

199-203 Henley Road & land to the rear of
205-207 Henley Road, Caversham RG4 6LJ



HARNISS
CONSULTING

ENERGY STRATEGY REPORT

FOR

**THE DEMOLITION OF EXISTING STRUCTURES AND
REDEVELOPMENT TO FORM A CARE HOME (CLASS C2),
COMMUNAL AND ANCILLARY FACILITIES, ASSOCIATED
PARKING AND LANDSCAPING**

LOCATED AT

**199-203 HENLEY ROAD AND LAND TO THE REAR OF 205-
207 HENLEY ROAD, CAVERSHAM RG4 6LJ**

ON BEHALF OF

SIGNATURE SENIOR LIFESTYLE DEVELOPMENTS LTD

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1.0 Executive Summary

This document details the intended energy strategy for the demolition of existing structures and redevelopment to form a care home (Class C2), communal and ancillary facilities, associated parking and landscaping at 199-203 Henley Road and land to the rear of 205-207 Henley Road, Caversham RG4 6LJ.

In order to achieve compliance with Building Regulations AD Part L2A: 2013, it was necessary to investigate appropriate L2C technologies to reduce the energy consumption and CO2 emissions. Additionally, and in compliance with local planning aspirations, it is a requirement to incorporate on site generation of energy from renewable sources and energy efficient design measures (including use of CHP where appropriate) to offset at least 20% of predicted carbon emissions from the estimated energy usage of the completed and occupied development. With this in mind, this report identifies that CHP is a feasible low carbon technology for use on the scheme which offers both compliance with AD Part L2A:2013 and local planning policy. Also, life cycle costing of the CHP shows that an estimated payback in under 5 years is feasible.

The ethos for the design of the proposed development follows the recognised energy hierarchy to “Be Lean, Be Clean, Be Green”, i.e. to minimise the building’s energy usage before applying renewable technologies to the design ensuring that high levels of insulation are incorporated prior to the design of the building services and low carbon technologies.

The following summarises the key drivers of the energy strategy proposed for the development:

- Enhanced building fabric performance has been targeted through improved thermal performance and reduced air permeability;
- Energy efficient heating, cooling, ventilation, domestic hot water and lighting systems have been targeted throughout;
- Energy efficient controls for HVAC and lighting to minimise building in-use energy.
- Following initial assessment with implementation of the enhanced building fabric and energy efficient systems, it was found that compliance with AD Part L was not achieved without the addition of low zero carbon technology;
- An initial desk-top study was undertaken to assess the most viable low zero carbon technologies for proposed implementation to achieve both compliance with AD Part L and local planning policy requirements.
- CHP was found to be the most feasible source of low carbon technology on this project based on the findings of section 7, whole life cost, spatial considerations and impact to the local population/building aesthetics;
- A CHP unit sized to provide 30% of the heating and hot water demand is sufficient to achieve compliance against AD Part L2A 2013 and local planning policy requirements;

This document explores a proposed route to compliance and further investigates the feasibility of renewable technologies. This document identifies the energy strategy intent at design concept stage for development by the Design and Build contractor, who will need to take ownership of the energy strategy, make it their own; ensuring compliance with Building Regulations and Local Planning Policy requirements is achieved. The design stage assessment undertaken by the Design and Build contractor will need to ensure that the fabric performance values being utilised as part of their assessment are being achieved by the principle contractor’s specification.

2.0 Introduction

The report has been prepared in accordance with Part L2A:2013 of the building regulations and the assessment shows compliance with all applicable criteria.

Additionally, this report will show how compliance with local planning policy is achieved. Specifically the policy states that *'All developments of more than 10 dwellings or 1000m² floorspace incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development'*.

Analysis for the building has been undertaken utilising EDSL TAS software version 9.4.4, which provides dynamic energy simulation against AD Part L2a. The software was used to determine a baseline output using fabric performance values as discussed with the development team (as detailed in the body of the report) without contribution from additional renewable technologies.

The Care Home takes into account the recognised energy hierarchy to “Be Lean, Be Clean, Be Green”, i.e. to minimise the building’s energy usage before applying renewable technologies to the design.

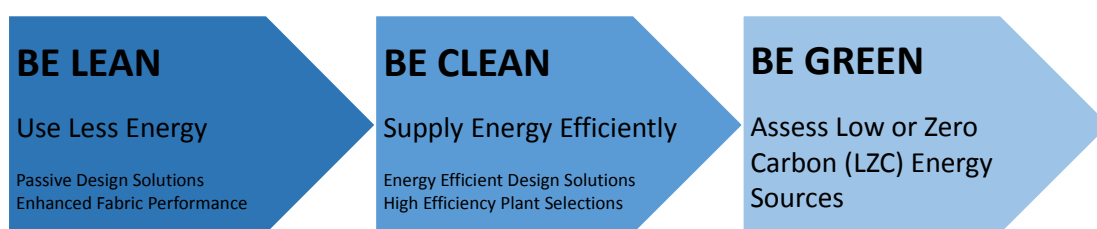


Figure 1: Energy Hierarchy

Further work will be required at later stages in the design process to ensure that the requirement to comply with the above targets and that all statutory guidelines or local planning enforcement requirements are met.

Assuming reasonable, but not unrealistic, values in line with good industry custom and best practice, the baseline building did not achieve compliance with Part L2A 2013 without some form of renewable or LZC technology being applied, although this is not unexpected given the latest changes to the regulations.

3.0 Description of the Development

the demolition of existing structures and redevelopment to form a care home (Class C2), communal and ancillary facilities, associated parking and landscaping at 199-203 Henley Road and land to the rear of 205-207 Henley Road, Caversham RG4 6LJ.



Figure 2: Proposed Site Plan

The assessment has been based on the following architectural drawings, produced by PRP Architects:

- AA7440 2003 – Proposed Site Plan
- AA7440 2004 – Proposed Lower Ground Floor Plan
- AA7440 2005 – Proposed Ground Floor Plan
- AA7440 2006 – Proposed First Floor Plan
- AA7440 2007 – Proposed Second Floor Plan
- AA7440 2010 – Proposed Elevations
- AA7440 2011 – Proposed Elevations & Sections

4.0 Energy Use in the Built Environment

In line with the first stage of the recognised energy hierarchy of intervention to “Be Lean, Be Clean, Be Green”, it is essential to ensure that an efficient building and building services systems have been designed and proposed, prior to the consideration of application of LZC technologies. Design measures that should be considered include, but are not limited to:

- Improved insulation of walls, roofs and floors to reduce heat losses (but not at the expense of summertime overheating).
- Maximisation of potential for natural ventilation (where ambient noise levels and room function and location permit).
- Minimisation of requirements for mechanical cooling, by the application of good ventilation techniques, the orientation of the building and the internal configuration of spaces.
- Reduction in electrical power usage via specification of efficient lighting controls, high efficiency luminaires and optimisation of daylighting through careful façade and building design.
- Specification of high efficiency plant/equipment.
- Minimising uncontrolled infiltration by robust construction details.
- Use of low energy ICT equipment.

To this end, the proposed design should promote reduced CO₂ emissions from delivered energy consumption by minimising operational energy demand through passive and best-practice measures. If these measures are incorporated then the addition of a renewable energy system will have a greater impact – renewable energy sources should not be used as an alternative to a well-designed building. The energy usage figures within this report have been based on reasonable but not unrealistic assumptions in line with good industry custom and practice at the present time.

5.0 Building Services Design

In line with the second stage of the recognised energy hierarchy of intervention to “Be Lean, Be Clean, Be Green”, the building services for the development should be designed with energy efficiency at the forefront, with plant and systems selected to have efficiencies in excess of those required by legislation to maximise carbon reduction. A summary of the proposed servicing strategy is provided below.

Heating shall be provided by gas fired boilers supplemented by a small scale CHP (see later in the report for details), serving the buildings domestic hot water load via LTHW fed calorifiers and the buildings space heating system throughout the building, complete with weather compensation and local thermostatic control. The boilers shall be sized to satisfy the peak heating and hot water demand of the building, simultaneously.

Where natural ventilation cannot be achieved, mechanical ventilation shall be provided by a series of high efficiency heat recovery units serving day spaces, corridors and ancillary areas.

Extract ventilation to en-suites, WC's, kitchenettes, sluice rooms, bathrooms, etc., shall be provided in accordance with the employers requirements and MEP performance specification, via local ceiling mounted extract fans ducted to façade or roof (where applicable). The systems will provide continuous trickle extract with a 'boost' activated upon presence detection.

Cooling systems shall be provided to reception/café, some day spaces, Laundry, the communications room and medical/drug stores. The Contractor shall develop the proposals and may use individual heat pump systems or utilise VRV/VRF systems to serve multiple indoor units from a single external unit. Units shall be heating and cooling type in all spaces. The communications room and drugs stores shall be fed from a separate DX system.

Electrical services shall generally be as per the specification and room data sheets, with LED lighting incorporated throughout in-line with the luminaire schedule.

6.0 Compliance with Part L/Planning Requirements

A preliminary thermal energy model has been constructed of the care home EDSL TAS software version 9.4.4, which provides dynamic energy simulation against AD Part L2a. The software was used to determine a baseline performance utilising the employer's requirements including the project specifications, room data sheets and also good industry custom and practice.

Detailed specific constructions were not available or determined at the time the model was produced, however target U-values were agreed with the architect prior to undertaking this pre-assessment, based on what is realistically achievable given the project constraints. These values were as follows:

- | | |
|------------------|-------------------------|
| • External Walls | 0.18 W/m ² K |
| • Ground Floor | 0.15 W/m ² K |
| • Exposed Roofs | 0.15 W/m ² K |
| • Windows/Doors | 1.40 W/m ² K |

Glazing with a g-value of around 0.40 was used. From analysis of the BRUKL document, this was found to be adequate to achieve compliance with Criterion 3 in all areas. It may be possible to use a worsened g-value to certain areas however this will need to be reviewed by the contractor whilst ensure full compliance with Criterion 3 of AD Part L2a.

These constructions and specific details shall be subject to review during the detailed design to provide a holistic compliance strategy.

Equally, uncontrolled ventilation losses should be controlled and the new building constructed to meet stringent air permeability targets. Whilst Part L minimum requirements are 10m³/m²/hr at 50Pa, the notional building used for analysis includes a significantly lower rate (5m³/m²/hr at 50Pa), therefore it would be advantageous for the project to target a better air permeability. A rate of 4m³/m²/hr at 50Pa. has been assumed for the purpose of this analysis which would be easily achieved with traditional construction and still be attained with SFS.

As the design progresses, the detailing architect will need to advise anticipated u-values and air permeability that will likely be achieved for this development, which should be factored into the on-going energy assessment/compliance calculations and the M&E services design undertaken as part of the mechanical contractors D&B remit.

6.1 Summary of Key Input Data

As well as the u-values and design air permeability previously indicated, the following information summarises the key input information assumed for this analysis:

Weather File

The NCM Swindon weather file has been utilised for this analysis and is considered to accurately represent the weather for the proposed location based on the BRE SBEM Weather Locations Lookup tool.

HVAC Systems

Heating generally assumed as low surface temperature radiator heating, however heat pump cooling units have been assumed in reception/café, some day spaces, laundry, the communications room and medical/drug stores rooms as per the specification. The following parameters have been assumed in the analysis:

Radiator Heating System:

Heat Source:	LTHW boiler
Fuel Type:	Natural gas
Seasonal Efficiency:	95 %
Circulation pump:	Variable Speed, pressure control across pump
System Controls:	Central time control, Weather compensation control

Heat Pump Systems:

Heat source:	Heat pump (electric): air source
Fuel type:	Electricity
SEER:	7.0
Nominal EER:	4.0

CHP Unit:

Fuel type:	Natural Gas
Heating Efficiency:	60%
Power Efficiency:	30%
Overall Efficiency:	90%

Mechanical extract is provided to bathrooms, WCs etc.

Mechanical extract SFP:	0.25 W/l/s
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Heat recovery ventilation is provided to bedrooms and ensembles.

Overall supply & extract SFP:	1.2 W/l/s
Min heat recovery efficiency:	80%

Heat recovery ventilation is provided to day spaces, corridors, offices, Laundry etc.

Overall supply & extract SFP:	1.5 W/l/s
Min heat recovery efficiency:	80%

Kitchen Ventilation

Overall supply & extract SFP:	1.0 W/l/s
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Hot Water Services:

Hot water services are to be provided via the same heating system as is utilised for the wet radiator space heating system.

HWS Storage Losses: 674 MJ/Month

Secondary Circulation

Lighting

Whilst a full lighting design is yet to be undertaken, the following parameters have been assumed based on our typical experience for the provision of LED lighting in a care home environment:

100lm/watt will be provided to all spaces.

All input data is to be reviewed and developed by the Contractor as the detailed design progresses. The above is provided for information only, and is typical of other similar developments in order to provide a realistic route to compliance for the purposes of tender.

6.2 Results without renewables

The baseline figures were determined as follows:

TER	37.0 kg.CO ₂ /m ² per annum
BER	39.6 kg.CO ₂ /m ² per annum

As the TER is less than the BER, it can be seen that the baseline building does not achieve compliance with Part L2A 2013.

Given the already included improvements to fabric design and building construction, appropriate technologies are considered in section 7 to achieve the further reduction required to attain compliance.

7.0 Renewable and Low Carbon Technologies

This section provides a brief overview of available renewable and low/zero carbon technologies, and discusses the advantages and disadvantages that are specific to the project. A tabulated summary of the technologies is provided at the end of this section.

7.1 Photovoltaic System (PV)

A PV system uses layers of semi-conductor material to produce electricity generated directly from sunlight. Several types of PV are available with varying costs and performance.

The efficiency ranges from approximately 8% to 15% for high performance panels, based on peak output under ideal conditions. For the panels to function effectively, they must be installed in an unshaded location, and correctly orientated based on the site latitude.

A PV panels system to achieve 10% of total building energy consumption requires 190 photovoltaic panels and a large roof area of 520 m². PV panels are mounted on a metal racking system which are angled at 30 degrees to improve the energy capture, for maintenance the system requires access paths, provided with man safe system. Visual impact has to be taken in consideration, PV solar system installation will be prevented on a sloping roof and therefore will be visible. The intermittency and unpredictability of solar energy due to weather is an element which can dictate that the system is not used at full potential. A further consideration, is the additional structural provisions to support the photovoltaic panels and metal racking system which for a system of this size is considerable.



Picture 1: Frame mounted PV on a flat roof



Picture 2: Roof Mounted PV Panels

7.2 Solar Thermal

Solar thermal panels convert solar radiation into thermal energy which can be used to supplement conventional heat generation methods such as gas boilers. There are 2 main types of system, evacuated tube collectors and flat plate collectors. Evacuated tube collectors can have efficiencies of up to 60%, and flat plate collectors of around 50%.

Similar to photovoltaic panels, the positioning of the panels requires careful consideration, however several manufactures of evacuated tube panels can lay their panels onto flat roofs without the requirement for A-frames as the tubes themselves can be set to the correct angle.

The Renewable Heat Incentive (the mechanical equivalent of the recently introduced electrical Feed-in-Tariff) currently provides a rebate mechanism providing 8.9 p/kWh of heat generated from solar thermal for 20 years following installation.



Picture 1: Evacuated tube solar thermal panels

7.3 Wind Turbines

Wind turbines convert the kinetic energy contained in wind into electricity. To ensure that they operate economically, most manufacturers recommend an average wind speed of 6ms⁻¹. The average wind speed for the site is approximately 5 m/s and whilst this is likely to be suitable for a reasonable yield, the nature of the development and close proximity to local residences is also likely to cause planning issues. Factors such as nearby obstacles (buildings, trees and planting), potential shadow flicker on the development and surrounding residential properties, noise etc. would suggest that this is not a suitable technology for consideration on this development.



Picture 4: Micro-Wind Turbine (multiple required for reasonable yield)

7.4 Biomass

Biomass boilers can be used as an alternative to conventional gas boilers. Biomass, usually wood chips or pellets, are burned instead of gas. A conventional gas back-up boiler will typically still be provided to ensure the building demands are met in the event of mechanical failure or a problem with fuel supply. Biomass fuel is deemed low carbon as the fuel absorbs CO₂ whilst growing, and hence burning the fuel is merely releasing this carbon back into the atmosphere. It is not zero carbon; however, as there are carbon emissions associated with the farming, processing and transportation of the biomass.

There are two main types of solid biofuel; wood chips and wood pellets. Wood chips are cheaper to buy as they require less processing, however wood pellets have a higher energy density (in terms of kWh per m³ of fuel), and a more predictable moisture content because of its processed nature. However, this processing produces a higher costing fuel, but the regular size of wood pellets means

that boilers operating on pellets are less prone to jamming and problems associated with delivery of fuel from the store.

Biomass boilers require storage for the fuel – the size of store depends on the size of boiler, and the required length of storage which is often determined by the frequency of deliveries and minimum delivery volumes. A 6 week frequency of delivery is a typical value for storage calculations.

Based on the urban nature of the site and the aesthetic impact of locating a fuel store and delivery area, the management and availability of supply and the potential impact of discharging particulates in an urban area, it is not proposed to consider biomass for this development.



Picture 5: Wood Pellet Fuel



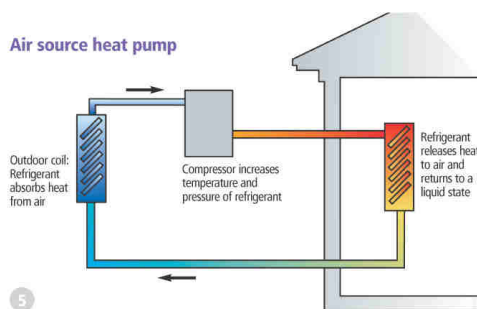
Picture 6: Wood Chip Fuel

7.5 Heat Pumps

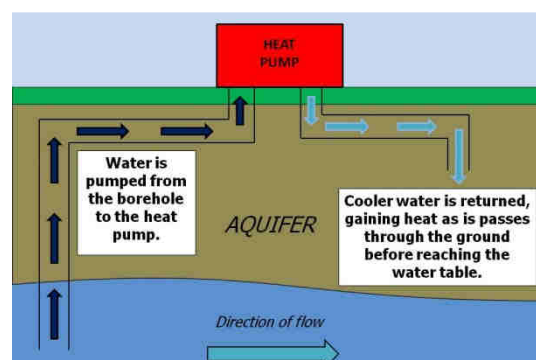
Heat pumps take a low grade source of heat e.g. a lake or external air, and through a process similar to that of a domestic refrigerator, “upgrade” the heat for use in a heating system, or for domestic hot water generation.

Reverse-cycle heat pumps can also use the same process in reverse to provide cooling if required. For the purposes of this report, given the nature of the development and typical servicing strategy it is assumed that any heat pumps installed will only operate in heating mode. Although there are several day spaces that will require cooling, the typical servicing arrangement would suggest these are best fed from local plant rather than the introduction of multiple heat pump units, chilled water pipework and equipment etc.

Air source heat pumps operate on the same principle as ground source heat pumps, but instead of using the earth as a heat source, they extract heat from external air. Heat pumps that generate significant amounts of heat will require external plant areas, and may have noise issues associated with the large quantities of air that will be circulated.



Picture 7: Air Source Heat Pump



Picture 8: Open Water Loop

Ground Source Heat Pumps:

Ground Source heat pumps utilise the constant temperatures encountered underground as a heat source or sink to provide low energy heating or cooling. Because of the relatively low temperatures generated the systems operate best when coupled to an underfloor heating system.

The renewable heat incentive currently allows 3.4p/kWh of heat generated from a ground source heat pump for 20 years following installation.

There are several variants – the indoor heat pump machinery remains the same however the heat source can be one of the following:

- **Open Loop Borehole**

A borehole is dug to an underground water source such as an aquifer. Water is drawn through the heat pump where heat is extracted or added, and then reinjected into another borehole.

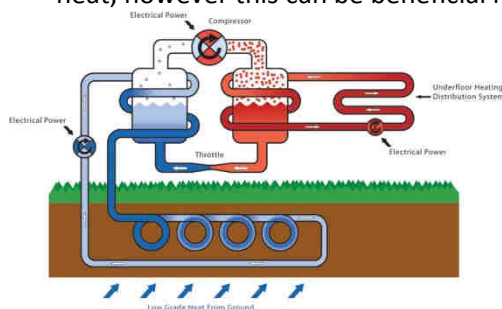
This is highly dependent on site geology, and abstraction rights are required from the Environment Agency to extract water from the ground. The Environment Agency are also keen to ensure that there is a net balance of energy into and out of the ground over the course of a year, so there is no net heat gain or loss, which requires that the system is used for both heating and cooling over the course of a year. On the basis that we have no information regarding underground water courses and the need for a balance of heating and cooling (the development will be predominantly heating only), these will not be considered further as part of this report.

- **Vertical Closed Loop**

Flow and return pipework is installed vertically, either in specifically drilled boreholes or, if the building structure permits, as part of the foundations. If the pipes can be integrated with in the piles of the building, this may be a reasonably cost effective method, however damage to the pipes during the remainder of the construction process may be a risk. If a large amount of heating or cooling is required, the lengths of coils will be significant. As the heat is collected from a relatively small area, an adequate flow of water is required, either from rainwater or groundwater to replenish the heat extracted. Ideally, if used for heating in winter, the system would be used for cooling in summer so the system is in balance. Again, as the development will be predominantly heating only, such technologies are unlikely to be suitable.

- **Horizontal Closed Loop**

This operates on the same principle as a vertical system, however the coils are laid horizontally at a shallow depth. Large areas would be required to gain significant sources of heat, however this can be beneficial if large amounts of earth are to be moved on site.



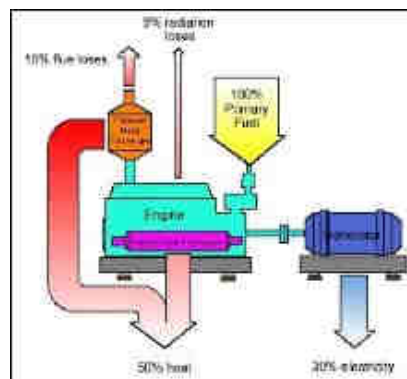
Picture 9: Ground Source Heat Pump Diagrammatic

7.6 Combined Heat and Power (CHP)

Combined heat and power (CHP) systems comprise a generator to provide electricity, and a system to convert waste heat from the generator to useful heating energy. Most small-scale CHP units are powered by natural gas so typically not classed as renewable energy, however, the technology is classed as low carbon technology and, as such, can be used to comply with local planning policy and BREEAM (where applicable). CHP can contribute significantly to carbon improvement targets; the generation of on-site electricity is regarded favourably as it is more efficient than using grid electricity with its associated transmission and generation losses.

Most CHP units use an automotive engine as the source of energy, so there is a maintenance requirement associated with their use.

There are now small scale CHP units that can be run from liquid biofuel. These units generate heat and electricity with very low carbon emissions, however a reliable source of fuel would have to be sourced to make this a viable proposition for the development.

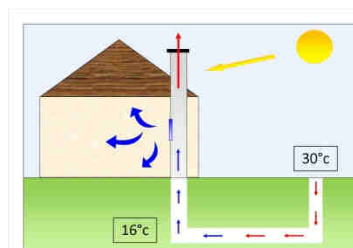


Picture 10: CHP Diagrammatic

7.7 Earth Ducts

Earth ducts allow the incoming air to be pre-heated by the earth in winter, and pre-cooled in summer. Pipes are laid into the ground under the site, and air is drawn through them. The constant temperature of the earth then transfers heat into the air in winter and absorbs heat in summer reducing the energy required to heat and cool the air mechanically. Typically, these would require significant trench work and riser space to be provided to the air handling plant for use as the incoming air route.

Due to the typical servicing strategy (which tends to favour local ventilation) and limited riser space, these have not been proposed for consideration as part of this report.



picture 11: Earth Tube (Summer Cycle)

7.8 Summary

The technical feasibility of installing each LZC technology at the proposed Care Home has been assessed in order to discount any unsuitable options at an early stage. A summary of the feasibility process is presented in the following table:

Technology	Brief Description	Benefits	Issues/Limitations	Feasible for site
Solar Photovoltaic	Photovoltaic panels convert solar radiation into electrical energy	Low maintenance. No moving parts. Easily integrated into building design.	Any overshadowing affects panel performance. Large area required for installation. Panels ideally inclined and facing southerly direction.	Yes
Solar Thermal	Solar thermal energy can contribute towards space heating and hot water requirements.	Low maintenance.	Must be sized for the building base load hot water requirements Panels ideally inclined and facing southerly direction	Yes
Wind Turbine	Wind generation equipment operates on the basis of wind turning a propeller, which is used to drive an alternator to generate electricity. Small scale (1kW – 15kW) wind turbines can be pole or roof mounted.	Low maintenance/ On-going cost. Excess electricity can be exported to the grid	Planning issues. Aesthetic impact. Background noise Space limitations on site. Minimum wind speed requirements. Wind survey to be undertaken to verify 'local' viability.	No
Biomass	Modern wood-fuel boilers are highly efficient, clean and almost carbon	Stable long term running costs. Potential good CO ₂ saving.	Large area needed for fuel delivery and storage. Reliable fuel supply chain required. Regular maintenance required Significant plant space required. Air pollution / Clean Air Act limits use.	No
Ground Source Heat Pump (GSHP)	GSHP systems tap into the earth's considerable energy store to provide both heating and cooling to buildings.	Minimal maintenance. Unobtrusive technology. Flexible installation options to meet available site footprint.	Large area required for horizontal pipes Full ground survey required to determine geology. More beneficial to the development if cooling is required. Integration with piled foundations must be done at an early stage.	No
Air Source Heat Pump	Electric air source heat pumps extract thermal energy from the surrounding air and transfer it to the working fluid (air or water).	Efficient use of fuel. Relatively low capital costs.	Specialist maintenance. Some additional plant space required. External proximity to boundary and noise generation with units cycling.	Yes
Combined Heat and Power	A Combined Heat and Power	Potential high CO ₂ saving available.	Maintenance intensive. Sufficient base thermal and	Yes

Technology	Brief Description	Benefits	Issues/Limitations	Feasible for site
	(CHP) installation is effectively a mini on-site power plant providing both electrical power and thermal heat. CHP is strictly an energy efficiency measure rather than a renewable energy technology.	Efficient use of fuel. Excess electricity can be exported to the grid	electrical demand required. Some additional plant space required.	
Earth Ducts	Passive pre-treatment of fresh air	Low cost Free energy	Requires significant air loads and riser space	No

Table 1: Summary of Renewable and Low Carbon Technology Energy Options

With careful consideration of the suitable technologies and known servicing strategies of the Client, our recommendation would be for a small scale CHP.

8.0 Results

Based on the thermal and electrical efficiencies, heat to power ratio and CHPQA Quality Index of typical commercially available units, the building was modelled to determine the proportion of CHP that would be required.

In order to achieve compliance with Part L2A 2013 and local planning policy, it was determined from the energy model that a CHP sized to provide in the order of 30% of the overall thermal demand would provide a revised Building Emission Rate (BER) of 31.5 kg CO₂/m².

From the baseline building CO₂ emissions of 39.6 kg CO₂/m², a reduction of 8.1 kg CO₂/m² is possible by CHP. This equates to a percentage reduction in CO₂ emissions of over 20% from the predicted CO₂ emissions of the proposed development and shows compliance against the aforementioned local planning policy.

Final results were as follows:

TER	37.0 kg.CO ₂ /m ² per annum
BER	31.5 kg.CO ₂ /m ² per annum

A copy of the BRUKL output document is provided in Appendix A for information.

Based on commercially available CHP sizes, the actual reduction is likely to be higher than this, although this will be subject to the specific equipment selected by the D & B contractor and the final calculated vessel size.

The CHP has been included within this energy strategy as one particular, low investment solution to achieve compliance with building regulations and local planning criteria as noted. It is the contractor's responsibility to provide a holistic energy strategy that will comply with both criteria whilst also achieving specification compliance.

9.0 Life Cycle Costing

This section of the report shall examine the life cycle cost of the CHP system, based on a system selected against following criteria:

CHP Electrical Energy Production = 157,293kWh
 % of Building Heat Demand by CHP = 30%

In order to fully establish the life cycle cost for systems the report will need to establish costing for Energy Consumption, Energy Generation, Maintenance and Estimated Fuel Tariffs.

For the basis of this study the following estimated fuel costs shall be used:

Fuel:	Cost (£/kWh)*:
Electricity	£0.151
Gas	£0.034

**Figures are based on a fair to good tariffs as current during 2018/2019.*

Analysis of a commercially available CHP unit against the figures provided by the BRUKL document in 'Appendix A' provides the basis for the energy used and generated which we can then use to calculate the overall costs.

9.1 Combined Heat & Power (CHP)

The CHP has been sized to account for around 30% of the heat requirements of the building which is estimated to be 314,586kWh/Annum. In a CHP unit heat is generated with an efficiency of around 60% whereas heat generated by a boiler will be around 95%. This will result in the following cost difference:

Heat Generator	Heat Energy Required (kWh)	Generator Efficiency (%)	Total Energy Consumed (kWh)	Fuel Cost (£) <i>Gas @ £0.034/kWh</i>
Boiler	314,586kWh	95%	331,143kWh	£11,258
CHP	314,586kWh	60%	524,310kWh	£17,827
			Cost Difference (£) =	£6,569

Although the CHP generates heat energy less efficiently than the boilers, it also provides electrical energy at the same time. The BRUKL document shows that the electrical energy production by the CHP unit will be around 157,293kWh/Annum when accounting for the above heat requirements.

This will result in the following savings:

Electricity Generator	Elec Energy Generated (kWh)	Fuel Cost (£) <i>Elec @ £0.151/kWh</i>
Grid	157,293kWh	£23,751
CHP	157,293kWh	£0*
		Cost Difference (£) =
		£23,751

**The fuel cost has already been taken in the Gas Fuel cost comparison.*

To fully understand the actual cost difference the total Gas and Electricity fuel costs must be combined and compared.

Heat & Electricity Generator	Cost for Gas Consumption (£)	Cost for Electricity Consumption (£)	Total Fuel Cost (£)
Boiler & Grid Electricity	£11,258	£23,751	£35,009
CHP	£17,827	£0*	£17,827
		Cost Difference (£) =	£17,182

**The fuel cost has already been taken in the Gas Fuel cost comparison.*

From the above calculations we can see that the CHP unit should provide fuel cost savings of around £17,182 per year.

Annual maintenance costs on such a unit has been estimated to be around £1'675.

Taking the maintenance costs away from the annual fuel savings leaves us with a total annual saving of £15,507.

The life cycle cost of this CHP unit can now be calculated.

Based on a commercially available CHP unit sized for the project the purchase cost of the unit would be around £57,000 (including installation and commissioning etc).

The total payback time for this unit can be seen below:

Cost of CHP Unit incl. Installation/Commissioning etc. (£)	Total Annual Savings after Maintenance (£)	Years to Payback (Unit Cost/Savings)
£57,000	£15,507	Under 5 years

A typical CHP unit of this capacity and theoretical operational profile would have a design life of around 15 years. Taking this into account we can see the total cost over the full design life of the CHP unit:

Cost of CHP Unit incl. Installation/Commissioning etc. (£)	Total Annual Savings after Maintenance x 15 years (£)	Total Savings over 15 years (£)
£57,000	£232,605	£175,605

The Life Cycle Cost of the proposed CHP unit will result in estimated total saving of £175,605.

10.0 Available Grants for LZC Technology

This section of the report lists the grants available for the LZC technology proposed on this scheme, in this case CHP.

CHPQA:

'The CHP Quality Assurance programme (CHPQA) is a government initiative providing a practical, determinate method for assessing all types and sizes of Combined Heat & Power (CHP) schemes throughout the UK. CHP, the simultaneous generation of heat & power in a single process, provides one of the most cost-effective approaches for making carbon savings and plays a crucial role in the UK Climate Change programme.'

CHPQA aims to monitor, assess and improve the quality of UK Combined Heat and Power.

While participation in the CHPQA programme is voluntary, the government is committed to increasing the UK's CHP capacity because of the considerable environmental, economic and social benefits it can bring together with its contribution to security of supply. Successful CHPQA certification grants eligibility to a range of benefits, including Renewable Obligation Certificates, Renewable Heat Incentive, Carbon Price Floor (heat) relief, Climate Change Levy exemption (in respect of electricity directly supplied), Enhanced Capital Allowances and preferential Business Rates.'

Description taken from www.gov.uk/guidance/combined-heat-power-quality-assurance-programme

RHI:

'The Renewable Heat Incentive (RHI), launched in November 2011, is a DECC initiative designed to provide support to renewable heat technologies in order to increase deployment and aid market development with the ultimate aim of reducing cost of installation. The RHI supports heat where that heat is used in a building for 'eligible purposes': heating a space, heating water, or for carrying out a process where the heat is used. Heat utilised to produce or process the renewable fuel, or used for electricity generation, does not qualify for RHI.'

The Climate Change Levy:

'The Climate Change Levy was introduced by the UK Government in 2001 and is charged on most non-domestic supplies of energy used as fuel for lighting, heating and power. The CCL is designed to promote energy efficiency and encourage investment in energy saving equipment, thereby reducing emissions of greenhouse gases. CHP schemes that are fully or partially certified as Good Quality CHP under CHPQA and have obtained a Secretary of State (CHP) Exemption Certificate are exempt from the main rates of CCL on the fuel they utilise (assuming they meet a power efficiency threshold of 40% otherwise this exemption is scaled back).'

ECA:

'The Enhanced Capital Allowances scheme allows businesses to write-off 100% of their investment in those energy saving technologies that are listed in the Energy Technology Criteria List against the taxable profits of the period during which they make the investment. ECAs are claimed in the same way as other capital allowances on the Corporation Tax Return for companies and the Income Tax Return for individuals and partnerships.'

Description above taken from www.gov.uk/guidance/combined-heat-and-power-incentives

11.0 Appendix A – BRUKL Documentation

The following pages detail the predicted BRUKL output and Part L compliance information for the proposed care home building based on the solution as described elsewhere in this report.

This analysis demonstrates feasibility only. It should be noted that detailed constructions were not available at the time of analysis. The contractor shall be responsible for developing a holistic solution in conjunction with the detailing architect to achieve compliance.

12.0 Appendix B – EPC Documentation

Project name

Signature Care Home - Caversham

As designed

Date: Sun Mar 24 11:34:45 2019

Administrative information

Building Details

Address: Henley Road, Caversham,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.4"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.4

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

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	37
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	37
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	31.5
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	External Wall
Floor	0.25	0.15	0.15	Ground Floor
Roof	0.25	0.15	0.15	Roof
Windows***, roof windows, and rooflights	2.2	1.44	1.47	Type 7b
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

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

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

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

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

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	4

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Bed HRU Vent/Rad Heating (172 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	0.8
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- HRU Vent/Rad Heating (40 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	-	-	1.5	0.8
Standard value	N/A	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

3- Extract Vent/Rad Heating (24 Zones)

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

4- Nat Vent/Rad Heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

5- Kit Vent/Rad Heating (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	-	-	-	0.7
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

6- HRU Vent/AC (7 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	4	-	1.5	0.8
Standard value	N/A	2.6	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

7- No Vent/AC (Comms 1)

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

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0
Standard value	N/A	N/A

1- New Heating Circuit

	CHPQA quality index	CHP electrical efficiency
This building	144	0.3
Standard value	105	0.2

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	ID of system type	SFP [W/(l/s)]									HR efficiency	
		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		
Bedroom 1		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 2		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 3		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 4		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 5		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 6		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 7		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 8		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 9		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 10		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 11		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 12		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 13		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 14		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 15		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 16		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 17		-	-	-	-	1.2	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Bedroom 18		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 19		-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 20		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 1		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 2		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 3		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 4		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 5		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 6		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 7		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 8		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 9		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 10		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 11		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 12		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 13		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 14		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 15		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 16		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 17		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 18		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 19		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 20		-	-	-	-	1.2	-	-	-	-	-	N/A
WC/Cleaners 1		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 2		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 3		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 4		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 5		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 6		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 7		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 8		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 9		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 10		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 11		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 12		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 13		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 14		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 15		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 16		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 17		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 18		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 19		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 20		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	
Corridor 1	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 2	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 3	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 4	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 5	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 6	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 7	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 8	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 9	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 10	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 11	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 12	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 13	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 14	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 15	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 16	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 17	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 18	-	-	-	1.5	-	-	-	-	-	-	N/A	
Corridor 19	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (AC) 1	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (AC) 3	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (AC) 4	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (AC) 5	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (AC) 6	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (AC) 7	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (No AC) 1	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (No AC) 2	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (No AC) 3	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (No AC) 4	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (No AC) 5	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (No AC) 6	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (No AC) 7	-	-	-	1.5	-	-	-	-	-	-	N/A	
Dayroom (No AC) 8	-	-	-	1.5	-	-	-	-	-	-	N/A	
Reception/Cafe 1	-	-	-	1.5	-	-	-	-	-	-	N/A	
Kitchen 1	-	1	-	-	-	-	-	-	-	-	N/A	
Kitchen 2	-	1	-	-	-	-	-	-	-	-	N/A	
Laundry 1	-	-	-	1.5	-	-	-	-	-	-	N/A	
Drugs 1	0.3	-	-	-	-	-	-	-	-	-	N/A	
Drugs 2	0.3	-	-	-	-	-	-	-	-	-	N/A	
Office 1	-	-	-	1.5	-	-	-	-	-	-	N/A	
Office 2	-	-	-	1.5	-	-	-	-	-	-	N/A	
Office 3	-	-	-	1.5	-	-	-	-	-	-	N/A	
Office 4	-	-	-	1.5	-	-	-	-	-	-	N/A	

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		
Office 5	-	-	-	1.5	-	-	-	-	-	-	N/A
Office 6	-	-	-	1.5	-	-	-	-	-	-	N/A
Office 7	-	-	-	1.5	-	-	-	-	-	-	N/A
Office 8	-	-	-	1.5	-	-	-	-	-	-	N/A
Office 9	-	-	-	1.5	-	-	-	-	-	-	N/A
Office 10	-	-	-	1.5	-	-	-	-	-	-	N/A
Staffroom 1	-	-	-	1.5	-	-	-	-	-	-	N/A
Staffroom 2	-	-	-	1.5	-	-	-	-	-	-	N/A
Bedroom 21	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 22	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 23	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 24	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 25	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 26	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 27	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 28	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 29	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 30	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 31	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 32	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 33	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 34	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 35	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 36	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 37	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 38	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 39	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 40	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 41	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 42	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 43	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 44	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 45	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 46	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 47	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 48	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 49	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 50	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 51	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 52	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 53	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 54	-	-	-	-	1.2	-	-	-	-	-	N/A
Bedroom 55	-	-	-	-	1.2	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
Bedroom 56	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 57	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 58	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 59	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 60	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 61	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 62	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 63	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 64	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 65	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 66	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 67	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 68	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 69	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 70	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 71	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 72	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 73	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 74	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 75	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 76	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 77	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 78	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 79	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 80	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 81	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 82	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 83	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 84	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 85	-	-	-	-	1.2	-	-	-	-	-	N/A	
Bedroom 86	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 21	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 22	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 23	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 24	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 25	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 26	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 27	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 28	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 29	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 30	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 31	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 32	-	-	-	-	1.2	-	-	-	-	-	N/A	

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
Ensuite 33	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 34	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 35	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 36	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 37	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 38	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 39	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 40	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 41	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 42	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 43	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 44	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 45	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 46	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 47	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 48	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 49	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 50	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 51	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 52	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 53	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 54	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 55	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 56	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 57	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 58	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 59	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 60	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 61	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 62	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 63	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 64	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 65	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 66	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 67	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 68	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 69	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 70	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 71	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 72	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 73	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 74	-	-	-	-	1.2	-	-	-	-	-	N/A	
Ensuite 75	-	-	-	-	1.2	-	-	-	-	-	N/A	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Ensuite 76		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 77		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 78		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 79		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 80		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 81		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 82		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 83		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 84		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 85		-	-	-	-	1.2	-	-	-	-	-	N/A
Ensuite 86		-	-	-	-	1.2	-	-	-	-	-	N/A
WC/Cleaners 21		0.3	-	-	-	-	-	-	-	-	-	N/A
WC/Cleaners 22		0.3	-	-	-	-	-	-	-	-	-	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	
Bedroom 1		-	100	-	66
Bedroom 2		-	100	-	68
Bedroom 3		-	100	-	68
Bedroom 4		-	100	-	68
Bedroom 5		-	100	-	68
Bedroom 6		-	100	-	68
Bedroom 7		-	100	-	71
Bedroom 8		-	100	-	68
Bedroom 9		-	100	-	69
Bedroom 10		-	100	-	70
Bedroom 11		-	100	-	71
Bedroom 12		-	100	-	70
Bedroom 13		-	100	-	70
Bedroom 14		-	100	-	70
Bedroom 15		-	100	-	74
Bedroom 16		-	100	-	71
Bedroom 17		-	100	-	59
Bedroom 18		-	100	-	62
Bedroom 19		-	100	-	61
Bedroom 20		-	100	-	61
Ensuite 1		-	100	-	22
Ensuite 2		-	100	-	22
Ensuite 3		-	100	-	22
Ensuite 4		-	100	-	22
Ensuite 5		-	100	-	22
Ensuite 6		-	100	-	22

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
Ensuite 7		-	100	-	22
Ensuite 8		-	100	-	22
Ensuite 9		-	100	-	25
Ensuite 10		-	100	-	25
Ensuite 11		-	100	-	25
Ensuite 12		-	100	-	25
Ensuite 13		-	100	-	25
Ensuite 14		-	100	-	25
Ensuite 15		-	100	-	25
Ensuite 16		-	100	-	25
Ensuite 17		-	100	-	24
Ensuite 18		-	100	-	25
Ensuite 19		-	100	-	24
Ensuite 20		-	100	-	24
WC/Cleaners 1		-	100	-	26
WC/Cleaners 2		-	100	-	26
WC/Cleaners 3		-	100	-	42
WC/Cleaners 4		-	100	-	64
WC/Cleaners 5		-	100	-	46
WC/Cleaners 6		-	100	-	30
WC/Cleaners 7		-	100	-	25
WC/Cleaners 8		-	100	-	29
WC/Cleaners 9		-	100	-	82
WC/Cleaners 10		-	100	-	37
WC/Cleaners 11		-	100	-	37
WC/Cleaners 12		-	100	-	43
WC/Cleaners 13		-	100	-	57
WC/Cleaners 14		-	100	-	26
WC/Cleaners 15		-	100	-	33
WC/Cleaners 16		-	100	-	33
WC/Cleaners 17		-	100	-	43
WC/Cleaners 18		-	100	-	57
WC/Cleaners 19		-	100	-	26
WC/Cleaners 20		-	100	-	33
Corridor 1		-	100	-	256
Corridor 2		-	100	-	163
Corridor 3		-	100	-	296
Corridor 4		-	100	-	167
Corridor 5		-	100	-	52
Corridor 6		-	100	-	102
Corridor 7		-	100	-	88
Corridor 8		-	100	-	275
Corridor 9		-	100	-	159

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
Corridor 10		-	100	-	118
Corridor 11		-	100	-	82
Corridor 12		-	100	-	128
Corridor 13		-	100	-	45
Corridor 14		-	100	-	207
Corridor 15		-	100	-	185
Corridor 16		-	100	-	243
Corridor 17		-	100	-	185
Corridor 18		-	100	-	227
Corridor 19		-	100	-	185
Dayroom (AC) 1		-	100	-	100
Dayroom (AC) 3		-	100	-	346
Dayroom (AC) 4		-	100	-	116
Dayroom (AC) 5		-	100	-	366
Dayroom (AC) 6		-	100	-	405
Dayroom (AC) 7		-	100	-	405
Dayroom (No AC) 1		-	100	-	145
Dayroom (No AC) 2		-	100	-	137
Dayroom (No AC) 3		-	100	-	247
Dayroom (No AC) 4		-	100	-	148
Dayroom (No AC) 5		-	100	-	127
Dayroom (No AC) 6		-	100	-	87
Dayroom (No AC) 7		-	100	-	87
Dayroom (No AC) 8		-	100	-	85
Stair/Unvented Corridor 1		-	100	-	73
Stair/Unvented Corridor 2		-	100	-	69
Stair/Unvented Corridor 3		-	100	-	76
Stair/Unvented Corridor 4		-	100	-	73
Stair/Unvented Corridor 5		-	100	-	71
Stair/Unvented Corridor 6		-	100	-	52
Stair/Unvented Corridor 7		-	100	-	58
Stair/Unvented Corridor 8		-	100	-	69
Stair/Unvented Corridor 9		-	100	-	73
Stair/Unvented Corridor 10		-	100	-	64
Stair/Unvented Corridor 11		-	100	-	69
Stair/Unvented Corridor 12		-	100	-	69
Stair/Unvented Corridor 13		-	100	-	64
Stair/Unvented Corridor 14		-	100	-	69
Stair/Unvented Corridor 15		-	100	-	64
Stair/Unvented Corridor 16		-	100	-	20
Stair/Unvented Corridor 17		-	100	-	64
Stair/Unvented Corridor 18		-	100	-	58
Reception/Cafe 1		-	100	22	1192

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
Kitchen 1		-	100	-	501
Kitchen 2		-	100	-	173
Laundry 1		-	100	-	425
Store 1		100	-	-	30
Store 2		100	-	-	42
Store 3		100	-	-	12
Store 4		100	-	-	13
Store 5		100	-	-	23
Store 6		100	-	-	49
Store 7		100	-	-	12
Store 8		100	-	-	33
Store 9		100	-	-	54
Store 10		100	-	-	21
Store 11		100	-	-	37
Store 12		100	-	-	33
Store 13		100	-	-	19
Store 14		100	-	-	20
Store 15		100	-	-	19
Store 16		100	-	-	33
Store 17		100	-	-	58
Store 18		100	-	-	38
Comms 1		100	-	-	38
Drugs 1		100	-	-	64
Drugs 2		100	-	-	75
Plantroom 1		100	-	-	128
Office 1		100	-	-	109
Office 2		100	-	-	86
Office 3		100	-	-	92
Office 4		100	-	-	116
Office 5		100	-	-	77
Office 6		100	-	-	111
Office 7		100	-	-	112
Office 8		100	-	-	91
Office 9		100	-	-	169
Office 10		100	-	-	91
Staffroom 1		-	100	-	170
Staffroom 2		-	100	-	82
Bedroom 21		-	100	-	61
Bedroom 22		-	100	-	60
Bedroom 23		-	100	-	66
Bedroom 24		-	100	-	68
Bedroom 25		-	100	-	68
Bedroom 26		-	100	-	68

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
Bedroom 27		-	100	-	68
Bedroom 28		-	100	-	68
Bedroom 29		-	100	-	71
Bedroom 30		-	100	-	68
Bedroom 31		-	100	-	56
Bedroom 32		-	100	-	59
Bedroom 33		-	100	-	58
Bedroom 34		-	100	-	58
Bedroom 35		-	100	-	58
Bedroom 36		-	100	-	58
Bedroom 37		-	100	-	59
Bedroom 38		-	100	-	59
Bedroom 39		-	100	-	60
Bedroom 40		-	100	-	59
Bedroom 41		-	100	-	59
Bedroom 42		-	100	-	59
Bedroom 43		-	100	-	57
Bedroom 44		-	100	-	56
Bedroom 45		-	100	-	56
Bedroom 46		-	100	-	57
Bedroom 47		-	100	-	56
Bedroom 48		-	100	-	57
Bedroom 49		-	100	-	55
Bedroom 50		-	100	-	57
Bedroom 51		-	100	-	54
Bedroom 52		-	100	-	54
Bedroom 53		-	100	-	57
Bedroom 54		-	100	-	54
Bedroom 55		-	100	-	63
Bedroom 56		-	100	-	59
Bedroom 57		-	100	-	59
Bedroom 58		-	100	-	59
Bedroom 59		-	100	-	60
Bedroom 60		-	100	-	59
Bedroom 61		-	100	-	59
Bedroom 62		-	100	-	61
Bedroom 63		-	100	-	55
Bedroom 64		-	100	-	57
Bedroom 65		-	100	-	54
Bedroom 66		-	100	-	56
Bedroom 67		-	100	-	56
Bedroom 68		-	100	-	57
Bedroom 69		-	100	-	56

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
Bedroom 70		-	100	-	57
Bedroom 71		-	100	-	55
Bedroom 72		-	100	-	57
Bedroom 73		-	100	-	54
Bedroom 74		-	100	-	57
Bedroom 75		-	100	-	55
Bedroom 76		-	100	-	57
Bedroom 77		-	100	-	54
Bedroom 78		-	100	-	57
Bedroom 79		-	100	-	56
Bedroom 80		-	100	-	56
Bedroom 81		-	100	-	57
Bedroom 82		-	100	-	56
Bedroom 83		-	100	-	57
Bedroom 84		-	100	-	55
Bedroom 85		-	100	-	57
Bedroom 86		-	100	-	54
Ensuite 21		-	100	-	24
Ensuite 22		-	100	-	25
Ensuite 23		-	100	-	22
Ensuite 24		-	100	-	22
Ensuite 25		-	100	-	22
Ensuite 26		-	100	-	22
Ensuite 27		-	100	-	22
Ensuite 28		-	100	-	22
Ensuite 29		-	100	-	22
Ensuite 30		-	100	-	22
Ensuite 31		-	100	-	21
Ensuite 32		-	100	-	23
Ensuite 33		-	100	-	22
Ensuite 34		-	100	-	22
Ensuite 35		-	100	-	22
Ensuite 36		-	100	-	23
Ensuite 37		-	100	-	23
Ensuite 38		-	100	-	22
Ensuite 39		-	100	-	22
Ensuite 40		-	100	-	22
Ensuite 41		-	100	-	23
Ensuite 42		-	100	-	22
Ensuite 43		-	100	-	22
Ensuite 44		-	100	-	24
Ensuite 45		-	100	-	21
Ensuite 46		-	100	-	22

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
Ensuite 47		-	100	-	21
Ensuite 48		-	100	-	21
Ensuite 49		-	100	-	22
Ensuite 50		-	100	-	21
Ensuite 51		-	100	-	22
Ensuite 52		-	100	-	21
Ensuite 53		-	100	-	22
Ensuite 54		-	100	-	22
Ensuite 55		-	100	-	21
Ensuite 56		-	100	-	22
Ensuite 57		-	100	-	23
Ensuite 58		-	100	-	22
Ensuite 59		-	100	-	23
Ensuite 60		-	100	-	23
Ensuite 61		-	100	-	23
Ensuite 62		-	100	-	22
Ensuite 63		-	100	-	21
Ensuite 64		-	100	-	22
Ensuite 65		-	100	-	21
Ensuite 66		-	100	-	22
Ensuite 67		-	100	-	21
Ensuite 68		-	100	-	22
Ensuite 69		-	100	-	22
Ensuite 70		-	100	-	21
Ensuite 71		-	100	-	22
Ensuite 72		-	100	-	21
Ensuite 73		-	100	-	22
Ensuite 74		-	100	-	21
Ensuite 75		-	100	-	21
Ensuite 76		-	100	-	22
Ensuite 77		-	100	-	21
Ensuite 78		-	100	-	22
Ensuite 79		-	100	-	21
Ensuite 80		-	100	-	22
Ensuite 81		-	100	-	22
Ensuite 82		-	100	-	21
Ensuite 83		-	100	-	22
Ensuite 84		-	100	-	21
Ensuite 85		-	100	-	22
Ensuite 86		-	100	-	21
WC/Cleaners 21		-	100	-	39
WC/Cleaners 22		-	100	-	26

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?
Bedroom 1	NO (-77%)	NO
Bedroom 2	NO (-65%)	NO
Bedroom 3	NO (-56%)	NO
Bedroom 4	NO (-56%)	NO
Bedroom 5	NO (-56%)	NO
Bedroom 6	NO (-56%)	NO
Bedroom 7	NO (-58%)	NO
Bedroom 8	NO (-78%)	NO
Bedroom 9	NO (-78%)	NO
Bedroom 10	NO (-66%)	NO
Bedroom 11	NO (-56%)	NO
Bedroom 12	NO (-56%)	NO
Bedroom 13	NO (-56%)	NO
Bedroom 14	NO (-56%)	NO
Bedroom 15	NO (-58%)	NO
Bedroom 16	NO (-79%)	NO
Bedroom 17	NO (-81%)	NO
Bedroom 18	NO (-79%)	NO
Bedroom 19	NO (-79%)	NO
Bedroom 20	NO (-79%)	NO
Dayroom (AC) 1	NO (-64%)	NO
Dayroom (AC) 3	NO (-54%)	NO
Dayroom (AC) 4	NO (-61%)	NO
Dayroom (AC) 5	NO (-71%)	NO
Dayroom (AC) 6	NO (-70%)	NO
Dayroom (AC) 7	NO (-76%)	NO
Dayroom (No AC) 1	NO (-72%)	NO
Dayroom (No AC) 2	NO (-61%)	NO
Dayroom (No AC) 3	NO (-56%)	NO
Dayroom (No AC) 4	NO (-67%)	NO
Dayroom (No AC) 5	NO (-83%)	NO
Dayroom (No AC) 6	N/A	N/A
Dayroom (No AC) 7	N/A	N/A
Dayroom (No AC) 8	N/A	N/A
Reception/Cafe 1	NO (-53%)	NO
Laundry 1	NO (-90%)	NO
Office 1	NO (-71%)	NO
Office 2	NO (-70%)	NO
Office 3	NO (-68%)	NO
Office 4	NO (-81%)	NO
Office 5	N/A	N/A
Office 6	NO (-69%)	NO
Office 7	N/A	N/A
Office 8	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Office 9	NO (-84%)	NO
Office 10	N/A	N/A
Staffroom 1	NO (-78%)	NO
Staffroom 2	N/A	N/A
Bedroom 21	NO (-79%)	NO
Bedroom 22	NO (-79%)	NO
Bedroom 23	NO (-78%)	NO
Bedroom 24	NO (-66%)	NO
Bedroom 25	NO (-56%)	NO
Bedroom 26	NO (-56%)	NO
Bedroom 27	NO (-56%)	NO
Bedroom 28	NO (-56%)	NO
Bedroom 29	NO (-58%)	NO
Bedroom 30	NO (-79%)	NO
Bedroom 31	NO (-81%)	NO
Bedroom 32	NO (-79%)	NO
Bedroom 33	NO (-79%)	NO
Bedroom 34	NO (-79%)	NO
Bedroom 35	NO (-79%)	NO
Bedroom 36	NO (-79%)	NO
Bedroom 37	NO (-81%)	NO
Bedroom 38	NO (-81%)	NO
Bedroom 39	NO (-81%)	NO
Bedroom 40	NO (-81%)	NO
Bedroom 41	NO (-82%)	NO
Bedroom 42	NO (-83%)	NO
Bedroom 43	NO (-71%)	NO
Bedroom 44	NO (-77%)	NO
Bedroom 45	NO (-77%)	NO
Bedroom 46	NO (-80%)	NO
Bedroom 47	NO (-79%)	NO
Bedroom 48	NO (-78%)	NO
Bedroom 49	NO (-76%)	NO
Bedroom 50	NO (-85%)	NO
Bedroom 51	NO (-88%)	NO
Bedroom 52	NO (-67%)	NO
Bedroom 53	NO (-69%)	NO
Bedroom 54	NO (-65%)	NO
Bedroom 55	NO (-76%)	NO
Bedroom 56	NO (-75%)	NO
Bedroom 57	NO (-74%)	NO
Bedroom 58	NO (-74%)	NO
Bedroom 59	NO (-75%)	NO
Bedroom 60	NO (-75%)	NO
Bedroom 61	NO (-74%)	NO
Bedroom 62	NO (-75%)	NO
Bedroom 63	NO (-67%)	NO
Bedroom 64	NO (-69%)	NO
Bedroom 65	NO (-66%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Bedroom 66	NO (-77%)	NO
Bedroom 67	NO (-77%)	NO
Bedroom 68	NO (-80%)	NO
Bedroom 69	NO (-79%)	NO
Bedroom 70	NO (-78%)	NO
Bedroom 71	NO (-76%)	NO
Bedroom 72	NO (-85%)	NO
Bedroom 73	NO (-88%)	NO
Bedroom 74	NO (-69%)	NO
Bedroom 75	NO (-67%)	NO
Bedroom 76	NO (-69%)	NO
Bedroom 77	NO (-66%)	NO
Bedroom 78	NO (-69%)	NO
Bedroom 79	NO (-77%)	NO
Bedroom 80	NO (-77%)	NO
Bedroom 81	NO (-80%)	NO
Bedroom 82	NO (-79%)	NO
Bedroom 83	NO (-78%)	NO
Bedroom 84	NO (-76%)	NO
Bedroom 85	NO (-85%)	NO
Bedroom 86	NO (-88%)	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

	Actual	Notional
Area [m ²]	4894	4894
External area [m ²]	6860	6860
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	4	3
Average conductance [W/K]	1729	2957
Average U-value [W/m ² K]	0.25	0.43
Alpha value* [%]	9	9

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
100	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	1.1	4.7
Cooling	3.59	4.03
Auxiliary	14.41	12.22
Lighting	20.67	15.06
Hot water	128.78	93.24
Equipment*	53.38	53.38
TOTAL**	136.42	129.25

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	32.14	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	58.21	69.59
Primary energy* [kWh/m ²]	178.53	213.2
Total emissions [kg/m ²]	31.5	37

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	0.1	0	0	0	11	0.9	0	0.95	0
Notional	2.9	0	1	0	9.9	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	0	0	0	0	21.8	0	0	0	0
Notional	0.2	0	0.1	0	18.5	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	0	0	0	0	13.2	0	0	0	0
Notional	5	0	1.7	0	15.2	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	41.2	0	12.7	0	3.6	0.9	0	0.95	0
Notional	140.9	0	47.8	0	2.3	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	0	0	0	0	21.9	0	0	0	0
Notional	0	0	0	0	33.2	0	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	0	640.4	0	44.5	29.8	0	4	0	4
Notional	0	646.9	0	49.9	18.5	0.82	3.6	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	External Wall
Floor	0.2	0.15	Ground Floor
Roof	0.15	0.15	Roof
Windows, roof windows, and rooflights	1.5	1.42	Type 7c
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4

12.0 Appendix B – EPC Documentation

Energy Performance Certificate

Non-Domestic Building



Henley Road
Caversham

Certificate Reference Number:

0270-1945-9331-8472-6124

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

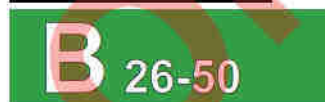
More energy efficient



Net zero CO₂ emissions



This is how energy efficient the building is.



Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Heating and Mechanical Ventilation
Total useful floor area (m ²):	4894
Building complexity (NOS level):	5
Building emission rate (kgCO ₂ /m ² per year):	31.45
Primary energy use (kWh/m ² per year):	178.53

Benchmarks

Buildings similar to this one could have ratings as follows:

27

If newly built

78

If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software: TAS v9.4.4 using calculation engine TAS v9.4.4

Property Reference: 123456789012

Assessor Name:

Assessor Number: ABCD123456

Accreditation Scheme: Information not available

Employer/Trading Name: Harniss Consulting Ltd

Employer/Trading Address:

Issue Date: 24 Mar 2019

Valid Until: 23 Mar 2029 (unless superseded by a later certificate)

Related Party Disclosure: Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 9182-4077-9413-1602-4525

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by Information not available. You can obtain contact details of the Accreditation Scheme at Information not available.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at: www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.