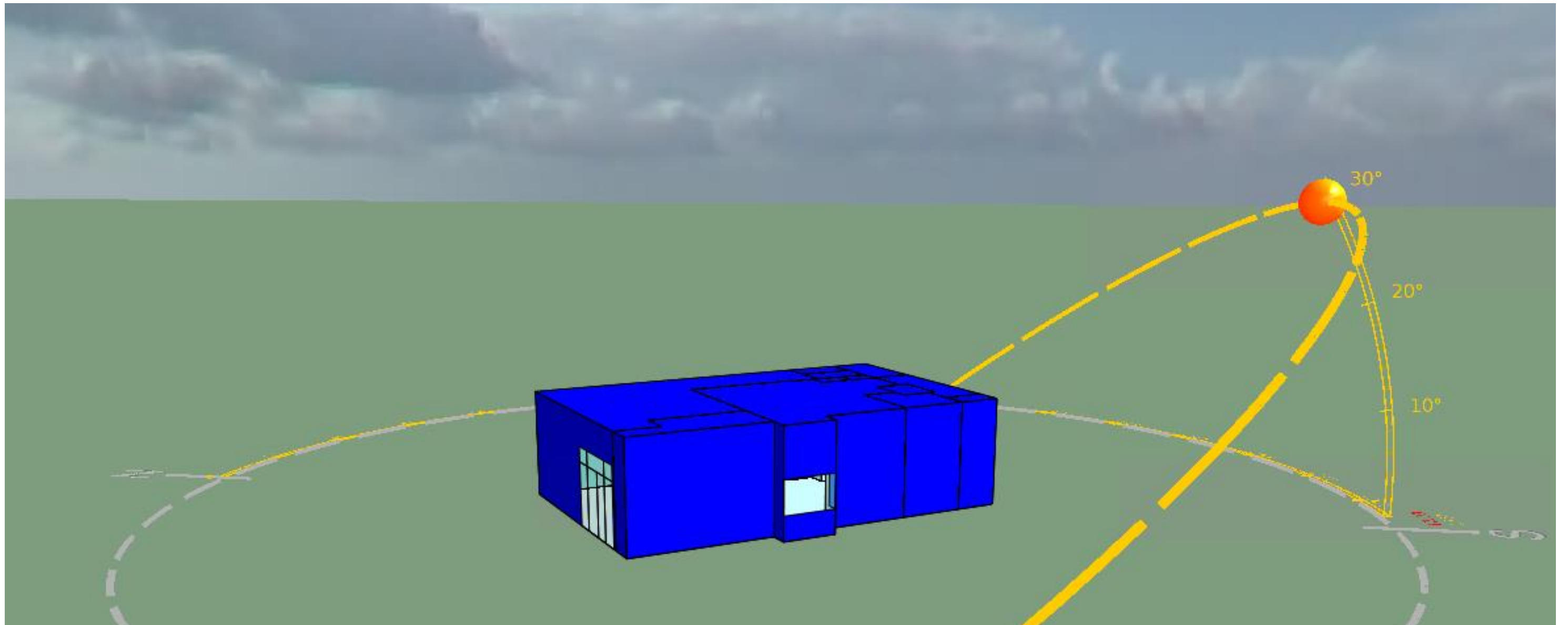




# SCOURS LANE DEVELOPMENT SCOURS LANE, READING

**STAGE 1 - ENERGY STRATEGY STATEMENT**

**(REVISION 01)**

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PROJECT INFORMATION

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JOB NO. 210715

DOC TITLE Energy & Sustainability Statement

VERSION 01

FILE NAME 210715 Scours Lane Development, Reading Energy & Sustainability Statement

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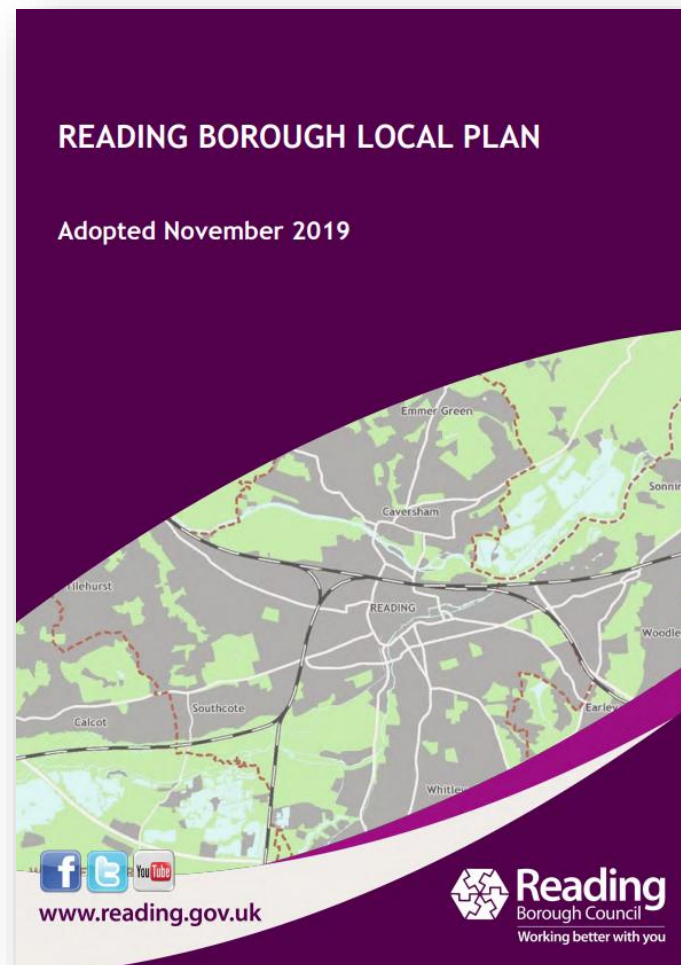
ADDRESS



# 1 Introduction

## 1.1 Purpose of Report

The purpose of this energy statement is to provide clarity on the design and proposed solutions that will address climate change mitigation opportunities and details the measures necessary to comply with the strategic and core policies laid out in Reading's Local Plan.



The design of the building uses the hierarchical approach to reducing energy and carbon dioxide emissions; reducing energy demand, efficient low carbon supply of energy and offsetting the remaining energy consumption through onsite renewable energy generation. These principles are integral to the proposed development's design and development.

The report sets targets for the building fabric and services to align with the current part L2A notional building performance. The report also details the Low and zero carbon technology options considered in the development of the design and explains the options chosen.

The proposed development is a single storey restaurant unit incorporating Food preparation area, eating/drinking seating areas, BOH & colleague areas. The building has an approximate floor area of 165m<sup>2</sup>.

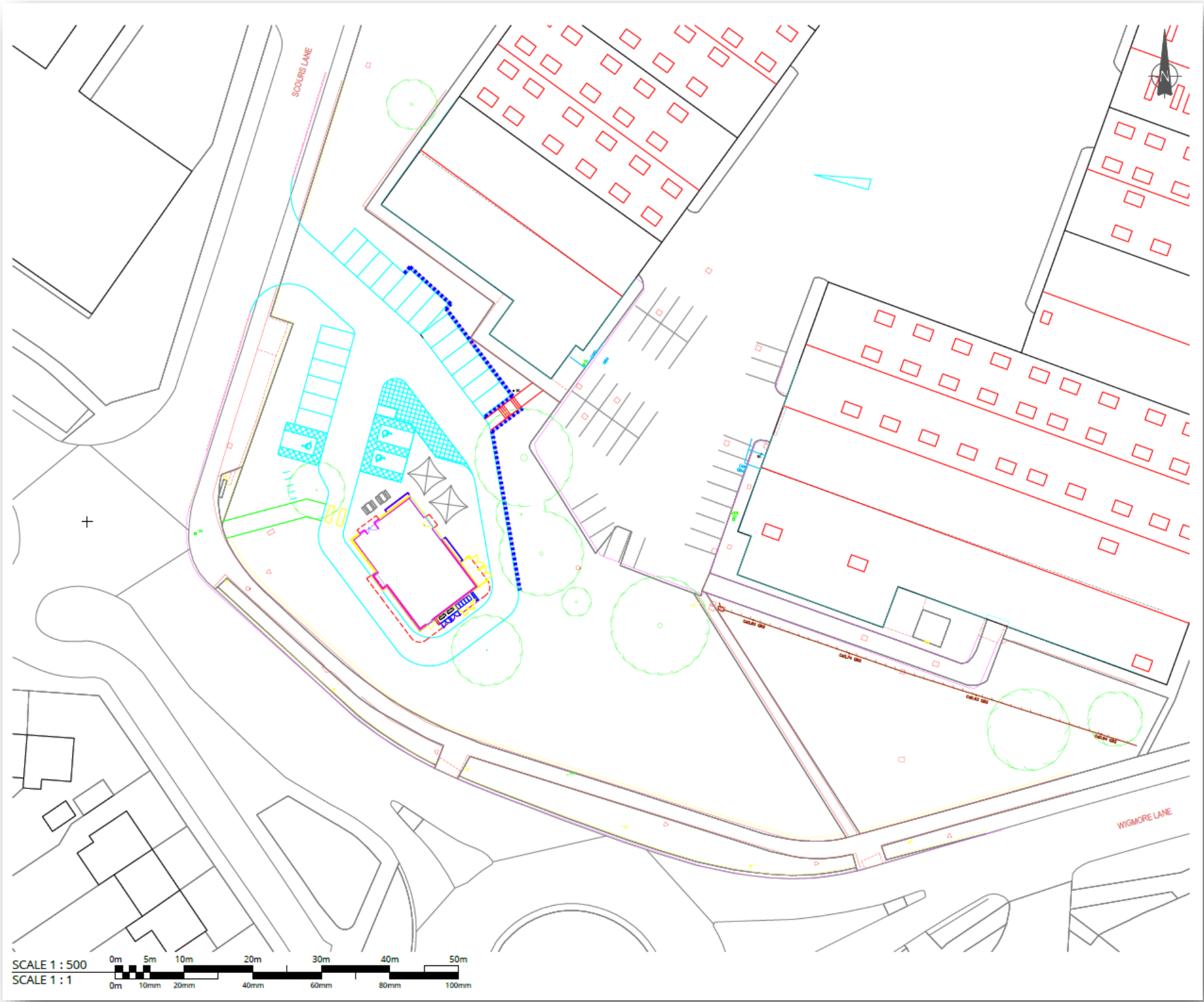
## 1.2 Site Description

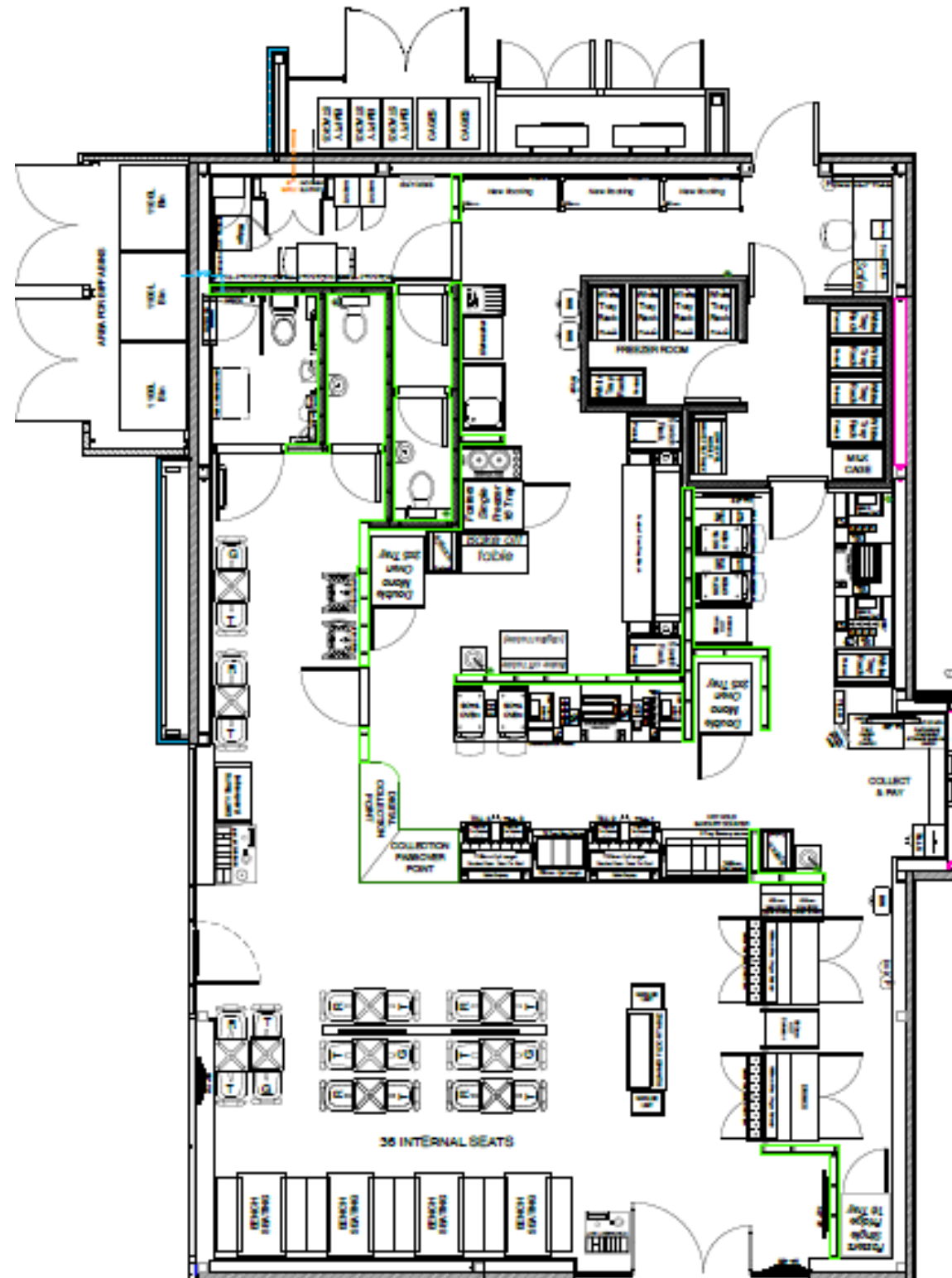
The site is located to the north of Reading Town Centre. The site is located on Stadium trade and business park off Scours Lane. The site will provide convenient vehicular access from the A329 and pedestrian access for local residents and workers. The site occupies approximately 0.3 acres.



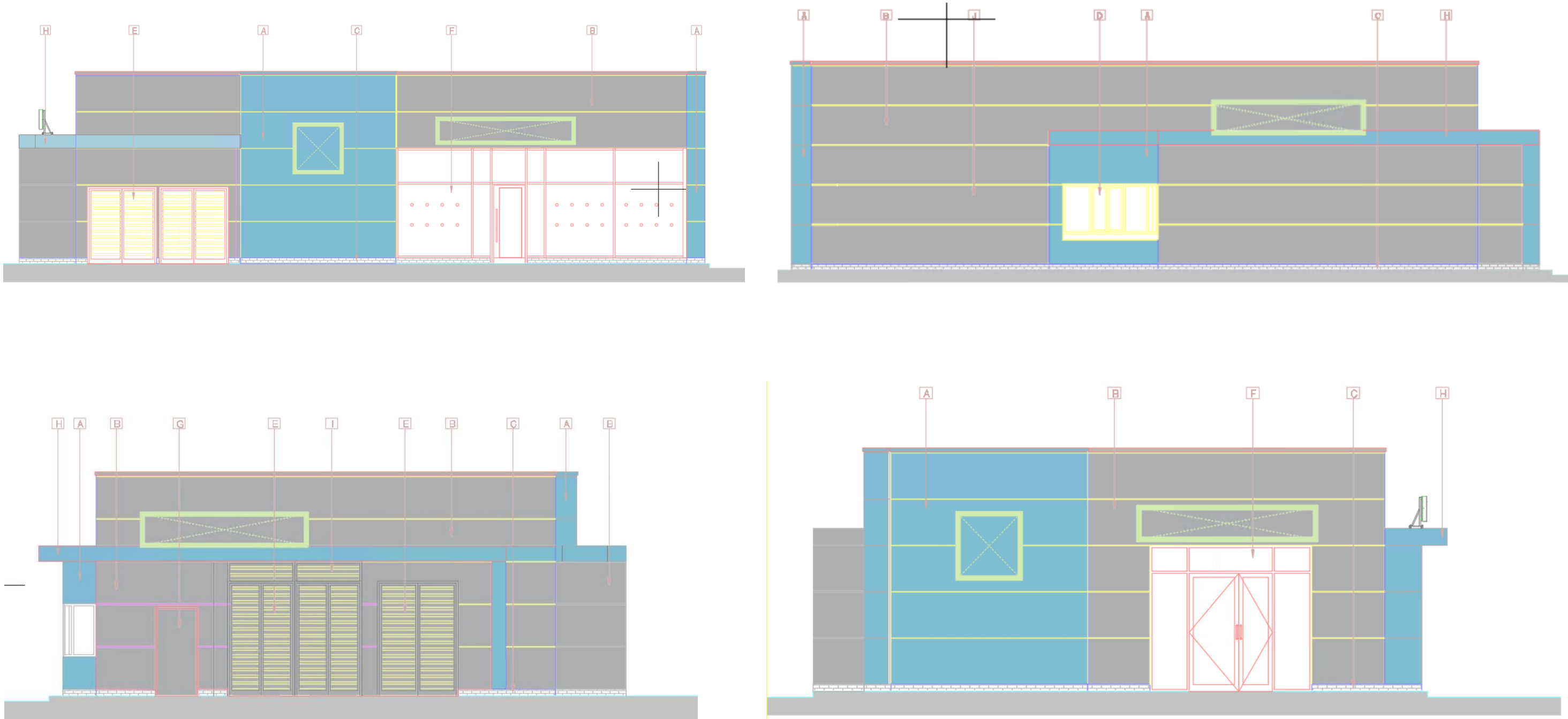
## 1.3 Development Description

1.3.1 Site Plan





1.3.3 Typical Store Elevations



1.4 Planning Policy

| Policy Document                         | Policy Reference                                                                   | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| National Planning Policy Framework 2019 | 2.(11) Achieving sustainable development                                           | (11) Plans to positively seek opportunities to meet the development needs of their area and be sufficiently flexible to adapt to rapid change.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                         | 3.(20) Plan-making                                                                 | (20) Strategic policies should make sufficient provision for: infrastructure for transport, telecommunications, security, waste management, water supply, wastewater, flood risk and coastal change management, and the provision of minerals and energy (including heat).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                         | 14.(149-151) Meeting the challenge of climate change, flooding, and coastal change | (149) Plans should take a proactive approach to mitigating and adapting to climate change, considering the long-term implications for: <ul style="list-style-type: none"><li>• flood risk,</li><li>• coastal change,</li><li>• water supply,</li><li>• biodiversity and landscapes,</li><li>• risk of overheating from rising temperatures.</li></ul> (150) New development to be planned to ensure that: <ul style="list-style-type: none"><li>• Risks can be managed through suitable adaptation measures, including planning of green infrastructure.</li><li>• They help to reduce GHG emissions via location, orientation, and design.</li></ul> (151) To increase the use and supply of renewable and low carbon energy and heat, plans should: <ul style="list-style-type: none"><li>• Create a positive strategy for energy from these sources</li><li>• Identify suitable areas for renewable and low carbon energy sources/supporting infrastructure</li><li>• Identify opportunities for the development to draw its energy from decentralised, renewable, or low carbon energy supply systems and for co-locating potential heat customers and suppliers.</li></ul> (153) In determining planning applications, local planning authorities should expect new development to: <ul style="list-style-type: none"><li>• Comply with any development plan policies on local requirements for decentralised energy supply (unless this is demonstrated too not be feasible).</li><li>• Take account of landform, layout, building orientation, massing, and landscaping to minimise energy consumption.</li></ul> |
|                                         | 15.(170-181) Conserving and enhancing the natural environment                      | (170) Planning policies and decisions should contribute to and enhance the natural and local environment by: <ul style="list-style-type: none"><li>• Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.</li><li>• Development should, wherever possible, help to improve local environmental conditions such as air and water quality, considering relevant information such as river basin management plans.</li></ul> (181) <ul style="list-style-type: none"><li>• Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, considering the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas.</li><li>• Opportunities to improve air quality or mitigate impacts should be identified at the plan-making stage, such as through traffic and travel management, and green infrastructure provision and enhancement.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                         | 17. (204) Facilitating the sustainable use of minerals                             | (204) Planning policies should: <ul style="list-style-type: none"><li>• Take account of the contribution that substitute, or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                         |                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| Policy Document                                     | Policy Reference                         | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reading Borough Local Plan<br>Adopted November 2019 | CC2: SUSTAINABLE DESIGN AND CONSTRUCTION | <p>Proposals for new development, including the construction of new buildings and the redevelopment and refurbishment of existing building stock, will be acceptable where the design of buildings and site layouts use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and take account of the effects of climate change.</p> <p>To meet these requirements:</p> <ul style="list-style-type: none"><li>• All major non-residential developments or conversions to residential are required to meet the most up to date BREEAM ‘Excellent’ standards, where possible;</li><li>• All minor non-residential developments or conversions to residential are required to meet the most up to date BREEAM ‘Very Good’ standard as a minimum;</li><li>• All non-residential development or conversions to residential should incorporate water conservation measures so that predicted per capita consumption does not exceed the appropriate levels set out in the applicable BREEAM standard. Both residential and non-residential development should include recycling greywater and rainwater harvesting where systems are energy and cost effective.</li></ul>                                                                                                                                                                                                                        |
| Reading Borough Local Plan<br>Adopted November 2019 | CC3: ADAPTATION TO CLIMATE CHANGE        | <p>All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development:</p> <ul style="list-style-type: none"><li>• Wherever possible, new buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements;</li><li>• Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example by including measures such as solar shading, thermal mass, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, green walls, etc;</li><li>• Use of trees and other planting, where appropriate as part of a landscape scheme, to provide shading of amenity areas, buildings and streets and to help to connect habitat, designed with native plants that are carefully selected, managed and adaptable to meet the predicted changed climatic conditions; and</li><li>• All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change</li></ul> |

1.5 Part L2A Building Regulations

The proposed building is required to meet the requirements of Part L2A 2013 of the building regulations. The building regulation document sets out minimum building fabric and services standards, limitations on the amount of acceptable solar gain and a Target CO2 Emission Rate (TER) that must not be exceeded by the actual Building Emission Rate (BER).

Building Control bodies in the UK will require evidence that the building complies with the five criteria set out in Approved Document L2A (2013), both at design stage and once built.

Approved Document L2A criteria:

Compliance with the Approved Document L2A for new non-dwellings is demonstrated by meeting the following five separate criteria [1]:

- Criterion 1: Predicted carbon dioxide emissions from the proposed building do not exceed the target emissions rating.
- Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits.
- Criterion 3: The building has appropriate passive control measures to limit solar gains in summer.
- Criterion 4: The performance of the building, as built, is consistent with the building emissions rating due to quality of construction and commissioning.
- Criterion 5: Providing information (building logbook).

This report assesses compliance with criteria 1 (BER/TER) and criteria 3 (solar gain check) of Part L2A of the building regulations. The Part L analysis is the “as designed” assessment and does not form the “as-built” Part L2A 2013 compliance report to be submitted to building control.

1.6 Future building standard, Part L2A 2021 & Net Zero Carbon

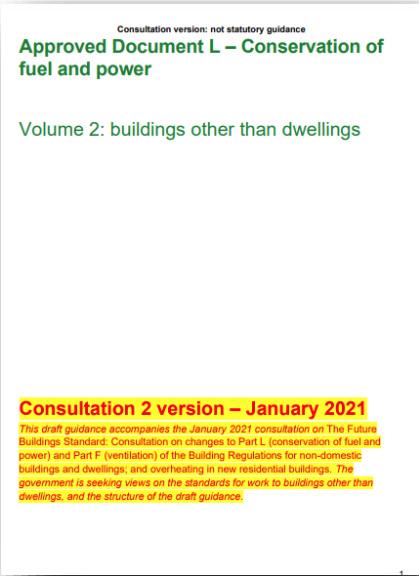
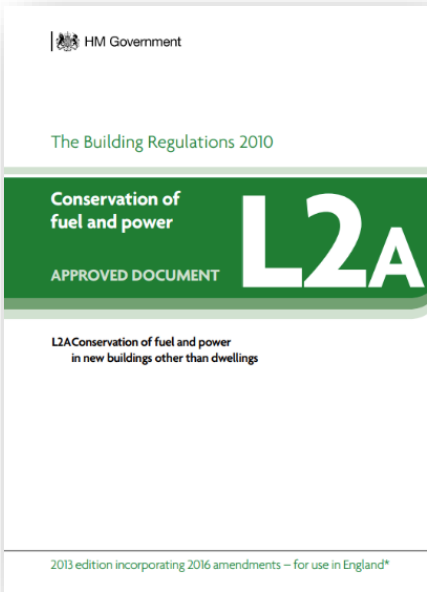
The government has released the initial draft of the future building standard which proposes changes to building regulations to decrease carbon emissions towards net zero by 2050. The ‘Future building standard’ is currently at consultation stage. The public consultation period closed in April 2021 and the industry awaits the governments response. The proposals include an interim uplift to part L reducing carbon emissions by up to 27% when compared to 2013 standards. The new guidance will recognise decarbonisation of grid supplied electricity by a significant reduction in the electricity emission factor.

1.7 SAP 10 Conversion

Since January 2019 it is recommended to convert the current BER to SAP10 emission levels, to consider the decarbonisation of the Electricity Grid as per London Energy Assessment Guidance 2018. The current carbon intensity of grid supplied electricity is 0.233KgCo2/KWh (Defra) approximately 50% lower than the current building regulation emission factor. The next revision of Part L2A is in consultation and will recognise this by incorporating lower emission factors. To demonstrate the significant impact this will have on the building emission rate and carbon reduction the current BER has been converted to SAP10 emission levels & the carbon emissions reduction is too be calculated using the SAP10 conversion figures.

1.8 BREEAM

The proposed development will be assessed against BREEAM criteria targeting “Very Good”. The proposals within this energy strategy support the BREEAM assessment targeting points under ENE01 Reduction of energy use and carbon emissions. Please see section 4 for further detail.



2 Energy assessment methodology and proposals

All development proposals should take the most appropriate action to minimising Carbon emissions in accordance with the Energy Hierarchy: Be Lean- Be Clean- Be Green as well as consider the need to reduce cooling demand and assess the impact of overheating.

The energy assessment is structured around the Energy Hierarchy which is generally accepted as the most effective way of reducing building Carbon emissions. The three stage strategy targets energy use by consideration of the following actions:

- Be Lean [Passive]

Energy demand reduction building fabric
- Be Lean [Active]

Energy demand reduction building services
- Be Clean

Consideration of heating infrastructure including CHP
- Be Green

Supply energy from renewable sources

This report is for the shell and core stage of the projec and therefore assumes building fabric and buidling services parameters to demonstrate how the buidling can comply with building regulations, planning policy and Part requirements.

The approach that will be undertaken (for this report) during the next stages of detailed design are proposed in this document and are based on and around the CIBSE methodology for energy reports and follows 4 primary steps:

- Step 1

Identifying the targets

•

Step 2

Assessing the Baseline

•

Step 3

Applying energy efficiency

•

Step 4

Applicability of renewable and LZC's
- Baseline building constructed to 2013 notional building specification with gas fired heating and domestic hot water.

•

Lean building incorporating passive and active energy demand reduction measures. (Improved u-values, high efficiency LED lighting with occupancy and daylight control. Space heating and domestic hot water remains as gas fired.

•

Green building – Renewable energy applied – PV & Air source heat pumps .

2.1 Building Data

2.1.1 Location Data

Building type: A3/A4/A5:Restaurants and cafes/Drinking Est./Takeaways

Weather Location: Swindon TRY05 for Part L2 compliance

2.2 Energy Demand (Be Lean)

2.2.1 Energy Demand Reduction (Be Lean) – Building Fabric (Passive)

The building will adopt a fabric first approach to minimise heat loss and energy consumption.

2.2.1.1 Opaque thermal elements

| Construction Element | Part L2A 2013<br>Notional building<br>U-value (W/m².K) | Proposed<br>Actual Building<br>U-Value (W/m2K) | Improvement % |
|----------------------|--------------------------------------------------------|------------------------------------------------|---------------|
| External Wall        | 0.26                                                   | 0.18                                           | 30%           |
| Ground Floor         | 0.22                                                   | 0.22                                           | 0%            |
| Roof                 | 0.18                                                   | 0.16                                           | 11%           |
| Personal Door        | 2.2                                                    | 1.4                                            | 36%           |
| Vehicle Access Door  | n/a                                                    | n/a                                            | n/a           |

2.2.1.2 Glazed thermal elements

The glazing is appropriately sized to reduce heat loss whilst allowing light and useful heat from the sun to enter the property.

| Construction Element          | Thermal<br>Transmittance<br>(U-Value), W/m2K | Solar<br>Transmittance<br>(G-Value) | Light<br>Transmittance<br>(LT) |
|-------------------------------|----------------------------------------------|-------------------------------------|--------------------------------|
| Part L 2013 Notional Building | 1.6                                          | 0.4                                 | 0.71                           |
| External Window               | 1.6                                          | 0.42                                | 0.71                           |
| Rooflights                    | n/a                                          | n/a                                 | n/a                            |
| High Usage Glazed Door        | 1.6                                          | 0.4                                 | 0.71                           |

\*G-value of the proposed glazing will be subject to and overheating assessment

2.2.1.3 Air permeability

| Air Permeability | Part L2A 2013<br>Notional building<br>(m³/m².h@50Pa) | Actual building air<br>permeability<br>(m³/m².h@50Pa) |
|------------------|------------------------------------------------------|-------------------------------------------------------|
| Air Permeability | 5                                                    | 3                                                     |

The proposed development's performance will be tested under the Air Permeability value at 3 m3/hour per m2 @ 50 Pa in the IES VE Compliance tool, in order to assess Compliance with Building Regulations approved document ADL2A, assess overheating risk and internal Air Quality.

2.2.2 Energy Demand Reduction (Be Lean) – Building Services (Active)

2.2.2.1 Heating and cooling

To demonstrate energy and carbon savings from passive and active energy demand reduction measures the restaurant space heating is assumed to be provided by a conventional gas fired heating system at first stage (Be Lean) of the energy heirachy. This will be replaced by an alternative low carbon heat source later in the analysis.

Space cooling is provide by VRF cassettee units to both customer and staff areas.

|          | Space Heating       | Space Cooling |
|----------|---------------------|---------------|
| Be Lean  | Gas Boiler SCOP 91% | ASHP SEER 4   |
| Be Green | ASHP SCOP 3.5       | ASHP SEER 4   |

2.2.2.2 Domestic Hot Water

As above to demonstrate energy and carbon savings from passive and active energy demand measures domestic hot water is assumed to be provided by a conventional gas fired heating system at this first stage (Be Lean). The gas fired system will be replaced by an alternative low carbon heat source later in the analysis.

It is proposed to provide domestic hot water from local electric water heaters in subsequent stages of the energy hierarchy.

|          | DHW                     |
|----------|-------------------------|
| Be Lean  | Gas Boiler SCOP 91%     |
| Be Green | Direct Electric Heating |

2.2.2.3 Ventilation

The fresh air supply to the restaurant will be supplied by a mechanical heat recovery ventilation system to maintain indoor air quality throughout the year at comfortable levels. The system will vary the volume of fresh air as required to maintain internal CO<sub>2</sub> levels.

| Lighting                 | Type           | SFP<br>W/l/s | HR% | Demand Control                         |
|--------------------------|----------------|--------------|-----|----------------------------------------|
| Eating and drinking area | MVHR           | 1.4          | 75% | Speed control Based on CO <sub>2</sub> |
| Food preparation area    | Remote Extract | 0.5          | n/a | n/a                                    |
| Staff Office             | MVHR           | 1.4          | 75% | n/a                                    |
| Staff room               | MVHR           | 1.4          | 75% | n/a                                    |
| Toilets                  | Local Extract  | 0.3          | n/a | n/a                                    |
| Plant/Circulation/Stores | n/a            | n/a          | n/a | n/a                                    |

2.2.2.4 Lighting Systems

Low energy LED light fittings throughout with occupancy sensing and daylight harvesting where perimeter windows allow (eating and drinking area)

| Lighting                         | Efficacy<br>Lm/cW | Occupancy<br>Sensing | Daylight<br>harvesting |
|----------------------------------|-------------------|----------------------|------------------------|
| Eating and drinking area         | >100              | Auto on/off          | Daylight dimming       |
| Food preparation area            | >100              | Auto on/off          | n/a                    |
| Staff Office                     | >85               | Auto on/off          | n/a                    |
| Staff room                       | >85               | Auto on/off          | n/a                    |
| Toilets                          | >60               | Auto on/off          | n/a                    |
| Plant/Circulation/Stores/lockers | >60               | Auto on/off          | n/a                    |

2.2.2.5 Control and Energy Metering Systems

Energy efficient control systems will be utilised to ensure systems are only used as required during the building operation (excluding main sales area – manual light switches only), with a dedicated onsite metering system to monitor energy usage and provide valuable feedback to maximise efficiency.

This will include variable speed drives on pumps and fans for commissioning and operation. Zoning of controls for M&E systems will allow separate control zones.

| Construction Element                                                     | Target (TER) CO <sub>2</sub> Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum) | Building (BER) CO <sub>2</sub> Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum) | % Reduction |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------|
|                                                                          | Based on SAP10 emission factors                                                                      |                                                                                                        |             |
|                                                                          |                                                                                                      |                                                                                                        |             |
| Baseline: Part L 2013 of the building regulations compliant development. | 7.17                                                                                                 |                                                                                                        |             |
| After energy demand reduction (Be Lean)                                  |                                                                                                      | 6.455                                                                                                  | 10%         |

2.3 Heating Infrastructure (Be Clean)

3.1.1 District Heating

There is no district heating option at present for the location of the proposed development.

2.3.1 Combined Heat and Power (CHP)

A Combined Heat and power (CHP) is an electricity generator where the waste heat is captured and then re-used within a building. Gas fired CHP is a well proven technology for buidlings with continuous simultaneous demand for both heat and power throughout the year. Typically buidlings with high domestic hot water demand are well suited to this technology allowing a correctly sized unit to be utilised to its full potential. For CHP to be effective in terms of carbon reduction and cost effectiveness it is very important that the engine operates for long periods of the day, throughout the year e.g. heat dominant buildings such as swimming pool, hotel and hospitals.

Gas fired CHP is a fossil fuel-based technology. Considering decarbonisation of the national electricity grid the carbon reduction from this technology is significantly reduced.

CHP is not suggested for this development due to;

- 1, The low demand for heat during summer and inconsistent heat load through the year that would cause the unit to sit idle.
2. A fossil fuel-based technology with minimal carbon reduction when decarbonisation of the national grid is considered.

2.3.2 Conclusion

The most appropriate heating infrastructure for the proposed development is a localised system. Space heating is provided by a low carbon heat source such as an air source heat pump system as part of VRF heating/cooling cassettes.

| Construction Element                                                     | Target (TER) CO <sub>2</sub> Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum) | Building (BER) CO <sub>2</sub> Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum) | % Reduction |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------|
|                                                                          | Based on SAP10 emission factors                                                                      |                                                                                                        |             |
| Baseline: Part L 2013 of the building regulations compliant development. | 7.27                                                                                                 |                                                                                                        |             |
| After energy demand reduction (Be Lean)                                  |                                                                                                      | 6.455                                                                                                  | 10%         |
| Heating infrastructure (Be Clean)                                        | As Baseline                                                                                          | As Be Lean                                                                                             | As Be Lean  |

2.4 Renewable Energy (Be Green).

2.4.1 Renewable Technology overview

Energy resources accepted as Renewable or Low Carbon Technologies are defined by the Department of Energy & Climate change Low Carbon Buildings Program. Those which are suitable for consideration in this case are:

- Solar photovoltaics
- Wind turbines
- Solar thermal hot water
- Ground Source Heat Pumps
- Biomass Heating

2.4.2 Solar photovoltaics

Photovoltaics (PVs) generate electricity from daylight using semiconductors. PV's are also a simple technology requiring little in the way of maintenance and offer a proven way of generating zero Carbon, renewable electricity. Photovoltaics generate electricity which displaces that which would otherwise be provided by the national grid.

PV would provide a valuable source of renewable energy to the site offset energy and carbon consumed within the building. The maximum amount of PV should be applied to the roof.

2.4.3 Wind turbines

Wind turbines generate electricity via a conventional generator connected to turbine blades which are in turn powered by the prevailing wind.

Whilst wind turbines can generate energy throughout the year they have a significant detrimental visual impact on the site and can cause light flickering and noise issues. Due to the proximity of the site to a busy road and residential property this technology is not recommended in this case.

2.4.4 Solar thermal hot water

Solar thermal could be considered to serve the domestic hot water system but this system would take up more plant space than other more suitable technologies.

The development has a relatively high hot water consumption and whilst a solar thermal installation could contribute to the energy and carbon reduction. Solar photovoltaic panels are likely to have a greater impact on overall carbon emissions.

2.4.5 Biomass Heating

The spatial requirement for biomass plant, equipment and associated fuel storage is significant. Given the buildings small size, low space heating demand and on-going fuel delivery requirement the inclusion of biomass has not been deemed appropriate. Biomass also emits NOx gas which would be detrimental to the natural environment.

Biomass has a slow response to changes in heat demand and requires frequent and regular deliveries of fuel which due to site servicing constraints would not be suitable for this development. It is therefore believed that this technology is not suitable for commercial operation.

2.4.6 Air Source Heat Pumps

Air source heat pumps extract thermal energy from the ambient external air and can be used to provide heating and/or cooling. It is proposed that the heating only is provided for the store supplementing the waste heat recovery system. Air source heat pumps have zero NOx emissions and are considered a clean technology.

Air source heat pumps require electricity to operate but have a high coefficient of performance which is why they are classed as a renewable source of energy. Seasonal coefficient of performance (SCoP) minimum standard is 250% but can exceed 320%.

As the national grid decarbonises buildings that use low carbon heating such as heat pumps will also decarbonise towards zero carbon.

2.4.7 Ground Source Heat Pumps

This captures natural energy through boreholes hundreds of metres beneath the ground, providing the restaurant with on-demand heating, hot water and cooling from renewable sources. However, the costs of ground source heat pumps are high due to the groundwork involved.

Due to the low demand for space heating and small building size GSHP is unlikely to provide a payback when compared to conventional plant. Ground source heat pumps are deemed to not be suitable for this project and have not been considered further.

2.5 LZC Summary

| Description                         | Comments applicable to the scheme                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| District Heating                    | There is no local area network within economical distance of the proposed development and has not been considered viable.                                                                                                                                                                                                                                                                                                               |
| Air Sourced Heat Pumps              | Air source heat pumps offer a low carbon source of heating that will continue to decarbonise as further renewable technology is incorporated into the national grid. The high performance of the building fabric makes it suitable for low temperature heating and ASHP equipment can be selected to operate at low ambient noise levels offering very high heating performance and is considered viable and will be developed further. |
| Ground Sourced Heat Pumps           | A relatively small building with low space heating demand means that the high capital cost of a GSHP is unlikely to payback within the plant lifecycle.                                                                                                                                                                                                                                                                                 |
| Biomass Boiler Plant                | The low heat demand of the building and practicality of installation / maintenance and fuel storage make a biomass system not viable for the scheme.                                                                                                                                                                                                                                                                                    |
| Solar Thermal (solar water heating) | Possible to serve the domestic hot water systems but PV system is prioritised due to greater impact.                                                                                                                                                                                                                                                                                                                                    |
| Active Solar (Photovoltaic)         | PV is well suited to the development offsetting electrical energy consumed within the building.                                                                                                                                                                                                                                                                                                                                         |
| Combined Heat and Power (CHP)       | A fossil fuel based technology that provides limited carbon reduction when new emission factors for grid supplied electricity are considered.                                                                                                                                                                                                                                                                                           |

### 3 Summary of Energy and Water Strategy

Design strategies and recommendations have been made in the previous sections of this report. In this section the main conclusions and recommendations are summarised.

It is proposed that the following energy efficiency measures are provided to reduce energy demand for the building before low or zero carbon technologies have been considered:

- Improved building fabric
- Energy efficient lighting.
- Lighting Control Systems.
- Space heating and domestic hot water provided by waste heat collected from refrigeration systems and supplemented by ASHP.
- High Efficiency mechanical ventilation.
- Improved services distribution..

Due consideration has been given to the different renewable technologies available, and a photovoltaic system has been selected to offset electrical energy consumed in the building.

With the energy efficiency measures proposed; Air to Water: Air Source Heat Pumps to the domestic areas and heat recovery VRF is the most suitable technology for the site.

| Construction Element                                                     | Target (TER) CO <sub>2</sub> Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum) | Building (BER) CO <sub>2</sub> Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum) | % Reduction |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------|
|                                                                          | Based on SAP10 emission factors                                                                      |                                                                                                        |             |
|                                                                          |                                                                                                      |                                                                                                        |             |
| Baseline: Part L 2013 of the building regulations compliant development. | 7.17                                                                                                 |                                                                                                        |             |
| After energy demand reduction (Be Lean)                                  |                                                                                                      | 6.455                                                                                                  | 10%         |
| After heat network (Be Clean)                                            | As Baseline                                                                                          | As Be Lean                                                                                             | As Be Lean  |
| After renewable energy – (Be Green) ASHP                                 |                                                                                                      | 5.135                                                                                                  | 36%         |
| After renewable energy – (Be Green) ASHP+30m2 PV                         |                                                                                                      | 3.87                                                                                                   | 46%         |
| After renewable energy – (Net Zero regulated energy) ASHP+130m2 PV       |                                                                                                      | -0.345                                                                                                 | 106%        |

4 Part L2A Assessment Results

The intention during the next phase will be modelling to illustrate the greenhouse gas emissions reduction for each step taken through the energy heirachy design process. This 'Part L2A 2013' analysis will be conducted using the Integrated Environmental Solutions IESVE 2021.2.0.0, VE Compliance 7.0.13.0 with BRUKL compliance check version v5.6.b.0.

Criterion 1 – carbon dioxide emissions

Criterion 1 is assessed by comparing the building emissions rate against the proposed building target emissions rate. The target emission rate is based upon the notional building which is the same size and shape as the actual building but built to concurrent specification defined in PARTL of the building regulations.

The model calculations and results are based on the information stated in this report – electric power factor <0.9 & adding lighting controls/metering.

The following table shows the Part L2A 2013 results for the proposed building and carbon reduction against a baseline building constructed to the 2013 notional building specification

- Green Building – Renewable energy applied – Air source heat pumps
- Green building – ASHPs & 30m² Photovoltaic array with 20.4 Module Efficiency added to achieve an indicative 3 BREEAM 2018 credits.
- Green Building – ASHP & 130m² Photovoltaic array with 20.4 Module Efficiency added to achieve an indicative 7 BREEAM 2018 credits and net zero regulated energy. This option would require the entire roof space to be dedicated to PV.

| Construction Element                                            | Target (TER) CO <sub>2</sub> Emissions for non-domestic buildings (KgCO <sub>2</sub> /m² per annum) | Building (BER) CO <sub>2</sub> Emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum) | % Reduction |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------|
|                                                                 | Based on 2013 emission factors                                                                      |                                                                                                        |             |
| After renewable energy – (Be Green)                             | 71.4                                                                                                | 69.1                                                                                                   | 3.2%        |
| After renewable energy – (Be Green + 30m² PV BREEAM 3 credits)  | 71.4                                                                                                | 52.1                                                                                                   | 27.03%      |
| After renewable energy – (Be Green + 130m² PV BREEAM 3 credits) | 71.4                                                                                                | -4.6                                                                                                   | 106%        |

The development targets BREEAM “Very Good” The following table shows the indicative BREEAM score under ENE01 for the proposed building including a 30m² PV array.

| Country of the UK where the building is located                       |  | England |          |                                         |
|-----------------------------------------------------------------------|--|---------|----------|-----------------------------------------|
| Assessment Criteria                                                   |  | Actual  | Notional |                                         |
| Photovoltaic systems                                                  |  | 32.310  | 0.000    | kWh/m <sup>2</sup>                      |
| Wind turbines                                                         |  | 0.000   | 0.000    | kWh/m <sup>2</sup>                      |
| CHP generators                                                        |  | 0.000   | 0.000    | kWh/m <sup>2</sup>                      |
| Solar thermal systems                                                 |  | 0.000   | 0.000    | kWh/m <sup>2</sup>                      |
| Building energy demand                                                |  | 315.020 | 353.810  | MJ/m <sup>2</sup> yr                    |
| Building primary energy consumption                                   |  | 408.500 | 379.380  | kWh/m <sup>2</sup> yr                   |
| Building CO <sub>2</sub> -eq emissions                                |  | 52.100  | 71.400   | KgCO <sub>2</sub> -eq/m <sup>2</sup> yr |
| Does this building contain areas that require a SAP assessment?       |  |         |          |                                         |
| What % of the building's total floor area (GIA) does it apply to?     |  |         |          |                                         |
| SAP Building energy demand                                            |  |         |          | MJ/m <sup>2</sup> yr                    |
| SAP Building primary energy consumption                               |  |         |          | kWh/m <sup>2</sup> yr                   |
| SAP Building CO <sub>2</sub> -eq emissions                            |  |         |          | KgCO <sub>2</sub> -eq/m <sup>2</sup> yr |
| Building Score                                                        |  |         |          |                                         |
| Total BREEAM credits achieved                                         |  | 3       |          |                                         |
| Heating and cooling demand energy performance ratio (EPRdem)          |  | 0.110   |          |                                         |
| Primary consumption energy performance ratio (EPRpc)                  |  | 0.071   |          |                                         |
| CO <sub>2</sub> -eq energy performance ratio (EPRCO <sub>2</sub> -eq) |  | 0.181   |          |                                         |
| Overall building energy performance ratio (EPRnc)                     |  | 0.362   |          |                                         |
| % improvement over building regulations (CO2-eq)                      |  | 27.03%  |          |                                         |

The following table shows the indicative BREEAM score under ENE01 for the proposed building including a 130m² PV array targeting net zero regulated carbon emissions.

| Country of the UK where the building is located                       |  | England |          |                                         |
|-----------------------------------------------------------------------|--|---------|----------|-----------------------------------------|
| Assessment Criteria                                                   |  | Actual  | Notional |                                         |
| Photovoltaic systems                                                  |  | 141.990 | 0.000    | kWh/m <sup>2</sup>                      |
| Wind turbines                                                         |  | 0.000   | 0.000    | kWh/m <sup>2</sup>                      |
| CHP generators                                                        |  | 0.000   | 0.000    | kWh/m <sup>2</sup>                      |
| Solar thermal systems                                                 |  | 0.000   | 0.000    | kWh/m <sup>2</sup>                      |
| Building energy demand                                                |  | 315.020 | 353.810  | MJ/m <sup>2</sup> yr                    |
| Building primary energy consumption                                   |  | 408.500 | 379.380  | kWh/m <sup>2</sup> yr                   |
| Building CO <sub>2</sub> -eq emissions                                |  | -4.600  | 71.400   | KgCO <sub>2</sub> -eq/m <sup>2</sup> yr |
| Does this building contain areas that require a SAP assessment?       |  |         |          |                                         |
| What % of the building's total floor area (GIA) does it apply to?     |  |         |          |                                         |
| SAP Building energy demand                                            |  |         |          | MJ/m <sup>2</sup> yr                    |
| SAP Building primary energy consumption                               |  |         |          | kWh/m <sup>2</sup> yr                   |
| SAP Building CO <sub>2</sub> -eq emissions                            |  |         |          | KgCO <sub>2</sub> -eq/m <sup>2</sup> yr |
| Building Score                                                        |  |         |          |                                         |
| Total BREEAM credits achieved                                         |  | 7       |          |                                         |
| Heating and cooling demand energy performance ratio (EPRdem)          |  | 0.110   |          |                                         |
| Primary consumption energy performance ratio (EPRpc)                  |  | 0.312   |          |                                         |
| CO <sub>2</sub> -eq energy performance ratio (EPRCO <sub>2</sub> -eq) |  | 0.333   |          |                                         |
| Overall building energy performance ratio (EPRnc)                     |  | 0.755   |          |                                         |
| % improvement over building regulations (CO2-eq)                      |  | 106.44% |          |                                         |

## 5 Annex A – BRUKL Report

### BRUKL Output Document

HM Government  
Compliance with England Building Regulations Part L 2013

Project name

**210715 Scours Lane Development**  
**Reading - Be Green Inc 30m<sup>2</sup> PV system** As designed

Date: Tue Oct 12 17:08:52 2021

#### Administrative information

##### Building Details

Address: Address 1, City, Postcode

##### Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

##### Certifier details

Name: Ben Paul Tysoe

Telephone number: 01536 403304

Address: 1 Weekley Wood Close, Kettering, NN141UQ

#### Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target

|                                                                                                    |                     |
|----------------------------------------------------------------------------------------------------|---------------------|
| CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum | 71.4                |
| Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum               | 71.4                |
| Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum             | 52.1                |
| 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 <sub>s-limit</sub> | U <sub>s-calc</sub> | U <sub>s-calc</sub> | Surface where the maximum value occurs*  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------|---------------------|------------------------------------------|
| Wall**                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.35                 | 0.18                | 0.18                | GR000000:Surf[0]                         |
| Floor                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.25                 | 0.22                | 0.22                | GR000000:Surf[2]                         |
| Roof                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.25                 | 0.16                | 0.16                | GR000000:Surf[3]                         |
| Windows***, roof windows, and rooflights                                                                                                                                                                                                                                                                                                                                                                                                     | 2.2                  | 1.6                 | 1.6                 | FD000003:Surf[0]                         |
| Personnel doors                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.2                  | -                   | -                   | No Personnel doors in building           |
| 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 <sub>s-limit</sub> = Limiting area-weighted average U-values [W/(m <sup>2</sup> K)]<br>U <sub>s-calc</sub> = Calculated area-weighted average U-values [W/(m <sup>2</sup> K)]<br>U <sub>s-calc</sub> = Calculated maximum individual element U-values [W/(m <sup>2</sup> K)]                                                                                                                                                               |                      |                     |                     |                                          |
| * There might be more than one surface where the maximum U-value occurs.<br>** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.<br>*** Display windows and similar glazing are excluded from the U-value check.<br>N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool. |                      |                     |                     |                                          |

|                                              |                           |               |
|----------------------------------------------|---------------------------|---------------|
| Air Permeability                             | Worst acceptable standard | This building |
| m <sup>3</sup> /(h.m <sup>2</sup> ) 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                     | <0.9 |

##### 1- Split System MVHR

|                | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|----------------|--------------------|--------------------|--------------------|---------------|---------------|
| This system    | 3.5                | 1.25               | 0                  | 0             | 0.75          |
| Standard value | 2.5*               | 1                  | N/A                | N/A           | 0.5           |

Automatic monitoring &amp; 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.

##### 2- Split System Local Extract

|                | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|----------------|--------------------|--------------------|--------------------|---------------|---------------|
| This system    | 3.5                | 1.25               | 0                  | 0             | -             |
| Standard value | 2.5*               | 1                  | N/A                | N/A           | N/A           |

Automatic monitoring &amp; 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.

##### 3- Split System Remote Extract

|                | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|----------------|--------------------|--------------------|--------------------|---------------|---------------|
| This system    | 3.5                | 1.25               | 0                  | 0             | -             |
| Standard value | 2.5*               | 1                  | N/A                | N/A           | N/A           |

Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system YES

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

##### 1- Electric DHW

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

##### Local mechanical ventilation, exhaust, and terminal units

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

| Zone name         | SFP [W/(l/s)] |     |     |     |     |     |     |     |   | HR efficiency |          |
|-------------------|---------------|-----|-----|-----|-----|-----|-----|-----|---|---------------|----------|
| ID of system type | A             | B   | C   | D   | E   | F   | G   | H   | I | Zone          | Standard |
| Standard value    | 0.3           | 1.1 | 0.5 | 1.9 | 1.6 | 0.5 | 1.1 | 0.5 | 1 | -             | -        |
| WC                | 0.3           | -   | -   | -   | -   | -   | -   | -   | - | -             | 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 |
| WC             |                   | 0.3 | -   | -   | -   | -   | -   | -   | -   | -             | N/A           |
| Staff room     |                   | -   | -   | -   | 1.4 | -   | -   | -   | -   | -             | N/A           |
| Seating Area   |                   | -   | -   | -   | 1.4 | -   | -   | -   | -   | 0             | N/A           |
| Food Prep      |                   | -   | -   | -   | -   | -   | -   | -   | -   | 0.5           | N/A           |

| General lighting and display lighting |  | Luminous efficacy [lm/W] |      |              | General lighting [W] |
|---------------------------------------|--|--------------------------|------|--------------|----------------------|
| Zone name                             |  | Luminaire                | Lamp | Display lamp |                      |
| Standard value                        |  | 60                       | 60   | 22           |                      |
| Office                                |  | 85                       | -    | -            | 41                   |
| WC                                    |  | -                        | 60   | -            | 48                   |
| WC                                    |  | -                        | 60   | -            | 49                   |
| Staff room                            |  | 85                       | -    | -            | 124                  |
| Seating Area                          |  | -                        | 100  | 50           | 181                  |
| Fridges                               |  | 85                       | -    | -            | 23                   |
| Freezer                               |  | 85                       | -    | -            | 9                    |
| Store                                 |  | 85                       | -    | -            | 16                   |
| BOH Circ                              |  | -                        | 85   | -            | 44                   |
| Food Prep                             |  | -                        | 100  | -            | 488                  |
| Staff WC lobby                        |  | -                        | 60   | -            | 8                    |
| Staff WC                              |  | -                        | 60   | -            | 20                   |

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? |
|--------------|--------------------------------|-----------------------|
| Office       | N/A                            | N/A                   |
| WC           | N/A                            | N/A                   |
| WC           | N/A                            | N/A                   |
| Staff room   | N/A                            | N/A                   |
| Seating Area | NO (-28.9%)                    | NO                    |
| Food Prep    | NO (-70%)                      | 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? | YES |
| Is evidence of such assessment available as a separate submission?                     | YES |
| Are any such measures included in the proposed design?                                 | YES |

Technical Data Sheet (Actual vs. Notional Building)

| Building Global Parameters  |        |          | Building Use |                                                                    |
|-----------------------------|--------|----------|--------------|--------------------------------------------------------------------|
|                             | Actual | Notional | % Area       | Building Type                                                      |
| Area [m²]                   | 185.8  | 185.8    | 100          | A1/A2 Retail/Financial and Professional services                   |
| External area [m²]          | 571.6  | 571.6    |              | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways             |
| Weather                     | SWI    | SWI      |              | B1 Offices and Workshop businesses                                 |
| Infiltration [m³/hm²@ 50Pa] | 3      | 5        |              | B2 to B7 General Industrial and Special Industrial Groups          |
| Average conductance [W/K]   | 181.05 | 0        |              | B8 Storage or Distribution                                         |
| Average U-value [W/m²K]     | 0.28   | 0        |              | C1 Hotels                                                          |
| Alpha value* [%]            | 10     | 10       |              | C2 Residential Institutions: Hospitals and Care Homes              |
|                             |        |          |              | C2 Residential Institutions: Residential schools                   |
|                             |        |          |              | C2 Residential Institutions: Universities and colleges             |
|                             |        |          |              | C2A Secure Residential Institutions                                |
|                             |        |          |              | Residential spaces                                                 |
|                             |        |          |              | D1 Non-residential Institutions: Community/Day Centre              |
|                             |        |          |              | D1 Non-residential Institutions: Libraries, Museums, and Galleries |
|                             |        |          |              | D1 Non-residential Institutions: Education                         |
|                             |        |          |              | D1 Non-residential Institutions: Primary Health Care Building      |
|                             |        |          |              | D1 Non-residential Institutions: Crown and County Courts           |
|                             |        |          |              | D2 General Assembly and Leisure, Night Clubs, and Theatres         |
|                             |        |          |              | Others: Passenger terminals                                        |
|                             |        |          |              | Others: Emergency services                                         |
|                             |        |          |              | Others: Miscellaneous 24hr activities                              |
|                             |        |          |              | Others: Car Parks 24 hrs                                           |
|                             |        |          |              | Others: Stand alone utility block                                  |

Energy Consumption by End Use [kWh/m²]

|            | Actual | Notional |
|------------|--------|----------|
| Heating    | 14.06  | 19.19    |
| Cooling    | 13.13  | 12.98    |
| Auxiliary  | 21.53  | 20.24    |
| Lighting   | 34.75  | 54.3     |
| Hot water  | 49.6   | 54.5     |
| Equipment* | 132.08 | 132.08   |
| TOTAL**    | 133.06 | 161.22   |

\* 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  | 32.77  | 0        |
| Wind turbines         | 0      | 0        |
| CHP generators        | 0      | 0        |
| Solar thermal systems | 0      | 0        |

Energy & CO<sub>2</sub> Emissions Summary

|                                  | Actual | Notional |
|----------------------------------|--------|----------|
| Heating + cooling demand [MJ/m²] | 315.02 | 353.81   |
| Primary energy* [kWh/m²]         | 408.5  | 379.38   |
| Total emissions [kg/m²]          | 52.1   | 71.4     |

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

| HVAC Systems Performance                                                                                      |                |                |                 |                 |                |           |            |               |               |
|---------------------------------------------------------------------------------------------------------------|----------------|----------------|-----------------|-----------------|----------------|-----------|------------|---------------|---------------|
| System Type                                                                                                   | Heat dem MJ/m2 | Cool dem MJ/m2 | Heat con kWh/m2 | Cool con kWh/m2 | Aux con kWh/m2 | Heat SSEF | Cool SSEER | Heat gen SEFF | Cool gen SEER |
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity |                |                |                 |                 |                |           |            |               |               |
| Actual                                                                                                        | 323.5          | 100.7          | 26.2            | 9.4             | 16.1           | 3.43      | 2.99       | 3.5           | 4             |
| Notional                                                                                                      | 316.3          | 147.3          | 34.3            | 10.8            | 6.4            | 2.56      | 3.79       | ----          | ----          |
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity |                |                |                 |                 |                |           |            |               |               |
| Actual                                                                                                        | 112.1          | 23.2           | 9.1             | 2.2             | 14.6           | 3.43      | 2.99       | 3.5           | 4             |
| Notional                                                                                                      | 280.5          | 89.8           | 30.5            | 6.6             | 19.5           | 2.56      | 3.79       | ----          | ----          |
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity |                |                |                 |                 |                |           |            |               |               |
| Actual                                                                                                        | 84.3           | 298.9          | 6.8             | 27.8            | 42.8           | 3.43      | 2.99       | 3.5           | 4             |
| Notional                                                                                                      | 83.1           | 338.5          | 9               | 24.8            | 51.3           | 2.56      | 3.79       | ----          | ----          |
| [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 <sub>i-Typ</sub> | U <sub>i-Min</sub> | Surface where the minimum value occurs*                            |
|--------------------------------------------------------------------------|--------------------|--------------------|--------------------------------------------------------------------|
| Wall                                                                     | 0.23               | 0.18               | GR000000:Surf[0]                                                   |
| Floor                                                                    | 0.2                | 0.22               | GR000000:Surf[2]                                                   |
| Roof                                                                     | 0.15               | 0.16               | GR000000:Surf[3]                                                   |
| Windows, roof windows, and rooflights                                    | 1.5                | 1.6                | FD000003:Surf[0]                                                   |
| Personnel doors                                                          | 1.5                | -                  | No Personnel doors in building                                     |
| 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 <sub>i-Typ</sub> = Typical Individual element U-values [W/(m²K)]       |                    |                    | U <sub>i-Min</sub> = 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             |