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SUSTAINABILITY
ENERGY AND SUSTAINABILITY DOCUMENT

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Audit sheet.

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Contents.

Executive Summary.

This report describes the Energy Strategy and Sustainability Statement for the proposed Guild Living Epsom development, in Epsom.

Figure 1 Proposed Development. (Credit: Marchese Partners)

The development will comprise of the demolition of the existing hospital buildings, accommodation block and associated structures and redevelopment of the site to provide a new care community for older people arranged in two buildings, comprising 267 care residences, 10 care apartments and 28 care suites proving transitional care, together with ancillary communal and support services Use Class C2, 24 key worker units Use Class C3, children's nursery Use Class E, as well as associated back of house and service areas, car and cycle parking, altered vehicular and pedestrian access, landscaping, private amenity space and public open space.

Carbon Dioxide Emissions.

The Epsom and Ewell Borough Council (EEBC) Core Strategy 2007 recognises that all development which takes place in Epsom and Ewell must contribute to addressing climate change. As such, all domestic development should contribute to a sustainable future in Epsom and, all new developments are encouraged to make use of renewable energy.

In addition to the progressively demanding standards for CO_2 emissions set through Building Regulations Part L 2013, the Core Strategy 2007 encourages the use of LZC energy technologies to reduce the total carbon emissions from the development by 10% as part of the aim to reduce pollution and climate change.

In order to demonstrate compliance with Part L 2013, energy modelling has been carried out on the proposed development. Part L 2013 compliant baseline calculations were carried out to establish the regulated carbon dioxide emissions for the development. In order to achieve Guild Living Brand standards, the development will target a 35% reduction over Part L 2013 (using SAP 10 Carbon Factors); and the development will achieve BREEAM 'Very Good', with aspirations of BREEAM 'Excellent'.

These calculations include a number of the following passive and active energy efficiency measures.

The passive measures include the specification of high-performance building fabric including u-values and an air permeability that are significantly beyond the minimum requirements of the Building Regulations.

The active measures include:

- Insulated pipework to reduce circulation losses;
- Highly energy efficient heat recovery ventilation; and
- Low energy lighting.

Research into a possible connection to an existing District Heating Network (DHN) has been looked into via the District Heating Installation Map provided by The Association for Decentralised Energy and found that there are no nearby connections. However, some of the leisure and retail facilities are looking at the potential of connecting to the district heating network for the general hospital, this is being investigated further.

A number of renewable technologies were investigated with the view to be incorporated in the development. Following this investigation, it was decided that a photovoltaic array is the preferred strategy to meet compliance with The Core Strategy 2007 and is proposed for this development.

The assessment showed that a reduction in carbon emissions of 44% over a Part L 2013 compliant development using SAP 10 carbon factors can be achieved. In addition, 26% of the development's energy will come from LZC energy sources.

Sustainability.

Sustainability has been a key design consideration for this development from the onset of the project, and consideration of the impact of design proposals and measures on the sustainable credentials of the development has been made throughout the design development to date and will continue throughout the design and construction process.

Below is a selection of some of the measures that will be incorporated into the scheme:

- Project delivery stakeholders will meet to identify and define roles and responsibilities of each of the key phases of project delivery;
- The contractor will be selected with consideration of their ability to comply with the Considerate Constructors Scheme;
- An Energy Assessment has been carried out in line with the requirements of The Core Strategy 2007;
- Where external lighting is required, energy efficient luminaires will be specified, and they will be automatically controlled for the prevention of operation during daylight hours;
- Any external lighting will be designed to reduce night-time light pollution;
- The site benefits from being within 1 mile of Epsom Town Centre and contains cycle and mobility scooter storage;
- Water consumption will be reduced through the specification of efficient sanitary ware;
- Materials with a low environmental impact will be implemented where feasible;
- Recycled, sustainable and locally sourced materials will be used where possible;
- All timber and timber-based products will be legally harvested and traded; and
- A Resource Plan will be developed to minimise construction waste related to on-site construction and dedicated off-site manufacture / fabrication.

1. Introduction.

The proposed Guild Living Epsom development is situated in the town of Epsom, Surrey. The development is adjacent to Epsom Hospital, with Epsom town centre to the North East.

The development will comprise of the demolition of the existing hospital buildings, accommodation block and associated structures and redevelopment of the site to provide a new care community for older people arranged in two buildings, comprising 267 care residences, 10 care apartments and 28 care suites proving transitional care, together with ancillary communal and support services Use Class C2, 24 key worker units Use Class C3, children's nursery Use Class E, as well as associated back of house and service areas, car and cycle parking, altered vehicular and pedestrian access, landscaping, private amenity space and public open space.

The site is highlighted in Figure 2.

Figure 2 Aerial view of the Proposed Development site. Credit: Google

This Energy and Sustainability Document has been prepared in support of the planning application for the proposed development of Guild Living Epsom, hereafter referred to as the Proposed Development.

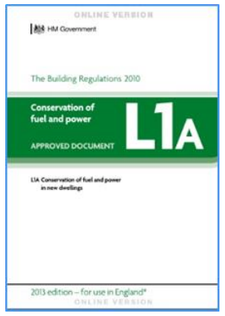
The purpose of this document is to set out the energy strategy and overall sustainability proposals for the Proposed Development. This document provides a summary of the key policies that are applicable to the Proposed Development and an energy strategy commensurate with the current building regulations as well as regional and local planning policies.

2. Policy Requirements & Building Regulations.

The policies and regulations that are required to be satisfied are summarised as follows.

2.1 The Building Regulations

Part L Conservation of Fuel and Power deals with energy efficiency requirements in the Building Regulations. New buildings will be assessed under Approved Document Part L1A (Domestic) and Part L2A (Non-Domestic) of the Building Regulations.

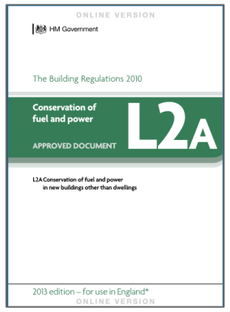


Part L1A 2013 of Building Regulations – New Domestic Elements

On a national level, Part L1A of The Building Regulations sets the energy efficiency requirements in new domestic buildings.

Under Building Regulations Approved Document Part L1A, compliance is achieved by demonstrating that the Dwelling Emission Rate (DER) does not exceed the Target Emission Rate (TER) and that the Dwelling Fabric Efficiency (DFEE) is not worse than the Target Fabric Efficiency (TFEE).

In addition, Part L1A also requires that the fabric elements and the fixed building services all meet minimum energy efficiency standards (Criterion 2), and reasonable provision for limiting solar gain through the building fabric (Criterion 3).

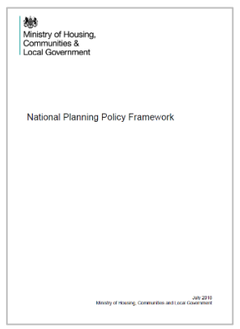


Part L2A 2013 of Building Regulations – New Non-Domestic Elements

On a national level, Part L2A of The Building Regulations sets the energy efficiency requirements in new non-domestic buildings.

Under Building Regulations Approved Document Part L2A: Conservation of Fuel and Power (2013 edition), compliance is achieved by demonstrating that the Building CO_2 Emission Rate (BER) is not worse than the Target CO_2 Emission Rate (TER).

In addition, Part L2A also requires that the fabric elements and the fixed building services all meet minimum energy efficiency standards (Criterion 2), and reasonable provision for limiting solar gain through the building fabric (Criterion 3).



2.2 National Planning Guidance

The National Planning Policy Framework, February 2019

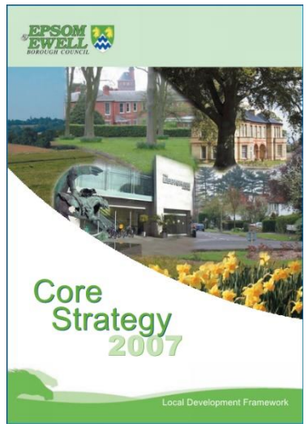
The National Planning Policy Framework (NPPF) was updated in February 2019. The NPPF sets out the Government's strategy on the delivery of sustainable development through the planning system. It provides a framework within which locally prepared plans for housing and other development can be produced.

Planning law requires that applications for planning permission be determined in accordance with the development plan, unless material considerations indicate otherwise. The NPPF must be considered in preparing the development plan and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.

The purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.

The applicable Development Plan for the Proposed Development is The Epsom Core Strategy 2007. Please refer to the following sections for further details.

2.3 Local Planning Guidance



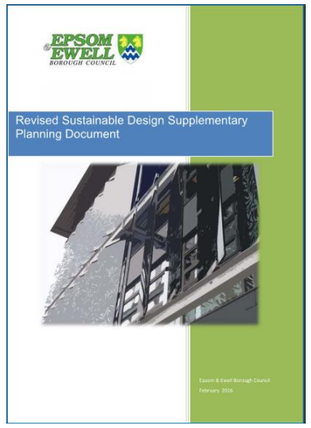
Epsom Core Strategy 2007

The Epsom Core Strategy 2007 is the overarching planning policy document, which forms part of a wider set of local planning policy documents known as the "Epsom and Ewell Borough Council (EEBC) Development Plan".

The Epsom Core Strategy has set out a vision and objectives for the development of Epsom up to 2022, and has been designed to target four broad aims:

- Conserving resources;
- Creating a quality environment and special places;
- Addressing community needs – now and in future; and
- Encouraging a prosperous economy.

Policy CS6 states "Proposals for development should result in a sustainable environment and reduce, or have a neutral impact upon, pollution and climate change. The council will expect proposals to demonstrate how sustainable construction and design can be incorporated to improve the energy efficiency of development – both new build and conversion."



Revised Sustainable Design Guide 2016

The Sustainable Design Guide 2016 is a supplementary planning document which provides detailed information on how planning policy will be implemented, specifically Core Strategy Policy CS6. By following this guidance document, prospective developers can help ensure that their development proposals are genuinely environmentally sustainable.

To demonstrate compliance with Core Strategy Policy CS6, all minor and major development proposals are required to be accompanied by a Sustainability Statement or appropriate BREEAM Assessment.

In order to comply with the Guild Living brand standard, the Retail, Nursery and Multi Residential areas have targeted to achieve BREEAM 'Very Good', with aspirations of 'Excellent'.

Please refer to Appendix E for a full review of the BREEAM Pre-Assessment.

3. Energy Efficiency Measures and Heating Infrastructure.

3.1 Passive Measures

In order to reduce the energy demand of the development, the fabric of the development will be improved significantly beyond the minimum requirements of Criterion 2 of Part L1A and Part L2A 2013. Table 1 shows the typical envelope performance characteristics that will be incorporated into the scheme design to limit the buildings' energy consumption.

Table 1 Element U-Values

Element		Domestic	Non-Domestic
Floor U - Value (W/m²K)		0.13	0.15
Roof U - Value (W/m²K)		0.13	0.15
External Walls U - Value (W/m²K)		0.15	0.18
Walls between heated spaces (W/m²K)		Fully filled cavity with sealed edges	N/A
Glazing Glazed doors	U-value (W/m²K)	1.4	1.40
	Frame type	Metal	Metal
	G-value	0.35	0.35
	Fraction Glazed	0.80	0.90
Air permeability (m³/hm² (@ 50Pa)		3.00	3.00
Thermal Bridge Specification		Accredited psi values	Default

3.2 Active Measures

Energy consumption will be further reduced by the incorporation of active energy efficiency measures in the design of the mechanical and electrical engineering systems. The following energy efficiency measures will be incorporated:

- Insulated pipework to reduce circulation losses;
- Highly energy efficient heat recovery ventilation; and
- Low energy lighting.

3.3 Overheating and Cooling

The Core Strategy 2007 considers planning for and the impacts of climate change. All development should be future proofed and able to recover from extreme weather events such as flooding, drought and heatwaves. Developments should incorporate thermal mass, shading devices and a night-time cooling strategy into building design in order to prevent overheating.

Below are the steps and proposals to demonstrate mitigation against overheating.

1. Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.

   The amount of heat entering the building will be reduced by:

   a. Energy efficient facades with appropriate proportions of glazing;

   b. External shading provided by balconies; and

   c. A glazing shading coefficient carefully selected to minimise solar gain in the summer, but also to maximise solar gain in winter.

2. Minimise internal heat generation through energy efficient design.
    a. Heat generation will be minimised through the specification of energy efficient ventilation systems, insulation on pipework and low energy lighting.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings.
    a. Ceiling heights in the development have been maximised within the constraints of the overall building height and massing.
4. Passive Ventilation
    a. Passive ventilation (openable windows) has been incorporated within the development. In addition, there will be a small amount of natural ventilation through infiltration
5. Mechanical Ventilation
    a. There will be a continuous extract from the kitchens and bathrooms in all units.
6. Active Cooling Systems
    a. No comfort cooling is proposed for the development.

3.4 District Heating Network (DHN)

Research into a possible connection to an existing District Heating Network (DHN) has been looked into via the District Heating Installation Map provided by The Association for Decentralised Energy and found that there are no nearby connections. However, some of the leisure and retail facilities are looking at the potential of connecting to the district heating network for the general hospital, this is being investigated further.

3.5 Proposed Heating Infrastructure

The heating infrastructure for the residential development will be via a direct electric approach. This will provide the heating and hot water loads.

For the non-residential areas, the assisted living suites will have fan coil units for the heating and cooling demand. The café and retail areas have heating and cooling provided by a VRF system, while the restaurant will have communal heating and cooling via an Air Source Heat Pump (ASHP) with MVHR units. The Domestic Hot Water (DHW) demand for the non-domestic spaces is all provided by the ASHP with an electric top-up.

4. Utilise Low and Zero Carbon (LZC) Technologies.

These measures are those which serve to reduce the overall emissions of the development through the inclusion of renewable technologies such as Ground Source Heat Pump (GSHP), Solar Photovoltaics array (PV panels), besides others.

This section addresses the requirements of Policy CS6 which encourages the use of renewable or low carbon energy technologies.

4.1 Appraisal of Renewable Technologies

A number of renewable technologies have been appraised in terms of technical and physical feasibility as potential renewable systems for use on the project.

4.1.1 Solar Photovoltaics

Solar photovoltaic (PV) cells generate electricity from the sun's energy. Solid PV panels can be either roof or façade mounted (although solar modules fitted on a south facing façade have only 75% the output of roof mounted modules).

Solar PV can be seen as an on-site zero carbon energy source as it will produce useable electrical energy without requiring any energy input. Although the output from the panels is unpredictable and weather dependent, the electrical energy produced by Solar PV panels could be used to provide additional carbon emission reductions and are compatible with the use of other energy generating technologies. Once installed they are very low maintenance and will also have a low visual impact at street level. In addition, this development has suitable south facing roof space available.

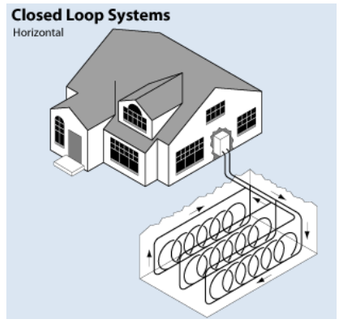
Taking the above into account, solar PV is considered an appropriate technology for this development and will be investigated further.

4.1.2 Solar Water Heating Panels

Solar water heating systems use heat from the sun to heat domestic hot water. The system requires solar panels on the roof, ideally south facing, linked to hot water storage cylinders. For solar water panels to be effective the development should have a high hot water demand.

This development has suitable south facing roof space available and has a high hot water demand due to the nature of the development, which initially makes this technology suitable for this development. However, solar water panels are more suited to individual/ standalone dwellings as the hot water produced through the panels will feed directly into the hot water storage for that particular dwelling. For a development like this, solar water panels would therefore not be suitable. The panels are higher maintenance than PV and they are highly dependent on the weather/season, arguably more so than photovoltaics, leading to unpredictability with the hot water load. In addition, the heat gained from the panels cannot be sold back to the grid and so if the hot water is not used once it has been produced it will eventually be wasted.

Due to the reasons highlighted above, solar water heating panels are therefore not proposed for this development.



4.1.3 Ground Source Heat Pumps

Ground source heat pumps (GSHP) utilise either water extracted from an aquifer (open loop) or water circulated within underground pipework (closed loop) as the heat source in a refrigeration process. This enables them to produce hot water, typically at around 45°C, that can be used as means of space heating in buildings. Due to the relatively constant temperature of the ground at depth (typically 10-14°C in the UK) this produces heat more efficiently in winter than an air source heat pump, and usually with lower carbon emissions than a gas-fired boiler.

Open loop systems require the water extracted to be re-injected into the aquifer at another borehole on another part of the site. A licence from the Environment Agency (EA) is required for both abstraction and discharge although these licences cannot be obtained until a test borehole has been constructed and the appropriate EA tests undertaken.

Since there is no cooling required for the development, there is an unbalanced heating and cooling demand, therefore this technology is not appropriate.

4.1.4 Biomass Boilers

A biomass boiler uses a natural fuel such as wood chips or wood pellets for combustion. Since it uses a natural resource that can be replanted it is considered as a renewable energy source subject to the distance the fuel is transported. The carbon dioxide emitted from burning biomass is balanced by that absorbed during the fuel's production. Biomass heating therefore approaches a carbon neutral process.

The primary disadvantage of a biomass boiler is that it would require a substantial amount of fuel storage for a development of this size, which would make for an inefficient use of space. Further to this, regular deliveries are required to ensure the boiler works as efficiently and continuously as possible and biomass exhaust gases would require significant treatment to avoid degrading local air quality. In addition, the nature of the fuel within the boiler would require regular cleaning which would increase the downtime of the boiler, whilst also effecting air quality through the emissions.

Due to the reasons highlighted above, biomass boilers are therefore not proposed for the development.

4.1.5 Wind Turbines

Wind turbines use the wind's lift forces to turn aerodynamic blades that turn a rotor thus generating electricity. There are three basic types to consider: horizontal axis (propeller type), vertical access (helical type) and building integrated (where the building design is adapted to suit the wind turbine).

Wind turbines have a significant visual impact and the roof space will be sensitive in townscape terms, which is likely to preclude wind turbines. They can create noise and vibration problems. Additionally, there is limited roof area across the site where clean air flows and good wind speeds can be realised which are vital to delivering a useful electrical output. Even if a suitable location could be found, the output of a wind turbine and the consequential carbon dioxide emissions will be very limited when compared to the emissions of the whole development.

Due to the reasons highlighted above, wind turbines are therefore not proposed for the development.

4.1.6 Air Source Heat Pumps

Air source heat pumps absorb heat from the outside air, even if the temperature is as low as -15°C. The air from the outside heats a liquid refrigerant, which is then compressed to increase the temperature. This is then condensed back into a liquid and heat is released. The heat can then be used for heating and hot water systems.

The main benefits of ASHPs are that they can provide both heating and cooling as the heat pump can be operated in reverse, and they are suitable for centralised heat networks. They are easy to install (more so than GSHP) and require very little maintenance once installed. However, this solution would require a large amount of outdoor space to accommodate enough ASHP to provide heating and hot water. This would either be at roof level and impact the overall height or number of floor levels or in the landscaping and would be difficult to conceal. Due to the hydraulic restrictions on pipework runs it is likely that the ASHPs would need to be located in a number of different areas to achieve the required pipework runs. This would also increase the bulk and massing of the development, taking away any space for a proposed PV Array.

The use of ASHPs will also impact on rights of light and outside space for tenants, whilst also being a source of noise.

Taking the above into account, ASHPs will only be considered for certain areas in the scheme, and is not considered an appropriate technology for the whole development.

To summarise, ASHPs will be considered for certain non-domestic spaces such as the restaurant, which will be investigated further. Solar Photovoltaics are considered a suitable technology for this development. Since the Core Strategy encourages LZC energy technologies to reduce the total carbon emissions from the development by 10%, and with other technologies inappropriate due to the reasons highlighted above, these are the only renewable technologies proposed.

After accounting for roof space required for heating and ventilation plant, we have identified space for 1138 sqm of PV panels (approximately 2200 sqm roof space on the taller eight storey roofs of building A and B). This will provide 227.6kWp for the residential units, assuming an efficiency of 0.2 kWp/sqm.

5. Results.

5.1 SAP 2012

With the inclusion of the contribution of ASHP and PV, the estimated reduction in regulated carbon dioxide emissions is approximately 6% below the Part L 2013 compliant baseline scheme for the domestic elements, 0% below the baseline scheme for the non-domestic elements and 4% below the baseline scheme for the site.

Please refer to Appendix A for the SAP DER Worksheets and Appendix B for the BRUKL Output Document.

5.2 SAP 10

It is becoming more widely recognised that energy derived from an electrical power source, will over time, provide a more robust carbon saving due to the decarbonisation of the grid supply. This trend is likely to continue as the carbon factor for electricity continues to reduce.

Grid electricity has significantly decarbonised since the last update of Part L in April 2014. The UK government announced that it will implement the closure of all coal-fired power stations by 2025, this is in line with the increase in renewable power generation.

2017 saw times where low-carbon generation, such as wind, solar and nuclear, generated more energy than coal and gas combined; showing very real progress towards a low-carbon future. In April 2018, Britain went for more than 3 days without the need for coal power and in May 2019 passed a week without the need for this fossil fuel; the first time since 1882.

It is clear that the grid in 2019 is much cleaner than in past years, and so it is therefore a hindrance that our new buildings still utilise the emissions rates of 2014 that give a false position of gas being greener than electricity.

5.2.1 What is a Carbon Factor?

A carbon emission factor (carbon factor) is the average emission rate of a given greenhouse gas for a given source, relative to units of activity.

5.2.2 SAP 10 Carbon Factors

In July 2018 the Government published updated carbon emission factors (SAP 10), demonstrating how the grid is decarbonising.

The table below details the carbon factors for electricity under SAP 2012, SAP 10, Actual (last 3 months) and Actual (last year).

They reflect the general decarbonisation of the grid.

Table 2 Electricity Factors

	Emissions kg CO_{2e} per kWh			
	SAP 2012 (2014)	SAP 10 (July 2018)	Actual (last 3 months)	Actual Last Year (2020)
Electricity	0.519[1]	0.233[2]	0.189[3]	0.169[4]

1: SAP 2012: https://www.bregroup.com/sap/standard-assessment-procedure-sap-2012/
2: SAP 10 (please note this is just the carbon factors not the SAP 10 methodology itself): https://www.bregroup.com/sap/sap10/
3: Britain's Electricity Demand: https://electricinsights.co.uk/#/dashboard?period=3-months&start=2020-11-03&&_k=vlbz4q
4. Britain's Electricity Demand: https://electricinsights.co.uk/#/dashboard?period=1-year&start=2020-01-01&&_k=d0sv9g

This clearly demonstrates that the use of SAP 10 carbon factors is appropriate for current day energy modelling.

5.2.3 SAP 10 Results

The overall predicted reduction in CO_2 emissions from the baseline development model using SAP 10 carbon factors is approximately 54% for the domestic elements and 0% for the non-domestic elements, which represents a total site wide reduction of 44% and an annual saving of approximately 254 tonnes of CO_2 (see Figure 3 below). See Appendix C for the SAP 10 calculation worksheets.

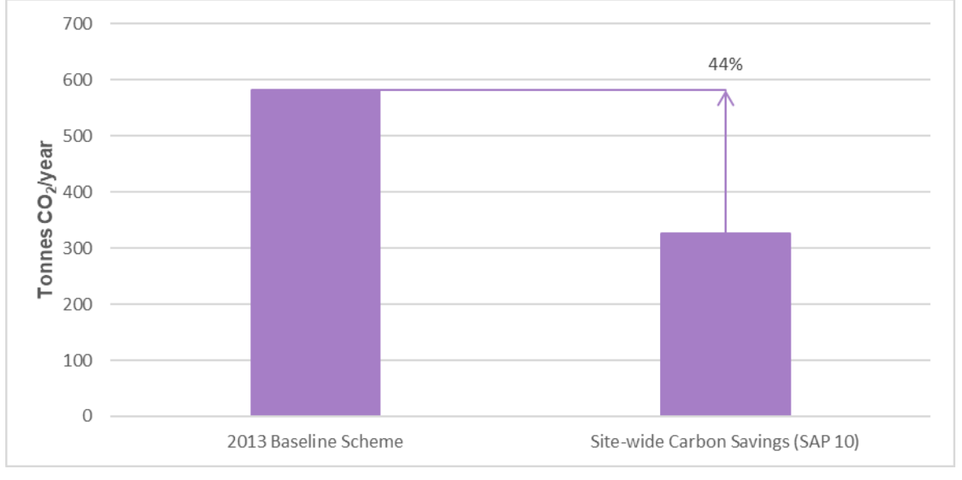


Figure 3 Proposed Development Regulated Carbon Dioxide Emissions (SAP 10 Carbon Factors)

5.3 Site Wide Energy from Low and Zero Carbon (LZC) Energy Sources

The Core Strategy details that The South East Plan encourages larger housing and commercial schemes to provide at least 10% of the development's energy from renewable sources. As a result, this development has implemented ASHP and PV panels throughout the site. Calculations have confirmed that 26% of the development's energy will come from LZC energy sources.

Appendix D shows the calculation of energy from LZC energy sources.

6. Sustainability.

Sustainability has been a key design consideration for this development from the onset of the project and consideration of the impact of design proposals and measures on the sustainable credentials of the development has been made throughout the design development to date and will continue throughout the design and construction process.

The following is a summary of the key sustainability issues that form the overall strategy for the project.

6.1 Environmental Assessments.

Showing a demonstration of the commitment to sustainable design and construction, the Commercial Areas will be designed to achieve a BREEAM New Construction 2018 'Very Good' rating.

The BREEAM UK New Construction scheme is a performance-based assessment method and certification scheme for new buildings.

The primary aim of BREEAM UK New Construction is to mitigate the life cycle impacts of new buildings on the environment in a robust and cost-effective manner. This is achieved through integration and use of the scheme by clients and their project teams at key stages in the design and construction process.

The BREEAM 2018 Pre-Assessment Strategy is included in Appendix E.

6.2 Management.

In order to ensure sustainable management practices are upheld throughout the project programme, efficient management practices will be encouraged in order to ensure sustainability is considered throughout the key stages of design, procurement and initial occupation, from the initial project brief stage to the appropriate provision of aftercare.

Aspects involving integrated design process and robust stakeholder engagement, utilising life cycle costing in order to improve design, and adopting environmentally social and responsible site practices will be made. The team will also be required to ensure properly planned handover and commissioning process are in place which reflect the needs of the building occupants.

6.3 Health and Wellbeing.

The development will be designed in order to maximise the health, wellbeing and safety of the building users. The internal environment will ensure natural daylight is maximised appropriately, and the use of artificial lighting is reduced as far as possible. Internal air quality considerations will also be adopted, ensuring products emitting low VOC emissions are selected throughout the building.

All areas of the buildings' acoustic performance, including plant spaces will be attenuated in order to meet the appropriate standards for this type of building.

Finally, the design will ensure an appropriate level of security to the building users, building and site is implemented.

6.4 Energy.

Measures will be implemented throughout the building design which focus on reduction of carbon emissions and support efficient management throughout the operational phase of the building's life.

A Direct Electric approach is the proposed strategy for the heating and hot water for the development.

An Energy Strategy has been devised in line with The Core Strategy 2007 and has confirmed a direct electric approach has been proposed for the residential areas providing the heating and hot water loads. The non-residential areas (including the assisted living suites) will have fan coil units for the heating and cooling demand. The café and retail areas have heating and cooling provided by a VRF system, while the restaurant will have communal heating and cooling via an Air Source Heat Pump (ASHP) with MVHR units. The Domestic Hot Water (DHW) demand for the non-domestic spaces is all provided by the ASHP with an electric top-up.

Please refer to Sections 3-5 of this report for further details on energy performance.

Further energy efficiency measures will look at ensuring the scheme installs energy sub-metering to facilitate the monitoring of operational energy consumption; specification of energy efficient light fittings for external areas; encourage the specification of energy efficient transportation systems; finally where feasible, encourage installation of energy efficient equipment to ensure optimum performance and energy savings in operation.

6.5 Transport.

A Transport Assessment and Travel Plan have been completed for the scheme assessing the overall impact the Proposed Development and surrounding environment and community.

The development and the travel documents will ensure key principles such as raising awareness, understanding and accessibility of travel options and local amenities, allowing for affordable access to services to the building users are made and promoted throughout the building life cycle. The travel documents have detailed sustainable modes of transport, as well as have worked towards reducing congestion and improving safety on the site and surrounding roads.

The scheme will also look at the inclusion of electric car recharging stations within the site, as well as promote reliance on active travel and work with local authorities to ensure sustainable transport measures, reducing building users' carbon footprint.

The site is located on the grounds of Epsom General Hospital, 1 mile south from Epsom Town Centre. The site provides access to numerous bus stops within 1km of the site, providing access to St Helier Hospital, Morden, Guildford, West Croydon, Little Brookham, Langley Vale, Effingham, Crawley and Leatherhead.

Epsom train station also ensures ongoing access into central London (Bridge, Waterloo, Victoria), Dorking and Guildford.

New and improved secure, covered spaces for bicycles and scooter storage will be installed throughout the site, for the building users and on-going visitors.

6.6 Water.

Sustainable water practices will be incorporated throughout the scheme ensuring the specification of water efficient equipment as well as minimising losses throughout leakage.

The design will ensure the effective management and monitoring of water consumption is made in order to reduce the consumption of potable water. Additionally, leak detection systems and flow control devices will be installed in order to minimise wastage due to water leaks.

All non-potable water usage e.g. Landscaping irrigation will be reduced as far as feasibly possible.

6.7 Materials.

The design and specification of the building will ensure the selection of products with low environmental impact (including embodied carbon) throughout the life cycle. Recycled, sustainable and locally sourced materials will be used where possible.

Initial studies will be taken assessing the durability and resilience of the materials selected, and ensuring appropriate mitigation measures are in place in order to reduce the need to repair and replace these. Additionally, material efficiency measures will be established from the onset of the project programme encouraging the design team to avoid unnecessary materials use arising from over specification without compromising structural stability, durability or the service life of the building.

6.8 Waste.

Waste will be reduced and minimised as far as feasibly possible throughout demolition, construction and lifetime of the building. The final design of the building will look at accommodating and ensuring appropriate waste management practices are adopted and continued by the building user throughout operation.

Aspects including ensuring best practice waste management practices are adopted by the Principal Contractor in order to minimise waste going to landfill. The building will ensure dedicated space is provided in order to accommodate and house operational waste generated. Additionally, the design team will undertake a Climate Change Adaptation Appraisal assessing the potential weather hazards and patterns which could occur within the environment throughout the buildings life cycle, and incorporate mitigation measures in order to minimise the future need of carrying out works.

6.9 Land Use and Ecology

The 'Proposed Development' will be situated on the existing grounds of Epsom General Hospital. The reuse of this land will reduce the environmental impact which would have incurred from using a Greenfield site and this method ensures an environmental health hazards e.g. land contamination are addressed. Additional land benefits which can be drawn upon from this scheme is the lower cost to maintain surrounding infrastructure. The development will be situated on a previously developed site, already accommodating services and highways to access.

The scheme will look at ensuring the existing ecological value of the site is maintained, including surrounding areas, and the opportunities for ecological protection and enhancement are identified and incorporated. All negative ecological impacts resulting from the project will be minimised within the zone of influence. The development will draw upon the advice of local environmental records on improving local biodiversity and incorporating aspects such as wildlife corridors, native floral or plant specifies, thus improving the health, wellbeing of the building occupants, through the provision of recreational space and an increased connection between people and the natural environment (biophilia).

These improvements on Brownfield site, as oppose to Greenfield site, offer greater environmental and social benefits for the surrounding community, as well as long term ecological benefits for the wildlife and biodiversity of the area.

The Principal Contractor will be required to ensure suitable protection measures are in place throughout demolition and construction in order to ensure no negative impact incurs throughout the project programme. Furthermore, the design team will be required to ensure minimal risk and maximised opportunities are identified and implemented within the final design ensuring an improvement in the ecological value of the site.

The developer will ensure a long-term ecological management and maintenance plan is established, informing the facilities management team on the management and maintenance procedures needed to preserve the ecology and landscaping.

6.10 Pollution

The site is located in Flood Zone 1. Figure 4 below shows the Environment Agency flood map, which contains more information on flood zones and flood risk assessments.

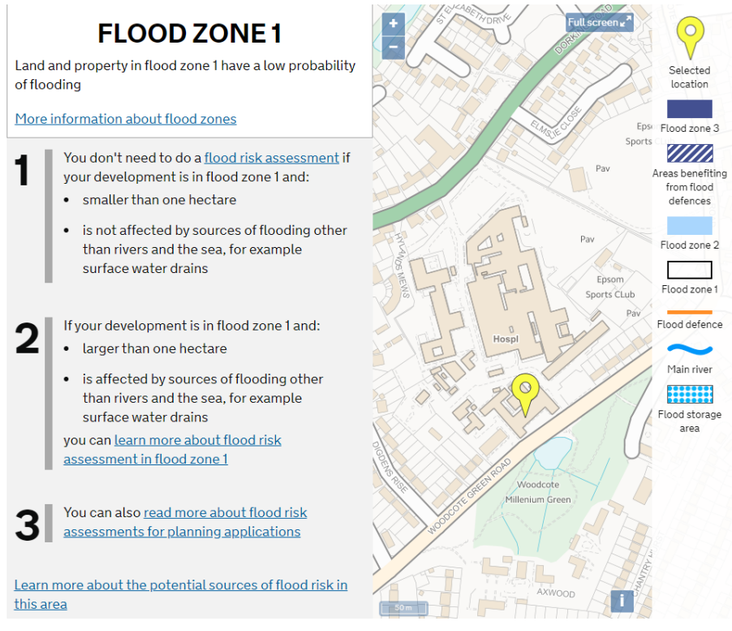


Figure 4 Environment Agency Flood Mapping

The materials used for the landscaping will be selected with consideration of reducing the flood risk. Such materials include permeable paving and other porous finishes. The types of materials and finishes will help promote infiltration into the ground.

Any external lighting provided will be designed with the consideration of reducing night-time light pollution.

7. Conclusion.

An energy assessment has been carried out to show compliance with of The Core Strategy 2007. The assessment showed that a reduction in carbon emissions of 44% over a Part L 2013 compliant development can be achieved. This reduction in carbon dioxide emissions will be achieved through the incorporation of passive and active energy efficiency measures and renewable technologies.

A range of sustainable measures, such as those highlighted below have been incorporated into this development.

- Project delivery stakeholders will meet to identify and define roles and responsibilities of each of the key phases of project delivery;
- The contractor will be selected with consideration of their ability to comply with the Considerate Constructors Scheme;
- An energy assessment has been carried out in line with the requirements of The Core Strategy 2007;
- Where external lighting is required, energy efficient luminaires will be specified, and they will be automatically controlled for the prevention of operation during daylight hours;
- Any external lighting will be designed to reduce night-time light pollution;
- The site benefits from close proximity to Epsom Town Centre and covered cycle and mobile scooter storage;
- Water consumption will be reduced through the specification of efficient sanitary ware;
- Materials with a low environmental impact will be implemented where feasible;
- Recycled, sustainable and locally sourced materials will be used where possible;
- All timber and timber-based products will be legally harvested and traded; and
- A resource plan will be developed to minimise construction waste related to on-site construction and dedicated off-site manufacture / fabrication.

Appendix A: Sample SAP DER Worksheets.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Type 01	**Issued on Date**	12/01/2021
Assessment Reference	V02 Be Green	**Prop Type Ref**	B0 2BS-5
Property			

SAP Rating	78 C	**DER**	28.87	**TER**	27.36
Environmental	80 C	**% DER<TER**	-5.53		
CO_2 Emissions (t/year)	1.58	**DFEE**	54.84	**TFEE**	55.35
General Requirements Compliance	Fail	**% DFEE<TFEE**	0.92		

Assessor Details	Ms. Madeleine Leonard, Madeleine Leonard, Tel: 01202654600, MadeleineLeonard@hoarelea.com	**Assessor ID**	T456-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Ground-floor flat, total floor area 78 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 27.36 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 28.87 kgCO□/m²Fail
Excess emissions =1.51 kgCO□/m² (5.5%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)54.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Electric underfloor heating - Electric
Underfloor heating in thin screed (standard tariff)

Secondary heating system: None

5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.18 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.61
Maximum 1.5 OK
MVHR efficiency: 88%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Very little
Windows facing North East: 7.80 m², No overhang
Windows facing South East: 12.28 m², Overhang width less than twice window, ratio 0.56
Air change rate: 2.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 3.0 m³/m²h
Photovoltaic array 0.79 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.9600 (1b)	x	3.2000 (2b)	=	249.4720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	249.4720	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	74.8000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2886	0.2854	0.2822	0.2663	0.2631	0.2471	0.2471	0.2439	0.2535	0.2631	0.2694	0.2758	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window 1.4 (Uw = 1.40)			20.0800	1.3258	26.6212			(27)
Ground floor			77.9600	0.1300	10.1348			(28a)
External Wall 1	60.2500	20.0800	40.1700	0.1500	6.0255			(29a)
Total net area of external elements Aum(A, m2)			138.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7815			(33)
to Corridor			8.3300	0.0000	0.0000			(32)
Party Wall			52.3600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	251.6500	(35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.4462	(36)	
Total fabric heat loss	(33) + (36) =	57.2277	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.7561	23.4937	23.2313	21.9192	21.6568	20.3448	20.3448	20.0823	20.8696	21.6568	22.1816	22.7065	(38)
Heat transfer coeff	80.9838	80.7214	80.4590	79.1469	78.8845	77.5725	77.5725	77.3101	78.0973	78.8845	79.4094	79.9342	(39)
Average = Sum(39)m / 12 =												79.0813	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0388	1.0354	1.0321	1.0152	1.0119	0.9950	0.9950	0.9917	1.0018	1.0119	1.0186	1.0253	(40)
HLP (average)												1.0144	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4230	(42)
Average daily hot water use (litres/day)	96.5753	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.2329	102.3699	98.5069	94.6438	90.7808	86.9178	86.9178	90.7808	94.6438	98.5069	102.3699	106.2329	(44)
Energy conte	157.5403	137.7857	142.1825	123.9582	118.9408	102.6369	95.1082	109.1380	110.4415	128.7089	140.4958	152.5694	(45)
Energy content (annual)										Total = Sum(45)m =		1519.5062	(45)
Distribution loss (46)m = 0.15 x (45)m	23.6310	20.6679	21.3274	18.5937	17.8411	15.3955	14.2662	16.3707	16.5662	19.3063	21.0744	22.8854	(46)
Water storage loss:													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1800	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7080	(55)
Total storage loss													
	21.9480	19.8240	21.9480	21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	(56)
If cylinder contains dedicated solar storage													
	21.9480	19.8240	21.9480	21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	179.4883	157.6097	164.1305	145.1982	140.8888	123.8769	117.0562	131.0860	131.6815	150.6569	161.7358	174.5174	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	179.4883	157.6097	164.1305	145.1982	140.8888	123.8769	117.0562	131.0860	131.6815	150.6569	161.7358	174.5174	(64)
								Total per year (kWh/year) = Sum(64)m =				1777.9262	(64)
Heat gains from water heating, kWh/month													
	69.9405	61.6730	64.8341	58.2081	57.1062	51.1188	49.1819	53.8468	53.7138	60.3541	63.7069	68.2877	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.1785	17.0342	13.8531	10.4877	7.8397	6.6186	7.1516	9.2959	12.4770	15.8424	18.4904	19.7115	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1242	217.3565	211.7311	199.7554	184.6382	170.4301	160.9383	158.7060	164.3313	176.3071	191.4243	205.6323	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	(71)
Water heating gains (Table 5)													
	94.0061	91.7752	87.1426	80.8446	76.7557	70.9983	66.1047	72.3747	74.6025	81.1211	88.4817	91.7846	(72)
Total internal gains													
	387.6540	385.5111	372.0720	350.4329	328.5787	307.3922	293.5398	299.7218	310.7560	332.6158	357.7417	376.4736	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.8000	11.2829	0.3500	0.8000	0.7700	17.0769	(75)
Southeast	12.2800	36.7938	0.3500	0.8000	0.7700	87.6728	(77)

Solar gains	104.7496	184.0996	266.9596	356.0297	421.8333	428.9220	409.3071	358.6645	297.5610	207.5316	126.4989	88.9754	(83)
Total gains	492.4036	569.6107	639.0317	706.4625	750.4121	736.3142	702.8469	658.3864	608.3170	540.1474	484.2405	465.4490	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.2927	67.5115	67.7316	68.8545	69.0835	70.2520	70.2520	70.4905	69.7799	69.0835	68.6269	68.1763	
alpha	5.4862	5.5008	5.5154	5.5903	5.6056	5.6835	5.6835	5.6994	5.6520	5.6056	5.5751	5.5451	
util living area													
	0.9975	0.9940	0.9833	0.9447	0.8388	0.6491	0.4815	0.5326	0.7938	0.9650	0.9943	0.9982	(86)
MIT	20.1605	20.2774	20.4564	20.6839	20.8555	20.9350	20.9495	20.9477	20.9002	20.6757	20.3783	20.1433	(87)
Th 2	20.0511	20.0539	20.0567	20.0707	20.0735	20.0875	20.0875	20.0903	20.0819	20.0735	20.0679	20.0623	(88)
util rest of house													
	0.9967	0.9920	0.9776	0.9257	0.7897	0.5670	0.3839	0.4312	0.7195	0.9491	0.9921	0.9976	(89)
MIT 2	18.9242	19.0967	19.3576	19.6889	19.9107	20.0063	20.0164	20.0186	19.9716	19.6856	19.2556	18.9081	(90)
Living area fraction									fLA = Living area / (4) =			0.4949	(91)
MIT	19.5360	19.6810	19.9014	20.1813	20.3783	20.4659	20.4782	20.4784	20.4311	20.1756	19.8112	19.5194	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5360	19.6810	19.9014	20.1813	20.3783	20.4659	20.4782	20.4784	20.4311	20.1756	19.8112	19.5194	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9910	0.9765	0.9283	0.8071	0.6020	0.4261	0.4751	0.7498	0.9512	0.9913	0.9971	(94)
Useful gains	490.4824	564.4710	624.0007	655.8080	605.6454	443.2867	299.4502	312.8079	456.0989	513.7844	480.0107	464.0955	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1233.8677	1193.1430	1078.2605	892.8820	684.5802	455.0339	300.8392	315.2988	494.4424	755.3659	1009.3868	1224.5428	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	553.0787	422.4676	337.9693	170.6932	58.7274	0.0000	0.0000	0.0000	0.0000	179.7366	381.1508	565.7728	(98)
Space heating												2669.5965	(98)
Space heating per m2											(98) / (4) =	34.2432	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	100.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2669.5965	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	553.0787	422.4676	337.9693	170.6932	58.7274	0.0000	0.0000	0.0000	0.0000	179.7366	381.1508	565.7728	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	553.0787	422.4676	337.9693	170.6932	58.7274	0.0000	0.0000	0.0000	0.0000	179.7366	381.1508	565.7728	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	179.4883	157.6097	164.1305	145.1982	140.8888	123.8769	117.0562	131.0860	131.6815	150.6569	161.7358	174.5174	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	179.4883	157.6097	164.1305	145.1982	140.8888	123.8769	117.0562	131.0860	131.6815	150.6569	161.7358	174.5174	(219)
Water heating fuel used												1777.9262	(219)
Annual totals kWh/year													
Space heating fuel - main system												2669.5965	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)													
mechanical ventilation fans (SFP = 0.7625)												232.0713	(230a)
Total electricity for the above, kWh/year												232.0713	(231)
Electricity for lighting (calculated in Appendix L)												338.6979	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.79 * 1080 * 1.00) =										-682.2596		-682.2596	(233)
Total delivered energy for all uses												4336.0324	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2669.5965	0.5190	1385.5206	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1777.9262	0.5190	922.7437	(264)
Space and water heating			2308.2643	(265)
Pumps and fans	232.0713	0.5190	120.4450	(267)
Energy for lighting	338.6979	0.5190	175.7842	(268)
Energy saving/generation technologies				
PV Unit	-682.2596	0.5190	-354.0927	(269)
Total CO2, kg/year			2250.4008	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			28.8700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		28.8700	ZC1
Total Floor Area	TFA	77.9600	
Assumed number of occupants	N	2.4230	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3517	ZC2
CO2 emissions from cooking, equation (L16)		2.2723	ZC3
Total CO2 emissions		47.4941	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		47.4941	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.9600 (1b)	x	3.2000 (2b)	=	249.4720	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	249.4720	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1203	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3703	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3147	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4013	0.3934	0.3855	0.3462	0.3383	0.2990	0.2990	0.2911	0.3147	0.3383	0.3541	0.3698	(22b)
Effective ac	0.5805	0.5774	0.5743	0.5599	0.5572	0.5447	0.5447	0.5424	0.5495	0.5572	0.5627	0.5684	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			19.4900	1.3258	25.8390			(27)
Ground floor			77.9600	0.1300	10.1348			(28a)
External Wall 1	60.2500	19.4900	40.7600	0.1800	7.3368			(29a)
Total net area of external elements Aum(A, m2)			138.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.3106			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.2430	(36)
Total fabric heat loss (33) + (36) =	51.5536	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	47.7906	47.5332	47.2810	46.0961	45.8744	44.8424	44.8424	44.6513	45.2399	45.8744	46.3229	46.7917	(38)
Heat transfer coeff	99.3442	99.0868	98.8346	97.6497	97.4280	96.3960	96.3960	96.2049	96.7935	97.4280	97.8765	98.3453	(39)
Average = Sum(39)m / 12 =												97.6486	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2743	1.2710	1.2678	1.2526	1.2497	1.2365	1.2365	1.2340	1.2416	1.2497	1.2555	1.2615	(40)
HLP (average)												1.2525	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4230 (42)
Average daily hot water use (litres/day)	91.7466 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.9212	97.2514	93.5815	89.9116	86.2418	82.5719	82.5719	86.2418	89.9116	93.5815	97.2514	100.9212	(44)
Energy conte	149.6633	130.8965	135.0734	117.7603	112.9938	97.5051	90.3528	103.6811	104.9194	122.2734	133.4710	144.9409	(45)
Energy content (annual)										Total = Sum(45)m =		1443.5309	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4495	19.6345	20.2610	17.6640	16.9491	14.6258	13.5529	15.5522	15.7379	18.3410	20.0207	21.7411	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

Total heat required for water heating calculated for each month

	195.8004	172.5687	181.2105	162.4091	159.1309	142.1538	136.4898	149.8182	149.5682	168.4105	178.1198	191.0780	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	195.8004	172.5687	181.2105	162.4091	159.1309	142.1538	136.4898	149.8182	149.5682	168.4105	178.1198	191.0780	(64)
								Total per year (kWh/year) = Sum(64)m =				1986.7578	(64)

Heat gains from water heating, kWh/month

	86.6727	76.8608	81.8216	74.8743	74.4801	68.1395	66.9520	71.3836	70.6047	77.5656	80.0981	85.1025	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	19.1785	17.0342	13.8531	10.4877	7.8397	6.6186	7.1516	9.2959	12.4770	15.8424	18.4904	19.7115	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	215.1242	217.3565	211.7311	199.7554	184.6382	170.4301	160.9383	158.7060	164.3313	176.3071	191.4243	205.6323	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	(71)

Water heating gains (Table 5)

	116.4956	114.3762	109.9752	103.9921	100.1077	94.6381	89.9892	95.9457	98.0621	104.2548	111.2474	114.3851	(72)

Total internal gains

	413.1434	411.1121	397.9047	376.5804	354.9307	334.0321	320.4243	326.2929	337.2156	358.7495	383.5073	402.0741	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.5700	11.2829	0.6300	0.7000	0.7700	26.1030	(75)
Southeast	11.9200	36.7938	0.6300	0.7000	0.7700	134.0365	(77)

Solar gains	160.1395	281.4471	408.1183	544.2801	644.8731	655.7079	625.7227	548.3065	454.8989	317.2685	193.3891	136.0243	(83)
Total gains	573.2829	692.5592	806.0229	920.8605	999.8038	989.7400	946.1470	874.5994	792.1145	676.0180	576.8965	538.0985	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.4963	54.6378	54.7773	55.4419	55.5681	56.1630	56.1630	56.2746	55.9324	55.5681	55.3135	55.0498	
alpha	4.6331	4.6425	4.6518	4.6961	4.7045	4.7442	4.7442	4.7516	4.7288	4.7045	4.6876	4.6700	
util living area	0.9952	0.9881	0.9687	0.9098	0.7818	0.5966	0.4427	0.4960	0.7485	0.9449	0.9896	0.9964	(86)
MIT	19.7177	19.9263	20.2307	20.5934	20.8528	20.9687	20.9938	20.9896	20.9112	20.5570	20.0667	19.6823	(87)
Th 2	19.8610	19.8636	19.8662	19.8782	19.8804	19.8909	19.8909	19.8929	19.8869	19.8804	19.8759	19.8711	(88)
util rest of house	0.9936	0.9842	0.9583	0.8808	0.7205	0.5043	0.3340	0.3817	0.6605	0.9207	0.9855	0.9952	(89)
MIT 2	18.1766	18.4807	18.9185	19.4262	19.7475	19.8720	19.8889	19.8890	19.8228	19.3921	18.6953	18.1320	(90)
Living area fraction									fLA = Living area / (4) =			0.4949	(91)
MIT	18.9393	19.1961	19.5679	20.0038	20.2945	20.4147	20.4357	20.4337	20.3614	19.9685	19.3740	18.8992	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9393	19.1961	19.5679	20.0038	20.2945	20.4147	20.4357	20.4337	20.3614	19.9685	19.3740	18.8992	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9918	0.9812	0.9549	0.8845	0.7446	0.5491	0.3880	0.4385	0.7005	0.9229	0.9830	0.9938	(94)
Useful gains	568.6069	679.5604	769.6936	814.4599	744.5030	543.4879	367.1189	383.4739	554.8856	623.9237	567.1157	534.7413	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1454.3268	1416.5518	1291.5555	1084.2851	837.3444	560.5151	369.7414	388.0593	606.0626	912.7590	1201.3362	1445.5995	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh

	658.9757	495.2582	388.2652	194.2742	69.0740	0.0000	0.0000	0.0000	0.0000	214.8935	456.6387	677.6785	(98)
Space heating												3155.0580	(98)
Space heating per m2											(98) / (4) =	40.4702	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3374.3936	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	658.9757	495.2582	388.2652	194.2742	69.0740	0.0000	0.0000	0.0000	0.0000	214.8935	456.6387	677.6785	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	704.7868	529.6879	415.2569	207.7798	73.8760	0.0000	0.0000	0.0000	0.0000	229.8326	488.3837	724.7898	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	195.8004	172.5687	181.2105	162.4091	159.1309	142.1538	136.4898	149.8182	149.5682	168.4105	178.1198	191.0780	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.8032	87.4694	86.7967	85.2926	82.7618	79.8000	79.8000	79.8000	79.8000	85.4650	87.2183	87.9075	(217)
Fuel for water heating, kWh/month													
	222.9992	197.2904	208.7759	190.4140	192.2758	178.1376	171.0399	187.7421	187.4288	197.0519	204.2229	217.3625	(219)
Water heating fuel used												2354.7409	(219)
Annual totals kWh/year													
Space heating fuel - main system												3374.3936	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												338.6979	(232)
Total delivered energy for all uses												6142.8324	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3374.3936	0.2160	728.8690	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2354.7409	0.2160	508.6240	(264)
Space and water heating			1237.4931	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	338.6979	0.5190	175.7842	(268)
Total CO2, kg/m2/year			1452.2023	(272)
Emissions per m2 for space and water heating			15.8734	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2548	(272b)
Emissions per m2 for pumps and fans			0.4993	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8734 * 1.55) + 2.2548 + 0.4993, rounded to 2 d.p.			27.3600	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	Type 15	**Issued on Date**	12/01/2021
Assessment Reference	V02 Be Green	**Prop Type Ref**	B8 2BL.M4(3)-1B
Property			

SAP Rating	75 C	**DER**	28.94	**TER**	26.40
Environmental	78 C	**% DER<TER**	-9.63		
CO_2 Emissions (t/year)	2.09	**DFEE**	53.62	**TFEE**	57.21
General Requirements Compliance	Fail	**% DFEE<TFEE**	6.26		

Assessor Details	Ms. Madeleine Leonard, Madeleine Leonard, Tel: 01202654600, MadeleineLeonard@hoarelea.com	**Assessor ID**	T456-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Top-floor flat, total floor area 98 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 26.40 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 28.94 kgCO□/m²Fail
Excess emissions =2.54 kgCO□/m² (9.6%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)57.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)53.6 kWh/m²/yrOK
---
2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Electric underfloor heating - Electric
Underfloor heating in thin screed (standard tariff)

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.18 kWh/day
Permitted by DBSCG 1.85 OK
Primary pipework insulated: No primary pipework
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.61
Maximum 1.5 OK
MVHR efficiency: 88%
Minimum: 70% OK
---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Very little
Windows facing North: 9.48 m², No overhang
Windows facing South: 6.18 m², No overhang
Windows facing West: 5.60 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Air permeability 3.0 m³/m²h
Photovoltaic array 0.99 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	97.7400 (1b)	x	2.5500 (2b)	=	249.2370	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.7400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	249.2370	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1388	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	74.8000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3029	0.2994	0.2960	0.2786	0.2752	0.2578	0.2578	0.2543	0.2648	0.2752	0.2821	0.2890	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window 1.4 (Uw = 1.40)			21.2600	1.3258	28.1856			(27)
External Wall 1	75.6000	21.2600	54.3400	0.1500	8.1510			(29a)
External Roof 1	94.7400		94.7400	0.1300	12.3162			(30)
Total net area of external elements Aum(A, m2)			170.3400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.6528			(33)
to Corridor			4.2000	0.0000	0.0000			(32)
Party Wall			57.5400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	137.4200	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	30.6680	(36)
Total fabric heat loss (33) + (36) =	79.3208	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.9135	24.6282	24.3429	22.9164	22.6311	21.2046	21.2046	20.9193	21.7752	22.6311	23.2017	23.7723	(38)
Heat transfer coeff	104.2343	103.9490	103.6637	102.2372	101.9519	100.5254	100.5254	100.2401	101.0960	101.9519	102.5225	103.0931	(39)
Average = Sum(39)m / 12 =												102.1659	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0664	1.0635	1.0606	1.0460	1.0431	1.0285	1.0285	1.0256	1.0343	1.0431	1.0489	1.0548	(40)
HLP (average)												1.0453	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7176 (42)
Average daily hot water use (litres/day)	103.9399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.3339	110.1763	106.0187	101.8611	97.7035	93.5459	93.5459	97.7035	101.8611	106.0187	110.1763	114.3339	(44)
Energy conte	169.5539	148.2929	153.0250	133.4109	128.0109	110.4637	102.3609	117.4606	118.8634	138.5239	151.2096	164.2039	(45)
Energy content (annual)										Total = Sum(45)m =		1635.3795	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4331	22.2439	22.9537	20.0116	19.2016	16.5696	15.3541	17.6191	17.8295	20.7786	22.6814	24.6306	(46)

Water storage loss:

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1800	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7080	(55)
Total storage loss													
	21.9480	19.8240	21.9480	21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	(56)
If cylinder contains dedicated solar storage													
	21.9480	19.8240	21.9480	21.2400	21.9480	21.2400	21.9480	21.9480	21.2400	21.9480	21.2400	21.9480	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month													
	191.5019	168.1169	174.9730	154.6509	149.9589	131.7037	124.3089	139.4086	140.1034	160.4719	172.4496	186.1519	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	191.5019	168.1169	174.9730	154.6509	149.9589	131.7037	124.3089	139.4086	140.1034	160.4719	172.4496	186.1519	(64)
								Total per year (kWh/year) = Sum(64)m =				1893.7995	(64)
Heat gains from water heating, kWh/month													
	73.9351	65.1666	68.4392	61.3511	60.1220	53.7212	51.5934	56.6140	56.5141	63.6176	67.2692	72.1562	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.5214	20.0033	16.2678	12.3158	9.2062	7.7722	8.3982	10.9163	14.6518	18.6038	21.7134	23.1473	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	252.6215	255.2429	248.6370	234.5739	216.8216	200.1371	188.9907	186.3693	192.9752	207.0384	224.7906	241.4752	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	(71)
Water heating gains (Table 5)													
	99.3751	96.9741	91.9882	85.2099	80.8092	74.6127	69.3459	76.0941	78.4918	85.5075	93.4294	96.9841	(72)
Total internal gains													
	438.2819	435.9843	420.6569	395.8635	370.6009	346.2860	330.4988	337.1437	349.8827	374.9136	403.6974	425.3706	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.4800	10.6334	0.3500	0.8000	0.7700	19.5601	(74)
South	6.1800	46.7521	0.3500	0.8000	0.7700	56.0635	(78)
West	5.6000	19.6403	0.3500	0.8000	0.7700	21.3416	(80)

Solar gains	96.9652	170.9467	249.2319	334.4901	398.0784	405.4974	386.6577	337.6467	278.5115	193.0687	117.1948	82.3006	(83)
Total gains	535.2472	606.9310	669.8888	730.3536	768.6793	751.7833	717.1564	674.7904	628.3942	567.9823	520.8922	507.6712	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.7939	35.8921	35.9909	36.4931	36.5952	37.1145	37.1145	37.2202	36.9050	36.5952	36.3915	36.1901	
alpha	3.3863	3.3928	3.3994	3.4329	3.4397	3.4743	3.4743	3.4813	3.4603	3.4397	3.4261	3.4127	
util living area													
	0.9872	0.9794	0.9634	0.9257	0.8483	0.7126	0.5669	0.6131	0.8145	0.9421	0.9796	0.9892	(86)
MIT	19.5309	19.6826	19.9359	20.2747	20.5799	20.7976	20.8809	20.8675	20.7071	20.3156	19.8675	19.5067	(87)
Th 2	20.0283	20.0307	20.0331	20.0452	20.0476	20.0597	20.0597	20.0621	20.0548	20.0476	20.0428	20.0379	(88)
util rest of house													
	0.9847	0.9753	0.9560	0.9094	0.8125	0.6426	0.4639	0.5121	0.7589	0.9262	0.9749	0.9871	(89)
MIT 2	18.0444	18.2664	18.6348	19.1275	19.5498	19.8343	19.9203	19.9120	19.7286	19.1939	18.5455	18.0161	(90)
Living area fraction										fLA = Living area / (4) =		0.3261	(91)
MIT	18.5291	18.7282	19.0590	19.5016	19.8857	20.1484	20.2335	20.2236	20.0477	19.5597	18.9765	18.5022	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5291	18.7282	19.0590	19.5016	19.8857	20.1484	20.2335	20.2236	20.0477	19.5597	18.9765	18.5022	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9795	0.9683	0.9464	0.8982	0.8055	0.6498	0.4841	0.5308	0.7584	0.9160	0.9681	0.9826	(94)
Useful gains	524.2758	587.6815	633.9840	655.9964	619.1597	488.5270	347.1839	358.1769	476.5719	520.2916	504.2529	498.8405	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1483.1587	1437.4258	1301.9165	1083.8741	834.5484	557.7576	365.2623	383.2757	601.2850	913.4553	1217.6113	1474.4537	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.4089	571.0281	496.9418	308.0719	160.2492	0.0000	0.0000	0.0000	0.0000	292.5138	513.6180	725.8562	(98)
Space heating												3781.6880	(98)
Space heating per m2											(98) / (4) =	38.6913	(99)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3781.6880	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	713.4089	571.0281	496.9418	308.0719	160.2492	0.0000	0.0000	0.0000	0.0000	292.5138	513.6180	725.8562	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	713.4089	571.0281	496.9418	308.0719	160.2492	0.0000	0.0000	0.0000	0.0000	292.5138	513.6180	725.8562	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	191.5019	168.1169	174.9730	154.6509	149.9589	131.7037	124.3089	139.4086	140.1034	160.4719	172.4496	186.1519	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month													
	191.5019	168.1169	174.9730	154.6509	149.9589	131.7037	124.3089	139.4086	140.1034	160.4719	172.4496	186.1519	(219)
Water heating fuel used												1893.7995	(219)
Annual totals kWh/year													
Space heating fuel - main system												3781.6880	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7625)													
mechanical ventilation fans (SFP = 0.7625)												231.8527	(230a)
Total electricity for the above, kWh/year												231.8527	(231)
Electricity for lighting (calculated in Appendix L)												397.7348	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1080 * 1.00) =										-854.9835		-854.9835	(233)
Total delivered energy for all uses												5450.0915	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3781.6880	0.5190	1962.6961	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1893.7995	0.5190	982.8819	(264)
Space and water heating			2945.5780	(265)
Pumps and fans	231.8527	0.5190	120.3316	(267)
Energy for lighting	397.7348	0.5190	206.4244	(268)
Energy saving/generation technologies				
PV Unit	-854.9835	0.5190	-443.7364	(269)
Total CO2, kg/year			2828.5975	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			28.9400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		28.9400	ZC1
Total Floor Area	TFA	97.7400	
Assumed number of occupants	N	2.7176	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3160	ZC2
CO2 emissions from cooking, equation (L16)		1.8848	ZC3
Total CO2 emissions		46.1408	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		46.1408	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	97.7400 (1b)	x	2.5500 (2b)	=	249.2370	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.7400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	249.2370	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1204	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3704	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3426	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4368	0.4282	0.4197	0.3768	0.3683	0.3255	0.3255	0.3169	0.3426	0.3683	0.3854	0.4025	(22b)
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5810	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			21.2600	1.3258	28.1856			(27)
External Wall 1	75.6000	21.2600	54.3400	0.1800	9.7812			(29a)
External Roof 1	94.7400		94.7400	0.1300	12.3162			(30)
Total net area of external elements Aum(A, m2)			170.3400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.2830			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.4200	(36)
Total fabric heat loss					(33) + (36) =		72.7030	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.9704	48.6657	48.3671	46.9643	46.7019	45.4802	45.4802	45.2539	45.9507	46.7019	47.2328	47.7879	(38)
Heat transfer coeff	121.6734	121.3687	121.0701	119.6674	119.4049	118.1832	118.1832	117.9569	118.6538	119.4049	119.9358	120.4909	(39)
Average = Sum(39)m / 12 =												119.6661	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2449	1.2418	1.2387	1.2243	1.2217	1.2092	1.2092	1.2068	1.2140	1.2217	1.2271	1.2328	(40)
HLP (average)												1.2243	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7176	(42)
Average daily hot water use (litres/day)												98.7429	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.6172	104.6675	100.7178	96.7681	92.8183	88.8686	88.8686	92.8183	96.7681	100.7178	104.6675	108.6172	(44)
Energy conte	161.0762	140.8782	145.3737	126.7403	121.6104	104.9405	97.2428	111.5875	112.9203	131.5977	143.6491	155.9937	(45)
Energy content (annual)										Total = Sum(45)m =		1553.6105	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1614	21.1317	21.8061	19.0111	18.2416	15.7411	14.5864	16.7381	16.9380	19.7397	21.5474	23.3991	(46)
Water storage loss:													
Store volume												145.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3665	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7379	(55)
Total storage loss	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	22.8747	20.6610	22.8747	22.1368	22.8747	22.1368	22.8747	22.8747	22.1368	22.8747	22.1368	22.8747	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

Total heat required for water heating calculated for each month

	207.2132	182.5504	191.5108	171.3891	167.7475	149.5893	143.3799	157.7246	157.5690	177.7347	188.2979	202.1307	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)

Output from w/h

	207.2132	182.5504	191.5108	171.3891	167.7475	149.5893	143.3799	157.7246	157.5690	177.7347	188.2979	202.1307	(64)
								Total per year (kWh/year) = Sum(64)m =				2096.8373	(64)

Heat gains from water heating, kWh/month

	90.4675	80.1798	85.2464	77.8602	77.3451	70.6117	69.2429	74.0125	73.2650	80.6659	83.4824	88.7776	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	135.8798	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	22.5386	20.0186	16.2802	12.3251	9.2132	7.7782	8.4046	10.9246	14.6630	18.6180	21.7300	23.1650	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	252.6215	255.2429	248.6370	234.5739	216.8216	200.1371	188.9907	186.3693	192.9752	207.0384	224.7906	241.4752	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	36.5880	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	-108.7038	(71)

Water heating gains (Table 5)

	121.5961	119.3151	114.5785	108.1392	103.9585	98.0719	93.0684	99.4792	101.7570	108.4219	115.9477	119.3247	(72)

Total internal gains

	463.5201	461.3406	446.2597	421.8021	396.7573	372.7510	357.2277	363.5370	376.1591	400.8422	429.2322	450.7288	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	9.4800	10.6334	0.6300	0.7000	0.7700	30.8072	(74)
South	6.1800	46.7521	0.6300	0.7000	0.7700	88.3001	(78)
West	5.6000	19.6403	0.6300	0.7000	0.7700	33.6130	(80)

Solar gains	152.7203	269.2410	392.5402	526.8219	626.9735	638.6583	608.9858	531.7936	438.6555	304.0832	184.5818	129.6235	(83)
Total gains	616.2404	730.5816	838.7999	948.6240	1023.7307	1011.4094	966.2135	895.3306	814.8146	704.9254	613.8140	580.3523	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7846	55.9246	56.0626	56.7197	56.8444	57.4320	57.4320	57.5422	57.2043	56.8444	56.5928	56.3321	
alpha	4.7190	4.7283	4.7375	4.7813	4.7896	4.8288	4.8288	4.8361	4.8136	4.7896	4.7729	4.7555	
util living area	0.9975	0.9940	0.9840	0.9500	0.8591	0.6910	0.5254	0.5836	0.8300	0.9702	0.9946	0.9981	(86)
MIT	19.6613	19.8396	20.1204	20.4816	20.7809	20.9454	20.9882	20.9809	20.8647	20.4708	19.9988	19.6322	(87)
Th 2	19.8843	19.8867	19.8892	19.9006	19.9027	19.9127	19.9127	19.9145	19.9088	19.9027	19.8984	19.8939	(88)
util rest of house	0.9966	0.9919	0.9782	0.9314	0.8085	0.5957	0.4021	0.4570	0.7523	0.9554	0.9924	0.9975	(89)
MIT 2	18.1107	18.3721	18.7805	19.2995	19.6919	19.8773	19.9085	19.9070	19.8027	19.2952	18.6135	18.0748	(90)
Living area fraction									fLA = Living area / (4) =			0.3261	(91)
MIT	18.6163	18.8506	19.2174	19.6849	20.0470	20.2256	20.2606	20.2571	20.1490	19.6785	19.0652	18.5826	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6163	18.8506	19.2174	19.6849	20.0470	20.2256	20.2606	20.2571	20.1490	19.6785	19.0652	18.5826	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9952	0.9892	0.9736	0.9269	0.8160	0.6248	0.4426	0.4985	0.7716	0.9515	0.9900	0.9963	(94)
Useful gains	613.2775	722.7118	816.6305	879.2379	835.3768	631.9542	427.6395	446.3386	628.7314	670.7097	607.6693	578.2238	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1741.9127	1693.1675	1539.6993	1290.6045	996.6703	664.8493	432.6190	454.9773	717.7352	1084.0225	1435.0538	1732.9696	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	839.7046	652.1463	537.9632	296.1840	120.0024	0.0000	0.0000	0.0000	0.0000	307.5047	595.7168	859.1309	(98)
Space heating												4208.3529	(98)
Space heating per m2											(98) / (4) =	43.0566	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4500.9122	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	839.7046	652.1463	537.9632	296.1840	120.0024	0.0000	0.0000	0.0000	0.0000	307.5047	595.7168	859.1309	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000		(210)
Space heating fuel (main heating system)													
	898.0798	697.4826	575.3617	316.7743	128.3448	0.0000	0.0000	0.0000	0.0000	328.8821	637.1303	918.8566	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	207.2132	182.5504	191.5108	171.3891	167.7475	149.5893	143.3799	157.7246	157.5690	177.7347	188.2979	202.1307	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.1603	87.9217	87.4226	86.2604	83.9388	79.8000	79.8000	79.8000	79.8000	86.2633	87.6765	88.2463	(217)
Fuel for water heating, kWh/month													
	235.0414	207.6284	219.0633	198.6881	199.8450	187.4553	179.6740	197.6499	197.4549	206.0374	214.7644	229.0528	(219)
Water heating fuel used												2472.3550	(219)
Annual totals kWh/year													
Space heating fuel - main system												4500.9122	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												398.0381	(232)
Total delivered energy for all uses												7446.3053	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4500.9122	0.2160	972.1970	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2472.3550	0.2160	534.0287	(264)
Space and water heating			1506.2257	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	398.0381	0.5190	206.5818	(268)
Total CO2, kg/m2/year			1751.7325	(272)
Emissions per m2 for space and water heating			15.4105	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.1136	(272b)
Emissions per m2 for pumps and fans			0.3983	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4105 * 1.55) + 2.1136 + 0.3983, rounded to 2 d.p.			26.4000	(273)

Appendix B: BRUKL Document.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Guild Living Epsom - Non Domestic

As designed

Date: Thu Jan 07 10:25:57 2021

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

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

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

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

CO_2 emission rate from the notional building, kgCO_2/m².annum	19.9
Target CO_2 emission rate (TER), kgCO_2/m².annum	19.9
Building CO_2 emission rate (BER), kgCO_2/m².annum	19.9
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	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.17	0.18	GR00000B:Surf[2]
Floor	0.25	0.15	0.15	LV00001B:Surf[0]
Roof	0.25	0.15	0.15	GR000007:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.41	2	LV000153:Surf[0]
Personnel doors	2.2	2.2	2.2	GR00000B:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- HVAC 1 - Elect Heater + Natural Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
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					YES

2- HVAC 4 - Elect Heater + Extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
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					YES

3- HVAC 5 - FCU + MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	3.4	0	1.8	0.8
Standard value	2.5*	3.2	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

4- HVAC 2 - All Air Heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	-	0	1.8	0.8
Standard value	2.5*	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Level 00 - A3 001 Acc Shower	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - A3 002 Female Changing Area	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - A3 004 Male Changing Area	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - A3 005 ACC Shower	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - A3 007 Gym	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A3 009 Waiting Area	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A3 010 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - A3 013 Therapy Room 01	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A3 015 Acc Shower	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - A3 016 Consultation Rooms-01	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A3 017 Unisex Therapy Room	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A3 018 Consultation Rooms-02	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 009 Lounge	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 011 Beauty Salon	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 011 Multipurpose Room	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 012 Multipurpose Room	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 013 M WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - A4 014 GM	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 015 Admin HR	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 016 Sales Office	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 017 Sales Suite	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 018 Main Entrance	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - A4 020 Office	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - B1 001 Resturant Kitchen	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - B1 003 Resturant Office	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - B1 004 Staff WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - B1 014 Female WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - B1 016 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - B1 017 Male WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - B1 018 Resturant/Cafe/Bar	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - B1 029 Retail	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - B1 030 M WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 00 - B2 007 Retail	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - B2 009 Retail	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - Lounge	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 01 - A3 109 Cinema	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 01 - A3 112 Changing Area	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 01 - A3 113 Assisted Bathroom	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 01 - A3 120 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 01 - A3 122 Nurse Office	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 01 - A3 124 Care Takers Office	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 01 - A3 125 Care Takers Workshop	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 01 - A3 128 Dis WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Level 01 - A3 129 Female WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 01 - A3 130 M WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 01 - A4 111 Bar/Banquette Seating	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 01 - A4 112 Unisex WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 01 - A4 114 M WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 01 - A4 115 Cinema/Theatre Bar	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 201 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 201 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 202 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 202 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 203 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 203 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 204 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 204 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 205 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 205 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 206 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 206 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 207 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 207 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 208 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 208 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 209 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 209 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 210 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 210 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 211 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 211 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 212 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 212 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 213 Nurse Room	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 214 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A3 215 Care Amenity Space	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 217 Kitchen/Dining	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 218 Care Amenity Space	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A3 220 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 201 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 201 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 202 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 202 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 203 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 203 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 204 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Level 02 - A4 205 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 205 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 206 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 206 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 207 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 207 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 208 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 208 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 209 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 209 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 210 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 210 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 211 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 211 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 212 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 212 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 213 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 213 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 214 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 214 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 215 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 215 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 216 GCS Bedroom	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 216 GCS Ensuite	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 219 Care Amenity Space	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 02 - A4 222 WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Level 02 - A4 224 Kitchen/Dining	-	-	-	-	-	-	-	0.2	-	-	N/A
Level 00 - Retail	-	-	-	-	-	-	-	0.3	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 00 - A1 004 Corridor	-	85	-	75
Level 00 - A1 005 Cold Water Storage	85	-	-	428
Level 00 - A1 006 Corridor	-	85	-	17
Level 00 - A1 007 Refuse	85	-	-	26
Level 00 - A1 008 Mail/BOH	85	-	-	8
Level 00 - A1 009 Refuse Lobby	-	85	-	18
Level 00 - A1 010 Corridor	-	85	-	55
Level 00 - A2 005 Lift Lobby	-	85	-	144
Level 00 - A2 006 Refuse	85	-	-	35
Level 00 - A2 007 Refuse Lobby	-	85	-	18
Level 00 - A2 008 APS Plant	85	-	-	95

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 00 - A2 010 BOH	85	-	-	8
Level 00 - A2 011 BT Intake Room	85	-	-	60
Level 00 - A2 012 Alternative Telecom Room	85	-	-	43
Level 00 - A2 013 Scooter/BOH	85	-	-	14
Level 00 - A2 014 Lobby	-	85	-	20
Level 00 - A2 015 Corridor	-	85	-	88
Level 00 - A2 016 Lift Lobby	-	85	-	38
Level 00 - A3 001 Acc Shower	-	85	-	33
Level 00 - A3 002 Female Changing Area	-	85	-	72
Level 00 - A3 003 Lobby	-	85	-	36
Level 00 - A3 004 Male Changing Area	-	85	-	72
Level 00 - A3 005 ACC Shower	-	85	-	33
Level 00 - A3 006 Corridor	-	85	-	46
Level 00 - A3 007 Gym	-	85	-	303
Level 00 - A3 009 Lobby	-	85	-	192
Level 00 - A3 009 Waiting Area	-	85	-	102
Level 00 - A3 010 WC	-	85	-	40
Level 00 - A3 011 Lobby	-	85	-	27
Level 00 - A3 012 Pool Store	85	-	-	22
Level 00 - A3 013 Therapy Room 01	-	85	60	391
Level 00 - A3 014 Trench Intake	85	-	-	74
Level 00 - A3 015 Acc Shower	-	85	-	33
Level 00 - A3 016 Consultation Rooms 01	-	85	60	271
Level 00 - A3 017 Unisex Therapy Room	-	85	60	374
Level 00 - A3 018 Consultation Rooms 02	-	85	60	306
Level 00 - A3 019 Lift Lobby	-	85	-	91
Level 00 - A3 020 Lobby	-	85	-	115
Level 00 - A3 021 Pool Water Treatment Plant	85	-	-	249
Level 00 - A3 022 Swimming Pool	-	85	-	1168
Level 00 - A3 024 Scooters/BOH	85	-	-	27
Level 00 - A3 025 Refuse	85	-	-	38
Level 00 - A3 026 Refuse Lobby	-	85	-	28
Level 00 - A3 030 Plant Room	85	-	-	838
Level 00 - A3 031 Generator	85	-	-	195
Level 00 - A3 032 Substation	85	-	-	195
Level 00 - A3 033 Gym Store	85	-	-	12
Level 00 - A4 001 Lift Lobby	-	85	-	84
Level 00 - A4 002 BoH	85	-	-	13
Level 00 - A4 004 Lift Lobby	-	85	-	78
Level 00 - A4 005 Lobby	-	85	-	32
Level 00 - A4 006 Store	85	-	-	30
Level 00 - A4 007 Linen	85	-	-	23
Level 00 - A4 008 Refuse	85	-	-	45

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 00 - A4 009 Lobby	-	85	-	190
Level 00 - A4 009 Lounge	-	85	-	100
Level 00 - A4 010 Airlock Lobby	-	85	-	11
Level 00 - A4 011 Beauty Salon	-	85	60	255
Level 00 - A4 011 Multipurpose Room	-	85	-	280
Level 00 - A4 012 Multipurpose Room	-	85	-	201
Level 00 - A4 013 M WC	-	85	-	43
Level 00 - A4 014 GM	85	-	-	219
Level 00 - A4 015 Admin HR	85	-	-	223
Level 00 - A4 016 Sales Office	85	-	-	190
Level 00 - A4 017 Sales Suite	85	-	-	211
Level 00 - A4 018 Main Entrance	-	85	60	920
Level 00 - A4 019 Airlock Lobby	-	85	-	35
Level 00 - A4 020 Office	85	-	-	169
Level 00 - A4 021 Post	85	-	-	21
Level 00 - A4 022 Refuse	85	-	-	45
Level 00 - A4 023 Refuse Lobby	-	85	-	26
Level 00 - A4 025 Salon BoH	85	-	-	12
Level 00 - A5 003 Refuse Lobby	-	85	-	37
Level 00 - A5 004 Trench Intake	85	-	-	71
Level 00 - A5 005 Lift Lobby	-	85	-	132
Level 00 - B1 001 Resturant Kitchen	-	85	-	465
Level 00 - B1 002 Kitchen BOH	85	-	-	34
Level 00 - B1 003 Resturant Office	85	-	-	144
Level 00 - B1 004 Staff WC	-	85	-	65
Level 00 - B1 005 Cold	85	-	-	14
Level 00 - B1 006 DRY	85	-	-	23
Level 00 - B1 007 Gas Meter Room	85	-	-	84
Level 00 - B1 008 Resturant Refuse	85	-	-	20
Level 00 - B1 009 ASHP Plant	85	-	-	389
Level 00 - B1 010 Store	85	-	-	23
Level 00 - B1 011 Switch Room	85	-	-	78
Level 00 - B1 012 Substation	85	-	-	122
Level 00 - B1 013 LV Switch Room	85	-	-	129
Level 00 - B1 014 Female WC	-	85	-	75
Level 00 - B1 015 WC Lobby	-	85	-	30
Level 00 - B1 016 Dis WC	-	85	-	50
Level 00 - B1 017 Male WC	-	85	-	73
Level 00 - B1 018 Resturant/Cafe/Bar	-	85	60	834
Level 00 - B1 020 Lift Lobby	-	85	-	70
Level 00 - B1 021 Lobby	85	-	-	33
Level 00 - B1 022 WC Lobby	-	85	-	30
Level 00 - B1 023 Scooters/BOH	85	-	-	33

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 00 - B1 024 Corridor	-	85	-	59
Level 00 - B1 025 Electrical	85	-	-	64
Level 00 - B1 026 Refuse	85	-	-	29
Level 00 - B1 027 Refuse Lobby	-	85	-	25
Level 00 - B1 028 Trench Intake	85	-	-	67
Level 00 - B1 029 Retail	-	85	60	1786
Level 00 - B1 030 M WC	-	85	-	41
Level 00 - B1 ST 001 Core B1	-	85	-	56
Level 00 - B1 ST Core B3	-	85	-	58
Level 00 - B2 007 Retail	-	85	60	1161
Level 00 - B2 008 Lobby/Corridor	-	85	-	104
Level 00 - B2 009 Retail	-	85	60	1793
Level 00 - B2 010 Scooters	85	-	-	31
Level 00 - B2 011 Corridor	-	85	-	125
Level 00 - B2 012 Lobby	-	85	-	22
Level 00 - B2 013 Airlock Lobby	-	85	-	11
Level 00 - B2 014 Lift Lobby	-	85	-	110
Level 00 - B2 015 Corridor	-	85	-	54
Level 00 - B2 016 Refuse	85	-	-	46
Level 00 - B2 017 Refuse Lobby	-	85	-	26
Level 00 - B2 018 Store	85	-	-	10
Level 00 - B2 019 Electrical Plant Room	85	-	-	48
Level 00 - B2 020 Corridor	-	85	-	120
Level 00 - Lounge	-	85	-	86
Level 00 - Stair	-	85	-	74
Level 00 - Stair	-	85	-	38
Level 00 - Stair	-	85	-	50
Level 00 - Stair	-	85	-	55
Level 00 - Stair	-	85	-	41
Level 00 - Stair Core A3	-	85	-	75
Level 00 - Stair Core A4	-	85	-	59
Level 00 - Stair Core A6	-	85	-	50
Level 01 - A1 105 Corridor	-	85	-	45
Level 01 - A1 106 Corridor	-	85	-	83
Level 01 - A2 106 Store	85	-	-	22
Level 01 - A2 107 Corridor	-	85	-	23
Level 01 - A2 108 Corridor	-	85	-	134
Level 01 - A2 109 Lift Lobby	-	85	-	40
Level 01 - A2 110 Residents Lockable Storage	85	-	-	157
Level 01 - A2 111 Lift Lobby	-	85	-	20
Level 01 - A3 108 Corridor	-	85	-	76
Level 01 - A3 109 Cinema	-	85	-	490
Level 01 - A3 110 AV Storage	85	-	-	32

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 01 - A3 111 Lobby	-	85	-	25
Level 01 - A3 112 Changing Area	-	85	-	24
Level 01 - A3 113 Assisted Bathroom	-	85	-	32
Level 01 - A3 114 Hot Water Storage	85	-	-	18
Level 01 - A3 115 Corridor	-	85	-	205
Level 01 - A3 116 Lift Lobby	-	85	-	60
Level 01 - A3 117 Equipment Store	85	-	-	20
Level 01 - A3 118 Linen Store	85	-	-	11
Level 01 - A3 119 Food Holding	85	-	-	11
Level 01 - A3 120 WC	-	85	-	35
Level 01 - A3 121 Medical Store	85	-	-	9
Level 01 - A3 122 Nurse Office	85	-	-	98
Level 01 - A3 123 Corridor	-	85	-	103
Level 01 - A3 124 Care Takers Office	85	-	-	134
Level 01 - A3 125 Care Takers Workshop	85	-	-	420
Level 01 - A3 126 Corridor	-	85	-	72
Level 01 - A3 127 LV Switch	85	-	-	77
Level 01 - A3 128 Dis WC	-	85	-	36
Level 01 - A3 129 Female WC	-	85	-	54
Level 01 - A3 130 M WC	-	85	-	54
Level 01 - A3 132 LV Switch Room	85	-	-	94
Level 01 - A3 133 WC Lobby	-	85	-	18
Level 01 - A3 133 WC Lobby	-	85	-	48
Level 01 - A3 134 Corridor	-	85	-	24
Level 01 - A4 106 Corridor	-	85	-	155
Level 01 - A4 107 BoH	85	-	-	11
Level 01 - A4 108 BoH	85	-	-	11
Level 01 - A4 109 Lift Lobby	-	85	-	71
Level 01 - A4 110 Corridor	-	85	-	89
Level 01 - A4 111 Bar/Banquette Seating	-	85	-	194
Level 01 - A4 112 Unisex WC	-	85	-	75
Level 01 - A4 113 WC Lobby	-	85	-	24
Level 01 - A4 114 M WC	-	85	-	48
Level 01 - A4 115 Cinema/Theatre Bar	-	85	-	212
Level 01 - A5 108 BoH	85	-	-	12
Level 01 - B1 108 Electrical	85	-	-	11
Level 01 - B1 109 Corridor	-	85	-	194
Level 01 - B2 116 Corridor	-	85	-	41
Level 01 - B2 117 Corridor	-	85	-	111
Level 01 - B2 118 Corridor	-	85	-	176
Level 01 - B2 119 Corridor	-	85	-	18
Level 01 - B2 120 Corridor	-	85	-	91
Level 01 - B2 121 Corridor	-	85	-	24

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 01 - Stair Core 01	-	85	-	39
Level 01 - Stair Core A2	-	85	-	46
Level 01 - Stair Core A3	-	85	-	59
Level 01 - Stair Core A4	-	85	-	46
Level 01 - Stair Core A5	-	85	-	43
Level 01 - Stair Core A6	-	85	-	45
Level 01 - Stair Core B1	-	85	-	46
Level 01 - Stair Core B2	-	85	-	60
Level 01 - Stair Core B3	-	85	-	47
Level 01 - Stair Core B4	-	85	-	43
Level 02 - A1 205 Corridor	-	85	-	89
Level 02 - A2 211 Sluice	85	-	-	14
Level 02 - A2 212 Cleaners Storage	85	-	-	13
Level 02 - A2 214 Lift Lobby	-	85	-	40
Level 02 - A2 215 Lobby/Corridor	-	85	-	188
Level 02 - A2 216 BoH	85	-	-	12
Level 02 - A2 217 BoH	85	-	-	17
Level 02 - A2 218 Corridor	-	85	-	64
Level 02 - A3 201 GCS Bedroom	-	85	-	65
Level 02 - A3 201 GCS Ensuite	-	85	-	27
Level 02 - A3 201 GCS Store	85	-	-	1
Level 02 - A3 202 GCS Bedroom	-	85	-	65
Level 02 - A3 202 GCS Ensuite	-	85	-	26
Level 02 - A3 202 GCS Store	85	-	-	1
Level 02 - A3 203 GCS Bedroom	-	85	-	65
Level 02 - A3 203 GCS Ensuite	-	85	-	26
Level 02 - A3 203 GCS Store	85	-	-	1
Level 02 - A3 204 GCS Bedroom	-	85	-	63
Level 02 - A3 204 GCS Ensuite	-	85	-	26
Level 02 - A3 204 GCS Store	85	-	-	1
Level 02 - A3 205 GCS Bedroom	-	85	-	61
Level 02 - A3 205 GCS Ensuite	-	85	-	26
Level 02 - A3 205 GCS Store	85	-	-	1
Level 02 - A3 206 GCS Bedroom	-	85	-	64
Level 02 - A3 206 GCS Ensuite	-	85	-	28
Level 02 - A3 206 GCS Store	85	-	-	1
Level 02 - A3 207 GCS Bedroom	-	85	-	64
Level 02 - A3 207 GCS Ensuite	-	85	-	27
Level 02 - A3 207 GCS Store	85	-	-	1
Level 02 - A3 208 GCS Bedroom	-	85	-	63
Level 02 - A3 208 GCS Ensuite	-	85	-	28
Level 02 - A3 208 GCS Store	85	-	-	2
Level 02 - A3 209 GCS Bedroom	-	85	-	61

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 02 - A3 209 GCS Ensuite	-	85	-	27
Level 02 - A3 209 GCS Store	85	-	-	1
Level 02 - A3 210 GCS Bedroom	-	85	-	61
Level 02 - A3 210 GCS Ensuite	-	85	-	27
Level 02 - A3 210 GCS Store	85	-	-	1
Level 02 - A3 211 GCS Bedroom	-	85	-	65
Level 02 - A3 211 GCS Ensuite	-	85	-	27
Level 02 - A3 211 GCS Store	85	-	-	1
Level 02 - A3 212 GCS Bedroom	-	85	-	63
Level 02 - A3 212 GCS Ensuite	-	85	-	27
Level 02 - A3 212 GCS Store	85	-	-	1
Level 02 - A3 213 Nurse Room	85	-	-	156
Level 02 - A3 214 GCS Ensuite	-	85	-	26
Level 02 - A3 214 Lobby	-	85	-	39
Level 02 - A3 215 Care Amenity Space	-	85	-	457
Level 02 - A3 216 BoH	85	-	-	11
Level 02 - A3 217 Kitchen/Dining	-	85	60	210
Level 02 - A3 218 Care Amenity Space	-	85	-	555
Level 02 - A3 219 Linen Store	85	-	-	10
Level 02 - A3 220 WC	-	85	-	38
Level 02 - A4 201 GCS Bedroom	-	85	-	59
Level 02 - A4 201 GCS Ensuite	-	85	-	26
Level 02 - A4 201 GCS Store	85	-	-	1
Level 02 - A4 201 GCS Ensuite	-	85	-	26
Level 02 - A4 201 GCS Store	85	-	-	1
Level 02 - A4 202 GCS Bedroom	-	85	-	67
Level 02 - A4 202 GCS Ensuite	-	85	-	27
Level 02 - A4 202 GCS Store	85	-	-	1
Level 02 - A4 203 GCS Bedroom	-	85	-	63
Level 02 - A4 203 GCS Ensuite	-	85	-	27
Level 02 - A4 203 GCS Store	85	-	-	1
Level 02 - A4 204 GCS Bedroom	-	85	-	59
Level 02 - A4 204 GCS Store	85	-	-	1
Level 02 - A4 205 GCS Bedroom	-	85	-	59
Level 02 - A4 205 GCS Ensuite	-	85	-	26
Level 02 - A4 205 GCS Store	85	-	-	1
Level 02 - A4 206 GCS Bedroom	-	85	-	64
Level 02 - A4 206 GCS Ensuite	-	85	-	26
Level 02 - A4 206 GCS Store	85	-	-	1
Level 02 - A4 207 GCS Bedroom	-	85	-	65
Level 02 - A4 207 GCS Ensuite	-	85	-	26
Level 02 - A4 207 GCS Store	85	-	-	1
Level 02 - A4 208 GCS Bedroom	-	85	-	64
Level 02 - A4 208 GCS Ensuite	-	85	-	26
Level 02 - A4 208 GCS Store	85	-	-	1

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 02 - A4 209 GCS Bedroom	-	85	-	64
Level 02 - A4 209 GCS Ensuite	-	85	-	27
Level 02 - A4 209 GCS Store	85	-	-	1
Level 02 - A4 210 GCS Bedroom	-	85	-	60
Level 02 - A4 210 GCS Ensuite	-	85	-	26
Level 02 - A4 210 GCS Store	85	-	-	1
Level 02 - A4 211 GCS Bedroom	-	85	-	66
Level 02 - A4 211 GCS Ensuite	-	85	-	26
Level 02 - A4 211 GCS Store	85	-	-	1
Level 02 - A4 212 GCS Bedroom	-	85	-	62
Level 02 - A4 212 GCS Ensuite	-	85	-	26
Level 02 - A4 212 GCS Store	85	-	-	1
Level 02 - A4 213 GCS Bedroom	-	85	-	62
Level 02 - A4 213 GCS Ensuite	-	85	-	26
Level 02 - A4 213 GCS Store	85	-	-	1
Level 02 - A4 214 GCS Bedroom	-	85	-	66
Level 02 - A4 214 GCS Ensuite	-	85	-	27
Level 02 - A4 214 GCS Store	85	-	-	1
Level 02 - A4 215 GCS Bedroom	-	85	-	68
Level 02 - A4 215 GCS Ensuite	-	85	-	27
Level 02 - A4 215 GCS Store	85	-	-	1
Level 02 - A4 216 GCS Bedroom	-	85	-	64
Level 02 - A4 216 GCS Ensuite	-	85	-	25
Level 02 - A4 216 GCS Bedroom	-	85	-	64
Level 02 - A4 216 GCS Ensuite	-	85	-	25
Level 02 - A4 217 Sluice	85	-	-	11
Level 02 - A4 218 Holding Store	85	-	-	12
Level 02 - A4 219 Care Amenity Space	-	85	-	1331
Level 02 - A4 220 Fire Lift Lobby	-	85	-	80
Level 02 - A4 221 BoH	85	-	-	11
Level 02 - A4 222 WC	-	85	-	45
Level 02 - A4 223 Lobby	-	85	-	65
Level 02 - A4 224 Kitchen/Dining	-	85	60	210
Level 02 - A5 209 BoH	85	-	-	12
Level 02 - B1 208 Electrical	85	-	-	43
Level 02 - B1 209 Corridor	-	85	-	194
Level 02 - B2 216 Corridor	-	85	-	41
Level 02 - B2 217 Corridor	-	85	-	111
Level 02 - B2 218 Corridor	-	85	-	176
Level 02 - B2 219 Electrical	85	-	-	36
Level 02 - B2 220 Corridor	-	85	-	91
Level 02 - B2 221 Corridor	-	85	-	24
Level 02 - Lift Lobby Core A3	-	85	-	60
Level 02 - Stair Core A6	-	85	-	45
Level 02 - Stair Core A1	-	85	-	39

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 02 - Stair Core A2	-	85	-	42
Level 02 - Stair Core A3	-	85	-	61
Level 02 - Stair Core A4	-	85	-	47
Level 02 - Stair Core A5	-	85	-	43
Level 02 - Stair Core B1	-	85	-	46
Level 02 - Stair Core B2	-	85	-	60
Level 02 - Stair Core B3	-	85	-	47
Level 02 - Stair Core B4	-	85	-	43
Level 02 - Store Core A2	85	-	-	26
Level 03 - A1 305 Corridor	-	85	-	89
Level 03 - A2 307 Corridor	-	85	-	151
Level 03 - A2 308 BoH	85	-	-	33
Level 03 - A2 309 Lift Lobby	-	85	-	40
Level 03 - A3 313 Lobby/Corridor	-	85	-	253
Level 03 - A3 314 Corridor	-	85	-	133
Level 03 - A3 315 Corridor	-	85	-	25
Level 03 - A4 309 Corridor	-	85	-	253
Level 03 - A4 310 BoH	85	-	-	11
Level 03 - A4 311 BoH	85	-	-	11
Level 03 - A5 308 BoH	85	-	-	12
Level 03 - B1 308 Electrical	85	-	-	43
Level 03 - B1 309 Corridor	-	85	-	194
Level 03 - B2 316 Corridor	-	85	-	41
Level 03 - B2 317 Corridor	-	85	-	111
Level 03 - B2 318 Corridor	-	85	-	176
Level 03 - B2 319 Electrical	85	-	-	36
Level 03 - B2 320 Corridor	-	85	-	91
Level 03 - B2 321 Corridor	-	85	-	24
Level 03 - Lift Overrun	85	-	-	59
Level 03 - Stair Core A1	-	85	-	39
Level 03 - Stair Core A2	-	85	-	46
Level 03 - Stair Core A3	-	85	-	61
Level 03 - Stair Core A4	-	85	-	45
Level 03 - Stair Core A5	-	85	-	43
Level 03 - Stair Core A6	-	85	-	45
Level 03 - Stair Core B1	-	85	-	46
Level 03 - Stair Core B2	-	85	-	60
Level 03 - Stair Core B3	-	85	-	47
Level 03 - Stair Core B4	-	85	-	43
Level 04 - A3 415 Lobby/Corridor	-	85	-	253
Level 04 - A3 416 Corridor	-	85	-	199
Level 04 - A4 409 Corridor	-	85	-	248
Level 04 - A4 410 BoH	85	-	-	11

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 04 - A5 408 BoH	85	-	-	12
Level 04 - B1 416 Corridor	-	85	-	350
Level 04 - B1 417 BoH	85	-	-	10
Level 04 - Stair Core A3	-	85	-	61
Level 04 - Stair Core A4	-	85	-	45
Level 04 - Stair Core A5	-	85	-	43
Level 04 - Stair Core A6	-	85	-	45
Level 04 - Stair Core B1	-	85	-	46
Level 04 - Stair Core B3	-	85	-	47
Level 05 - A3 515 Lobby/Corridor	-	85	-	253
Level 05 - A3 516 Corridor	-	85	-	199
Level 05 - A4 509 Corridor	-	85	-	248
Level 05 - A4 510 BoH	85	-	-	11
Level 05 - B1 516 Corridor	-	85	-	260
Level 05 - Stair Core A3	-	85	-	61
Level 05 - Stair Core A4	-	85	-	45
Level 05 - Stair Core A6	-	85	-	45
Level 05 - Stair Core B1	-	85	-	46
Level 05 - Stair Core B3	-	85	-	47
Level 06 - A3 615 Lobby/Corridor	-	85	-	253
Level 06 - A3 616 Corridor	-	85	-	199
Level 06 - A4 609 Corridor	-	85	-	248
Level 06 - A4 610 BoH	85	-	-	11
Level 06 - B1 616 Corridor	-	85	-	260
Level 06 - Stair Core A3	-	85	-	61
Level 06 - Stair Core A4	-	85	-	45
Level 06 - Stair Core A6	-	85	-	45
Level 06 - Stair Core B1	-	85	-	46
Level 06 - Stair Core B3	-	85	-	47
Level 07 - A3 715 Lobby/Corridor	-	85	-	263
Level 07 - A3 716 Corridor	-	85	-	212
Level 07 - A4 709 Corridor	-	85	-	257
Level 07 - A4 710 BoH	85	-	-	12
Level 07 - B1 716 Corridor	-	85	-	273
Level 07 - Stair Core A3	-	85	-	63
Level 07 - Stair Core A4	-	85	-	47
Level 07 - Stair Core A6	-	85	-	47
Level 07 - Stair Core B1	-	85	-	48
Level 07 - Stair Core B3	-	85	-	50
Level 08 - A3 815 Lobby/Corridor	-	85	-	256
Level 08 - A3 816 Corridor	-	85	-	203
Level 08 - A4 809 Corridor	-	85	-	251
Level 08 - A4 810 BoH	85	-	-	11

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Level 08 - B1 815 Corridor	-	85	-	79
Level 08 - B1 816 Corridor	-	85	-	264
Level 08 - Stair Core A3	-	85	-	62
Level 08 - Stair Core A4	-	85	-	46
Level 08 - Stair Core A6	-	85	-	45
Level 08 - Stair Core B1	-	85	-	46
Level 08 - Stair Core B3	-	85	-	48
Level 07 - B1 715 Corridor	-	85	-	78
Level 06 - B1 615 Corridor	-	85	-	78
Level 05 - B1 515 Corridor	-	85	-	78
Level 00 - Retail	-	67	15	2141
Level 01 - A5 107 Corridor	-	85	-	170
Level 02 - A5 210 Corridor	-	85	-	214
Level 03 - A5 307 Corridor	-	85	-	172
Level 04 - A5 407 Corridor	-	85	-	172

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?
Level 00 - A3 007 Gym	NO (-26.9%)	NO
Level 00 - A3 009 Waiting Area	N/A	N/A
Level 00 - A3 013 Therapy Room 01	N/A	N/A
Level 00 - A3 016 Consultation Rooms 01	N/A	N/A
Level 00 - A3 017 Unisex Therapy Room	N/A	N/A
Level 00 - A3 018 Consultation Rooms 02	N/A	N/A
Level 00 - A3 022 Swimming Pool	NO (-21.1%)	NO
Level 00 - A4 009 Lounge	NO (-97.8%)	NO
Level 00 - A4 011 Beauty Salon	YES (+17.5%)	NO
Level 00 - A4 011 Multipurpose Room	NO (-45.5%)	NO
Level 00 - A4 012 Multipurpose Room	NO (-35.6%)	NO
Level 00 - A4 014 GM	N/A	N/A
Level 00 - A4 015 Admin HR	YES (+16.1%)	NO
Level 00 - A4 016 Sales Office	N/A	N/A
Level 00 - A4 017 Sales Suite	NO (-2%)	NO
Level 00 - A4 018 Main Entrance	YES (+82.2%)	NO
Level 00 - A4 020 Office	YES (+7.8%)	NO
Level 00 - B1 003 Resturant Office	NO (-41.6%)	NO
Level 00 - B1 018 Resturant/Cafe/Bar	NO (-23%)	NO
Level 00 - B1 029 Retail	NO (-53.4%)	NO
Level 00 - B2 007 Retail	NO (-52%)	NO
Level 00 - B2 009 Retail	NO (-66.4%)	NO
Level 00 - Lounge	N/A	N/A
Level 01 - A3 109 Cinema	N/A	N/A
Level 01 - A3 122 Nurse Office	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Level 01 - A3 124 Care Takers Office	N/A	N/A
Level 01 - A3 125 Care Takers Workshop	N/A	N/A
Level 01 - A4 111 Bar/Banquette Seating	N/A	N/A
Level 01 - A4 115 Cinema/Theatre Bar	N/A	N/A
Level 02 - A3 201 GCS Bedroom	NO (-76.8%)	NO
Level 02 - A3 202 GCS Bedroom	NO (-74.3%)	NO
Level 02 - A3 203 GCS Bedroom	NO (-73.4%)	NO
Level 02 - A3 204 GCS Bedroom	NO (-70.4%)	NO
Level 02 - A3 205 GCS Bedroom	NO (-77.3%)	NO
Level 02 - A3 206 GCS Bedroom	NO (-78.5%)	NO
Level 02 - A3 207 GCS Bedroom	NO (-78.6%)	NO
Level 02 - A3 208 GCS Bedroom	NO (-78.7%)	NO
Level 02 - A3 209 GCS Bedroom	NO (-59.5%)	NO
Level 02 - A3 210 GCS Bedroom	NO (-77.7%)	NO
Level 02 - A3 211 GCS Bedroom	NO (-79.7%)	NO
Level 02 - A3 212 GCS Bedroom	NO (-69.1%)	NO
Level 02 - A3 213 Nurse Room	NO (-50%)	NO
Level 02 - A3 215 Care Amenity Space	NO (-61.8%)	NO
Level 02 - A3 217 Kitchen/Dining	NO (-49.4%)	NO
Level 02 - A3 218 Care Amenity Space	N/A	N/A
Level 02 - A4 201 GCS Bedroom	NO (-70.1%)	NO
Level 02 - A4 202 GCS Bedroom	NO (-75.7%)	NO
Level 02 - A4 203 GCS Bedroom	NO (-76.6%)	NO
Level 02 - A4 204 GCS Bedroom	NO (-72.2%)	NO
Level 02 - A4 205 GCS Bedroom	NO (-74.4%)	NO
Level 02 - A4 206 GCS Bedroom	NO (-78.8%)	NO
Level 02 - A4 207 GCS Bedroom	NO (-81.7%)	NO
Level 02 - A4 208 GCS Bedroom	NO (-81.7%)	NO
Level 02 - A4 209 GCS Bedroom	NO (-82%)	NO
Level 02 - A4 210 GCS Bedroom	NO (-77.9%)	NO
Level 02 - A4 211 GCS Bedroom	NO (-77.4%)	NO
Level 02 - A4 212 GCS Bedroom	NO (-75%)	NO
Level 02 - A4 213 GCS Bedroom	NO (-74.5%)	NO
Level 02 - A4 214 GCS Bedroom	NO (-75.8%)	NO
Level 02 - A4 215 GCS Bedroom	NO (-35.1%)	NO
Level 02 - A4 216 GCS Bedroom	NO (-64.5%)	NO
Level 02 - A4 219 Care Amenity Space	N/A	N/A
Level 02 - A4 224 Kitchen/Dining	NO (-14.7%)	NO
Level 00 - Retail	NO (-57.4%)	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 [m²]	11996.6	11996.6
External area [m²]	11998.9	10482.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	4397.33	4470.82
Average U-value [W/m²K]	0.37	0.43
Alpha value* [%]	10.55	10

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

Building Use

% Area	Building Type
5	**A1/A2 Retail/Financial and Professional services**
5	**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
7	**C2 Residential Institutions: Hospitals and Care Homes**
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
56	**Residential spaces**
24	**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
3	**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	4.62	6.05
Cooling	2.15	1.26
Auxiliary	6.24	5.56
Lighting	11.71	16.23
Hot water	14.66	14.08
Equipment*	32.5	32.5
TOTAL**	**39.39**	**43.18**

* 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 & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	47.35	47.64
Primary energy* [kWh/m²]	117.89	121.41
Total emissions [kg/m²]	19.9	19.9

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	4	0	1.3	0	0	0.84	0	1	0
	Notional	9.3	0	3	0	0	0.86	0	----	----
[ST] Fan coil systems, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	33.2	92.5	3.4	9.2	21.8	2.75	2.8	3	3.6
	Notional	27.4	73.4	3	5.4	20.4	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	195.3	0	64.4	0	7.2	0.84	0	1	0
	Notional	213.3	0	68.7	0	8.6	0.86	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	488.5	0	44.2	0	25.9	3.07	0	3	0
	Notional	629.6	0	68.4	0	26.1	2.56	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

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	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.15	LV00001E:Surf[5]
Floor	0.2	0.13	LV000093:Surf[1]
Roof	0.15	0.15	GR000007:Surf[1]
Windows, roof windows, and rooflights	1.5	1.4	GR000007:Surf[2]
Personnel doors	1.5	2.2	GR00000B:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Appendix C: SAP 10 Calculation Worksheets.

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 CO_2 ANALYSIS

DEMAND

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.) - 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/m^2)
	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														
Type 01	*77.96*	*1*	*77.96*	**27.4**	**27.4**	*5230.31008*	*Natural Gas*	*3649.848395*	*Natural Gas*	*338.6979*	*75*		**1,130**	**788**	**176**	**39**		**2,133**	**1,098**	**766**	**79**	**17**		**1,961**	**25.2**	55.35
Type 02	*89.8*	*1*	*89.8*	**23.2**	**23.2**	*4688.847185*	*Natural Gas*	*3796.460725*	*Natural Gas*	*404.7683*	*75*		**1,013**	**820**	**210**	**39**		**2,082**	**985**	**797**	**94**	**17**		**1,894**	**21.1**	43.3
Type 03	*74.65*	*1*	*74.65*	**23.2**	**23.2**	*3406.155845*	*Natural Gas*	*3632.973235*	*Natural Gas*	*336.8354*	*75*		**736**	**785**	**175**	**39**		**1,734**	**715**	**763**	**78**	**17**		**1,574**	**21.1**	39.36
Type 04	*107.75*	*1*	*107.75*	**21.4**	**21.4**	*5437.31785*	*Natural Gas*	*3960.47785*	*Natural Gas*	*449.5675*	*75*		**1,174**	**855**	**233**	**39**		**2,302**	**1,142**	**832**	**105**	**17**		**2,096**	**19.5**	41.52
Type 05	*63.08*	*1*	*63.08*	**26.9**	**26.9**	*3352.018375*	*Natural Gas*	*3612.039555*	*Natural Gas*	*284.3528*	*84*		**724**	**780**	**148**	**44**		**1,695**	**704**	**759**	**66**	**20**		**1,548**	**24.5**	40.12
Type 06	*81.48*	*1*	*81.48*	**19.2**	**19.3**	*2411.40816*	*Natural Gas*	*3760.95472*	*Natural Gas*	*378.078*	*75*		**521**	**812**	**196**	**39**		**1,568**	**506**	**790**	**88**	**17**		**1,402**	**17.2**	28.01
Type 07	*75.13*	*1*	*75.13*	**18.8**	**18.8**	*1841.073725*	*Natural Gas*	*3693.377975*	*Natural Gas*	*338.9462*	*75*		**398**	**798**	**176**	**39**		**1,410**	**387**	**776**	**79**	**17**		**1,259**	**16.8**	24.92
Type 08	*58.04*	*1*	*58.04*	**22.5**	**22.6**	*1890.076975*	*Natural Gas*	*3329.38388*	*Natural Gas*	*274.4226*	*75*		**408**	**719**	**142**	**39**		**1,309**	**397**	**699**	**64**	**17**		**1,178**	**20.3**	31.18
Type 09	*101.99*	*1*	*101.99*	**23.3**	**23.3**	*5921.70153*	*Natural Gas*	*3924.281785*	*Natural Gas*	*411.9274*	*75*		**1,279**	**848**	**214**	**39**		**2,379**	**1,244**	**824**	**96**	**17**		**2,181**	**21.4**	47.44
Type 10	*53.12*	*1*	*53.12*	**28.3**	**28.3**	*2979.637385*	*Natural Gas*	*3193.8804*	*Natural Gas*	*252.4811*	*75*		**644**	**690**	**131**	**39**		**1,503**	**626**	**671**	**59**	**17**		**1,373**	**25.8**	48.47
Type 11	*54.37*	*1*	*54.37*	**22.2**	**22.2**	*1466.871485*	*Natural Gas*	*3269.70764*	*Natural Gas*	*281.2292*	*75*		**317**	**706**	**146**	**39**		**1,208**	**308**	**687**	**66**	**17**		**1,078**	**19.8**	27.41
Type 12	*94.19*	*1*	*94.19*	**18.1**	**18.1**	*2800.001995*	*Natural Gas*	*3883.811285*	*Natural Gas*	*423.1375*	*75*		**605**	**839**	**220**	**39**		**1,702**	**588**	**816**	**99**	**17**		**1,520**	**16.1**	27.52
Type 13	*83.05*	*1*	*83.05*	**21.8**	**21.8**	*3595.71418*	*Natural Gas*	*3751.00155*	*Natural Gas*	*355.3436*	*75*		**777**	**810**	**184**	**39**		**1,810**	**755**	**788**	**83**	**17**		**1,643**	**19.8**	38.66
Type 14	*75.13*	*1*	*75.13*	**29.3**	**29.3**	*5618.3222*	*Natural Gas*	*3598.516735*	*Natural Gas*	*332.4511*	*75*		**1,214**	**777**	**173**	**39**		**2,202**	**1,180**	**756**	**77**	**17**		**2,030**	**27.0**	60.08
Type 15	*97.74*	*1*	*97.74*	**26.4**	**26.4**	*6976.41391*	*Natural Gas*	*3832.15025*	*Natural Gas*	*398.0381*	*75*		**1,507**	**828**	**207**	**39**		**2,580**	**1,465**	**805**	**93**	**17**		**2,380**	**24.4**	57.21
Sum	**1,187**	**15**	**1,187**	**23.3**	**-**	**57,616**	**N/A**	**54,889**	**N/A**	**5,260**	**1,134**	**0**	**12,445**	**11,856**	**2,730**	**589**	**0**	***27,620***	**12,099**	**11,527**	**1,226**	**264**	**0**	***25,116***	**21.2**	**41.20**

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

DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS

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 GREEN' SAP DER WORKSHEET															REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.)								SAP 2012 CO2 PERFORMANCE								SAP10 CO2 PERFORMANCE							
				Calculated DER 2012 (kgCO2 / m2)	DER Worksheet DER 2012 (kgCO2 / m2)	Space Heating (Heat Source 1)	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	Fuel type Domestic Hot Water	Space Heating (Heat source 2) if applicable	Fuel type Space Heating	Domestic Hot Water (Heat source 2) if applicable	Fuel type Domestic Hot Water	Space and Domestic Hot Water from CHP if applicable	Fuel type CHP if applicable	Total Electricity generated by CHP (-) if applicable	Electricity generated by renewable (-) if applicable	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP if applicable	Electricity generated by CHP if applicable	Electricity generated by renewable if applicable	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP if applicable	Electricity generated by CHP if applicable	Electricity generated by renewable if applicable	Lighting	Auxiliary	Cooling	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated DER SAP10 (kgCO2 / m2)
					DER Sheet (Row 384)	DER Sheet (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 310b x (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 307c x (Row 367c x 0.01)]	Select fuel type	DER Sheet [Row 310c x (Row 367c x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) x (Row 362 x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) + (Row 361 + 362)]	DER Sheet Row 380	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315																										
Type 01	77.96	1	77.96	28.9	28.9	2669.5965	Grid Electricity	1777.9262	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-682.2596	338.6979	232.0713	0	1,386	923			-354	176	120	0	2,250	622	414			-159	79	54	0	1,010	13.0
Type 02	89.8	1	89.8	20.9	20.9	1933.5358	Grid Electricity	1856.5797	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-785.8939	390.4916	213.0179	0	1,004	964			-408	204	111	0	1,874	451	433			-183	92	50	0	841	9.4
Type 03	74.65	1	74.65	20.8	20.9	1396.8158	Grid Electricity	1750.5956	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-636.351	330.2227	177.0801	0	725	909			-341	171	92	0	1,556	325	408			-153	77	41	0	699	9.4
Type 04	107.75	1	107.75	18.3	18.3	2134.0068	Grid Electricity	1930.8383	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-949.9817	437.5614	255.5978	0	1,108	1,002			-493	227	133	0	1,976	497	450			-221	102	60	0	887	8.2
Type 05	63.08	1	63.08	23.1	23.1	1320.4469	Grid Electricity	1609.5155	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-552.7168	284.4091	147.1814	0	685	835			-287	148	76	0	1,458	308	375			-129	66	34	0	654	10.4
Type 06	81.48	1	81.48	15.1	15.1	722.85	Grid Electricity	1804.41	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-716.8043	367.4855	193.2818	0	375	936			-372	191	100	0	1,231	168	420			-167	86	45	0	552	6.8
Type 07	75.13	1	75.13	15.3	15.3	601.7536	Grid Electricity	1754.7033	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-656.351	332.1618	178.2187	0	312	911			-341	172	92	0	1,147	140	409			-153	77	42	0	515	6.9
Type 08	58.04	1	58.04	18.4	18.4	613.1436	Grid Electricity	1553.843	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-509.5356	268.3526	135.4218	0	318	806			-264	139	70	0	1,070	143	362			-119	63	32	0	480	8.3
Type 09	101.99	1	101.99	23.2	23.2	2889.8837	Grid Electricity	1913.7574	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-898.1645	408.4973	241.9343	0	1,500	993			-466	212	126	0	2,365	673	446			-209	95	56	0	1,062	10.4
Type 10	53.12	1	53.12	28.6	28.6	1520.5918	Grid Electricity	1497.3535	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-466.3546	247.2574	123.9422	0	789	777			-242	128	64	0	1,517	354	349			-109	58	29	0	681	12.8
Type 11	54.37	1	54.37	17.1	17.1	352.8103	Grid Electricity	1511.8206	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-474.9908	273.0517	126.8588	0	183	785			-247	142	66	0	929	82	352			-111	64	30	0	417	7.7
Type 12	94.19	1	94.19	16.5	16.5	1310.1521	Grid Electricity	1878.5554	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-829.0749	411.0345	223.4316	0	680	975			-430	213	116	0	1,554	305	438			-193	96	52	0	698	7.4
Type 13	83.05	1	83.05	21.2	21.2	1748.6416	Grid Electricity	1815.3613	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-725.4405	355.3436	197.006	0	908	942			-377	184	102	0	1,760	407	423			-169	83	46	0	790	9.5
Type 14	75.13	1	75.13	30.8	30.8	2857.8837	Grid Electricity	1754.7033	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-656.351	329.0356	178.2187	0	1,483	911			-341	171	92	0	2,317	666	409			-153	77	42	0	1,040	13.8
Type 15	97.74	1	97.74	28.9	28.9	3781.688	Grid Electricity	1893.7995	Grid Electricity		Grid Electricity		Grid Electricity		Grid Electricity		-854.9835	397.7348	231.8527	0	1,963	983			-444	206	120	0	2,829	881	441			-199	93	54	0	1,270	13.0
Sum	1,187	15	1,187	21.8	-	25,854	N/A	26,304	N/A	0	N/A	0	N/A	0	N/A	0	-10,415	5,174	2,855	0	13,418	13,652	0	0	-5,406	2,685	1,482	0	25,832	6,024	6,129	0	0	-2,427	1,206	665	0	11,597	9.8

Appendix D: Calculation of Energy from LZC Sources.

Domestic

BE LEAN (Nos from DER Worksheet)		
URN	TFA (m2)	kWh/year
		Total Energy Used (238)
Type 01	77.96	5018.2919
Type 02	89.8	4396.625
Type 03	74.65	3654.7142
Type 04	107.75	4758.0043
Type 05	63.08	3361.5529
Type 06	81.48	3088.0273
Type 07	75.13	2866.8374
Type 08	58.04	2570.761
Type 09	101.99	5454.0727
Type 10	53.12	3389.1449
Type 11	54.37	2264.5414
Type 12	94.19	3823.1736
Type 13	83.05	4116.3545
Type 14	75.13	5119.8413
Type 15	97.74	6305.075
Modelled Floor Area	1,187	60187.0174
Total Resi Floor Area	22,294	1129957.6780

Be Green (Nos from DER Worksheet)		
kWh/year		
Total Delivered Energy (238)	Elec produced from PV (233)	Elec produced by other renewables
4336.0323	682.2596	0
3610.7311	785.8939	0
2998.3632	656.351	0
3808.0226	949.9817	0
2808.8363	552.7166	0
2371.223	716.8043	0
2210.4864	656.351	0
2061.2254	509.5356	0
4555.9082	898.1645	0
2922.7903	466.3546	0
1789.5506	474.9908	0
2994.0987	829.0749	0
3390.914	725.4405	0
4463.4903	656.351	0
5450.0915	854.9835	0

Total Energy Renewables provides kWh/year	% of Energy Requirements
682.2596	13.60%
785.8939	17.87%
656.351	17.96%
949.9817	19.97%
552.7166	16.44%
716.8043	23.21%
656.351	22.89%
509.5356	19.82%
898.1645	16.47%
466.3546	13.76%
474.9908	20.98%
829.0749	21.69%
725.4405	17.62%
656.351	12.82%
854.9835	13.56%
10415.2535	17.30%

Non-Domestic

URN	TFA (m2)	Energy kWh/m2/year						Energy provided by Heat Pump	% of Energy Requirements
		Heating	Cooling	Auxiliary	Lighting	Hot Water	Total Energy		
Non Residential Lean	11996.6	4.620	2.150	6.240	11.710	14.660	39.38	16.2315	41.22%

	TFA (m2)	% of Energy Requirements
Total Residential	22,294	17.30%
Total Non-Residential	11,997	41.22%

Total Percentage of Energy Requirement from LZCs	25.67%

Appendix E: BREEAM UK New Construction 2018 Pre-Assessment Documents.

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SUSTAINABILITY

BREEAM UK NEW CONSTRUCTION 2018 PRE-ASSESSMENT REPORT
APPROACH TO MULTI RESIDENTIAL AREAS FOR GUILD LIVING EPSOM.
REVISION 0 – 15 JANUARY 2021

Audit Sheet.

Rev.	Date	Description	Prepared	Verified
0	15/01/2021	Issue for Planning	AB	ML

BREEAM Audit box.

Assessment	Multi Residential: Fully Fitted
BRE registration number	Multi Residential: (TBC)
Licensed assessor	Alexandra Bryant
BREEAM scheme	BREEEAM UK New Construction 2018.
BREEAM scheme version	Issue 3.0
Assessment Stage	Pre-Assessment

BREEAM Credit filtering box.

Building type and sub-group	Multi Residential (Care Home)
Building floor area	>500-<10,000m^2
Building services (heating)	Direct Electric
Building services (cooling)	Other cooling system
Building services (DHW system)	ASHP with electric top-up
Building services (controls)	Standard times/controls
Commercial cold storage systems	N/A
Laboratory (type, area and size)	N/A
Laboratory containment level	N/A
Fume cupboards / containment devices	N/A
Unregulated water uses	Yes

Contents.

1. Executive Summary.

This report provides an outline approach to the BREEAM 2018 UK New Construction (NC) Pre-Assessment strategy for the proposed Multi Residential commercial areas included in the Guild Living Epsom development.

In order to demonstrate compliance with Epsom and Ewell Borough Council, Core Strategy (2007) Policy CS6 and Guild Living Brand Standards, this Pre-Assessment will outline a route for each of the proposed areas to achieve 'BREEAM 'Very Good' (min. 55%>).

The current anticipated baseline score for the proposed Guild Living Epsom Multi Residential areas are as follows:

– Multi Residential - Baseline score / rating: 64.4% (BREEAM 'Very Good').

All assessments are currently exceeding the minimum requirements for BREEAM 'Very Good' rating by 9.00%. We recommend a margin of at least 5%–7% is maintained above the minimum required score at this stage in order to secure the target rating, as well as consider potential design changes and constraints identified during the construction stage.

Figure 1 summarises a visual representation of the current anticipated 'baseline' scores for each assessment, relative to the minimum required score for each BREEAM rating threshold.

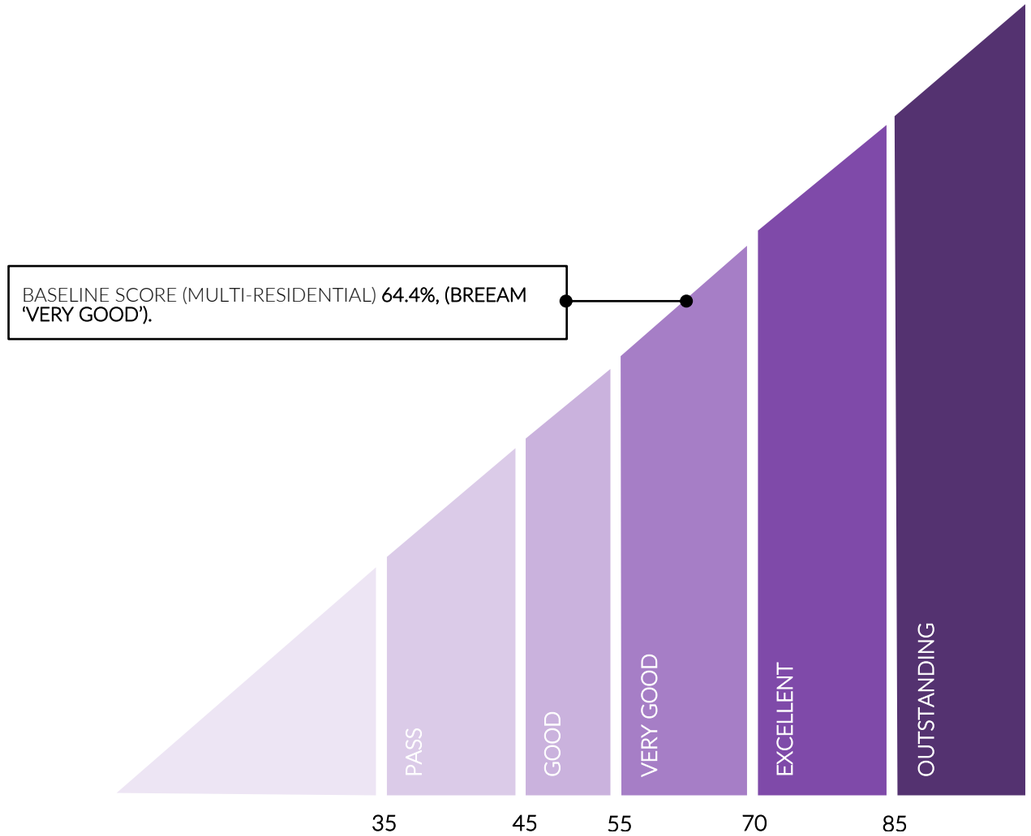

Figure 1: BREEAM 2018 Scale and Anticipated Performance Scores.

2. Assessment Details.

2.1 Introduction

This report provides an outline approach to the BREEAM UK New Construction 2018 Pre-Assessment strategy for the proposed commercial areas included in the Guild Living Epsom development.

2.2 Assessment Type

The Multi Residential areas will be assessed under the BREEAM UK New Construction (NC) 2018, Fully Fitted criteria.

Figure 2 below identifies the alignment with MEP level of fit out and the BREEAM Assessment methodologies being completed.

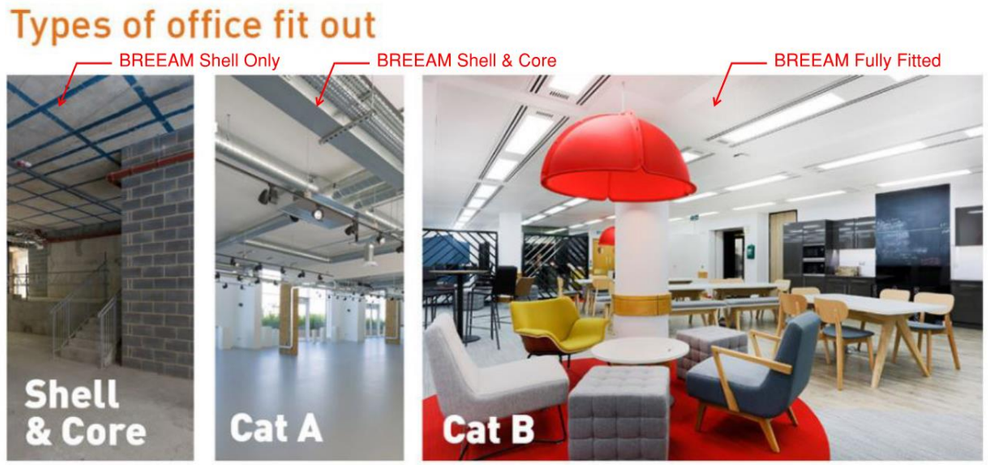

Figure 2 BREEAM Assessment Type Definitions

2.3 Assessment Rating

In line with Epsom and Ewell Borough Council Core Strategy (2007), Policy CS6 and Guild Living Brand Standards, the Commercial areas will be designed to achieve a BREEAM UK New Construction (NC) 2018 'Very Good' rating (55%>) with an aspiration for 'Excellent' where feasible.

2.4 Pre-Assessment

The Pre-Assessment strategy has been put together for the Multi Residential areas setting out a route to achieve BREEAM 'Very Good' (55%>), as well as highlight the key stages evidence was to be received by, additional appointments, and the design team members responsible for each credit issue.

Credits currently included in the credit score will need to be reviewed by the design team and each team member will be expected to provide feedback regarding credits under their responsibility, identifying any relevant issues. Once comments have been raised by the project team, the report and the predicted scores will be updated.

Currently the following predicted scores have been calculated based upon experience with similar buildings and Hoare Lea's current understanding of the proposed development:

– Multi Residential - Baseline score / rating: 64.4% (BREEAM 'Very Good').

All mandatory and minimum standards for the BREEAM 'Very Good' rating have been incorporated within the assessment strategy for the targeted baseline score.

3. Project Team Members.

Discipline	Organisation
Developer/Client	Guild Living
Project Manager	Cast Consultancy
Quantity Surveyor Team/Cost Consultant	Cast Consultancy
Architect	Marchese Partners
Principle Designer	Orsa
Building Services Consultant	Hoare Lea LLP
Civils / Drainage / Structural Consultant	Hydrock
Vertical Transportation Consultant	Hoare Lea LLP
Security Consultant	Hoare Lea LLP
Daylighting and Glare Control Consultant	Avison Young
Energy Assessor (Part L)	Hoare Lea LLP
Landscape Architect	Andy Sturgeon
Ecologist	Arup
Acoustician	Hoare Lea LLP
Planning Consultant	QED
Transport Consultant	Mayer Browne

4. Summary Score Sheet.

The summary table below highlights the list of targeted credits for the current BREEAM UK NC 2018 Pre-Assessment. Mandatory credits to achieve a 'Very Good' rating and above are highlighted by **(M).** Additional mandatory credits for an 'Excellent' or 'Outstanding' rating is highlighted by **(M_e) and (M_o)** respectively. Exemplary (innovation) credits are written in brackets, e.g. (+1).

Table 1: BREEAM Target Summary.

Category	Issue	Multi Residential: Fully Fitted	
		Available	Targeted
Management	Man 01: Project brief and design	4	2
	Man 02: Lifecycle cost and service life planning	4	4
	Man 03: Responsible construction practices (M_e), (M_o)	6 (+1)	6 (+1)
	Man 04: Commissioning and handover (M_e), (M_o)	4	3
	Man 05: Aftercare (M_e), (M_o)	3	2
Health & Wellbeing	Hea 01: Visual comfort	4 (+2)	4
	Hea 02: Indoor air quality	4 (+1)	2
	Hea 04: Thermal comfort	3	3
	Hea 05: Acoustic performance	4	3
	Hea 06: Safety	1 (+1)	1
	Hea 07 Safe and healthy surroundings	2	2
Energy	Ene 01: Reduction of energy use and CO_2 emissions (M_e) (M_o)	9	0
	Ene 02: Energy monitoring (M) (M_e) (M_o)	2	2
	Ene 03: External lighting	1	1
	Ene 04: Low carbon design	3	0
	Ene 05: Energy efficient cold storage	N/A	N/A
	Ene 06: Energy efficient transportation systems	2	2
	Ene 07 Energy efficient laboratory systems	N/A	N/A
	Ene 08: Energy efficient equipment	2	0
Transport	Tra 01: Transport assessment and travel plan	2	2
	Tra 02: Sustainable transport measures	10	5
Water	Wat 01: Water consumption (M) (M_e) (M_o)	5 (+1)	3
	Wat 02: Water monitoring (M) (M_e) (M_o)	1	1
	Wat 03: Water leak detection and prevention	1	1
	Wat 04: Water efficient equipment	1	1
Materials	Mat 01: Environmental impacts from construction products - Building life cycle assessment	7 (+3)	0
	Mat 02: Environmental impacts from construction products	1	1
	Mat 03: Responsible sourcing of materials (M) (M_e) (M_o)	4 (+1)	3
	Mat 05: Designing for durability and resilience	1	1
	Mat 06: Material efficiency	1	0
Waste	Wst 01: Construction waste management (M_o)	5 (+1)	4
	Wst 02: Use of recycled and sustainably sourced aggregates	1 (+1)	0
	Wst 03: Operational waste (M_e), (M_o)	1	1
	Wst 04 Speculative floor and ceiling finishes	N/A	N/A
	Wst 05: Adaptation to climate change	1 (+1)	1
	Wst 06: Design for disassembly and adaptability	2	2
Land Use and Ecology	LE 01: Site selection	2	2
	LE 02: Identifying and understanding the risks and opportunities for the project	2 (+1)	2
	LE 03: Managing negative impacts on ecology	3	3
	LE 04: Change and enhancement of ecological value	4 (+1)	3
	LE 05: Long term ecology management and maintenance	2	2
Pollution	Pol 01: Impact of refrigerants	3	2
	Pol 02: Local air quality	2	1
	Pol 03: Flood and surface water management	5	4
	Pol 04: Reduction of night-time light pollution	1	1
	Pol 05: Reduction of noise pollution	1	1
Innovation	Inn 01: Approved Innovation and Exemplary Level Credits	10	1
Totals	Targeted weighted score:	64.4%	
	Targeted weighted Rating	BREEAM Very Good (55%)	

5. Early Action Credits.

Under the BREEAM Assessment there are a number of credits that are time critical and require early action by the design team in order for the credits to be achieved. For these credits, the actions are required prior to end of RIBA Stages 1 and 2.

It is advised that the Design Team fully to review the actions required in Tables 2 and 3 below to understand the required evidence needed to be demonstrated prior to the completion of RIBA Stages 1 and 2.

Table 2: BREEAM NC 2018 RIBA Stage 1 Evidence Requirements

Credit Issues	RIBA Stage 1 Actions	Owner	Comment
LE 02 Ecological risks and opportunities	A Suitably Qualified Ecologist (SQE) carries out a survey and evaluation (see Methodology) for the site early enough to influence site preparation works, layout and, where necessary, strategic planning decisions. The SQE's survey and evaluation determines the site's ecological baseline (see Definitions), including: – Current and potential ecological value and condition of the site and related areas within the Zone of Influence. – Direct and indirect risks to current ecological value from the project. – Capacity and feasibility for enhancement of the site's ecological value and, where relevant, areas within the Zone of Influence.	Arup	Credit partially complete. Arup have provided Ecological Impact Assessment (EIA) to support the planning application, with a Preliminary Ecological Appraisal and Bat Report appended

Table 3 BREEAM NC 2018 RIBA Stage 2 Evidence Requirements

Credit Issues	RIBA Stage 2 Actions	Owner	Comment
Man 01 Project brief and design	Prior to completion of the Concept Design, the project delivery stakeholders meet to identify and define for each key phase of project delivery: (a) Roles; (b) Responsibilities, and (c) Contributions. The project team demonstrates how the project delivery stakeholders' contributions and the consultation process outcomes influence the following: (a) Initial Project Brief; (b) Project Execution Plan; (c) Communication Strategy; and (d) Concept Design.	Morgan Sindall	Credit partially complete. DAS Report to be provided alongside early stage meeting minutes, and Public Consultation Documents.
	Prior to completion of the Concept Design, the design team consult with all interested parties on matters that cover the minimum consultation content. Demonstrate how the stakeholder contributions and consultation exercise outcomes influence the Initial Project Brief and Concept Design.		
Man 02: Life cycle costing and service life planning	Stage 2 Elemental Life Cycle Cost analysis is completed in line with 'Standardised method of life cycle costing for construction procurement' PD 156865: 2008(6). The plan informs the client on: (a) Future replacement costs over a period of analysis as required by the client (e.g. 20, 30, 50 or 60 years); and (b) Includes service life, maintenance and operation cost estimates.	Anthony Waterman (ADW)	Credit Outstanding. Multi Residential report to be commissioning confirming the cost analysis assessment for these areas.
Hea 06 Security	Appoint a Suitability Qualified Security Specialist (SQSS) to conduct a Security Needs Assessment (SNA).	Hoare Lea Security	Credit partially complete. HL Security have provided SNA outlining the recommendations identified for the scheme. HL Security to confirm if recommendations have changed following recent changes on the scheme. Credit to be secured at Stage 4.
Tra 01 Transport assessment and travel plan	A site-specific transport assessment AND draft travel plan are provided demonstrating full compliance with Tra 01 issue.	Mayer Browne	Credit partially complete. Transport Assessment and Travel Plan documentation have been provided by consultant confirming compliance. Credit to be secured at Stage 4.
Wst 01 Construction waste management	Complete a pre-demolition audit of any existing buildings, structures or hard surfaces being considered for Demolition*. *If Demolition is not taking place at RIBA Stage 2 this documentation can be accepted at a later stage.	Demolition Contractor	Credit preliminary awarded. Due to appointment timescales, requirement has been captured within Principal Contractors (Demo + Construction) prelims document.
Wst 05 Adaptation to climate change	Conduct a climate change adaptation strategy appraisal. The assessment covers the installation of building services and renewable systems, as well as structural and fabric resilience aspects.	Marchese Partners + Hydrock + Hoare Lea LLP	Credit Outstanding. Wst 05 Proforma will be required to be provided by the design team detailing the structural and fabric resilience aspects.
Wst 06 Design for disassembly and adaptability	Conduct a study to explore the ease of disassembly and the functional adaptation potential of different design scenarios. Develop recommendations or solutions based on the study during or prior to Concept Design, that aim to enable and facilitate disassembly and functional adaptation.	Marchese Partners Hydrock + Hoare Lea LLP	Credit Outstanding. Wst 06 Proforma to be provided detailing the ease of disassembly and the functional adaptation potential of different design Scenarios.
LE 02 Ecological risks and opportunities	The project team liaise and collaborate with representative stakeholders early enough to influence key planning decisions to: (a) Identify the optimal ecological outcomes for the site; and (b) Identify, appraise and select measures	Arup	Credit partially complete. Arup have been appointed to undertake LE 02 and LE 03 criteria within their package of works. Full package to be

Credit Issues	RIBA Stage 2 Actions	Owner	Comment
	to meet the optimal ecological outcomes for the site in line with the mitigation hierarchy of action, according to the route being used.		provided post planning submission.
LE 03 Managing impacts on ecology	Further planning to avoid and manage negative ecological impacts on-site is carried out early enough to influence the concept design and design brief as well as site preparation planning.		

6. Conclusion.

Based upon an initial credit review, it is anticipated that the assessed areas can achieve a targeted score well within the BREEAM 'Very Good' (55%>) benchmark rating. Currently the targeted scores for each assessment are as follows:

– Multi Residential - Baseline score / rating: 64.4% (BREEAM 'Very Good').

Following from this Pre-Assessment issue it is advised all early stage credits are fully reviewed and actioned as soon as possible in order to secure the strategy moving forward.

Figures 3 and 4 below provide a visual representation for the scores targeted and unachievable credit scores currently identified for each assessment.

Figure 3 BREEAM Performance Summary and Targeted Credits.

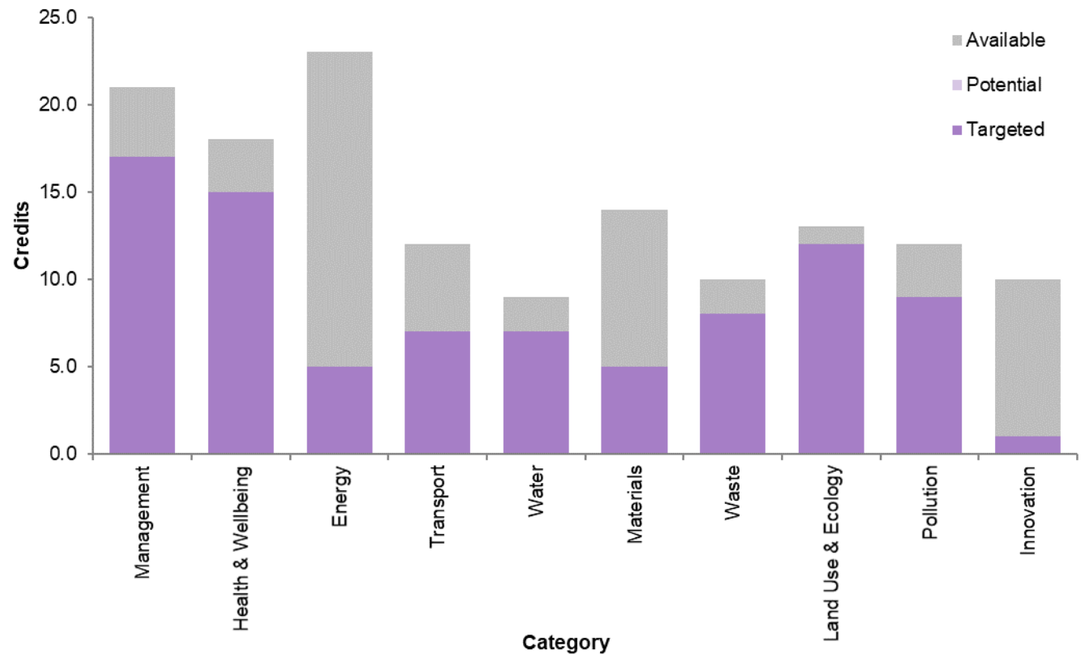

Figure 4 BREEAM Performance Summary and Targeted Credits: Multi Residential assessment (Bar Representation)

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SUSTAINABILITY

BREEAM UK NEW CONSTRUCTION 2018 PRE-ASSESSMENT REPORT
APPROACH TO RETAIL & NURSERY AREAS FOR GUILD LIVING EPSOM.
REVISION 3 – 15 JANUARY 2021

Audit Sheet.

Rev.	Date	Description	Prepared	Verified
0	20/12/2019	Issue for Planning	AB	RC/GB
1	31/01/2020	Stage 2 Issue	AB	RC/GB
2	30/03/2020	Issue for Planning	AB	RC/GB
3	15/01/2021	Update for planning.	AB	ML

BREEAM Audit box.

Assessment	Retail: Shell Only Nursery: Shell Only
BRE registration number	Retail: BREEAM-0080-4120 Nursery: BREEAM-0080-4146
Licensed assessor	Alexandra Bryant
BREEAM scheme	BREEEAM UK New Construction 2018.
BREEAM scheme version	Issue 3.0
Assessment Stage	Pre-Assessment

BREEAM Credit filtering box.

Building type and sub-group	Retail + Nursery areas.
Building floor area	<500m^2
Building services (heating)	Other type of heating system – to be installed by tenant.
Building services (cooling)	Other type of heating system – to be installed by tenant.
Building services (DHW system)	ASHP
Building services (controls)	Standard times/controls
Commercial cold storage systems	N/A
Laboratory (type, area and size)	N/A
Laboratory containment level	N/A
Fume cupboards / containment devices	N/A
Unregulated water uses	Yes

Contents.

1. Executive Summary.

This report provides an outline approach to the BREEAM 2018 UK New Construction (NC) Pre-Assessment strategy for the proposed commercial (retail and nursery) areas included in the Guild Living Epsom development.

In order to demonstrate compliance with Epsom and Ewell Borough Council, Core Strategy (2007) Policy CS6 and Guild Living Brand Standards, this Pre-Assessment will outline a route for each of the proposed areas to achieve 'BREEAM 'Very Good' (min. 55%>).

The current anticipated baseline score for the proposed Guild Living Epsom commercial areas are as follows:

- Retail - Baseline score / rating: 64.5% (BREEAM 'Very Good'); and
- Nursery – Baseline score / rating: 64.5% (BREEAM 'Very Good').

All assessments are currently exceeding the minimum requirements for BREEAM 'Very Good' rating by 9.00%. We recommend a margin of at least 5%–7% is maintained above the minimum required score at this stage in order to secure the target rating, as well as consider potential design changes and constraints identified during the construction stage.

Figure 1 summarises a visual representation of the current anticipated 'baseline' scores for each assessment, relative to the minimum required score for each BREEAM rating threshold.

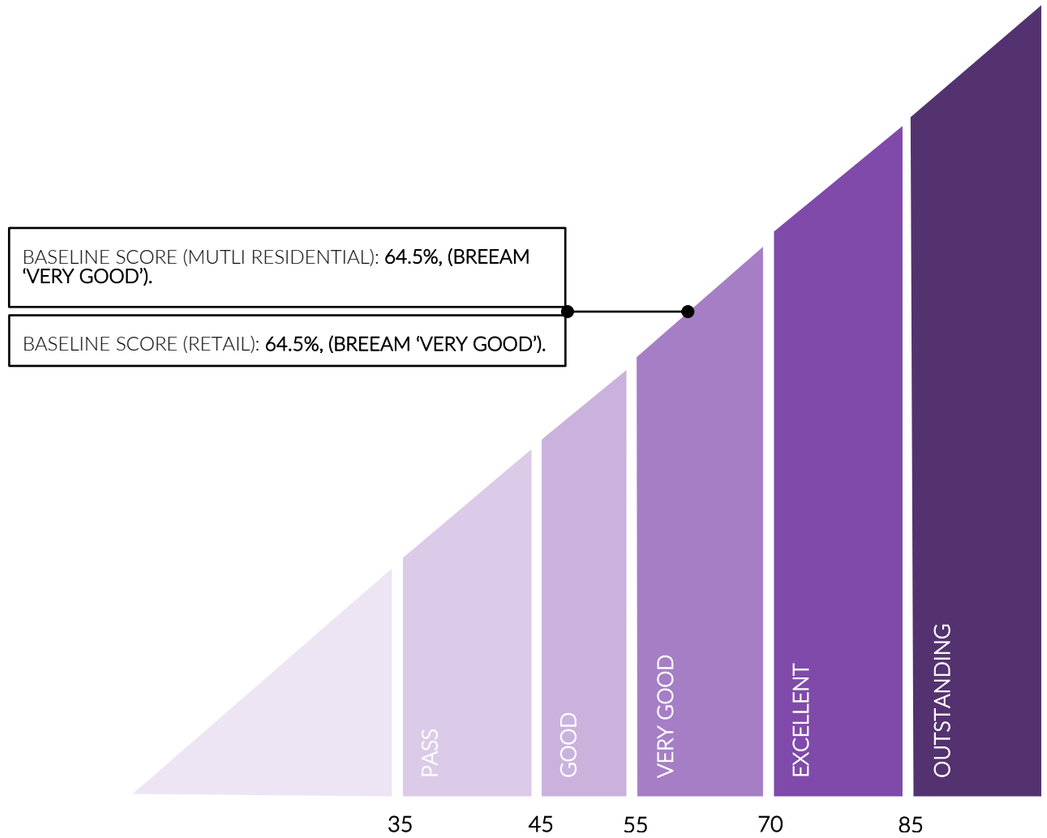

Figure 1: BREEAM 2018 Scale and Anticipated Performance Scores.

2. Assessment Details.

2.1 Introduction

This report provides an outline approach to the BREEAM UK New Construction 2018 Pre-Assessment strategy for the proposed commercial areas included in the Guild Living Epsom development.

2.2 Assessment Type

Two BREEAM UK New Construction (NC) 2018 assessments are currently required for the proposed development. These assessments include:

- Retail: BREEAM UK NC 2018 Shell Only assessment; and
- Nursery: BREEAM UK NC 2018 Shell Only assessment.

Figure 2 below identifies the alignment with MEP level of fit out and the BREEAM Assessment methodologies being completed.

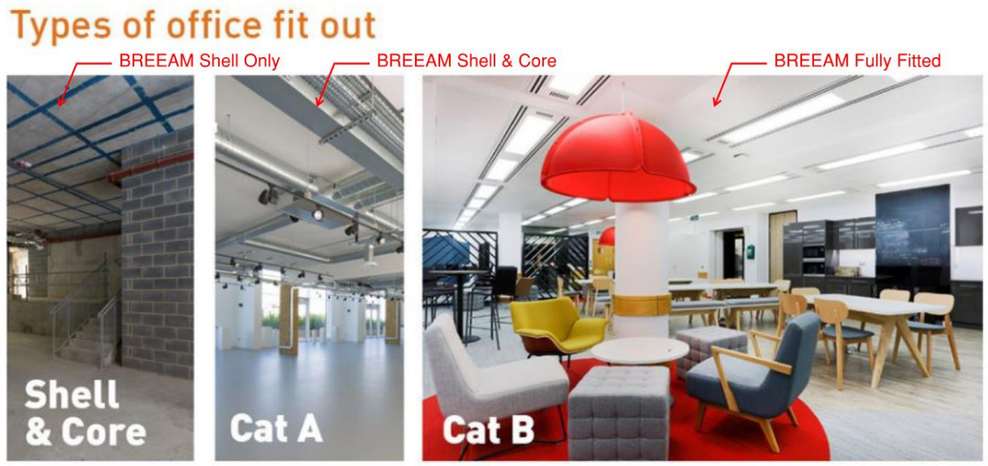

Figure 2 BREEAM Assessment Type Definitions

2.3 Assessment Rating

In line with Epsom and Ewell Borough Council Core Strategy (2007), Policy CS6 and Guild Living Brand Standards, the retail and nursery areas will be designed to achieve a BREEAM UK New Construction (NC) 2018 'Very Good' rating (55%>) with an aspiration for 'Excellent' where feasible.

2.4 Pre-Assessment

A Pre-Assessment strategy has been put together for the commercial areas. The strategy has been undertaken by an independently qualified BREEAM Assessor setting out a route to achieve BREEAM 'Very Good' (55%>), as well as highlight the key stages evidence is to be received by, additional appointments, and the design team members responsible for each credit issue.

Credits currently included in the credit score have been reviewed by the design team and each team member has provided feedback regarding credits under their responsibility, as well as any relevant issues.

Following this engagement, the predicted scores were re-calculated, and the following scores were established:

- Retail - Baseline score / rating: 64.5% (BREEAM 'Very Good').
- Nursery – Baseline score / rating: 64.5% (BREEAM 'Very Good').

All mandatory and minimum standards for the BREEAM 'Very Good' rating have been incorporated within the assessment strategy for the targeted baseline score.

3. Project Team Members.

Discipline	Organisation
Developer/Client	Guild Living
Project Manager	Cast Consultancy
Quantity Surveyor Team/Cost Consultant	Cast Consultancy
Architect	Marchese Partners
Principle Designer	Orsa
Building Services Consultant	Hoare Lea LLP
Civils / Drainage / Structural Consultant	Hydrock
Vertical Transportation Consultant	Hoare Lea LLP
Security Consultant	Hoare Lea LLP
Daylighting and Glare Control Consultant	Avison Young
Energy Assessor (Part L)	Hoare Lea LLP
Landscape Architect	Andy Sturgeon
Ecologist	Arup
Acoustician	Hoare Lea LLP
Planning Consultant	QED
Transport Consultant	Mayer Browne

4. Summary Score Sheet.

The summary table below highlights the list of targeted credits for the current BREEAM UK NC 2018 Pre-Assessment. Mandatory credits to achieve a 'Very Good' rating and above are highlighted by **(M).** Additional mandatory credits for an 'Excellent' or 'Outstanding' rating is highlighted by **(M_e) and (M_o)** respectively. Exemplary (innovation) credits are written in brackets, e.g. (+1).

Table 1: BREEAM Target Summary.

Category	Issue	Retail + Nursery Shell Only Approach	
		Available	Targeted
Management	Man 01: Project brief and design	4	2
	Man 02: Lifecycle cost and service life planning	4	4
	Man 03: Responsible construction practices (M_e), (M_o)	6 (+1)	6 (+1)
	Man 04: Commissioning and handover (M_e), (M_o)	1	1
	Man 05: Aftercare (M_e), (M_o)	N/A	N/A
Health & Wellbeing	Hea 01: Visual comfort	4 (+1)	2
	Hea 02: Indoor air quality	N/A	N/A
	Hea 04: Thermal comfort	N/A	N/A
	Hea 05: Acoustic performance	1	1
	Hea 06: Safety	1 (+1)	1
	Hea 07 Safe and healthy surroundings	2	2
Energy	Ene 01: Reduction of energy use and CO_2 emissions (M_e) (M_o)	9	0
	Ene 02: Energy monitoring (M) (M_e) (M_o)	N/A	N/A
	Ene 03: External lighting	1	1
	Ene 04: Low carbon design	3	0
	Ene 05: Energy efficient cold storage	N/A	N/A
	Ene 06: Energy efficient transportation systems	N/A	N/A
	Ene 07 Energy efficient laboratory systems	N/A	N/A
	Ene 08: Energy efficient equipment	N/A	N/A
Transport	Tra 01: Transport assessment and travel plan	2	2
	Tra 02: Sustainable transport measures	10	5
Water	Wat 01: Water consumption (M) (M_e) (M_o)	N/A	N/A
	Wat 02: Water monitoring (M) (M_e) (M_o)	1	1
	Wat 03: Water leak detection and prevention	1	1
	Wat 04: Water efficient equipment	1	1
Materials	Mat 01: Environmental impacts from construction products - Building life cycle assessment	7 (+2)	0
	Mat 02: Environmental impacts from construction products	1	1
	Mat 03: Responsible sourcing of materials (M) (M_e) (M_o)	4 (+1)	2
	Mat 05: Designing for durability and resilience	1	1
	Mat 06: Material efficiency	1	0
Waste	Wst 01: Construction waste management (M_o)	5 (+1)	4
	Wst 02: Use of recycled and sustainably sourced aggregates	1 (+1)	0
	Wst 03: Operational waste (M_e), (M_o)	1	1
	Wst 04 Speculative floor and ceiling finishes	N/A	N/A
	Wst 05: Adaptation to climate change	1 (+1)	1
	Wst 06: Design for disassembly and adaptability	2	2
Land Use and Ecology	LE 01: Site selection	2	2
	LE 02: Identifying and understanding the risks and opportunities for the project	2 (+1)	2
	LE 03: Managing negative impacts on ecology	3	3
	LE 04: Change and enhancement of ecological value	4 (+1)	3
	LE 05: Long term ecology management and maintenance	2	2
Pollution	Pol 01: Impact of refrigerants	N/A	N/A
	Pol 02: Local air quality	N/A	N/A
	Pol 03: Flood and surface water management	5	4
	Pol 04: Reduction of night-time light pollution	1	1
	Pol 05: Reduction of noise pollution	N/A	N/A
Innovation	Inn 01: Approved Innovation and Exemplary Level Credits	10	1
Totals	Targeted weighted score:	64.5%	
	Targeted weighted Rating	55%	

5. Early Action Credits.

Under the BREEAM Assessment there are a number of credits that are time critical and require early action by the design team in order for the credits to be achieved. For these credits, the actions are required prior to end of RIBA Stages 1 and 2.

It is advised that the Design Team fully to review the actions required in Tables 2 and 3 below to understand the required evidence needed to be demonstrated prior to the completion of RIBA Stages 1 and 2.

Table 2: BREEAM NC 2018 RIBA Stage 1 Evidence Requirements

Credit Issues	RIBA Stage 1 Actions	Owner	Comment
LE 02 Ecological risks and opportunities	A Suitably Qualified Ecologist (SQE) carries out a survey and evaluation (see Methodology) for the site early enough to influence site preparation works, layout and, where necessary, strategic planning decisions. The SQE's survey and evaluation determines the site's ecological baseline (see Definitions), including: – Current and potential ecological value and condition of the site and related areas within the Zone of Influence. – Direct and indirect risks to current ecological value from the project. – Capacity and feasibility for enhancement of the site's ecological value and, where relevant, areas within the Zone of Influence.	Arup	Credit partially complete. Arup have provided Ecological Impact Assessment (EIA) to support the planning application, with a Preliminary Ecological Appraisal and Bat Report appended

Table 3: BREEAM NC 2018 RIBA Stage 2 Evidence Requirements

Credit Issues	RIBA Stage 2 Actions	Owner	Comment
Man 01 Project brief and design	Prior to completion of the Concept Design, the project delivery stakeholders meet to identify and define for each key phase of project delivery: (a) Roles; (b) Responsibilities, and (c) Contributions. The project team demonstrates how the project delivery stakeholders' contributions and the consultation process outcomes influence the following: (a) Initial Project Brief; (b) Project Execution Plan; (c) Communication Strategy; and (d) Concept Design. Prior to completion of the Concept Design, the design team consult with all interested parties on matters that cover the minimum consultation content. Demonstrate how the stakeholder contributions and consultation exercise outcomes influence the Initial Project Brief and Concept Design.	Morgan Sindall	Credit partially complete. DAS Report to be provided alongside early stage meeting minutes, and Public Consultation Documents.
Man 02: Life cycle costing and service life planning	Stage 2 Elemental Life Cycle Cost analysis is completed in line with 'Standardised method of life cycle costing for construction procurement' PD 156865: 2008(6). The plan informs the client on: (a) Future replacement costs over a period of analysis as required by the client (e.g. 20, 30, 50 or 60 years); and (b) Includes service life, maintenance and operation cost estimates.	Anthony Waterman (ADW)	Credit Outstanding. ADW have provided a Stage 2 report. Outstanding queries are to be addressed prior to awarding of credit.

Credit Issues	RIBA Stage 2 Actions	Owner	Comment
Hea 06 Security	Appoint a Suitability Qualified Security Specialist (SQSS) to conduct a Security Needs Assessment (SNA).	Hoare Lea Security	Credit partially complete. HL Security have provided SNA outlining the recommendations identified for the scheme. HL Security to confirm if recommendations have changed following recent changes on the scheme. Credit to be secured at Stage 4.
Tra 01 Transport assessment and travel plan	A site-specific transport assessment AND draft travel plan are provided demonstrating full compliance with Tra 01 issue.	Mayer Browne	Credit partially complete. Transport Assessment and Travel Plan documentation have been provided by consultant confirming compliance. Credit to be secured at Stage 4.
Wst 01 Construction waste management	Complete a pre-demolition audit of any existing buildings, structures or hard surfaces being considered for Demolition*. *If Demolition is not taking place at RIBA Stage 2 this documentation can be accepted at a later stage.	Demolition Contractor	Credit preliminary awarded. Due to appointment timescales, requirement has been captured within Principal Contractors (Demo + Construction) prelims document.
Wst 05 Adaptation to climate change	Conduct a climate change adaptation strategy appraisal. The assessment covers the installation of building services and renewable systems, as well as structural and fabric resilience aspects.	Marchese	Credit partially complete. Credit partially completed Outstanding evidence awaiting from Marchese.
Wst 06 Design for disassembly and adaptability	Conduct a study to explore the ease of disassembly and the functional adaptation potential of different design scenarios. Develop recommendations or solutions based on the study during or prior to Concept Design, that aim to enable and facilitate disassembly and functional adaptation.	Marchese	Credit partially complete. Credit partially completed. Outstanding evidence awaiting from Marchese.
LE 02 Ecological risks and opportunities	The project team liaise and collaborate with representative stakeholders early enough to influence key planning decisions to: (a) Identify the optimal ecological outcomes for the site; and (b) Identify, appraise and select measures to meet the	Arup	Credit partially complete. Arup have been appointed to undertake LE 02 and LE 03 criteria within their package of works.

Credit Issues	RIBA Stage 2 Actions	Owner	Comment
	optimal ecological outcomes for the site in line with the mitigation hierarchy of action, according to the route being used.		Full package to be provided post planning submission (Stage 4).
LE 03 Managing impacts on ecology	Further planning to avoid and manage negative ecological impacts on-site is carried out early enough to influence the concept design and design brief as well as site preparation planning.		

6. Conclusion.

Based upon an initial credit review, it is anticipated that the assessed areas can achieve a targeted score well within the BREEAM 'Very Good' (55%>) benchmark rating. Currently the targeted scores for the assessment as follows:

- Retail - Baseline score / rating: 64.5% (BREEAM 'Very Good'); and
- Nursery – Baseline score / rating: 64.5% (BREEAM 'Very Good').

Following from this Pre-Assessment issue it is advised all early stage credits are fully reviewed and actioned as soon as possible in order to secure the strategy moving forward.

Figures 3 and 4 below provide a visual representation for the scores targeted and unachievable credit scores currently identified for each assessment.

Figure 3 BREEAM Performance Summary and Targeted Credits: Retail + Nursery assessment.

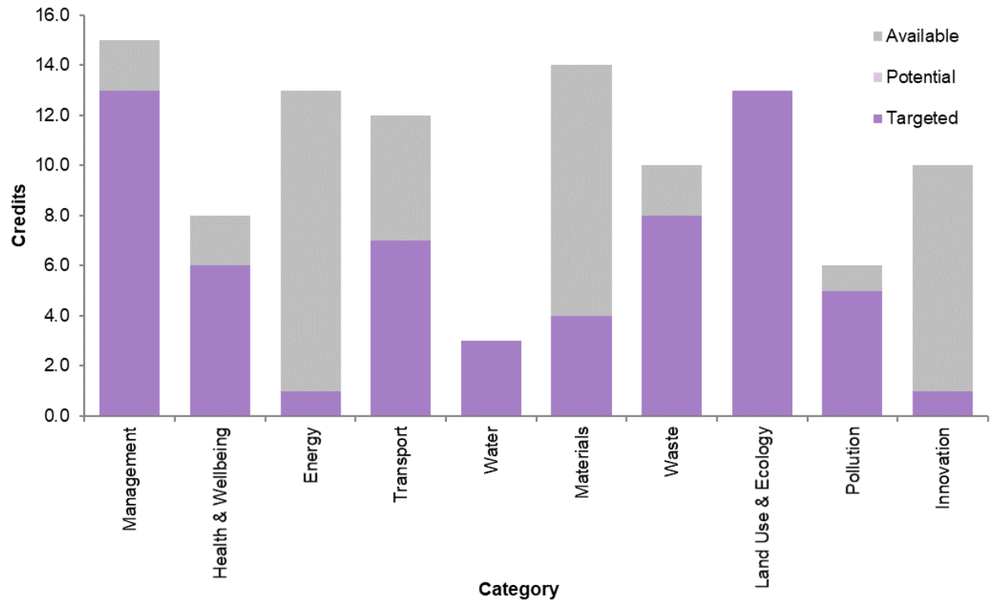

Figure 4 BREEAM Performance Summary and Targeted Credits (Bar Representation).

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