	Part L Limiting Fabric Parameters	Proposed Specification – Residential Apartments
Air Permeability	8.0 m³/h.m² at 50 Pa	4.0 - 4.5 m³/h.m² at 50 Pa
Thermal Bridging	Y = 0.150 (default)	Y = ≤ 0.050 (calculated)

Non-residential

5.10. Tables 7 and 8 detail an indicative fabric specification of the major building elements for the local centre and children's home, with the first column in this table setting out the Part L2 limiting fabric parameters in order to demonstrate the improvements that will be made.

5.11. Unlike the residential units, within the calculation methodology of Approved Document L2, applicable to non-residential development, more emphasis is placed on building services and lighting as these generally have a significantly greater impact on the overall performance of the unit.

Table 7. Indicative construction specification – Local centre units

	Part L2 Limiting Fabric Parameters	Indicative Proposed Fabric Specification
External wall	0.26 W/m²K	0.20 W/m²K
Roof	0.18 W/m²K	0.11 W/m²K
Ground floor	0.28 W/m²K	≤ 0.15 W/m²K
Windows	1.60 W/m²K	1.40 W/m²K
Doors – U-value	1.60 W/m²K	1.20 W/m²K
Air Permeability	8 m³/(h.m²) @50Pa	5.00 W/m²K

Table 8. Indicative construction specification – Children's home

	Part L2 Limiting Fabric Parameters	Indicative Proposed Fabric Specification
External wall – U-value	0.26 W/m²K	0.25 W/m²K
Plane roof – U-value	0.18 W/m²K	0.09 W/m²K
Ground floor – U-value	0.18 W/m²K	0.10 – 0.14 W/m²K
Windows – U-value	1.60 W/m²K	0.86 – 0.89 W/m²K
Doors – U-value	1.60 W/m²K	1.20 W/m²K
Air Permeability	8 m³/h.m² at 50 Pa	5.0 m³/h.m² at 50 Pa

Thermal Bridging

5.12. The significance of thermal bridging as a potentially major source of fabric heat losses is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the thermal bridging will not achieve the desired energy and CO_2 reduction targets for the residential units.

5.13. The specification should seek to minimise unnecessary bridging of the insulation layers, with avoidable heat loss therefore being reduced wherever possible. Accurate calculation of these heat losses forms an integral part of the SAP calculations undertaken to establish energy demand of the dwellings, and as such thermal modelling will be undertaken to assess the performance of all main building junctions.

Air Leakage

5.14. After conductive heat losses through building elements are reduced, convective losses through draughts are the next major source of energy wastage. The proposal adopts an airtightness standard of 4.5 m³/h.m² at 50Pa for the residential units and 5.0 m³/h.m² at 50Pa for the non-residential unit, with pressure testing of all buildings to be undertaken on completion to confirm that the design figure has been met.

Provisions for Energy-Efficient Operation of the Dwelling

5.15. The occupant of the dwelling should be provided with all necessary literature and guidance relating to the energy efficient operation of fixed building services. Currently it is assumed that all dwellings will be provided with modern, highly efficient Air Source Heat Pumps (ASHPs), fully insulated primary pipework, and controls including programmers, thermostats and Thermostatic Radiator Valves to avoid unnecessary heating of spaces when not required.

Active Measures – Non-residential

5.16. Low energy lighting will be used with a lighting efficacy of 125 lumens per circuit Watt within the local centre and 95 lumens per circuit Watt within the children's home.

5.17. The local centre space lighting will be low energy and fitted with Photoelectric dimming standalone controls and time switches where appropriate.

5.18. Heating will be provided via an ASHP (450% efficiency) to the local centre areas. The children's home with be provided with an ASHP with 306% efficiency. Time and temperature zoning controls will be included in each zone to avoid unnecessary heating of uninhabited spaces when not required.

5.19. The local centre units will be provided with hot water through instantaneous hot water system at a 100% efficiency, whereas for the children's home the ASHP will provide domestic hot water to the building through a hot water storage cylinder with an assumed capacity of 198.2 litres.

6. Be Green - Low Carbon and Renewable Energy Systems

6.1. Once energy demand is reduced and energy used as efficiently as possible, methods for generating that energy in a sustainable, renewable way should be considered.

6.2. A range of technologies have been assessed for potential incorporation into the scheme in accordance with Regulation 25A of the Building Regulations.

6.3. These options are considered over the lifetime of the development and are considered at early stage design to ensure that they are integrated successfully.

6.4. A number of low carbon energy systems are not considered applicable to the nature of the development; however, they have been reviewed for completeness.

Combined Heat and Power (CHP) and District Energy Networks

6.5. A CHP unit is capable of generating heat and electricity from a single fuel source. The electricity generated by the CHP unit is used to displace electricity that would otherwise be supplied from the national grid, with the heat generated as effectively a by-product utilised for space and water heating. However, the reduced emissions from the national grid due now means that CHP systems will not deliver CO_2 savings.

6.6. In addition, the economic and technical viability of a CHP system is largely reliant on a consistent demand for heat throughout the day to ensure that it operates for over 5000 hours per year. Heat demand from mainly residential schemes is not conducive to efficient system operation, with a defined heating season and intermittent daily profile, with peaks in the morning and the evening. For this reason, the use of a CHP system is considered unfeasible for this development.

6.7. There are currently no heat networks which extend near Oaklands Blossom. High network heat losses associated with distribution to individual houses, as opposed to large high-rise apartment blocks and commercial developments mean that a new heat network to serve the area is not considered viable or an environmentally preferred option.

[3] NOABL Wind Map (http://www.rensmart.com/Weather/BERR)

Wind Turbines

6.8. A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 4.9m/s[3]. Wind turbines at this site are therefore unlikely to generate enough electrical energy to be cost effective[4].

6.9. Locating wind turbines adjacent to areas with buildings presents a number of potential obstacles to deployment. These include the area of land onsite required for effective operation, installation and maintenance access, environmental impact from noise and vibration, visual impact on landscape amenity and potential turbulence caused by adjacent obstacles, including the significant amount of woodland on and around the development.

6.10. For these reasons wind power is not considered feasible.

[4] CIBSE TM38:2006. Renewable energy sources for buildings.

Appraisal of Building Scale Renewable Energy Systems

6.11. The remaining renewable or low carbon energy systems that would be considered potentially feasible are at a building scale. These are as follows;

- Solar Thermal systems
- Biomass heating
- Solar Photovoltaic systems (PV)
- Air Source Heat Pumps (ASHP)
- Ground Source Heat Pumps (GSHP)

6.12. The advantages and disadvantages of each technology are evaluated in the following tables 9-14;

Solar Thermal

Table 9. Solar Thermal systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Mature and reliable technology offsetting the water heating fuel • Solar thermal systems require relatively low maintenance • Typically ~50% of hot water demand in dwellings can be met annually	• Installation is restricted to favourable orientations on an individual building basis • The benefit of installation is limited to the water heating demand of the building • Safe access must be considered for maintenance and service checks • Buildings need to be able to accommodate a large solar hot water cylinder • Distribution losses can be high if long runs of hot water pipes are required • Visual impact may be a concern in special landscape designations (e.g. AONB) • Communal system required for apartments
Conclusions	
Solar thermal systems are considered technically feasible on all buildings with suitable roof orientations. However, due to the intermittent and unknown level of water usage within some building uses, especially during periods of unoccupancy, this option is not considered favourable. For the residential dwellings in order to reduce energy demand water cylinders are to be kept to a minimum therefore solar thermal is only feasible for larger dwellings with separate cylinder. At this stage of the design, it is therefore not considered feasible.	

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Biomass

Table 10. Biomass Heating feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Potential to significantly reduce CO_2 emissions as the majority of space and water heating will be supplied by a renewable fuel • Decreased dependence on fossil fuel supply	• A local fuel supply is required to avoid increased transport emissions • Fuel delivery, management and security of supply are critical • Space is required to store fuel, a thermal store and plant • A maintenance regime would be required even though modern systems are relatively low maintenance • Building users or a management company must be able to ensure fuel is supplied to the boiler as required. • Local environmental impacts potentially include increased NO_x and particulate emissions
Conclusions	
Sustainable and local fuel supply is critical to ensuring predicted CO_2 emissions savings for biomass energy systems. Fuel storage capacity on site dictates the length of time required between deliveries and the volume of fuel delivery required. With limited space for access and storage of fuel more frequent deliveries would be required. Combustion of wood products would give rise to significant NOx and particulate emissions. For these reasons, biomass is not considered an appropriate fuel source for this proposed development.	

Solar Photovoltaic

Table 11. Solar Photovoltaic systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• The technology offsets the high carbon content of grid supplied electricity used for lighting, pumps and fans, appliances and equipment • Mature and well proven technology that is relatively easily integrated into building fabric • Adaptable to future system expansion • Solar resource is not limited by energy loads of the dwelling as any excess generation can be transferred to the national grid • PV systems generally require very little maintenance • Occupiers could benefit from smart export tariffs • Service and maintenance requirement minimal, and 2-3 storey buildings should not require significant additional safety measures (mansafe systems etc) for roof access.	• Poor design and installation can lead to lower than expected yields (e.g. from shaded locations) • Installation is restricted to favourable orientations • Safe access must be considered for maintenance and service checks • Visual impact may be a concern in special landscape designations (e.g. AONB) or conservation areas • Reflected light may be a concern in some locations
Conclusions	
PV panels are considered technically feasible for all buildings with suitable roof orientation and pitch. The relatively low cost, high carbon saving potential and limited additional impacts mean that PV is considered a feasible option for this development.	

Air Source Heat Pumps

Table 12. Air Source Heat Pump feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle • Heat pumps are a highly efficient way of providing heat using electricity, with overall efficiencies from 250% upwards • Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings • Reductions in carbon emissions from grid electricity means that heat pumps are potentially low carbon heat sources in the long term	• It is critical that heat pump systems are designed and installed correctly to ensure efficient operation can be achieved. Users must be educated in how heat pump systems should be operated for optimal efficiency. • Air source heat pump plants should be integrated into the building design to mitigate concerns regarding the visual impact • Noise in operation may be an issue particularly when operating at high output • Peak demand periods for heating (i.e. winter) coincide with lowest operational efficiency due to cold air temperatures and therefore potentially costly in operation • Additional electricity demand on grid may require upgrade to local infrastructure
Conclusions	
Air source heat pumps are technically feasible for this scheme. An ASHP will provide efficient heat and hot water without the need for fossil fuels and can reduce running costs, lower carbon emissions and offer reliable, sustainable heating and hot water all year round. However, system design and integration into a communal system, together with visual impact and noise implications would need to be carefully considered. ASHPs are therefore considered a viable technology, both in individual use for houses and as part of a local heat network for the assisted living facility. For non-domestic spaces where heating is predominately required during daytime hours ASHP can provide a cost effective and efficient solution for heating and cooling where required.	

Hot Water Heat Pumps

Table 13. Hot Water Heat Pump Feasibility Appraisal

Potential Advantages	Risks & Disadvantages
• Hot water demand met through grid electricity with low effective emissions factor • Heat pump element increases efficiency over immersion heater, circa 200%+ • No external heat exchanger requirement, only intake and exhaust duct runs • Low noise levels • Compact solution in same footprint as hot water cylinder	• Maximum length of duct runs means that cylinder positioning needs to be considered within the dwelling • Less appropriate for larger dwellings with higher hot water demands due to potentially slower recharge rate • Some noise, however likely to be easily suppressed with appropriate cylinder location • Space heating must be met through separate system
Conclusions	
Hot water heat pumps are considered feasible for dwellings with relatively low number of wetrooms and appropriate cylinder location to allow for duct runs to building façade. Hot water heat pumps are considered a preferred low-carbon technology at this stage.	

Ground Source Heat Pumps

Table 14. Ground Source Heat Pump systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle • Heat pumps are a highly efficient way of providing heat using electricity, with manufacturers reporting efficiencies from 320% • Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings • Ground source heat pumps are powered by electricity. The current carbon factor of electricity as stated in SAP2021 is 0.136 $kgCO_2/kWh$ and compared to a gas heated building this can lead to an overall decrease in calculated building emissions	• Low temperature heating circuits (underfloor heating) would be required to maximise the efficiency of heat pumps • A hot water cylinder would also be required for both space and water heating • It is critical that heat pump systems are designed and installed correctly to ensure efficient operation can be achieved • Ground source heat pumps either require significant land to incorporate a horizontal looped system or significant expense to drill a bore hole for a vertical looped system
Conclusions	
The ground pipe system of a GSHP can be horizontal or vertical. For horizontal systems, a coiled pipe network, commonly called a 'slinky', may be used. It is buried at around 2m below ground level. This requires a large area of open space and intensive civil works. For vertical systems, the pipes are placed in holes bored straight into the ground to a depth of between 15 and 150 metres depending on ground conditions and size of system. The installation of GSHPs requires a large amount of civil engineering works and feasibility of installation is highly dependent upon the geological conditions at the site, due to extensive groundworks and costs this option is discounted.	

Summary

6.13. Following this feasibility assessment, it is considered the following low-carbon and renewable energy technologies, summarised in Table 15, are consider potentially feasible options for the development at this time.

Table 15. Summary of feasible technologies

Feasible	Unfeasible
• ASHPs • Hot Water Heat Pumps (HWHPs) • Solar PV	• CHP • Wind • Biomass • Solar Thermal • GSHP

Air Source Heat Pumps

6.14. Air Source Heat Pumps (ASHP) are a low carbon technology. An ASHP works by converting energy from the outside air into heat.

6.15. This can be used for heating in the winter but can be reversed for cooling in the summer months. ASHP's work by extracting latent heat from the outside air and passing it through a heat exchanger which increases its temperature. The heat is then fed to the required rooms. An ASHP will produce a lower CoP than a Ground Source Heat Pump (GSHP) due to the lower temperature of outside air and greater variance in temperature. However, the cost of an ASHP is much lower as there is no need for any expensive ground works.

6.16. ASHPs can have a number of environmental and operation advantages. More heat is supplied to the building than energy is consumed by the heat pump.

6.17. An ASHP with a heating efficiency of 3.5 will supply 3 kilowatts of heat energy for the consumption of 1 kilowatt of electricity. If the heat pump is replacing (or being used as an alternative to) electric space heating, the use of the heat pump offers significant carbon savings.

6.18. The introduction of an ASHP would provide a low carbon heating option, generally considered renewable energy if efficiency >250% and lifetime emissions will reduce with ongoing decarbonisation of grid electricity.

6.19. Factors to consider:

- During times of peak demand (i.e., during winter months) the ambient air temperatures are at their minimum, meaning the ASHP needs to work harder to extract the desired amount of heat.
- External space is required for the units, which will need to have adequate air flow whilst being made safe and secure within the building's grounds.
- Due to being powered by grid-sourced electricity they can potentially result in increased energy bills for the occupant when compared with gas-fired heating systems in the short term, however, with the government's plan of grid decarbonisation, costs will continue to decrease over time.

6.20. The calculations have been based on a leading brand air source heat pump monobloc system which can operate singularly, or form part of a multiple unit system and has a seasonal coefficient of performance of 4.5 & 3.06 for the local centre and children's home respectively.

6.21. By using a monobloc system installation and ongoing maintenance is reduced

Photovoltaic Panels (PV)

6.22. Photovoltaics (PV) or solar cells, as they are often referred to, are semiconductor devices that convert sunlight into direct current (DC) electricity.

6.23. Groups of PV cells are electrically configured into modules and arrays which can be used to charge batteries, operate motors and power any number of electrical loads. With the appropriate power conversion equipment (inverters), PV systems can produce alternating current (AC) compatible with any conventional appliances and operate in parallel with the utility grid.

6.24. Excess electricity can be sold to the National Grid when the generated power exceeds the local need, this can be beneficial with a large system, when the building is not used all of the time. PV systems require only daylight, not sunlight to generate electricity (although more electricity is produced with more sunlight). Therefore, energy can still be produced in overcast or cloudy conditions and used successfully in all parts of the UK.

6.25. PV panels can be fitted to the top of roofs. Ideally the panels should face between south-east and south-west, at an elevation of about 30-40°. However, in the UK even flat roofs receive 90% of the energy of an optimum system.

6.26. A provisional distribution will be developed in conjunction with a specialist PV designer following further design progression to ensure that the overall required output is achieved. It is currently estimated that between 0 to 4.4 kWp will be needed per private house type as these are gas heated. It is not foreseen that electric (affordable) units require PV, but should they specifically require PV at design stage to achieve an EPC B rating then this data will be provided.

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7. Design and Indicative Performance

Residential Emissions

7.1. The residential portion of Oaklands Blossom is designed and constructed to meet the requirements of Building Regulations 2021 with consideration being given to the FHS. Compliance with Building Regulations 2021 forms the first stage in the sustainable construction approach.

7.2. Part L1 compliance is assessed through the Standard Assessment Procedure (SAP), which uses the 'Target Emission Rate' (TER) – expressed in kilograms CO_2 per meter squared of total useful floor area, per annum – as the benchmark. The calculated performance of the dwelling as designed - the Dwelling Emission Rate (DER) – is required to be lower than this benchmark level.

7.3. For the reserved matters element of the scheme, calculations have been undertaken to every house type and a sample of the local centre apartments, to assess the carbon emissions of the development these results can be seen in Table 16.

Table 16. CO_2 emissions by house type – Reserved Matters

Unit Identifier	DER CO_2 emissions ($kgCO_2/m^2/yr$)	TER CO_2 emissions ($kgCO_2/m^2/yr$)	% Reduction
EMAP22 - Affordable	3.48	11.25	69.07
EMAW22 - Affordable	3.13	9.89	68.35
EMAW22	9.52	10.12	5.93
EMA34	11.06	11.68	5.31
EMAP32 - Affordable	3.25	10.08	67.76
EMB31	9.69	10.29	5.83
EMT31D - Affordable	3.55	10.75	66.98
4907-P635-6758-EMT31	10.50	10.96	4.20
EMT32	10.70	11.22	4.63
EMAW31	8.87	9.37	5.34
EMC31	9.88	10.38	4.82
EMT34	9.97	10.46	4.68
EMT33	9.61	9.95	3.42
EMA42	9.95	10.40	4.33
EMA43	9.81	10.15	3.35
EMB41	9.41	9.92	5.14
EMAP41 - Affordable	3.00	9.50	68.42
EMT41	9.70	9.99	2.90
EMA46	9.55	9.78	2.35
EMT45	9.29	9.49	2.11
EMB51	9.13	9.32	2.04
EMB52	8.89	9.13	2.63
EMG51	9.10	9.14	0.44
Sample FF Apartment	5.00	12.50	60.00
Sample FF Apartment	5.04	13.84	63.58
Sample SF Apartment	3.55	10.31	65.57
Sample TF Apartment	4.70	11.78	60.10
Sample SF Apartment	3.41	10.26	66.76
Sample TF Apartment	4.26	11.68	63.53

7.4. For the outline proposal, samples have been taken for a variety of 2-to-5 bed houses and sample apartment types, these results can be seen in Table 17.

Table 17. CO_2 emissions by house type – Outline Application

Unit Identifier	DER CO_2 emissions ($kgCO_2/m^2/yr$)	TER CO_2 emissions ($kgCO_2/m^2/yr$)	% Reduction
2-Bed Affordable	3.48	11.25	69.07
2-Bed	10.66	11.53	7.55
3-Bed Affordable	3.25	10.08	67.76
3-Bed	9.72	10.32	5.81
4-Bed Affordable	3.00	9.50	68.42
4-Bed	9.26	9.72	4.73
5-Bed	9.13	9.32	2.04
Sample FF Apartment	5.19	13.91	62.69
Sample FF Apartment	5.18	12.50	58.56
Sample SF Apartment	4.31	10.31	58.20
Sample SF apartment	4.45	10.26	56.63
Sample TF apartment	5.09	11.78	56.79
Sample TF apartment	4.91	11.68	57.96

7.5. Tables 18 and 19 show the estimated site-wide emission reductions over a Part L 2021 baseline based on the approach described for both the reserved matters and outline elements respectively. The total savings estimated for the site are therefore 25.86% and 36.84% over Part L 2021 for the reserved matters and outline stages respectively.

Table 18. Estimated residential site-wide CO_2 emissions – Reserved Matters

	Part L 2021 CO_2 emissions ($kgCO_2/yr$)	
Part L compliant	184,267	
As Designed	136,618	
	$kgCO_2/yr$	%
Total savings	47,649	25.86%

Table 19. Estimated residential site-wide CO_2 emissions – Outline

	Part L 2021 CO_2 emissions ($kgCO_2/yr$)	
Part L compliant	297,578	
As Designed	187,956	
	$kgCO_2/yr$	%
Total savings	109,622	36.84%

Non-Residential Emissions

7.6. The non-residential portion of Oaklands Blossom is to be designed and constructed to meet the requirements of Part L 2021 and therefore compliance with this standard forms the first stage in the sustainable construction approach.

7.7. Indicative SBEM & DSM calculations have been undertaken on the proposed local centre units and the children's home to demonstrate that the proposed specification meets these requirements. The results of these calculations are shown in Table 20.

7.8. These reductions in carbon dioxide emissions have been achieved with a combination of improved fabric, and the incorporation of low carbon technologies with proposed heating strategy being delivered via air source heat pumps.

Table 20. CO_2 emissions non-domestic units – Reserved Matters

Unit Identifier	BER CO_2 emissions ($kgCO_2/m^2/yr$)	TER CO_2 emissions ($kgCO_2/m^2/yr$)	% Reduction
Retail Unit 1	3.18	3.20	0.62
Retail Unit 2	5.16	5.86	11.94
Retail Unit 3	4.05	4.68	13.46
Retail Unit 4	3.98	4.55	12.52
Community Centre	4.14	5.09	18.66
Children's Home	3.84	5.03	23.65

Table 21. Indicative Non-Residential CO_2 emissions– Reserved Matters

	Part L2 2021 CO_2 emissions ($kgCO_2/yr$)	
Part L2 compliant	3,643	
As Designed	3,230	
	$kgCO_2/yr$	%
Total savings	414	11.33

7.9. As Table 21 demonstrates, the non-domestic units are currently predicted to achieve a 11.33% reduction in carbon dioxide emissions over Building Regulations 2021.

Total CO_2 Reductions – Reserved Matters

7.10. Through a combination of the described fabric first approach to sustainable construction and the installation of ASHPs and solar PV panels, the RM area of the development will deliver overall CO_2 emission reductions of 25.57% over Part L 2021.

7.11. Table 22 demonstrates the total CO_2 reduction achieved through the combination of the Fabric First approach and the addition of renewable and low carbon technology for both the residential and commercial buildings.

Table 22. Total site-wide CO_2 savings

	CO_2 Emissions ($kgCO_2/yr$)	
Part L compliant	187,910	
After fabric, low carbon and renewable measures	139,848	
	$kgCO_2$/year	%
Total savings from fabric, low carbon and renewable measures	48,062	25.57

8. Overheating Risk and Passive Design

8.1. Buildings constructed today may be operating in a substantially different climate over the coming decades and therefore should be designed to ensure that they are able to adapt and reduce the risk of overheating with potentially higher summer temperatures and longer hot spells. Therefore, Passive design measures will be considered and incorporated to enhance resilience to climate change impacts throughout the lifetime of the development complying with policy SP2.

8.2. Key design decisions can affect the potential risk of overheating:

- Poor consideration of orientation of large glazed facades
- High density development contributing to urban heat island effects
- High glazing ratios contributing to excessive unwanted solar gain
- Inadequate ventilation strategies
- Very high levels of thermal insulation without considering heat build-up

8.3. Other factors which additionally contribute to heat build-up within homes and should be addressed where possible include:

- High levels of occupation
- Appliance use contributing to internal gains

Cooling Hierarchy

8.4. In common with sustainable heating strategies, it is possible to apply a sustainable 'cooling hierarchy' which sets out the priorities to ensure overheating risk is minimised:

- Minimise internal heat gain
- Manage heat through internal thermal mass and design of spaces
- Passive ventilation strategies
- Mechanical ventilation systems
- Active cooling systems

Addressing Overheating Risk

8.5. The cooling hierarchy described has been considered, with passive measures of reducing overheating risk given priority. Key measures which will be taken within the development include:

- A layout which incorporates green space around the units that benefits from shading from the tree canopy directly south of the site, reducing the potential for heat build-up in enclosed and low albedo external areas such as tarmac and dark roofs
- Glazing specification and areas which have been considered to balance the requirements for useful winter solar gain with unwanted summer gain in summer, assuming a g-value of 0.64 for residential units.
- Non-residential buildings are proposed to have a g-glazing value of 0.35 to reduce possible risk of overheating in areas with greater glazing.
- Inclusion of mechanical ventilation where required to provide a consistent background air flow for the residential units.

8.6. Majority of the dwellings will be able to benefit from cross-ventilation to effectively purge warm air from the properties during periods of hot weather. Window openings will need to be considered and guided by a Part O assessment, with increased opening areas being designed in as required.

Approved Document O

8.7. In order to address overheating risk more robustly, the Government has introduced a new Approved Document, Part O, into the Building Regulations. This document requires a more in-depth assessment of the risk of overheating, taking into account site location, residential unit orientation, glazing proportions and openable window areas for natural ventilation.

8.8. This assessment will be undertaken at the start of detailed design and any mitigation measures that may be required will be built in.

Non domestic buildings - Part L2 2021

8.9. SBEM & DSM assessments for non-domestic buildings involve a limiting solar gains check to ensure that excessive solar gains do not have to be mitigated by excessive use of air conditioning. The non-domestic units on this site have been assessed, with all occupied areas within compliant levels for solar gains.

8.10. To achieve this the glazing design has been reviewed and g-glazing values of 0.35 utilised and where needed the inclusion of blinds to strike the balance between useful solar gain in the winter and unwanted solar gain in the summer.

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9. Sustainable Design

9.1. The proposed scheme aims to apply a range of sustainability measures to meet and exceed the requirements set out within the St Albans current and new Local Plan, Sandridge Neighbourhood Plan, and relevant St Albans SPDs.

Materials

9.2. The impacts of construction materials range from the depletion of natural resources to the greenhouse gas emissions and water use associated with their manufacture and installation.

9.3. Within the development choices will be made to reduce the consumption of primary resources and using materials with fewer negative impacts on the environment, including but not limited to the following.

- Use fewer resources and less energy through designing buildings more efficiently
- Specify and select. materials and products that strike a responsible balance between social, economic and environmental factors
- To improve environmental, economic and social sustainability of construction products by recognising and encouraging the selection of products with responsible sourcing certification.
- All materials used will be responsibly sourced, with certification obtained wherever possible.
- All timber sourced will be sustainably sourced timber from FSC certified forests.

Waste

9.4. Sending waste to landfill has various environmental impacts, such as the release of local pollution, ecological degradation and methane emissions, in addition to exacerbating resource depletion. Waste in housing/commercial buildings comes from two main streams: construction waste and domestic/operational waste during occupation. Waste management infrastructure will be an integral part of the masterplan and carefully considered.

Household Waste

9.5. In this respect regard has been given to the policy advice contained in the NPPF together with the Council's current guidance to ensure that the new dwellings are provided with adequate storage facilities for both waste and recyclable materials.

St Albans District Council offers kerbside collections for mixed recycling, paper and card, food waste, textiles, small electricals, garden waste (by subscription), and general waste, along with bulky waste collections, local recycling drop-off points, and community reuse schemes like wood recycling. Operational Waste – Non-residential

9.6. The building will be provided with suitable internal and external spaces to sort and store waste for recycling as appropriate to St Albans District Council's collection services. There will be designated external storage for rubbish and recycling bins for collection.

Construction Waste

9.7. The proposed development will look to minimise waste generation during construction and divert construction waste from landfill via re-use and recycling. A Site Waste Management Plan will be provided by way of a Construction Environmental Management Plan (CEMP), to ensure that construction site waste is minimised, with benchmarks set in accordance with best practice. Wherever possible materials will be diverted from landfill through re-use, recycling, return to supplier or recycling.

9.8. The development will aim to reduce the burden on the environment from construction products, by recognising and encouraging measures to optimise construction product efficiency and the selection of products with a low environmental impact (including embodied carbon) over the life cycle of the building where possible.

Electrical Vehicle Charging Points

9.9. There is a government ambition for all new cars to be effectively zero emission by 2035. The 'Road to Zero' strategy set out a £1.5b package of support for the transition. A number of initiatives are already in place including grants, as well as road tax and vehicle excise duty exemptions.

9.10. All dwellings will be provided with one active EV charging space. For new non-domestic buildings, that have more than 10 parking spaces, one of those spaces will have access to one electric vehicle charge points and cable routing will be installed in a minimum of 20% of the remaining parking spaces. Please see Appendix B for the proposed site layout parking strategy plan that indicates the proposed EV charging points.

Water Conservation

9.11. The UK Climate Change Risk Assessment 2017 identified risks of shortages in water supply as a future climate change impact. Therefore, the efficient use of water is an important factor when considering future resilience to climate change.

9.12. As well as aiming to minimise water usage through the materials used, water consumption of the end user will be considered in line with current national policy. Building Regulations 2021 Part G, requires water efficiency measures for all new residential units:

> Water Efficiency
>
> G2. Reasonable provision must be made by the installation of fittings and fixed appliances that use water efficiently for the prevention of undue consumption of water.
>
> Water Efficiency of New Residential units
>
> 36. (1) The potential consumption of wholesome water by persons occupying a new residential unit must not exceed the requirement in paragraph (2)
>
> (2) The requirement referred to in paragraph (1) is either –
>
> a) 125 litres per person per day; or
>
> b) in a case to which paragraph (3) applies, the optional requirement of 110 litres per person per day,

9.13. Water efficiency measures are met under Part G if: The estimated consumption of wholesome water resulting from the design of cold and hot water systems (calculated in accordance with the methodology set out in Appendix A) is not greater than the standard set by the Secretary of State of 125/litres/person/day, or the optional standard of 110 litres/person/day.

9.14. Appendix A of Part G provides a water efficiency calculation methodology. This assesses the whole house potable water consumption in new residential units. The calculation methodology is to be used to assess compliance against the water performance targets in Regulation 36 to ensure that all new residential units meet the water efficiency requirement.

9.15. Water efficiency measures including the use of efficient dual flush WCs, low flow showers and taps and appropriately sized baths will be encouraged with the aim to limit the use of water during the operation of the development to ensure water does not exceed 110 litres per person per day for the residential units.

9.16. Each new residential unit will minimise water usage to at least 110 litres/person/day in line with the current national optional standards and complying with Policy CE1.

9.17. For the non-residential unit flow control devices will be installed on sanitaryware with pulsed water meter for the unit and submeters for any high water consuming uses required.

9.18. Whilst exact design may be subject to changes made during the design process, the overall targets will still be achieved across the development. Table 23 demonstrates a typical water calculation capable of achieving under 110 litres/person/day.

Table 23 Typical Water Demand Calculation

Installation Type	Unit of measure	Capacity/ flow rate	Litres/occupier/ day
WC (dual flush)	Full flush (l)	6	8.76
	Part flush (l)	4	11.84
Taps (excluding kitchen taps)	flow rate (l/min)	4	7.90
Bath	Capacity to overflow (l)	181	19.91
Shower	Flow rate (l/min)	8	34.96
Kitchen sink taps	Flow rate (l/min)	6	13.00
Washing Machine	Litres/kg dry load	6.8	14.28
Dishwasher	Litres/place setting	1.04	3.74
Calculated Use			114.4
Normalisation Factor			0.91
Total Internal Consumption (L)			104.1
External Use			5.00
Building Regulations 17.K			109.1