
- Building fabric construction U-values significantly improved compared with standard Building Regulations U-values;
 - Reduced Air Permeability, lower than standard Buildings Regulations, and in accordance with prospective development building occupiers;
 - High efficiency LED lighting utilizing low-energy control systems such as daylight dimming and occupancy sensing;
 - Mechanical Ventilation Heat Recovery (MVHR) to all apartments.
 - High-efficient communal Air-Source Heat Pumps providing efficient space and water heating to the residential portion;
 - High-efficient Air-Source Heat Pumps providing efficient heating, cooling and hot water to the A1/A3 & D2 use;
 - HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values.
- 6.3 The strategy proposed follows the three-step 'Energy Hierarchy' and meets all policies as outlined in Section 3 of the report, with the development expected to perform as follows:
1. The developments overall reduction in carbon emissions (domestic & non-domestic uses) over the Part L 2013 (using SAP 10 emission figures) baseline is **53.81%**;
 2. The residential portion alone achieves a **55.37%** reduction in CO₂ emissions. In line with RPB Policy H5(c) order to bring in order to bring the residential carbon savings to 100%, the remaining residential carbon emissions are to be offset through a carbon offset payment. The carbon offset payment, priced at £60 per tonne of CO₂ per year (over 30 years) to be paid via a S106 to Reading Borough Council is **£25,110**.

- 6.4 Further optimising of the air source heat pump installation will be assessed at the detail-design phase. For this Energy Report, the solutions have been optimised to suit the predicted energy consumption and carbon emissions as per Envision's calculations.
- 6.5 The scheme will deliver a series of sustainability measures which are compatible with RBC local policy requirements for sustainable design and construction, including:
- A high-quality residential development, incorporating high levels of natural light, sustainable transport options and low-carbon heating solutions;
 - SuDs strategy to achieve a 50% reduction in peak discharge rates in comparison with the existing regime;
 - Sustainable material selections with timber to be procured with Forest Stewardship Council accreditation;
 - Incorporation of climate adaptation measures, including permeable paving, green roof(s) and passive building design including MVHR;
 - Responsible construction practices during site construction, including a pre-demolition audit and a site waste management plan;
 - Water conservation measures within the units to comply with 110 litres / bedspace per day;
 - Amenity space for all residents.
- 6.6 A BREEAM predictive assessment has been undertaken to consider the possible performance of the development against BREEAM. The non-domestic elements of the scheme are below 1000 m² and therefore it is considered that a BREEAM Very Good rating would be an acceptable target to apply. The BREEAM predictive assessments identify that the development aligns to a Very Good rating, albeit that due to the small size of the commercial uses, and the varying use classes proposed multiple separate BREEAM assessment would be required, which is considered to be overly onerous. In this case it is recommended that just the Gym (D2 use) is subject to a BREEAM assessment, which would be undertaken against the shell only criteria. This would avoid the duplication of costs associated with undertaking multiple BREEAM assessments, but the principles of BREEAM are applied to all non-domestic elements proposes. Further details on BREEAM is provided in Appendix 4.
- 6.7 The development is therefore considered to comply with the sustainability & energy requirements outlined in the Reading Borough Council Local Plan (adopted November 2019) and the Reading Borough Council Sustainable Design & Construction SPD (Adopted December 2019).

APPENDIX I – LOW/ZERO CARBON/RENEWABLE ANALYSIS

Renewable Technology	Rating (out of 5)	Comment
Photovoltaics	**	PV arrays are a suitable solution for the development, however given the CO ₂ reductions already achieved on-site their inclusion is deemed extraneous. The CO ₂ offset offered by PV using SAP 10 emission factors is significantly reduced when compared to previous Part L emission factors, meaning a significant quantum is required to lower CO ₂ emissions meaningfully.
Solar Thermal	**	The use of a solar thermal system would not offer significant CO ₂ savings compared to PV
Wind Turbine	*	The restricted nature of the site, coupled with the noise, aesthetic (planning) and building vibrations arising from their installation means this system is unviable.
Ground Source Heat Pump	**	The site has limited accessible ground to allow the installation of the horizontal ground loops required for this system. Vertical ground loops set within the pile foundations are possible, but come with significant capital cost due to the ground heat exchanger and they add significant complexity to the thermal modelling of the building to ensure they are effectively serving the heating requirements of the building. These would require additional renewable services to achieve RBC targets.
Air Source Heat Pump	****	ASHPs are viable for the development and are capable of providing a significant portion of the building's energy from effectively a renewable source, as for each kW of electricity in excess of 3kW of heating will be extracted. The ASHPs will also meet with client requirements for both heating and cooling options to commercial units This makes ASHPs the preferred renewable technology for the provision of heating and hot water to each dwelling and to non-domestic uses.
Biomass Communal Boiler	**	The significant plant and in particular, storage space required for a biomass boiler is unsuitable for a development of this size.

APPENDIX II – GLA SAP 10 EMISSIONS SHEET

The applicant should complete all the light blue cells including information on the modelled units, the area per unit, the number of units, the baseline energy consumption figures, the TER and the TFEE.												SAP 2012 CO2 PERFORMANCE						SAP10 CO2 PERFORMANCE																										
DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS																							DEMAND																					
Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - TER WORKSHEET						REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.)						REGULATED CO2 EMISSIONS PER UNIT						Fabric Energy Efficiency (FEE)																				
				Calculated TER 2012 (kgCO2 / m2)	TER Worksheet TER 2012 (kgCO2 / m2)	Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated TER SAP10 (kgCO2 / m2)	Target Fabric Energy Efficiency (TFEE) (kWh/m²)																		
TER Worksheet (Row 4)				TER Worksheet (Row 273)		TER Worksheet (Row 211)		TER Worksheet (Row 219)		TER Worksheet (Row 232)		TER Worksheet (Row 231)		N / A																														
1B-MF (N)	51.67	3	151.87	18.1	18.1	1491.43	Natural Gas	2087.46	Natural Gas	239.19	75		322	451	124	39		936	313	438	56	17		825	16.0	18.12																		
1B-MF (S)	51.9	7	356.55	16.6	16.6	1116.29	Natural Gas	2105.39	Natural Gas	240.13	75		241	455	125	39		859	234	442	56	17		750	14.5	16.56																		
1B-MF (E-W)	47.7	6	300.3	16.6	16.6	834.49	Natural Gas	2058.65	Natural Gas	246.24	75		180	445	128	39		792	175	432	57	17		682	14.3	16.6																		
2B-MF (N)	64.22	1	64.22	17.2	17.2	1865.31	Natural Gas	2359.71	Natural Gas	295.88	75		403	510	154	39		1,105	392	496	69	17		974	15.2	17.21																		
2B-MF (S)	64.22	2	124.13	15.4	15.4	1293.94	Natural Gas	2380.82	Natural Gas	295.88	75		279	514	154	39		986	272	500	69	17		858	13.4	15.36																		
2B-MF (E-W)	62.1	5	319.55	16.1	16.1	1425.55	Natural Gas	2350.62	Natural Gas	285.04	75		308	508	148	39		1,003	299	494	66	17		877	14.1	16.14																		
3B-MF (E-W)	70	1	70	17.1	17.1	2176.05	Natural Gas	2420.77	Natural Gas	321.99	75		470	523	167	39		1,199	457	508	75	17		1,058	15.1	17.13																		
1B-TF (N)	51.67	1	51.67	21.1	21.1	2201.08	Natural Gas	2067.28	Natural Gas	245.96	75		475	447	128	39		1,089	462	434	57	17		971	18.8	21.07																		
1B-TF (S)	51.9	2	91.92	19.7	19.7	1873.05	Natural Gas	2078.94	Natural Gas	246.93	75		405	449	128	39		1,021	393	437	58	17		905	17.4	19.67																		
1B-TF (E-W)	47.7	3	151.76	18.9	18.9	1366.63	Natural Gas	2036.68	Natural Gas	246.24	75		295	440	128	39		902	287	428	57	17		790	16.6	18.91																		
2B-TF (S)	64.22	1	64.22	17.6	17.6	1975.89	Natural Gas	2357.62	Natural Gas	295.88	75		427	509	154	39		1,129	415	495	69	17		996	15.5	17.57																		
2B-TF (E-W)	62.1	2	134.29	17.6	17.6	1871.45	Natural Gas	2335.9	Natural Gas	285.04	75		404	505	148	39		1,096	393	491	66	17		967	15.6	17.64																		
3b-Duplex	88	1	92.09	20.7	20.7	4828.19	Natural Gas	2539.58	Natural Gas	370.54	75		1,043	549	192	39		1,823	1,014	533	86	17		1,651	18.8	20.71																		
1B-Duplex	69.71	1	69.71	20.5	20.5	3406.32	Natural Gas	2275.79	Natural Gas	309.61	75		736	492	161	39		1,427	715	478	72	17		1,283	18.4	20.47																		
Sum	2,022	36	2,042	17.6	-	55,053	N/A	78,827	N/A	9,535	2,700	0	11,891	17,027	4,949	1,401	0	35,606	11,561	16,554	2,222	629	0	31,260	15.5	17.44																		
NON-DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS																																												
Building Use	Area per unit (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION BY END USE (kWh/m² p.a.) TER - SOURCE: BRUKL OUTPUT						REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) TER - SOURCE: BRUKL.INP or *SIM.CSV FILE					REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) - TER BRUKL				REGULATED CO2 EMISSIONS																							
				Calculated TER 2012 (kgCO2 / m2)	BRUKL TER 2012 (kgCO2 / m2)	Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling	Natural Gas	Grid Electricity	2012 CO2 emissions (kgCO2 p.a.)	Natural Gas	Grid Electricity	SAP10 CO2 emissions (kgCO2 p.a.)	BRUKL TER SAP10 (kgCO2 / m2)																									
A1 & A3 Units	214.7	1	214.7	44.8	44.8	27.4	Natural Gas	39.08	Natural Gas	36.24	3.99	19.99	66	59	9,625	66	59	5,934	27.6																									
D2 Use	262.1	1	262.1	116.5	116.5	12.85	Natural Gas	413.02	Natural Gas	19.09	18.13	11.2	426	47	30,533	426	47	26,324	100.4																									

Sum	477	2	477	84.2	-	9,251	9,251	0	0	0	0	0	492	106	N/A	N/A	N/A	40,158	492	106	N/A	N/A	N/A	32,258	67.7
SITE-WIDE ENERGY CONSUMPTION AND CO2 ANALYSIS																									
Use	Total Area (m²)	Calculated TER 2012 (kgCO2 / m2)	-	REGULATED ENERGY CONSUMPTION									REGULATED CO2 EMISSIONS			REGULATED CO2 EMISSIONS PER UNIT									
				Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)		2012 CO2 emissions (kgCO2 p.a.)		SAP10 CO2 emissions (kgCO2 p.a.)	Calculated TER SAP10 (kgCO2 / m2)										
Sum	2,519	30.1	-	64,303		78,827		9,535	2,700	0			75,765				63,518						25.2		

SAP10 CO2 PERFORMANCE

DOMESTIC ENERGY CONSUMPTION AND CO ₂ ANALYSIS																	DOMESTIC ENERGY DEMAND DATA																	
Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m ²)	Number of units	Total area represented by model (m ²)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE LEAN' SAP DER WORKSHEET						REGULATED CO ₂ EMISSIONS PER UNIT (kgCO ₂ p.a.)					REGULATED CO ₂ EMISSIONS PER UNIT						Fabric Energy Efficiency (FEE)	REGULATED ENERGY DEMAND PER UNIT PER ANNUM (kWh p.a.)										
				Calculated DER 2012 (kgCO ₂ / m2)	DER Worksheet DER 2012 (kgCO ₂ / m2)	Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	2012 CO ₂ emissions (kgCO ₂ p.a.)	Space Heating CO ₂ emissions (kgCO ₂ p.a.)	Domestic Hot Water CO ₂ emissions (kgCO ₂ p.a.)	Lighting CO ₂ emissions (kgCO ₂ p.a.)	Auxiliary CO ₂ emissions (kgCO ₂ p.a.)		Cooling CO ₂ emissions (kgCO ₂ p.a.)	SAP10 CO ₂ emissions (kgCO ₂ p.a.)	Calculated DER SAP10 (kgCO ₂ / m2)	Dwelling Fabric Energy Efficiency (DFEE) (kWh/m ²)	Space Heating (kWh p.a.)	Domestic Hot Water (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)		
				DER Sheet (Row 384)		DER Sheet [(Row 307a) + (Row 367a x 0.01)]	Select fuel type	DER Sheet [(Row 310a) + (Row 367a x 0.01)]	Select fuel type	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315																						
1B-MF (N)	51.67	3	151.87	17.1	17.1	1074.84492	Natural Gas	1934.427807	Natural Gas	238.64	209.2	232	418	124	109	882	226	406	56	49		736	14.2	39.5	1,005	1,809	239	181						
1B-MF (S)	51.9	7	356.55	15.4	15.4	684.0219904	Natural Gas	1937.272727	Natural Gas	239.58	206.37	148	418	124	107	798	144	407	56	48		654	12.6	31.4	640	1,811	240	182						
1B-MF (E-W)	47.7	6	300.3	15.1	15.1	443.2299465	Natural Gas	1885.465241	Natural Gas	235.98	178.26	96	407	122	93	718	93	396	55	42		586	12.3	28	414	1,763	236	156						
2B-MF (N)	64.22	1	64.22	15.2	15.2	1216.385027	Natural Gas	2203.026738	Natural Gas	288.83	170.45	263	476	150	88	977	255	463	67	40		825	12.8	37.7	1,137	2,060	289	138						
2B-MF (S)	64.22	2	124.13	13.5	13.5	707.2085561	Natural Gas	2203.026738	Natural Gas	288.83	165.69	153	476	150	86	865	149	463	67	39		717	11.2	28.8	661	2,060	289	138						
2B-MF (E-W)	62.1	5	319.55	14.6	14.6	973.2941176	Natural Gas	2178.791444	Natural Gas	280.53	156.75	210	471	146	81	908	204	458	65	37		764	12.3	33.3	910	2,037	281	127						
3B-MF (E-W)	70	1	70	15.9	15.9	1712.898396	Natural Gas	2265.144385	Natural Gas	312.68	180.66	370	489	162	94	1,115	360	476	73	42		950	13.6	41.2	1,602	2,118	313	143						
1B-TF (N)	51.67	1	51.67	21.4	21.4	2083.540107	Natural Gas	1934.427807	Natural Gas	238.64	218.63	450	418	124	113	1,105	438	406	56	51		950	18.4	57.1	1,948	1,809	239	181						
1B-TF (S)	51.9	2	91.92	19.6	19.6	1684.320856	Natural Gas	1937.272727	Natural Gas	239.58	215.72	364	418	124	112	1,019	354	407	56	50		867	16.7	49.8	1,575	1,811	240	182						
1B-TF (E-W)	47.7	3	151.76	18.6	18.6	1212.641711	Natural Gas	1885.465241	Natural Gas	235.98	185.46	262	407	122	96	888	255	396	55	43		749	15.7	43.6	1,134	1,763	236	156						
2B-TF (S)	64.22	1	64.22	16.8	16.8	1679.326203	Natural Gas	2203.026738	Natural Gas	288.83	174.78	363	476	150	91	1,079	353	463	67	41		923	14.4	43.5	1,570	2,060	289	138						
2B-TF (E-W)	62.1	2	134.29	17.0	17.0	1631.358289	Natural Gas	2178.791444	Natural Gas	280.53	162.9	352	471	146	85	1,053	343	458	65	38		903	14.5	43.3	1,525	2,037	281	127						
3b-Duplex	88	1	92.09	20.7	20.7	4195.657754	Natural Gas	2412.534759	Natural Gas	370.54	397.36	906	521	192	206	1,826	881	507	86	93		1,567	17.8	67	3,923	2,256	371	336						
1B-Duplex	69.71	1	69.71	21.7	21.7	3353.679144	Natural Gas	2144.128342	Natural Gas	309.56	317.21	724	463	161	165	1,513	704	450	72	74		1,301	18.7	62.5	3,136	2,005	310	266						
Sum	2,022	36	2,042	16.6	-	41,464	N/A	73,028	N/A	9,346	7,030	0	8,956	15,774	4,851	3,648	0	33,542	8,707	15,336	2,178	1,638	0	28,122	13.9	38.41	38,769	68,281	9,346	5,959	0			
NON-DOMESTIC ENERGY CONSUMPTION AND CO ₂ ANALYSIS																	NON-DOMESTIC ENERGY DEMAND																	
Building Use	Area per unit (m ²)	Number of units	Total area represented by model (m ²)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION BY END USE (kWh/m ² p.a.) 'BE LEAN' BER - SOURCE: BRUKL OUTPUT						REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m ² p.a.) 'BE LEAN' BER - SOURCE: BRUKLINP or 'SIM.C					REGULATED CO ₂ EMISSIONS PER UNIT						N/A	REGULATED ENERGY DEMAND PER UNIT PER ANNUM (kWh p.a.)										
				Calculated BER 2012 (kgCO ₂ / m2)	BRUKL BER 2012 (kgCO ₂ / m2)	Space Heating (kWh/m ² p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m ² p.a.)	Fuel type Domestic Hot Water	Lighting (kWh/m ² p.a.)	Auxiliary (kWh/m ² p.a.)	Cooling (kWh/m ² p.a.)	Natural Gas	Grid Electricity	2012 CO ₂ emissions (kgCO ₂ p.a.)	Natural Gas	Grid Electricity	SAP10 CO ₂ emissions (kgCO ₂ p.a.)	BRUKL BER SAP10 (kgCO ₂ / m2)	Space Heating (kWh p.a.)	Domestic Hot Water (kWh p.a.)	Lighting (kWh p.a.)		Auxiliary (kWh p.a.)	Cooling (kWh p.a.)									
A1 & A3 Units	214.7	1	214.7	33.2	33.2	15.33	Natural Gas	37.13	Natural Gas	25.72	7.05	9.35	52	42	7,126	52	42	4,472	20.8															
D2 Use	262.1	1	262.1	114.4	114.4	5.66	Natural Gas	395.27	Natural Gas	12.88	28.5	12.11	401	54	29,976	401	54	25,335	96.7															
Sum	477	2	477	77.8	-	4,775	N/A	111,572	N/A	8,898	8,983	5,181	453	96	N/A	N/A	N/A	37,103	453	96				29,808	62.5	N/A	0	0	0	0	0			
SITE-WIDE ENERGY CONSUMPTION AND CO ₂ ANALYSIS																																		
Use	Total Area (m ²)	Calculated BER 2012 (kgCO ₂ / m2)	-	REGULATED ENERGY CONSUMPTION						REGULATED CO ₂ EMISSIONS			REGULATED CO ₂ EMISSIONS			N/A	REGULATED ENERGY DEMAND PER UNIT PER ANNUM (kWh p.a.)																	
				Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	2012 CO ₂ emissions (kgCO ₂ p.a.)			SAP10 CO ₂ emissions (kgCO ₂ p.a.)	Calculated BER SAP10 (kgCO ₂ / m2)		Space Heating (kWh p.a.)	Domestic Hot Water (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)													
Sum	2,519	28.0	-	46,239				18,244	16,013	5,181			70,645			57,930	23.0																	

The applicant should complete all the light blue cells including information on the 'be clean' energy consumption figures and the 'be clean' DER.

DOMESTIC ENERGY CONSUMPTION AND CO ₂ ANALYSIS															SAP 2012 CO ₂ PERFORMANCE										SAP10 CO ₂ PERFORMANCE									
Unit Identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m ²)	Number of units	Total area represented by model (m ²)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE CLEAN' SAP DER WORKSHEET										REGULATED CO ₂ EMISSIONS PER UNIT (kgCO ₂ p.a.)								REGULATED CO ₂ EMISSIONS PER UNIT (kgCO ₂ p.a.)										
				Calculated DER 2012 (kgCO ₂ / m2)	DER Worksheet DER 2012 (kgCO ₂ / m2)	Space Heating (Heat Source 1)	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	Fuel type Domestic Hot Water	Space and Domestic Hot Water from CHP	Fuel type CHP	Total Electricity generated by CHP (-)	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP	Electricity generated by CHP	Lighting	Auxiliary	Cooling	2012 CO ₂ emissions (kgCO ₂ p.a.)	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP	Electricity generated by CHP	Lighting	Auxiliary	Cooling	SAP10 CO ₂ emissions (kgCO ₂ p.a.)	Calculated DER SAP10 (kgCO ₂ / m2)		
				DER Sheet (Row 384)		DER Sheet (Row 307b + (Row 367b x 0.01))	Select fuel type	DER Sheet (Row 310b + (Row 367b x 0.01))	Select fuel type	If applicable	If applicable	If applicable	DER Sheet (Row 307a + 310a) + (Row 361 + 362)	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315																		
1B-MF (N)	51.67	3	151.87	17.1	17.1	1074.84492	Natural Gas	1934.427807	Natural Gas				238.64	209.2		232	418				124	109		882	226	406			56	49	736	14.2		
1B-MF (S)	51.9	7	356.55	15.4	15.4	684.0213904	Natural Gas	1937.272727	Natural Gas				239.58	206.37		148	418				124	107		798	144	407			56	48	654	12.6		
1B-MF (E-W)	47.7	6	300.3	15.1	15.1	443.2299465	Natural Gas	1885.465241	Natural Gas				235.98	178.26		96	407				122	93		718	93	396			55	42	586	12.3		
2B-MF (N)	64.22	1	64.22	15.2	15.2	1216.385027	Natural Gas	2203.026738	Natural Gas				288.83	170.45		263	476				150	88		977	255	463			67	40	825	12.8		
2B-MF (S)	64.22	2	124.13	13.5	13.5	707.2085561	Natural Gas	2203.026738	Natural Gas				288.83	165.69		153	476				150	86		865	149	463			67	39	717	11.2		
2B-MF (E-W)	62.1	5	319.55	14.6	14.6	973.2941176	Natural Gas	2178.791444	Natural Gas				280.53	156.75		210	471				146	81		908	204	458			65	37	764	12.3		
3B-MF (E-W)	70	1	70	15.9	15.9	1712.898396	Natural Gas	2265.144385	Natural Gas				312.68	180.66		370	489				162	94		1,115	360	476			73	42	950	13.6		
1B-TF (N)	51.67	1	51.67	21.4	21.4	2083.540107	Natural Gas	1934.427807	Natural Gas				238.64	218.63		450	418				124	113		1,105	438	406			56	51	950	18.4		
1B-TF (S)	51.9	2	91.92	19.6	19.6	1684.320856	Natural Gas	1937.272727	Natural Gas				239.58	215.72		364	418				124	112		1,019	354	407			56	50	867	16.7		
1B-TF (E-W)	47.7	3	151.76	18.6	18.6	1212.641711	Natural Gas	1885.465241	Natural Gas				235.98	185.46		262	407				122	96		888	255	396			55	43	749	15.7		
2B-TF (S)	64.22	1	64.22	16.8	16.8	1679.326203	Natural Gas	2203.026738	Natural Gas				288.83	174.78		363	476				150	91		1,079	353	463			67	41	923	14.4		
2B-TF (E-W)	62.1	2	124.29	17.0	17.0	1631.358289	Natural Gas	2178.791444	Natural Gas				280.53	162.9		352	471				146	85		1,053	343	458			65	38	903	14.5		
3b-Duplex	88	1	92.09	20.7	20.7	4195.657754	Natural Gas	2412.534759	Natural Gas				370.54	397.36		906	521				192	206		1,826	881	507			86	93	1,567	17.8		
1B-Duplex	69.71	1	69.71	21.7	21.7	3353.679144	Natural Gas	2144.128342	Natural Gas				309.56	317.21		724	463				161	165		1,513	704	450			72	74	1,301	18.7		
Sum	2,022	36	2,042	16.6	-	41,464	N/A	73,028	N/A	0	N/A	0	9,346	7,030	0	8,956	15,774	0	0	4,851	3,648	0	33,542	8,707	15,336	0	0	2,178	1,638	0	28,122	13.9		
NON-DOMESTIC ENERGY CONSUMPTION AND CO ₂ ANALYSIS																																		
Building Use	Area per unit (m ²)	Number of units	Total area represented by model (m ²)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION BY END USE (kWh/m ² p.a.) 'BE CLEAN' BER - SOURCE: BRUKL OUTPUT								REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m ² p.a.) 'BE CLEAN' BER - SOURCE: BRUKL.INP or *SIM.CSV FILE								REGULATED CO ₂ EMISSIONS PER UNIT												
				Calculated BER 2012 (kgCO ₂ / m2)	BRUKL BER 2012 (kgCO ₂ / m2)	Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Total Electricity generated by CHP (-)	Lighting	Auxiliary	Cooling	Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-)	2012 CO ₂ emissions (kgCO ₂ p.a.)	Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-)	SAP 10 CO ₂ emissions (kgCO ₂ p.a.)	BRUKL BER SAP10 (kgCO ₂ / m2)										
A1 & A3 Units	214.7	1	214.7	33.2	33.2	15.33	Natural Gas	37.13	Natural Gas				25.72	7.05	9.35	52	42							7,126	52	42					4,472	20.8		
D2 Use	262.1	1	262.1	114.4	114.4	5.66	Natural Gas	395.27	Natural Gas				12.88	28.5	12.11	401	54							29,976	401	54					25,335	96.7		
Sum	477	2	477	77.8	-	4,775	N/A	111,572	N/A			0	8,898	8,983	5,181	453	96	0	0				37,103	453	96	0	0				29,808	62.5		
SITE-WIDE ENERGY CONSUMPTION AND CO ₂ ANALYSIS																																		
Use	Total Area (m ²)	Calculated BER 2012 (kgCO ₂ / m2)	-	REGULATED ENERGY CONSUMPTION								REGULATED CO ₂ EMISSIONS				REGULATED CO ₂ EMISSIONS PER UNIT																		
				Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Space and Domestic Hot Water from CHP (kWh p.a.)	N/A	Electricity generated by CHP (kWh p.a.) If applicable	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	2012 CO ₂ emissions (kgCO ₂ p.a.)	SAP 10 CO ₂ emissions (kgCO ₂ p.a.)	Calculated BER SAP10 (kgCO ₂ / m2)																		
Sum	2,519	28.0	-	46,239		184,600		0		0	18,244	16,013	5,181	70,645	57,930	23.0																		

The applicant should complete all the light blue cells including information on the 'be green' energy consumption figures and the 'be green' DER.

[illegible]

NON-DOMESTIC ENERGY CONSUMPTION AND CO₂ ANALYSIS

[illegible]

SITE-WIDE ENERGY CONSUMPTION AND CO₂ ANALYSIS

Use	Total Area (m²)	Calculated BER 2012 (kgCO2 / m2)	-	REGULATED CO2 EMISSIONS										REGULATED CO2 EMISSIONS										REGULATED CO2 EMISSIONS PER UNIT										
				Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Space and Domestic Hot Water from CHP (kWh p.a.)	N/A	Electricity generated by CHP (kWh p.a.) if applicable	Electricity generated by renewable (kWh p.a.) if applicable	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	Space Heating CO2 emissions	Domestic Hot Water CO2 emissions	Space Heating and DHW from CHP CO2 emissions	Electricity generated by CHP CO2 savings	Electricity generated by renewable CO2 savings	Lighting CO2 emissions	Auxiliary CO2 emissions	Cooling CO2 emissions	2012 CO2 emissions	Space Heating CO2 emissions	Domestic Hot Water CO2 emissions	Space Heating and DHW from CHP CO2 emissions	Electricity generated by CHP CO2 savings	Electricity generated by renewable CO2 savings	Lighting CO2 emissions	Auxiliary CO2 emissions
Sum	2,519	0.0	-	14,213	N/A	71,702	N/A	0	0	0	0	18,244	16,013	5,181	6,307	16,242	0	0	0	0	4,851	3,648	0	45,351	2,832	7,439	0	0	0	2,178	1,638	0	29,839	11.6

DOMESTIC

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	36	30
After energy demand reduction	34	30
After heat network / CHP	34	30
After renewable energy	31	30

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	2	6%
Savings from heat network / CHP	0	0%
Savings from renewable energy	2	7%
Cumulative on site savings	5	13%
Annual savings from off-set payment	31	-
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	932	-
Cash in-lieu contribution (£)	55,932	

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	31	13
After energy demand reduction	28	13
After heat network / CHP	28	13
After renewable energy	14	13

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	3	10%
Savings from heat network / CHP	0	0%
Savings from renewable energy	14	45%
Cumulative on site savings	17	55%
Annual savings from off-set payment	14	-
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	419	-
Cash in-lieu contribution (£)	25,110	

NON-DOMESTIC

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	40	14
After energy demand reduction	37	14
After heat network / CHP	37	14
After renewable energy	34	14

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	32	6
After energy demand reduction	30	6
After heat network / CHP	30	6
After renewable energy	15	6

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	3	8%
Savings from heat network / CHP	0	0%
Savings from renewable energy	3	7%
Total Cumulative Savings	6	15%

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO ₂)	Cumulative Shortfall (Tonnes CO ₂)
Total Target Savings	14	-
Shortfall	8	245
Cash in-lieu contribution (£)	14,715	-

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from energy demand reduction	2	8%
Savings from heat network / CHP	0	0%
Savings from renewable energy	14	45%
Total Cumulative Savings	17	52%

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO ₂)	Cumulative Shortfall (Tonnes CO ₂)
Total Target Savings	11	-
Shortfall	-6	-167
Cash in-lieu contribution (£)	-10,043	-

SITE-WIDE

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	76		
Be lean	71	5	7%
Be clean	71	0	0%
Be green	65	5	7%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	1,177	-

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	64		
Be lean	58	6	9%
Be clean	58	0	0%
Be green	29	29	45%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	251	-

Building use	Energy demand following energy efficiency measures (MWh/year)						
	Space Heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated electricity	Unregulated gas
Domestic	39	68	9	6	0		
Non-domestic	0	0	0	0	0		

	Target Fabric Energy Efficiency (kWh/m ²)	Dwelling Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Development total	17.44	38.41	-120%

	Area weighted average non-domestic cooling demand (MJ/m ²)	Total area weighted non-domestic cooling demand (MJ/year)
Actual		
Notional		

APPENDIX III – PART L SAP SUMMARY AT EACH STAGE

Block Compliance WorkSheet: Baseline & Be-Lean

User Details

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP

Software Version:

Version: 1.0.4.26

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
1B-MF-N (Be-Lean)	17.08	18.12	39.5	41	51.67
1B-MF-S (Be-Lean)	15.37	16.56	31.4	33.2	51.9
1B-MF (E-W) (Be-Lean)	15.05	16.6	28	28.5	47.7
2B-MF-N (Be-Lean)	15.21	17.21	37.7	40.5	64.22
2B-MF-S (Be-Lean)	13.46	15.36	28.8	30.6	64.22
2B-MF (E-W) (Be-Lean)	14.62	16.14	33.3	34.5	62.1
3B-MF (E-W) (Be-Lean)	15.93	17.13	41.2	42.4	70
1B2P-TF-N (Be-Lean)	21.39	21.07	57.1	55.7	51.67
1B2P-TF-S (Be-Lean)	19.63	19.67	49.8	48.8	51.9
1B-TF (E-W) (Be-Lean)	18.61	18.91	43.6	40.8	47.7
2B3P-TF-S (Be-Lean)	16.8	17.57	43.5	42.3	64.22
2B-TF (E-W) (Be-Lean)	16.96	17.64	43.3	42.3	62.1
3B-DUPLEX (Be-Lean)	20.75	20.71	67	68.1	88
1B-DUPLEX (Be-Lean)	21.7	20.47	62.5	61.9	69.71

Calculation Summary

Total Floor Area	847.11
Average TER	18.14
Average DER	17.41
Average DFEE	44.36
Average TFEE	44.72
Compliance	Pass

Block Compliance WorkSheet: Baseline & Be-LeanCont...

% Improvement DER|TER4.02

% Improvement DFEE|TFEE0.81

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Block Compliance WorkSheet: Be-Green

User Details

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP

Software Version:

Version: 1.0.4.26

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
1B-MF-N (Be-Green)	13.36	26.35	39.5	41	51.67
1B-MF-S (Be-Green)	12.14	23.93	31.4	33.2	51.9
1B-MF (E-W) (Be-Green)	11.93	23.8	28	28.5	47.7
2B-MF-N (Be-Green)	11.81	25.02	37.7	40.5	64.22
2B-MF-S (Be-Green)	10.57	22.16	28.8	30.6	64.22
2B-MF (E-W) (Be-Green)	11.38	23.37	33.3	34.5	62.1
3B-MF (E-W) (Be-Green)	12.3	24.93	41.2	42.4	70
1B2P-TF-N (Be-Green)	16.42	30.88	57.1	55.7	51.67
1B2P-TF-S (Be-Green)	15.17	28.71	49.8	48.8	51.9
1B-TF (E-W) (Be-Green)	14.47	27.38	43.6	40.8	47.7
2B3P-TF-S (Be-Green)	12.94	25.59	43.5	42.3	64.22
2B-TF (E-W) (Be-Green)	13.04	25.69	43.3	42.3	62.1
3B-DUPLEX (Be-Green)	15.95	30.66	67	68.1	88
1B-DUPLEX (Be-Green)	16.66	30.15	62.5	61.9	69.71

Calculation Summary

Total Floor Area	847.11
Average TER	26.44
Average DER	13.49
Average DFEE	44.36
Average TFEE	44.72
Compliance	Pass

Block Compliance WorkSheet: Be-GreenCont...

% Improvement DER|TER48.98

% Improvement DFEE|TFEE0.81

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APPENDIX IV – BREEAM PRE-ASSESSMENT

BREEAM Review

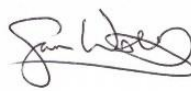
Dukesbridge House, Reading

Prepared for Lipman Properties
01st July 2020



envision

Revision	Date
First Issue	1 st July 2020

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1 BREEAM REVIEW

Summary Findings

- 1.1 Policy CC2 of the adopted Core Strategy requires BREEAM Very Good to be achieved for non-residential development of less than 1000 m².
- 1.2 Envision is a BREEAM assessment organisation and holds Accredited Professional status with the BRE. A review has been undertaken to consider the applicability of the BREEAM standards for a development of this nature and how these could align with BREEAM.
- 1.3 This review of BREEAM has been made against the BREEAM New Construction criteria (2018), and tailored to consider the credits applicable to the two separate building uses on a speculative basis.
- 1.4 The conclusion of this review is that BREEAM Very Good should be possible for the development, however applying BREEAM to all aspects of the scheme would be impractical, given the limited floorspace and mix of uses proposed by the applicant. The application of BREEAM on a development of this nature remains unduly complex, and would add excessive administrative and cost burden to the design & construction process.
- 1.5 BREEAM Very Good should be a requirement of the gym use only, which represents the largest floor area of the non domestic aspects of the development.

Applicability of BREEAM and Assessment Approach

- 1.6 Dukesbridge House is a residential-led development, albeit includes a modest area of non-residential development at ground and first floor levels. This is envisaged to be for a potential gym operator (D2 use) and open retail (A1 – A5). The development is being taken forward on a speculative basis with leases not yet agreed. The units will be brought forward on a shell only basis.
- 1.7 The proposals include five separate commercial units, which are identified as A1 – A5 and D2 uses. Each individual unit will be very small. The largest unit (allocated as a gym) would be circa 262 m². Despite the shell only approach, under BREEAM retail and gyms uses are opposing land uses and therefore would need to be subject to separate BREEAM assessment criteria, requiring certification of at least two different building types on the site. This adds to the administrative expense of applying BREEAM in this case.
- 1.8 Therefore the recommendation is a condition is sought for the D2 use only.
- 1.9 A BREEAM predictive assessment strategy for the D2 use is provided below.

Credit Title	Available Credits	Targeted Credits	Potential Credits	Unachievable Credits	Requirements	Comments
Management						
Man 01 – Project delivery planning	1		1		Project delivery stakeholders (client, building occupier (if known) and principal contractor or construction project manager) involved from RIBA Stage 2, including discussions on operational energy.	This credit is potentially possible and should be kept under review to determine if evidence can be collated under formal assessment conditions.
Man 01 –Stakeholder consultation (interested parties)	1			1	Consultation carried out with future FM, representatives from local community and existing partnerships working on similar buildings, with demonstration of how contributions have influenced the design, and feedback has been given.	Statutory consultation has not occurred for the project, and the extent of the consultation exercise would need to be extensive to qualify for BREEAM, including holding public exhibitions and consulting with a broad range of local stakeholders. This is considered unnecessary for the scheme.
Man 01 – (Pre-requisite) BREEAM Advisory Professional		X			Project team and client formally agree the strategic performance targets early in the design process.	Envision is a BREEAM AP organisation.
Man 01 – BREEAM AP (Concept Design)	1	1			BREEAM Advisory Professional appointed at RIBA Stage 1 and advises throughout design process to set the performance target.	Envision is a BREEAM AP organisation.
Man 01 – BREEAM AP (Developed Design)	1	1			The BREEAM AP continues to monitor the progress to achieving 'Very Good' during the design process.	It is possible to retain Envision for this advice post planning.
Man 02 – Elemental LCC	2			2	Elemental Life Cycle Cost (LCC) assessment must be carried out at RIBA Stage 2.	An elemental LCA is considered to be onerous for a speculative development of

						this scale. LCC analysis would typically cost between £3,000 – £5,000 for an analysis covering each building use, which is not considered to be appropriate given the small scale of the project and simple nature.
Man 02 – Component level LCC options appraisal	1			1	Component level LCC carried out at RIBA Stage 4.	As above, an elemental LCA is considered to be onerous for a speculative development.
Man 02 – Capital cost reporting	1	1			Capital cost for the building in pounds per square metre of GIFA.	Capital costs should be available for reporting to BRE if required.
Man 03 – (Prerequisite) Legally harvested and traded timber		x			All site timber to be sourced in accordance with UK Gov's Timber Procurement Policy.	This is possible and standard practice for projects. This should be included in contractor ERs.
Man 03 – Environmental management	1	1			Principal contractor operates ISO 14001 EMS.	This is possible and standard practice for projects to have a main contractor certified with EMS 14001. This should be included in contractor pre-qualification.
Man 03 – (Prerequisite) BREEAM AP					The client and contractor formally agree performance targets.	It is possible to retain Envision for this advice post planning.
Man 03 – BREEAM AP (site)	1	1			BREEAM Accredited Professional appointed to monitor achievement of BREEAM targets through construction stage.	This is possible and standard practice for projects. This should be included in contractor ERs.
Man 03 – Responsible construction management	2	2			Set plans and implement actions to minimise identified risks during construction.	A CCS score of 37 is expected feasible for the project. Higher scores for the third credits is not practical given the size of the site.

Man 03 – (EXE Credit) Responsible construction management	(+1)	(+1)			Implement 6 extra measures to improve construction management.	It is possible to work with a future contractor to achieve these credits. This should be included in contractor ERs.
Man 03 – Monitoring of construction site impacts: Utility consumption	1	1			Construction contractor monitor energy and water consumption on site.	It is possible to work with a future contractor to achieve these credits. This should be included in contractor ERs.
Man 03 – Monitoring transport of construction materials and waste	1	1			Contractor to monitor fuel consumption of transport of materials and waste to/from site.	It is possible to work with a future contractor to achieve these credits. This should be included in contractor ERs.
Man 04 – Commissioning - testing schedule and responsibilities	N/A				Commissioning of all building services and control systems, including BMS, in accordance with a prepared schedule, in line with relevant CIBSE/BSRIA guidelines. Appointed team member to monitor. Commissioning included in overall project programme.	
Man 04 – Commissioning – design and preparation	N/A				Appointed commissioning manager involved from design stage to undertake design reviews. For complex building services, must be a specialist commissioning manager.	
Man 04 – Testing and inspecting building fabric	1	1			Complete post construction testing and inspecting to quality assure the integrity of building fabric by a suitably qualified professional and rectify any defects identified.	This will require a thermographic survey and an air test.

Man 04 – Handover	N/A				Production of two Building User Guides (one for FM and one for occupiers) and committed schedule of training for building occupiers.	
Man 05 – Aftercare support	N/A				Monitor energy and water consumption data for first 12 months of occupation and providing aftercare support to building occupiers.	
Man 05 – Commissioning - implementation	N/A				Appoint specialist commissioning manager to undertake seasonal commissioning of complex systems.	This is not relevant for the BREEAM assessment of a speculative development.
Man 05 – Post occupancy evaluation	N/A				Commitment to post occupancy evaluation, including committed funds and responsibility.	This is not relevant for the BREEAM assessment of a speculative development.
Health and Wellbeing						
Hea 01 – Control of glare from sunlight	N/A				Glare control strategy designs out potential glare in relevant building areas where risk identified.	This is not relevant for the BREEAM assessment of a speculative development.
Hea 01 – Daylighting	2			2	Daylighting criteria for relevant building type (2% daylight factor for 80% of the occupied floor area, uniformity ratio of 0.3 and daylight illuminance of at least 300 lux for 2000 hours per year).	The units have varied levels of glazing, however in each case it is expected that the levels would be difficult to reach for the units types. Indeed daylighting in some the D2 use may not be desirable.
Hea 01 – (EXE credit) Daylighting	(+1)			(+1)	Exemplary daylight factor / daylight illuminance criteria met.	The exemplary level daylight criteria are not expected possible.
Hea 01 – View out	1		1		95% of floor area within 8m of external wall with window, and window size >20% of surrounding wall area.	The credit is not expected possible due to the floorplate of the D2 use. Similarly the A class unit is unlikely to comply.

Hea 01 – Internal and external lighting levels, zoning and control	1	1			External lighting designed in accordance with BS5489 and BS EN 12464-2:2-14.	External lighting can be designed in accordance with BREEAM standards. Standards to be included as part of the lighting design.
Hea 01 – (EXE Credit) Internal and external lighting	N/A				Internal lighting can be manually dimmed to 20% of maximum light output.	This is not relevant for the BREEAM assessment of a speculative development.
Hea 02 – (Prerequisite) Indoor air quality (IAQ) plan	N/A				Site specific (IAQ) plan produced and implemented, the plan must be produced no later than the end of Concept Design.	This is not relevant for the BREEAM assessment of a speculative development.
Hea 02 – Ventilation	N/A				Designed to minimise the indoor concentration and recirculation of pollutant in the building. Provide fresh air into the building in accordance with the criteria of the relevant standard for ventilation.	This is not relevant for the BREEAM assessment of a speculative development.
Hea 02 – Emissions from construction products	N/A				Three out of the five product types meet the emission limits and testing requirements. All wood-based products used for internal fixtures and fittings must be tested and classified as formaldehyde E1 class as a minimum.	This is not relevant for the BREEAM assessment of a speculative development.
Hea 02 – (EXE Credit) Minimising sources of air pollution – Emissions from construction products	N/A				All product types listed meet the emission limits and testing requirements.	This is not relevant for the BREEAM assessment of a speculative development.

Hea 02 – Post-construction indoor air quality measurement	N/A				The formaldehyde concentration in indoor air is measured post construction and does not exceed 100ug/m3 averaged over 30 minutes. Where levels exceed these will be rectified with measures implemented.	This is not relevant for the BREEAM assessment of a speculative development.
Hea 04 – Thermal modelling	N/A				Thermal modelling in accordance with CIBSE AM11 inc full dynamic thermal analysis, winter temp ranges in accordance with CIBSE Guide A, and building designed to limit risk of overheating.	
Hea 04 – Design for future thermal comfort	N/A				Thermal modelling to include projected climate change environment.	
Hea 04 – Thermal zoning and controls	N/A				Provision of appropriate zoning strategy for heating/cooling system.	
Hea 05 – Acoustic performance	1		1		Meet relevant acoustic performance standards for indoor ambient noise levels. A programme of acoustic measures set out by a compliant test body in accordance with the ANC Good Practice Guide, Acoustic testing of schools.	The acoustic levels are considered to be possible, however it is generally impractical to deliver internal acoustic standards for shell units.
Hea 06 – Security of site and building	1		1		Consultation with Architectural Liaison Officer at RIBA Stage 2 and design embodies recommendations and is built to confirm with principles of Secure by Design.	It should be possible to liaise with the local police / a security consultant to award this credit. Note that the security credit is not applicable for simple liaison with the councils ALO.

Hea 06 – (EXE Credit) Security of site and building	(+1)			(+1)	A compliant risk-based security rating scheme has been used and confirmed by independent assessment and verification.	This would require formal certification against a scheme such as Secured by Design/SABRE, which would involve tenant engagement.
Hea 07 – Safe access	NA			1	Dedicated safe cycle and pedestrian access provision within the site to building entrance. Vehicle delivery and drop off area not accessed through general parking areas and does not cross pedestrian/cycle paths.	Not Relevant.
Hea 07 – Outside space	1	1			Provision of outside landscaped space as an external amenity area, including appropriate seating.	Outside amenity space is generally available in the locality.
Energy						
Ene 01 – Energy performance	9	0		0	BRUKL calculations must be undertaken in DSM modelling to inform the results.	The assessment of the D2 / A 1-5 uses as a shell only building prevents maximum credits from being achieved under Ene 01. See attached BRUKL calcs in the Energy Statement for details.
Ene 01 – Prediction of operational energy consumption	4			4	Undertake additional energy modelling during the design and post-construction stage to generate predicted operational energy consumption figures. Requires minimum 7 different energy modelling scenarios, including weather data. Report predicted energy consumption targets by end use, design assumptions and input data.	As unregulated power associated with the development will be the responsibility of the future operators, it is not possible to pursue these credits.

					Carry out a risk assessment to highlight any significant design, technical, and process risks that should be monitored and managed throughout the construction and commissioning process.	
Ene 01 – (EXE Credit 1) Beyond zero net regulated carbon	(+2)			(+2)	Building achieves zero net regulated carbon.	Not possible to achieve a Net Zero Building.
Ene 01 – (EXE Credit 2) Carbon negative	(+3)			(+3)	Building is deemed carbon negative.	Not possible to achieve a Carbon Negative Building.
Ene 02 – Sub-metering of major energy consuming systems	1	N/A			All major energy consuming systems separately metered and monitored using a BMS (or with pulsed output to enable connection to future BMS). -	-
Ene 02 – Sub-metering of high energy load and tenancy areas	1	N/A			Separate sub-metering of tenanted areas or relevant function areas.	-
Ene 03 – External lighting	1	1			For installation of energy-efficient light fittings and relevant daylight controls for external lighting.	There will be limited external lighting. Daylight controls can be included on the external lighting and will be highly efficient LED lighting.
Ene 04 – Passive design analysis	1			1	Carry out a passive design analysis, including thermal comfort modelling to achieve credit Hea 04, at RIBA Stage 2 and design incorporates measures to reduce energy demand in accordance with analysis.	Basic passive design analysis has been undertaken in the energy assessment which supports the planning application. The assessment also considers criterion 3 checks, although formal thermal comfort analysis has not been progressed using CIBSE TM59.

Ene 04 – Free cooling	1			1	Include a free cooling analysis in passive design analysis and identify opportunities to implement free cooling solutions.	This is not expected to be possible.
Ene 04 – Low zero carbon feasibility study	1	1			Carry out low and zero carbon (LZC) feasibility study at RIBA Stage 2 and design incorporates recommended LZC technology.	An LZC study has not been undertaken in support of the application and there is no requirement to submit this through validation. An energy statement has been produced. This will be developed further at detailed design stage, however a series of concepts have been analysed for the planning application. The credit can be awarded.
Ene 05 – Energy efficient cold storage	N/A				Design, install and commission the refrigeration system and demonstrate a saving in indirect greenhouse gas emissions from installed system.	This is not relevant for the BREEAM assessment of a speculative development.
Ene 06 – Energy consumption	N/A				Analyse the transportation demand and usage patterns for the building, calculate the energy consumption in accordance with BS EN ISO 25745 Part 2 or 3.	This is not relevant for the BREEAM assessment of a speculative development.
Ene 06 – Energy efficient features	N/A				Specify three energy efficient features for each list – standby condition, lift car lighting of >70 luminaire lumens per circuit Watt, drive controller capable of variable speed and regenerative drives.	This is not relevant for the BREEAM assessment of a speculative development
Ene 07 – Energy efficient laboratory systems	N/A				Design specification of laboratory to determine performance criteria and install best practice energy efficient measures.	This is not relevant for the BREEAM assessment of this type.

Ene 08 – Energy efficient equipment	N/A				Identify the building's unregulated energy consuming loads and the systems/processes that use a significant proportion of the unregulated energy. Demonstrate reduction in unregulated consumption with energy efficient measures.	This is not relevant for the BREEAM assessment of a speculative development.
Transport						
Tra 01 – Transport assessment and travel plan	2	2			Transport Assessment and preparation of Travel Plan to align with BREEAM requirements.	A Transport assessment & Travel Plan have been prepared.

Tra 02 – Sustainable transport measures	10	5			- Measures available for review: - Accessibility index to be calculated (AI > 4). - Improve AI through liaison with local bus companies. - Provide public transport information. - Provide a dedicated service. - Provide electric car parking spaces for 10% of the vehicles - Set up a car sharing group and raise awareness of the scheme, including a priority space. - Install cycle storage for 10% of personnel. - Provide showers and lockers for staff.	5 points are available based on... • Travel Plan confirms the site has an AI of >4. • Compliant cycle parking spaces • Access to 3 different local amenities
Water						
Wat 01 – Water consumption	5	N/A			Use the BREEAM Wat 01 calculator to assess the efficiency of the domestic water-consuming components.	This is not relevant for the BREEAM assessment of a speculative development.
Wat 01 – (EXE Credit) Water consumption	1	N/A			1 credit available for up to a 65% improvement in water consumption.	This is not relevant for the BREEAM assessment of a speculative development.
Wat 02 – Water monitoring	1	1*			Specification of water meter with pulsed output on mains water supply to each building.	The commercial units will be separately metered. This will include pulsed water

					Install water sub-meters for all water consuming systems over 10% of the building demand.	meters which have potential to connect into a future tenant BMS system.
Wat 03 – Leak detection system	1		1		Provision of leak detection system capable of detecting major water leak on mains water supply within building and between building and utilities water meter.	A leak detection system installed on the shell works which would pick up leaks from the behind the water board meter to the building boundary. This is possible although would require tenant interfaces.
Wat 03 – Flow control devices	N/A				Installation of flow control devices in the WCs.	This is not relevant for the BREEAM assessment of a speculative development.
Wat 04 – Water efficient equipment	N/A				Identify water demands for the building and ensure that unregulated water demands are minimised.	This is not relevant for the BREEAM assessment of a speculative development.
Materials						
Mat 01 – Superstructure	6	2			Carry out building LCA options appraisal of 2 to 4 significantly different superstructure design options. Use a building LCA tool. Complete each design option and same functional requirements. Integrate LCA options appraisal in wider decision-making. Record in Mat 01/02 Results Submission Tool.	The activities could occur post planning to attain 2 credits.
Mat 01 – Substructure and hard landscaping	1	1			Carry out LCA options appraisal of a combined total of at least 6 significantly different hard landscaping design options.	The activities could occur post planning to attain 1 credits

Mat 01 – (EXE credit 1) Core building services	(+1)			(+1)	Carry out LCA options appraisal for at least 3 significantly different core services.	Not possible based on speculative nature of the building.
Mat 01 – (EXE Credit 2) LCA and LCC alignment	(+1)			(+1)	Achieve Mat 02 credit 1 and 2 and integrate the aligned LCA and LCC options appraisal activity within the wider design decision-making process.	This credit is not targeted.
Mat 01 – (EXE Credit 3) Third party verification	(+1)			(+1)	A suitably qualified third party carries out the building LCAs or produces a report verifying the building LCAs accurately represent the designs under consideration.	This credit is not targeted.
Mat 02 – Specification of products with a recognised environmental product declaration (EPD)					Specify construction products with Environmental Product Declaration (EPD) that achieves a total EPD points score of at least 20.	This requirement will be addressed through future obligations passed to the contractors.
Mat 03 – (Prerequisite) Legally harvested and traded timber	*	*			Minimum requirement for all timber products to be legally sourced.	This requirement will be addressed through future obligations passed to the contractors.
Mat 03 – Enabling sustainable procurement	1	1			Produce a sustainable procurement plan by the design team to guide specification towards sustainable construction products in place before Concept Design. Following the process set out in BS ISO 20400:2017.	This requirement will be addressed through future obligations passed to the contractors.
Mat 03 – Measuring responsible sourcing	3	2			Achieve up to 30% of the points available in the Mat 03 calculation.	This credit will be targeted. The simple building envelope will mean that at least 2

						credit (20%) of the materials will be able to be fully verified with EPD information. This may exclude internal finishes, which are expected to be fitted out by the future tenants.
Mat 03 – (EXE credit) Measuring responsible sourcing	(+1)			(+1)	Achieve >50% points in Mat 03 calculator and include core building services.	This credit is not expected to be possible.
Mat 05 – Designing for durability and resilience	1		1		Protection measures implemented for vulnerable and exposed parts of the building from damage and material degradation.	A durability and resilience study may be undertaken.
Mat 06 – Material efficiency	1		1		At Preparation and Brief and Concept Design set targets and report on opportunities and methods to optimise the use of materials continuing to Developed design, Technical design and Construction.	A BREEAM specific Material Efficiency study has not occurred although this could be revisited at Stage 3
Waste						
Wst 01 – Pre-demolition audit	1	1			Complete a pre-demolition audit of any existing buildings, structures or hard surfaces being considered for demolition.	This could be undertaken by the contractor, albeit that the requirements should be considered from RIBA 2.
Wst 01 – Construction resource efficiency	3	2			Prepare a compliant Resource Management Plan (RMP) and a construction waste resource efficiency benchmark of 6.5 tonnes of construction waste generated per 100m2 GIFA.	Targets will need to be set. This requirement will be addressed through future obligations passed to the contractors. Note higher targets are not possible based on small Nett floor area.

Wst 01 – Diversion of resources from landfill	1	1			Meet the following requirements for diversion from landfill - 80% by volume or 90% by tonnage of demolition waste diverted from landfill 70% by volume or 80% by tonnage of non-hazardous construction waste diverted from landfill.	This requirement will be addressed through future obligations passed to the contractors. 90% diversion rates are expected possible.
Wst 01 – (EXE Credit)	(+1)			(+1)	Non-hazardous construction waste is less than or equal to 1.6m ³ (or 1.9 tonnes) of construction waste generated per 100m ² GIFA. Diversion from landfill – non-hazardous 85%, demolition 85% and excavation 95%.	This credit is not expected to be possible. It is expected that the landfill diversion targets may be achievable however.
Wst 02 – (Prerequisite) Pre-demolition audit		NA			Pre-demolition audit must be completed if demolition occurs on site.	NA
Wst 02 – Project Sustainable aggregate points	1		1		Identify all aggregate uses and types, determine quantity, region aggregate source is located, distance in kilometres and complete BREEAM Wst 02 calculator.	The ability to meet the recycled aggregate credit will be evaluated further. This will depend on the ability to use and process site won material and also source recycled aggregate from the surrounding areas. Given the geographic area, the areas where material can come from is reduced.
Wst 02 – (EXE Credit) Sustainable aggregate points	(+1)			(+1)	The Sustainable Aggregate Points score meets or exceeds >6.	This target is not expected possible.
Wst 03 – Operational waste	1	1			A dedicated central space for storage of recyclable waste, clearly labelled and accessible to building occupants/facilities operators.	Waste storage equipment will be provided by the tenants. Space is given to each tenant at the rear of units for waste storage. This is shown on plans.

Wst 04 – Speculative finishes (offices only)	N/A				Floor and ceiling finishes selected by known occupant, where occupant is not known only installed in show area.	
Wst 05 – Adaptation to climate change	1			1	A systemic risk assessment to identify the impact of expected extreme weather conditions arising from climate change on the building over its life cycle. Develop solutions based on strategy.	A climate change risk assessment is not expected to be relevant to the site.
Wst 05 – (EXE Credit) Responding to climate change	(+1)			(+1)	Holistic approach developed links with certain credits and requirements in Hea 04, Ene 01, Ene 04, Wat 01, Mat 05 and Pol 03.	Some of the credit requirements are not possible to address.
Wst 06 – Design for disassembly and functional adaptability – recommendations	1	1			Carry out and implementation a functional adaptation appraisal to explore the ease of disassembly and the functional adaptation potential of different design scenarios at concept design.	The credit is expected to be possible, however is more relevant for the B2 and gym units, which could be designed to cater for different occupiers in the future. The drive thru is less flexible and suits an A3 use.
Wst 06 – Disassembly and functional adaptability – implementation	1		1		Provide an update, during Technical Design which explains how the recommendations or solutions proposed by Concept Design have been implemented where practical and cost effective.	As above, however not confirmation recommendations will be implemented.
Land Use and Ecology						
LE 01 – Previously occupied land	1	1			Development is on previously occupied land.	The development comprises hardstanding

LE 01 – Contaminated land	1			1	Only achieved if site found to be contaminated and implement appropriate remediation strategy.	It is not envisaged that there will be contamination which requires remediation.
LE 02 – (Prerequisite) Assessment route selection					An assessment route has been determined using BREEAM Ecological Risk Evaluation Checklist. Compliance is monitored against all relevant UK and EU or international legislation relating to the ecology of the site.	The site is currently devoid of landscaping and would qualify as having low ecological value on route 1.
LE 02 – Survey and evaluation (Route 1)	1	1			An appropriate individual is appointed at an early stage to survey and evaluate the ecological baseline of the site and the capability of enhancement.	The site has been surveyed by an SQE and therefore this credit is applicable.
LE 02 – Determining the ecological outcomes of the site	1			1	Consider the ecological outcome for the site following the hierarchy of action and liaising with the representative stakeholders and project team.	This credit has not occurred during concept design and is not deemed appropriate for a site of this nature.
LE 02 – (EXE Credit) Determine the ecological outcomes of the site	(+1)			(+1)	Achieve wider site sustainability-related activities and the potential for the ecosystem including certain criteria in Hea 07, Pol 03 and Pol 05.	The integrated approach to ecological enhancement is not considered appropriate in this case.
LE 03 – (Prerequisite) Identification and understanding the risks and opportunities for the site					Client or contractor confirms compliance is monitored against all relevant UK and EU legislation relating to the ecology of the site.	

LE 03 – Planning, liaison, implementation and data	1	1			Roles and responsibilities have been clearly defined and site preparation and construction works planned at an early stage to optimise benefits and outputs.	Route 1.
LE 03 – Managing negative impacts of the project	2	1			Negative impacts from site preparation and construction works have been managed according to the hierarchy and either no overall loss of ecological value occurred (2 credits) OR the loss of ecological value has been limited as far as possible (1 credit).	No loss is expected.
LE 04 – (Prerequisite) Identification and understanding the risks and opportunities for the project					Confirms EU and UK legislation and roles and responsibilities have been allocated and site preparation and construction works have been planned for and implemented at an early stage.	
LE 04 – Liaison, implementation and data collection	1			1	Solutions and measures implemented in a way that enhances ecological value on site, and where not feasible off site within the zone of influence.	Not possible.
LE 04 – Enhancement of ecology	3	1			Credits awarded based on calculation of the change in the ecological value occurring as a result of the project.	No net loss.
LE 05 – (Prerequisite) Roles and responsibilities, implementation, statutory obligations					Confirms EU and UK legislation and roles and responsibilities have been allocated and site preparation and construction works have been planned for and implemented at an early stage.	

LE 05 – Planning, liaison, data, monitoring and review management and maintenance	1	1			Project team liaise and collaborate on solutions and measures implemented to monitor and report on the ecological outcomes and successes from the project.	This credit is possible.
LE 05 – Landscape and ecology management plan development	1	1			Landscape and ecology management plan developed in accordance with BS 42020:2013 covering minimum five years after project completion.	This credit is possible.
Pollution						
Pol 01 – No refrigerant use	2				No refrigerant use within the installed plant or systems.	This is not relevant for the BREEAM assessment of a speculative development.
Pol 01 – (Prerequisite)	N/A				All systems with electric compressors comply with BS EN 378:2016 parts 2 and 3. Refrigeration systems containing ammonia comply with the Institute of Refrigeration Ammonia Refrigeration Systems code of practice.	This is not relevant for the BREEAM assessment of a speculative development.
Pol 01 – Impact of refrigerant	N/A				Systems using refrigerants have a DELC of < 100 (2 credits) or 1000 (1 credit) kgCO ₂ eq/kW cooling and heating capacity.	This is not relevant for the BREEAM assessment of a speculative development.
Pol 01 – Leak detection	N/A				All systems are hermetically sealed or only use environmentally benign refrigerants OR where not hermetically sealed an automated refrigerant leak detection system installed.	This is not relevant for the BREEAM assessment of a speculative development.
Pol 02 – Local air quality	N/A				All heating and hot water supplied by non-combustion systems OR emissions from	This is not relevant for the BREEAM assessment of a speculative development.

					combustion plant that provide heating and hot water do not exceed.	
Pol 03 – (Prerequisite)		A			An appropriate consultant is appointed to carry out and demonstrate the development's compliance.	An FRA has been undertaken for planning purposes.
Pol 03 – Flood resilience	2	1			A site-specific FRA is undertaken confirming the development's flood zone.	See FRA.
Pol 03 – Surface water run-off	2	1			Drainage measures specified to achieve peak rate of run-off from site no greater post development than pre-development (including allowance for climate change), flooding will not occur in event of local drainage system failure, and post development run-off volume no greater than pre-development.	Surface water run-off will be restricted to the existing run off rate, minus 30% for storm event up to a 1 in 100 + 40% climate change/uncertainty
Pol 03 – Minimising watercourse pollution	1			1	Specification of suitable SUDs systems, including water pollution prevention measures where relevant.	This credit is not possible as it will not be possible to retain 5mm on site before being discharged.
Pol 04 – Reduction of night time light pollution	1	1			External lighting designed in compliance with Table 1 and accompanying notes of ILE Guidance Note for reduction of obtrusive light. Safety and security lighting complies with lower levels in ILE guidance when operating between 2300hrs and 0700hrs. Illuminated advertisements, where specified, must be designed in compliance with ILP PLG 05 The Brightness of Illuminated Advertisements.	The new external lighting will be designed in compliance with this. Tenant lighting would be subject to separate advertising consent.

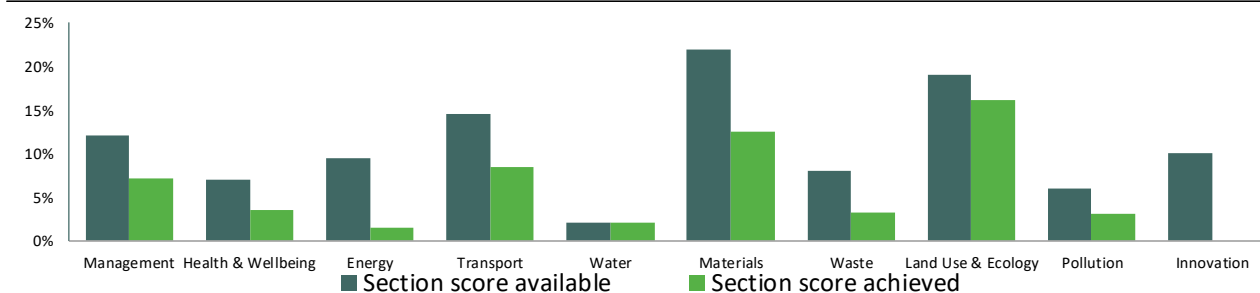
Pol 05 – Reduction of noise pollution	NA				Completion of a noise impact assessment and noise levels of proposed site/building is no greater than +5db during the day and +3dB at night compared to background noise levels (or appropriate measures are installed to attenuate the noise).	NA
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Summary Scores

Overall Building Performance

Building name	Dukesbridge House (D2 Use)
BREEAM rating	Very Good
Total Score	57.40%
Min. standards level achieved	Very Good level

Building Performance by Environment Section

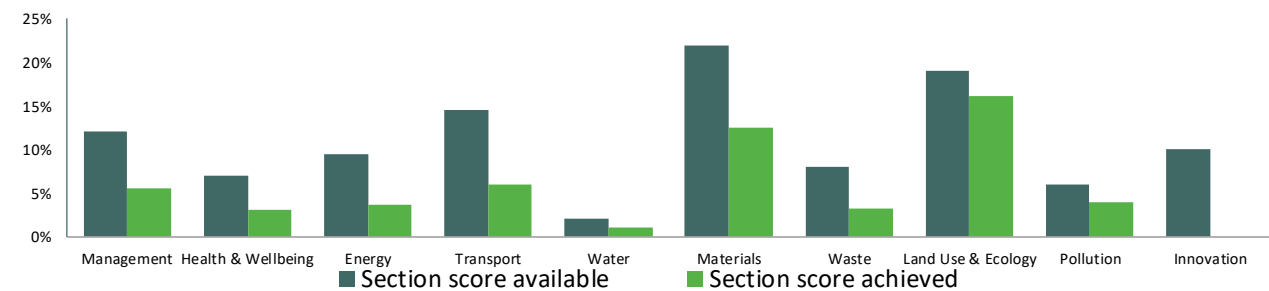


Environmental Section	No. credits available	No. credits Achieved	% credits achieved	Section Weighting	Section Score
Management	15	9	60.00%	12.00%	7.20%
Health & Wellbeing	6	3	50.00%	7.00%	3.50%
Energy	13	2	15.38%	9.50%	1.46%
Transport	12	7	58.33%	14.50%	8.45%
Water	2	2	100.00%	2.00%	2.00%
Materials	14	8	57.14%	22.00%	12.57%
Waste	10	4	40.00%	8.00%	3.20%
Land Use & Ecology	13	11	84.62%	19.00%	16.07%
Pollution	6	3	50.00%	6.00%	3.00%
Innovation	10	0	0.00%	10.00%	0.00%

Overall Building Performance

Building name	Dukesbridge House - A1-A5
BREEAM rating	Very Good
Total Score	55.10%
Min. standards level achieved	Very Good level

Building Performance by Environment Section



Environmental Section	No. credits available	No. credits Achieved	% credits achieved	Section Weighting	Section Score
Management	15	7	46.67%	12.00%	5.60%
Health & Wellbeing	7	3	42.86%	7.00%	3.00%
Energy	13	5	38.46%	9.50%	3.65%
Transport	12	5	41.67%	14.50%	6.04%
Water	2	1	50.00%	2.00%	1.00%
Materials	14	8	57.14%	22.00%	12.57%
Waste	10	4	40.00%	8.00%	3.20%
Land Use & Ecology	13	11	84.62%	19.00%	16.07%
Pollution	6	4	66.67%	6.00%	4.00%
Innovation	10	0	0.00%	10.00%	0.00%

2 BREEAM CONCLUSION

- 2.1 Envision has been appointed by Lipman Properties Ltd (the applicant) to undertake a BREEAM review and prepare a BREEAM predictive assessment for the planning application.
- 2.2 Policy CC2 of the adopted Local Plan relates to Sustainable Construction Standards requires “All minor non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM ‘Very Good’ standard as a minimum”.
- 2.3 A predictive BREEAM Assessment has been undertaken for each use. This concludes that the development could align with a high BREEAM Very Good rating, albeit that the formally certifying separate uses against the BREEAM standard is not considered appropriate due to the additional administration expenses.
- 2.4 A BREEAM Very Good against the shell only criteria should therefore be a requirement of the D2 unit, with the principles of BREEAM applied to all areas.

APPENDIX V – BRUKLS FOR SCHEME

Project name

Shell and Core

Dukesbridge A1 & A3 Units (Be-Lean)

As designed

Date: Wed Jul 01 13:58:37 2020

Administrative information

Building Details

Address: Dukesbridge House, Reading,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Envision

Telephone number: 02074860680

Address: 24 Charlotte Street, London, W1T 2ND

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	44.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	44.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	33.2
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 fixed building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.17	0.17	UGF A1 - A1 WC_P_6
Floor	0.25	0.12	0.12	UGF A3 - A3 WC_F_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.3	1.3	UGF A1 - A1 Shop Floor_G_8
Personnel doors	2.2	-	-	"No external personnel doors"
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 -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	4

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- BOH (Be-Lean)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- Be-Lean Split

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.24	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Instantaneous DHW (Be-Lean)

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

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	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
UGF A1 - A1 WC		0.4	-	-	-	-	-	-	-	-	-	N/A
UGF A3 - A3 WC		0.4	-	-	-	-	-	-	-	-	-	N/A
UGF A1 - A1 Shop Floor		-	-	-	1.4	-	-	-	-	-	0.73	0.5
UGF A3 - A3 Customer Seating		-	-	-	1.4	-	-	-	-	-	0.73	0.5
LGF A3 - A1		-	-	-	1.4	-	-	-	-	-	0.73	0.5
LGF A3 - Prep		-	-	-	1.4	-	-	-	-	-	0.73	0.5
LGF A3 - A3 Customer Seating		-	-	-	1.4	-	-	-	-	-	0.73	0.5

Shell and core configuration

Zone	Assumed shell?
UGF A1 - A1 Store	NO

Shell and core configuration

Zone	Assumed shell?
LGF A3 - A3 Circulation	NO
UGF A1 - A1 WC	NO
UGF A3 - A3 WC	NO
UGF A1 - A1 Shop Floor	NO
UGF A1 - A1 Office	NO
UGF A3 - A3 Customer Seating	NO
LGF A3 - A1	NO
LGF A3 - Prep	NO
LGF A3 - A3 Customer Seating	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
UGF A1 - A1 Store	100	-	-	17
LGF A3 - A3 Circulation	-	100	-	18
UGF A1 - A1 WC	-	100	-	37
UGF A3 - A3 WC	-	100	-	42
UGF A1 - A1 Shop Floor	-	100	100	905
UGF A1 - A1 Office	100	-	-	66
UGF A3 - A3 Customer Seating	-	100	100	114
LGF A3 - A1	-	100	100	224
LGF A3 - Prep	-	100	-	51
LGF A3 - A3 Customer Seating	-	100	100	39

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?
UGF A1 - A1 Shop Floor	NO (-28.3%)	NO
UGF A1 - A1 Office	N/A	N/A
UGF A3 - A3 Customer Seating	NO (-70.4%)	NO
LGF A3 - A1	NO (-69.8%)	NO
LGF A3 - Prep	N/A	N/A
LGF A3 - A3 Customer Seating	NO (-59.3%)	NO

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

Separate submission

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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	214.7	214.7
External area [m ²]	447	447
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	4	5
Average conductance [W/K]	133.16	293.66
Average U-value [W/m ² K]	0.3	0.66
Alpha value* [%]	29.06	18.85

* 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 Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: 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	15.33	27.4
Cooling	9.35	19.99
Auxiliary	7.05	3.99
Lighting	25.72	36.24
Hot water	37.13	39.08
Equipment*	31.97	31.97
TOTAL **	94.57	126.7

* Energy used by equipment does not count towards the total for consumption or 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	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	240.09	384.94
Primary energy* [kWh/m ²]	193.3	261.37
Total emissions [kg/m ²]	33.2	44.8

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

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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] No Heating or Cooling										
	Actual	193.4	6.8	0	0	0	0	0	0	0
	Notional	217.4	146.5	0	0	0	0	----	----	----
[ST] Other local room heater - fanned, [HS] Room heater, [HFT] Natural Gas, [CFT] Natural Gas										
	Actual	208.8	14.6	79.7	0	10.4	0.73	0	0.91	0
	Notional	285.4	177.9	96.8	0	8.8	0.82	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	38.6	207.1	12.6	11	7.6	0.85	5.21	0.91	7.34
	Notional	75.9	306.1	25.7	23.6	4.1	0.82	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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.17	UGF A1 - A1 WC_P_6
Floor	0.2	0.12	UGF A3 - A3 WC_F_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.3	UGF A1 - A1 Shop Floor_G_8
Personnel doors	1.5	-	"No external personnel doors"
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-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-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	4

Project name

Shell and Core

Dukesbridge D2 (Be-Lean)

As designed

Date: Wed Jul 01 14:10:59 2020

Administrative information

Building Details

Address: Dukesbridge House, Reading,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Envision

Telephone number: 02074860680

Address: 24 Charlotte Street, London, W1T 2ND

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	116.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	116.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	114.4
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 fixed building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.17	0.17	D2 Gym - WC Block_W_5
Floor	0.25	0.12	0.12	D2 Gym - WC Block_S_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.3	1.3	D2 Gym - Gym Floor_G_12
Personnel doors	2.2	-	-	"No external personnel doors"
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 -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	4

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- BOH (Be-Lean)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- Be-Lean Split

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.24	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- D2 DHW (Be-Lean)

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.001
Standard value	0.8	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	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
D2 Gym - WC Block		-	-	0.4	-	-	-	-	-	-	-	N/A
D2 Gym - Office		-	-	-	1.4	-	-	-	-	-	0.73	0.5
D2 Gym - Gym Floor		-	-	-	1.4	-	-	-	-	-	0.73	0.5
D2 Gym - Changing Block 1		-	-	-	1.4	-	-	-	-	-	0.73	0.5
D2 Gym - Staff		-	-	-	1.4	-	-	-	-	-	0.73	0.5

Shell and core configuration

Zone	Assumed shell?
D2 Gym - BOH & Store	NO
D2 Gym - WC Block	NO
D2 Gym - Office	NO
D2 Gym - Gym Floor	NO

Shell and core configuration

Zone	Assumed shell?
D2 Gym - Changing Block 1	NO
D2 Gym - Staff	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
D2 Gym - BOH & Store		-	100	-	65
D2 Gym - WC Block		-	100	-	42
D2 Gym - Office		100	-	-	67
D2 Gym - Gym Floor		-	100	-	436
D2 Gym - Changing Block 1		-	100	-	42
D2 Gym - Staff		100	-	-	67

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?
D2 Gym - BOH & Store	N/A	N/A
D2 Gym - Office	N/A	N/A
D2 Gym - Gym Floor	NO (-53.2%)	NO
D2 Gym - Changing Block 1	N/A	N/A
D2 Gym - Staff	N/A	N/A

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

Separate submission

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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	262.1	262.1
External area [m ²]	458.2	458.2
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	4	3
Average conductance [W/K]	68.29	135.82
Average U-value [W/m ² K]	0.15	0.3
Alpha value* [%]	25.69	13.58

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

Building Use

% Area Building Type

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 Institutions: Hospitals and Care Homes
C2 Residential Institutions: Residential schools
C2 Residential Institutions: Universities and colleges
C2A Secure Residential Institutions
Residential spaces
D1 Non-residential Institutions: Community/Day Centre
D1 Non-residential Institutions: Libraries, Museums, and Galleries
D1 Non-residential Institutions: Education
D1 Non-residential Institutions: Primary Health Care Building
D1 Non-residential Institutions: Crown and County Courts
100 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	5.66	12.85
Cooling	12.11	11.2
Auxiliary	28.5	18.13
Lighting	12.88	19.09
Hot water	395.27	413.02
Equipment*	77.25	77.25
TOTAL **	454.44	474.29

* Energy used by equipment does not count towards the total for consumption or 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	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	277.15	243.21
Primary energy* [kWh/m ²]	653.39	664.51
Total emissions [kg/m ²]	114.4	116.5

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

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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] No Heating or Cooling										
	Actual	418.9	67.4	0	0	0	0	0	0	0
	Notional	580.8	210.1	0	0	0	0	----	----	----
[ST] Other local room heater - fanned, [HS] Room heater, [HFT] Natural Gas, [CFT] Natural Gas										
	Actual	167.2	30.6	63.8	0	15.1	0.73	0	0.91	0
	Notional	288.4	192.2	97.8	0	20.8	0.82	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	11.1	253.8	3.6	13.5	31.2	0.85	5.21	0.91	7.34
	Notional	30.2	162.2	10.2	12.5	19.4	0.82	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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.17	D2 Gym - WC Block_W_5
Floor	0.2	0.12	D2 Gym - WC Block_S_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.3	D2 Gym - Gym Floor_G_12
Personnel doors	1.5	-	"No external personnel doors"
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-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-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	4

Project name

Shell and Core

Dukesbridge A1 & A3 Units (Be-Green)

As designed

Date: Wed Jul 01 14:22:05 2020

Administrative information

Building Details

Address: Dukesbridge House, Reading,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Envision

Telephone number: 02074860680

Address: 24 Charlotte Street, London, W1T 2ND

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	48.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	48.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	42.6
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 fixed building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.17	0.17	UGF A1 - A1 WC_P_6
Floor	0.25	0.12	0.12	UGF A3 - A3 WC_F_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.3	1.3	UGF A1 - A1 Shop Floor_G_8
Personnel doors	2.2	-	-	"No external personnel doors"
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 -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * 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	4

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- BOH (Be-Green)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- Be-Green Split

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.92	3.24	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* 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- Instantaneous DHW (Be-Green)

	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		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
UGF A1 - A1 WC	0.4	-	-	-	-	-	-	-	-	-	-	N/A
UGF A3 - A3 WC	0.4	-	-	-	-	-	-	-	-	-	-	N/A
UGF A1 - A1 Shop Floor	-	-	-	1.4	-	-	-	-	-	0.73	0.5	
UGF A3 - A3 Customer Seating	-	-	-	1.4	-	-	-	-	-	0.73	0.5	
LGF A3 - A1	-	-	-	1.4	-	-	-	-	-	0.73	0.5	
LGF A3 - Prep	-	-	-	1.4	-	-	-	-	-	0.73	0.5	
LGF A3 - A3 Customer Seating	-	-	-	1.4	-	-	-	-	-	0.73	0.5	

Shell and core configuration

Zone	Assumed shell?
UGF A1 - A1 Store	NO
LGF A3 - A3 Circulation	NO

Shell and core configuration

Zone	Assumed shell?
UGF A1 - A1 WC	NO
UGF A3 - A3 WC	NO
UGF A1 - A1 Shop Floor	NO
UGF A1 - A1 Office	NO
UGF A3 - A3 Customer Seating	NO
LGF A3 - A1	NO
LGF A3 - Prep	NO
LGF A3 - A3 Customer Seating	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
		60	60	22	
UGF A1 - A1 Store		100	-	-	17
LGF A3 - A3 Circulation		-	100	-	18
UGF A1 - A1 WC		-	100	-	37
UGF A3 - A3 WC		-	100	-	42
UGF A1 - A1 Shop Floor		-	100	100	905
UGF A1 - A1 Office		100	-	-	66
UGF A3 - A3 Customer Seating		-	100	100	114
LGF A3 - A1		-	100	100	224
LGF A3 - Prep		-	100	-	51
LGF A3 - A3 Customer Seating		-	100	100	39

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?
UGF A1 - A1 Shop Floor	NO (-28.3%)	NO
UGF A1 - A1 Office	N/A	N/A
UGF A3 - A3 Customer Seating	NO (-70.4%)	NO
LGF A3 - A1	NO (-69.8%)	NO
LGF A3 - Prep	N/A	N/A
LGF A3 - A3 Customer Seating	NO (-59.3%)	NO

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

Separate submission

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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	214.7	214.7
External area [m ²]	447	447
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	4	5
Average conductance [W/K]	133.16	293.66
Average U-value [W/m ² K]	0.3	0.66
Alpha value* [%]	29.06	18.85

* 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 Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: 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	6.19	12.96
Cooling	9.35	19.99
Auxiliary	7.05	3.99
Lighting	25.72	36.24
Hot water	33.78	39.08
Equipment*	31.97	31.97
TOTAL **	82.08	112.26

* Energy used by equipment does not count towards the total for consumption or 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	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	240.09	384.94
Primary energy* [kWh/m ²]	251.99	251.41
Total emissions [kg/m ²]	42.6	48.4

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

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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] No Heating or Cooling										
	Actual	193.4	6.8	0	0	0	0	0	0	0
	Notional	217.4	146.5	0	0	0	0	----	----	----
[ST] Other local room heater - fanned, [HS] Room heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	208.8	14.6	72.5	0	10.2	0.8	0	1	0
	Notional	285.4	177.9	96.8	0	8.8	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	38.6	207.1	2.3	11	7.6	4.59	5.21	4.92	7.34
	Notional	75.9	306.1	8.7	23.6	4.1	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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.17	UGF A1 - A1 WC_P_6
Floor	0.2	0.12	UGF A3 - A3 WC_F_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.3	UGF A1 - A1 Shop Floor_G_8
Personnel doors	1.5	-	"No external personnel doors"
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-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-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	4

Project name

Shell and Core

Dukesbridge D2 (Be-Green)

As designed

Date: Wed Jul 01 14:25:52 2020

Administrative information

Building Details

Address: Dukesbridge House, Reading,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.1

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.0

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Envision

Telephone number: 02074860680

Address: 24 Charlotte Street, London, W1T 2ND

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	97.7
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	97.7
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	95.9
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 fixed building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.17	0.17	D2 Gym - WC Block_W_5
Floor	0.25	0.12	0.12	D2 Gym - WC Block_S_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.3	1.3	D2 Gym - Gym Floor_G_12
Personnel doors	2.2	-	-	"No external personnel doors"
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 -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* 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	4

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- BOH (Be-Green)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- Be-Green Split

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.92	3.24	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* 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- D2 DHW (Be-Green)

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2.8	0.001
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

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	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
D2 Gym - WC Block		-	-	0.4	-	-	-	-	-	-	-	N/A
D2 Gym - Office		-	-	-	1.4	-	-	-	-	-	0.73	0.5
D2 Gym - Gym Floor		-	-	-	1.4	-	-	-	-	-	0.73	0.5
D2 Gym - Changing Block 1		-	-	-	1.4	-	-	-	-	-	0.73	0.5
D2 Gym - Staff		-	-	-	1.4	-	-	-	-	-	0.73	0.5

Shell and core configuration

Zone	Assumed shell?
D2 Gym - BOH & Store	NO
D2 Gym - WC Block	NO
D2 Gym - Office	NO

Shell and core configuration

Zone	Assumed shell?
D2 Gym - Gym Floor	NO
D2 Gym - Changing Block 1	NO
D2 Gym - Staff	NO

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
D2 Gym - BOH & Store		-	100	-	65
D2 Gym - WC Block		-	100	-	42
D2 Gym - Office		100	-	-	67
D2 Gym - Gym Floor		-	100	-	436
D2 Gym - Changing Block 1		-	100	-	42
D2 Gym - Staff		100	-	-	67

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?
D2 Gym - BOH & Store	N/A	N/A
D2 Gym - Office	N/A	N/A
D2 Gym - Gym Floor	NO (-53.2%)	NO
D2 Gym - Changing Block 1	N/A	N/A
D2 Gym - Staff	N/A	N/A

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

Separate submission

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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	262.1	262.1
External area [m ²]	458.2	458.2
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	4	3
Average conductance [W/K]	68.29	135.82
Average U-value [W/m ² K]	0.15	0.3
Alpha value* [%]	25.69	13.58

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

Building Use

% Area Building Type

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 Institutions: Hospitals and Care Homes
C2 Residential Institutions: Residential schools
C2 Residential Institutions: Universities and colleges
C2A Secure Residential Institutions
Residential spaces
D1 Non-residential Institutions: Community/Day Centre
D1 Non-residential Institutions: Libraries, Museums, and Galleries
D1 Non-residential Institutions: Education
D1 Non-residential Institutions: Primary Health Care Building
D1 Non-residential Institutions: Crown and County Courts
100 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	2.79	6.78
Cooling	12.11	11.2
Auxiliary	28.5	18.13
Lighting	12.88	19.09
Hot water	128.46	139.2
Equipment*	77.25	77.25
TOTAL **	184.75	194.4

* Energy used by equipment does not count towards the total for consumption or 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	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	277.15	243.21
Primary energy* [kWh/m ²]	567.19	574.91
Total emissions [kg/m ²]	95.9	97.7

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

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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] No Heating or Cooling										
	Actual	418.9	67.4	0	0	0	0	0	0	0
	Notional	580.8	210.1	0	0	0	0	----	----	----
[ST] Other local room heater - fanned, [HS] Room heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	167.2	30.6	58.1	0	15	0.8	0	1	0
	Notional	288.4	192.2	97.8	0	20.8	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	11.1	253.8	0.7	13.5	31.2	4.59	5.21	4.92	7.34
	Notional	30.2	162.2	3.4	12.5	19.4	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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.17	D2 Gym - WC Block_W_5
Floor	0.2	0.12	D2 Gym - WC Block_S_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.3	D2 Gym - Gym Floor_G_12
Personnel doors	1.5	-	"No external personnel doors"
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-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-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	4

APPENDIX VI – TER SAP WORKSHEETS

APPENDIX VII – BE LEAN SAP WORKSHEETS

APPENDIX VIII – BE GREEN SAP WORKSHEETS