RIDGE

BATCHELORS FARM

SUSTAINABILITY STATEMENT

February 2025

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FAIRFAX ACQUISITIONS LIMITED

February 2025

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1. EXECUTIVE SUMMARY

1.1. General

Ridge & Partners LLP have been appointed to complete a Sustainability Statement for the Batchelors Farm development, Burgess Hill, on behalf of Fairfax Acquisitions Limited in support of a planning application for the scheme. The Proposed Development comprises 26 new residential dwellings - including a mix of 1, 2, 3 and 4 bed homes.

When reviewing the energy and sustainability strategy for this development, careful consideration has been given to the context of the Application Site, local & regional planning policy and the 2021 Building Regulations. The energy efficiency, resource efficiency, water efficiency and impact of climate change have all been considered in the development of a sustainability strategy for the scheme in line with the requirements of the Mid Sussex District Plan.

1.2. Key Energy Efficient Design Measures

The approach taken in developing the energy strategy for the scheme has followed a sequential approach, assessing in turn:

- The feasibility of the integration of passive design measures and energy efficient building services strategies;
- Determining the viability of a decentralised energy network; and
- A preliminary assessment of the feasibility of a number of Low or Zero Carbon (LZC) Technologies for application to the site.

Passive design and energy efficient design measures are proposed for inclusion in the development as detailed below:

- U-values of external walls: 0.15 W/m^2K;
- U-values of ground floors: 0.13 W/m^2K;
- U-values of roofs: 0.11 W/m^2K;
- Maximum U-values for windows: 0.8 W/m^2K;
- U-values of external doors: 1.2 W/m^2K;
- Air leakage rate is to be >60% lower than the maximum permissible under the Building Regulations – with a target of $3.0m^3/m^2.h$ at 50Pa;
- Centralised continuous mechanical ventilation with heat recovery (MVHR) in each of the dwellings, in accordance with SAP Appendix Q;
- Reduction in hot water demand, in part due to higher insulation standards but also due to lower water consumption;
- Maximise daylighting and consequently passive solar heating (whilst not providing excessive areas of glazing that would cause overheating risk when considering future climate change);
- Reduce energy requirements for internal lighting by utilising daylighting and by incorporating LED luminaires throughout;
- Specification of energy efficient external lighting; and
- Recommendations to building users regarding energy efficient appliances and operation of systems and equipment.

An analysis of the feasibility of adopting a decentralised energy strategy on site has been explored. There is not an established district heating network in the vicinity of the Application Site, and due to the size and density of the proposals it has been determined that a new decentralised heating network would not be a practical or financially viable solution.

The appropriateness of a number of LZC technologies have been assessed for their applicability to the Site. This preliminary appraisal has identified Air Source Heat Pumps (ASHPs) and PV technology as the most appropriate forms of potential LZC for the scheme. This will be explored further as the detailed design of the homes progresses, the thermal loads are established and the roof layouts are further developed.

Indicative Standard Assessment Procedure (SAP) calculations have been undertaken for a sample of representative dwellings using the proposed architectural site layout (Illustrative Masterplan – 2501/PL.04 Rev A) and a preliminary accompanying Accommodation Schedule to establish an energy strategy in accordance with the requirements of Part L 2021. As the design for the new homes progresses – a set of detailed SAP calculations will need to be undertaken to verify the proposed energy strategy, utilising the developed floorplans and elevation drawings.

The preliminary energy performance calculations that have been completed have demonstrated that the proposed energy strategy would result in improvements over the minimum performance levels set in Part L 2021.

1.3. Key Resource Efficiency Design Measures

A strategy has been developed for the Batchelors Farm scheme to maximise the efficient use of resources, both through the construction process and during future occupation. The waste hierarchy has been referenced throughout this assessment process to prioritise measures that would have the most significant resource saving impacts.

A summary of the key resource efficiency proposals for the Application Site are detailed below:

- The production of a Site Waste Management Plan (SWMP) to set good practice target waste benchmarks, set procedures for minimising, measuring, monitoring & reporting various waste streams and identifying potential for re-use to divert potential waste from landfill.
- Reduce the resource intensity of the detailed design architectural proposals where feasible and maximise end of life potential.
- Encourage the use of recycling and composting facilities. Provide guidance to future occupants via Home User Guides detailing Local Authority collection schemes, information on local recycling facilities & tips, guidance on procedures to discard potentially hazardous waste (i.e. batteries, fridges / freezers etc.) and WRAP sustainable waste disposal principles.

1.4. Key Water Efficiency Design Measures

A water efficiency strategy has been developed for the Batchelors Farm scheme to meet a water consumption target of 110 litres per person per day (including external water use) that is set in the Mid Sussex District Plan. The feasibility of a number of measures have been explored, including the installation of water conservation appliances, rainwater harvesting and greywater harvesting.

An analysis has been undertaken of various routes to meet the targeted performance level. A standard approach is proposed for the scheme utilising water conservation appliances such as dual flush toilets, low flow taps and baths with a low capacity to overflow. A Water Efficiency Calculator for New Dwellings tool has been utilised to demonstrate that this approach could meet the Local Authority target of 110 l/p/day.

2. INTRODUCTION

2.1. Site Overview

The Batchelors Farm development will be located in Burgess Hill, West Sussex. The red line boundary of the Application Site is shown in Figure 2.1, below.

Figure 1.1 – Site Red Line Boundary (Original Source: Paul J Hewett R.I.B.A. Chartered Architect)

The Application Site is located to the south of Burgess Hill and to the east of the adjacent Batchelors Farm Nature Reserve. The Application Site is bordered to the east by Keymer Road, beyond which there are a number of residential properties.

The proposals for the Site are illustrated in Figure 2.2, on the next page. The Proposed Development consists of 26no. residential properties in total.

The Proposed Development is to consist of approximately 2no. single bed homes, 11no. two bed homes, 9no. three bed homes and 4no. four bed homes.

Figure 2.2 – Residential Site Proposals Drawing (Original Source: Paul J Hewett R.I.B.A. Chartered Architect)

2.2. Policy Context

2.2.1. Planning Policy

There is increasing awareness and legislation regarding low carbon and sustainable design in the built environment. This Sustainability Statement supplements the planning application for the Batchelors Farm development site and seeks to address strategic issues raised by local, regional and national planning policies relating to climate change and sustainability.

Against a context of the relevant planning policies, this report focuses on minimising the environmental impact of the Proposed Development during the construction, occupation and demolition of the proposed dwellings.

The Application Site is located within Mid Sussex. The Mid Sussex District Plan sets out a number of core issues facing the district.

The District Council, in conjunction with four other West Sussex local authorities, commissioned the 'West Sussex Sustainable Energy Study' to inform their policies on carbon emission standards for new development. This research and the general context of the current government position on sustainable development has informed **DP39: Sustainable Design and Construction**, included in Figure 2.3 below.

DP39: Sustainable Design and Construction

Strategic Objectives: 1) To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change.
Evidence Base: Gatwick Sub Region Water Cycle Study; West Sussex Sustainable Energy Study, Mid Sussex Sustainable Energy Study.

All development proposals must seek to improve the sustainability of development and should where appropriate and feasible according to the type and size of development and location, incorporate the following measures:

- **Minimise energy use through the design and layout of the scheme including through the use of natural lighting and ventilation;**
- **Explore opportunities for efficient energy supply through the use of communal heating networks where viable and feasible;**
- **Use renewable sources of energy;**
- **Maximise efficient use of resources, including minimising waste and maximising recycling/ re-use of materials through both construction and occupation;**
- **Limit water use to 110 litres/person/day in accordance with Policy DP42: Water Infrastructure and the Water Environment;**
- **Demonstrate how the risks associated with future climate change have been planned for as part of the layout of the scheme and design of its buildings to ensure its longer term resilience**

Figure 3.3 – Policy DP39 – Sustainable Design and Construction (Source: Mid Sussex District Plan 2014 - 2031)

This policy outlines sustainability measures relating to the efficiency of energy usage, water resource usage, waste minimisation and climate change risk mitigation. **Policy DP42: Water Infrastructure and the Water Environment** further details the District's approach to water conservation. This policy is included in Figure 2.4.

DP42: Water Infrastructure and the Water Environment

Strategic Objectives: 1) To promote development that makes the best use of resources and increases the sustainability of communities within Mid Sussex, and its ability to adapt to climate change; 6) To ensure that development is accompanied by the necessary infrastructure in the right place at the right time that supports development and sustainable communities. This includes the provision of efficient and sustainable transport networks.

Evidence Base: Building Regulations (Approved Document G); Gatwick Sub Region Water Cycle Study; DCLG Housing Standards Review: Technical Consultation, September 2014; South East Water - Water Resources Management Plan 2014, Strategic Flood Risk Assessment.

New development proposals must be in accordance with the objectives of the Water Framework Directive, and accord with the findings of the Gatwick Sub Region Water Cycle Study with respect to water quality, water supply and wastewater treatment and consequently the optional requirement under Building Regulations – Part G applies to all new residential development in the district. Development must meet the following water consumption standards:

- **Residential units should meet a water consumption standard of 110 litres per person per day (including external water use);**
- **Non-residential buildings should meet the equivalent of a 'Good' standard, as a minimum, with regard to the BREEAM water consumption targets for the development type.**

Development proposals which increase the demand for off-site service infrastructure will be permitted where the applicant can demonstrate;

- **that sufficient capacity already exists off-site for foul and surface water provision. Where capacity off-site is not available, plans must set out how appropriate infrastructure improvements approved by the statutory undertaker will be completed ahead of the development's occupation; and**
- **that there is adequate water supply to serve the development.**

Planning conditions will be used to secure necessary infrastructure provision.

Development should connect to a public sewage treatment works. If this is not feasible, proposals should be supported by sufficient information to understand the potential implications for the water environment.

The development or expansion of water supply or sewerage/sewage treatment facilities will normally be permitted, either where needed to serve existing or proposed new development, or in the interests of long term water supply and waste water management, provided that the need for such facilities outweighs any adverse land use or environmental impacts and that any such adverse impact is minimised.

Figure 4.4 – Policy DP42 – Water Infrastructure and the Water Environment (Source: Mid Sussex District Plan)

Policy DP42 confirms that residential units should meet a water consumption standard of 110 l/p/day, inclusive of external water usage.

2.2.2. Building Regulations Part L

Approved Document Part L sets out the energy efficiency requirements of the Building Regulations.

A revised version of Part L - Part L 2021 - came into force in June 2022. Achieving energy performance compliance in line with the requirements of Part L 2021 is significantly more onerous than complying with Part L 2013, the previous version of this regulatory document.

Part L 2021 is comprised of 2 volumes – volume 1 is for application to dwellings, and volume 2 is for application to buildings other than dwellings. Volume 1 will be applicable to the Batchelors Farm development.
Part L 2021 sets three primary compliance targets for residential schemes in the form of:

- Target Emission Rate (TER). In order to comply, the calculated Dwelling Emission Rate (DER) for a new home will need to be less than or equal to the TER;
- Target Primary Energy Rate (TPER). In order to comply, the calculated Dwelling Primary Energy Rate (DPER) for a new home will need to be less than or equal to the TPER; and
- Target Fabric Energy Efficiency (TFEE). In order to comply, the calculated Dwelling Fabric Energy Efficiency (DFEE) for a new home will need to be less than or equal to the TFEE.

2.2.3. Emerging Future Homes Standard

The Future Homes Standard (FHS) aims to require new build homes to be future proofed with low carbon forms of heating and industry leading levels of energy efficiency.

The FHS was initially due to be implemented in 2025, however, the timeline for its implementation is currently unknown and the government has not confirmed if this will still be the case, or if it is to be delayed.

As the design for this scheme develops - depending on the project programme and the implementation date of the FHS – the energy strategy will need to accord with the finalised requirements of this yet to be published standard.

2.3. Report Objectives

The objectives of this report are:

- to demonstrate to the Planning Authority, (Mid Sussex District Council), that the Proposed Development will comply with the relevant policies in the Mid Sussex District Plan;
- to provide an initial assessment of the measures required to comply with Part L 2021 of the Building Regulations; and
- to contribute to the development of a low carbon and sustainable strategy for the site which will be carried through to detailed design, construction, operation and ultimate demolition.

3. ENERGY STRATEGY

3.1. Introduction

This section of the report looks at areas where the dwellings' energy demand can be reduced in order to create an energy efficient design solution.

The implications of the Building Regulations and the local policy are explored, with reference to the technical, functional and economic feasibility of various energy efficiency measures.

In line with the Energy Hierarchy, a passive first approach will be considered for the scheme. The Energy Hierarchy is summarised below:

1. Be lean: Use less energy;
2. Be clean: Supply energy efficiently; and
3. Be green: Use renewable energy.

This section of the Sustainability Statement will outline the sequential approach taken to the development of the energy strategy for the Batchelors Farm development in line with the Energy Hierarchy.

3.2. Application of Passive Design Principles

3.2.1. Overview

Passive design uses local climatic conditions to reduce the amount of applied energy required to heat, cool or light a building. For example, passive solar gain via south facing windows can reduce the heating requirements of a space, although this must be balanced against the risk of excessive solar gains in summer, especially when considering the increased overheating risks associated with climate change. Passive design centres around the building envelope and its relationship with its surroundings.

3.2.2. Building Design Principles

The Proposed Development includes materials and a construction methodology that aims to meet the following requirements:

- minimise energy use;
- maximise daylighting to main living spaces within dwellings;
- utilise natural ventilation where feasible; and
- minimise summertime overheating risk to reduce the likelihood of future comfort cooling systems being installed.

Notably, the majority of the proposed homes on the Batchelors Farm Proposed Development are semi-detached or terraced, reducing the degree of heat that will be lost through external walls in the proposed dwellings.

3.2.3. Building Envelope Thermal Performance

Preliminary SAP calculations will be carried out to indicate Part L compliance. At this early stage, it is anticipated that these will be based on the building envelope properties outlined in Table 3.1.

Table 3.1 – Proposed Building Fabric Properties

Element	Limiting Fabric Parameters Set out by Part L 2021	Proposed Properties	% Improvement
Walls	0.26 W/m^2K	0.15 W/m^2K	42%
Party Walls	0.2 W/m^2K	0 W/m^2K*	100%
Ground Floor	0.18 W/m^2K	0.13 W/m^2K	28%
Roof	0.16 W/m^2K	0.11 W/m^2K	31%
Windows	1.6 W/m^2K	0.8 W/m^2K	50%
Doors	1.6 W/m^2K	1.2 W/m^2K	25%
Air Permeability	8 $m^3/h/m^2$	3 $m^3/h/m^2$	63%

* Note that a U value calculation is not required for this building fabric element. In order to utilise a U value of 0W/m^2K for party walls in the SAP calculations, one of the following definitions needs to be met – 'Solid Wall' or 'Fully Sealed and Sealed Cavity'.

It can be seen that the building fabric of the proposed properties are more stringent than the limiting fabric parameters set out in Part L 2021 of the Building Regulations.

Further to these performance parameters relating to the conductivity of the building fabric and the targeted air tightness performance – an enhanced level of thermal bridging design will be integrated into the design, driven by the requirements of the Part L 2021 TFEE.

It is proposed for PSI values to meet or exceed the PSI values of the Part L notional dwelling in each instance.

3.3. Energy Efficient Design

3.3.1. Overview

Further to the application of passive design measures to reduce the energy demand of the scheme, it is proposed to optimise the efficiency of the building services systems meeting the remaining energy demands of the Proposed Development.

In the first instance, this section of the report will explore the feasibility of connecting the scheme to a district heating scheme / the development of a community heating scheme. Should this strategy not be determined to be an appropriate approach for this development, individual heat generation plant installations methods will be explored.

Additionally, this section of the report will address the energy efficiency of other regulated building energy uses within the scheme and how they may be reduced.

3.3.2. Servicing Option 1: Centralised Heating Plant

General

A community or district energy scheme may be appropriate for large scale residential developments, particularly if high density apartments blocks are proposed as part of a scheme.

The Association for Decentralised Energy online district heating installation map has been accessed to determine if there is an established district heating network in the vicinity of the Application Site. It has been determined that the nearest established network is in Haywards Heath at the Princess Royal Hospital. Due to the distance from the Application Site, a connection to this network would not be feasible.

Were a new community heating system to be proposed, the plant room installation for a base scheme would include efficient gas fired condensing boilers and inverter driven pumps. Alternative fuel sources could be incorporated in order for the scheme to benefit from a renewable or low carbon energy source. All the major plant would be accommodated in an energy centre which can be easily accessed.

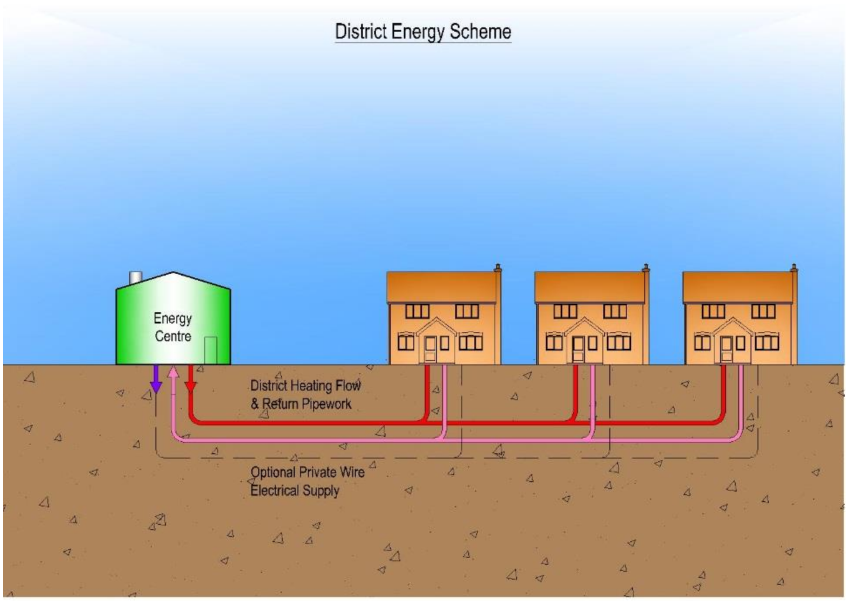

Figure 3.1 – Indicative District Energy Scheme Configuration

Distribution pipework above and below ground would be selected to exceed minimum standards required by Building Regulations and design temperatures optimised to minimise distribution losses.

A Building Energy Management System (BEMS) would control the centralised plant, commissioned to maximize efficiency to best utilise the energy sources available and to closely match the building load. The BEMS would also collect the data from the various sub-meters installed throughout the buildings, allowing billing (see sections below), and targeting and monitoring.

The BEMS would also alert the appointed management company of any system faults and generate reminders that maintenance is due.

Heating of Dwellings
Individual properties would be served by the following:

1. Heating Interface Unit (HIU).
2. A HIU will replace a conventional boiler, comprising a heat exchanger and valve arrangement, plus a heat meter. Heat will be drawn from the central distribution system to satisfy the requirements of the dwelling.
3. Distribution Pipework.
4. Hot water for heating and domestic water purposes will be pumped to the heat emitters and hot water draw-offs.
5. Heat Emitters – radiators and / or underfloor heating.
6. Automatic and Thermostatic Controls - including a 24-hour / 7-day programmer for the heating.

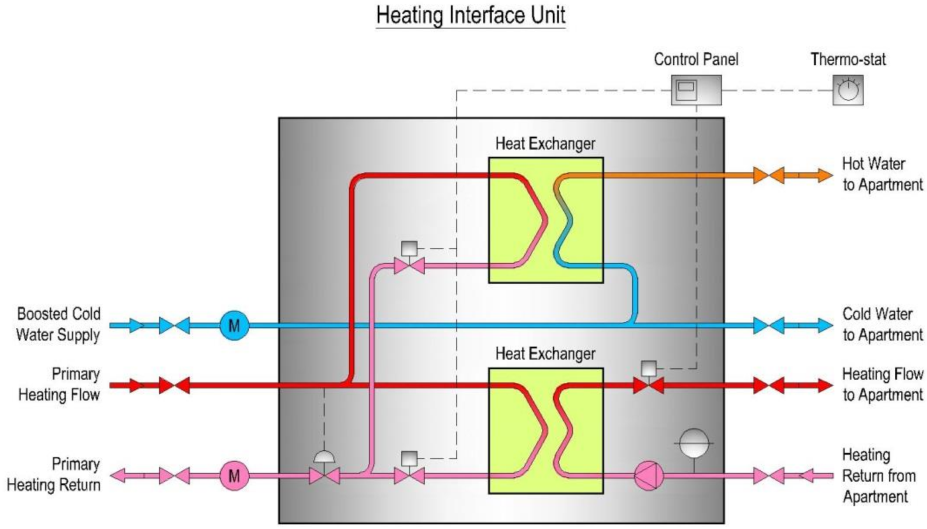

Figure 3.2 – HIU Configuration

Thermostatic radiator valves (TRVs) will be included on each heat emitter to provide local room control and to avoid overheating when casual and solar gains are significant.

Billing of Dwellings
The data from the sub-metered water and energy supplies would be automatically collected via a data retrieval device in each dwelling and processed remotely using a dedicated piece of software except where there will be direct billing from statutory authorities. This software would automatically generate bills.

In a similar manner to ordinary utilities accounts, all relevant information would be contained on the bill and would include latest and previous readings, the number of pulses (method of measurement), conversion to volume or units of energy, plant efficiency factors and unit costs.

Additional Considerations
Location of an energy centre and distribution routes for a district heating system are a particular concern, as typically local highways departments resist the routing of non-statutory services in the adopted road, pavement or any service margin. To route pipework through gardens there would need to be 24-hour access rights and legal agreements put in place to define access arrangements and the responsibility of reinstatement works.

Developments of this size would not be of interest for adoption by a statutory supplier or Energy Service Company (ESCo). The relatively low density of the site proposals also makes district or community heating marginal in terms of economic viability. Standing charges – incorporating management charges, cost of maintenance and funding of plant replacement, can be considerable, especially on smaller schemes.

3.3.3. Servicing Option 2: Individual Heating Plant

General
Providing heating plant to the houses on an individual basis would appear to be appropriate for this scheme due to the number of dwellings proposed and the density of the proposals.

Historically, a standard approach in housing design has been the provision of a gas fired boiler to meet the space heating and domestic water (dhw) loads of a dwelling.

However, the UK's drive for net zero has resulted in a marked shift towards electrically driven forms of plant to meet thermal loads, as the UK electricity grid is continually being decarbonised.

With the introduction of Part L 2021, it has also notably become significantly more onerous to achieve compliance with a gas fired form of heating plant.

Forms of potential electrically fed renewable heating technologies will be explored further in Section 3.4.

3.3.4. Reduction of Mechanical Cooling and Ventilation Loads

Appropriate analysis will be undertaken at design stage to ensure that the dwellings are adequately provided for by natural ventilation in summer, so that the introduction of comfort cooling at a future date is avoided. This analysis will take into account the rising summertime temperatures associated with climate change.

For an airtight building with an air permeability equal to or less than $3.0m^3/m^2.hr$ it would be appropriate for a whole house mechanical ventilation system with heat recovery (MVHR) to be installed.

SAP Appendix Q listed mechanical ventilation systems have been tested and certified as being more energy efficient and the best performing units will be considered in the calculations, i.e. those with the lowest specific fan power (electrical energy consumption).

3.3.5. Reduction of Domestic Hot Water Loads

The dwellings will be designed to meet a maximum domestic water consumption of 110 l/p/day, in accordance with Part G of the Building Regulations; this compares with the UK average of 150 l/p/day. Therefore, the domestic hot water (DHW) for dwellings will be reduced and a saving in DHW energy requirements may be achieved.

DHW heat losses will be minimised via factory applied thermal insulation to cylinders and the insultation of all DHW distribution pipework.

3.3.6. Building Services Controls Systems

The heating controls will comprise of a programmer and room thermostats. All radiators will be installed fitted with thermostatic radiator valves (TRV) - 'trimming' temperatures on a room by room basis.

Ventilation systems will operate on a trickle and boost arrangement, with the air flow rate increasing in response to a signal from a local switch (for kitchen ventilation) and humidistats / light switches (for bathroom or WCs).

3.3.7. Energy Consumption Monitoring

It is anticipated that each dwelling will be provided with smart meters and a display device by the energy supplier.

The device will provide both a simple means for real time observation of energy consumed and cost consumption together with the facility to view / print out historic records for energy consumption for the associated dwelling.

3.3.8. Artificial Lighting

Internal Lighting Strategy

Preliminary analysis assumes that all main internal lighting systems will incorporate energy efficient, LED lighting.

As a minimum, it is assumed that all fittings will achieve ≥80lm/W.

External Lighting Strategy
The external lighting will be designed in accordance with the minimum requirements set by Part L of the Building Regulations.

3.3.9. Home User Guides

It is anticipated that a Home User Guide will be supplied by the Developer to each dwelling. The guide will include recommendations on energy efficient operation of the dwelling, including buying A-rated appliances (if not fitted) and instructions on operation of systems.

3.3.10. Services Strategy: Summary

As outlined earlier in this section there are two major servicing options for heating provision; individual dwellings or district / community wide.

However, in part due to the number of proposed dwellings and the relative low density of the site proposals, the adopted approach is for heating and renewables systems to be applied on an individual dwelling basis.

Heat recovery ventilation systems will be provided to reduce winter heat losses associated with providing fresh air to the building occupants.

The DHW system will feature enhanced levels of insulation - to both the cylinder and the pipework – to reduce heat losses and improve the system efficiencies.

All internal and external lighting systems will be designed to be energy efficient. LED lighting will be provided throughout.

Electricity supplies to each dwelling or property within the development will be individually metered by the statutory service provider.

3.4. Assessment of Low and Zero Carbon Technologies

3.4.1. Overview

There are a number of renewable and low carbon energy technologies which may be suitable for multi-residential developments. The Low or Zero Carbon (LZC) technologies listed below have been assessed for their applicability to this development:

- Air source heat pumps (ASHP);
- Ground source heat pumps (GSHP);
- Photovoltaic arrays (PV);
- Solar Thermal for hot water; and
- Wind Energy.

The final selection of LZC technology for the Site will be made at design stage, but this initial appraisal will help to shortlist the most appropriate technologies for further consideration at that later stage.

Technologies such as biomass and Combined Heat and Power (CHP) have not been considered further in this section, as it has been determined that a district heating strategy (which would form the most appropriate application of these technologies) would not be a suitable strategy for this Site.

3.4.2. Air Source Heat Pumps

Heat pump boilers or air source heat pumps (ASHP) have, in general, been developed using existing air conditioning technology. However, instead of cooling, the refrigerant cycle is reversed so that heating is supplied to the dwelling.

The equipment is supplied as a package, with two major components:

- External unit; and
- Thermal store (hot water cylinder).

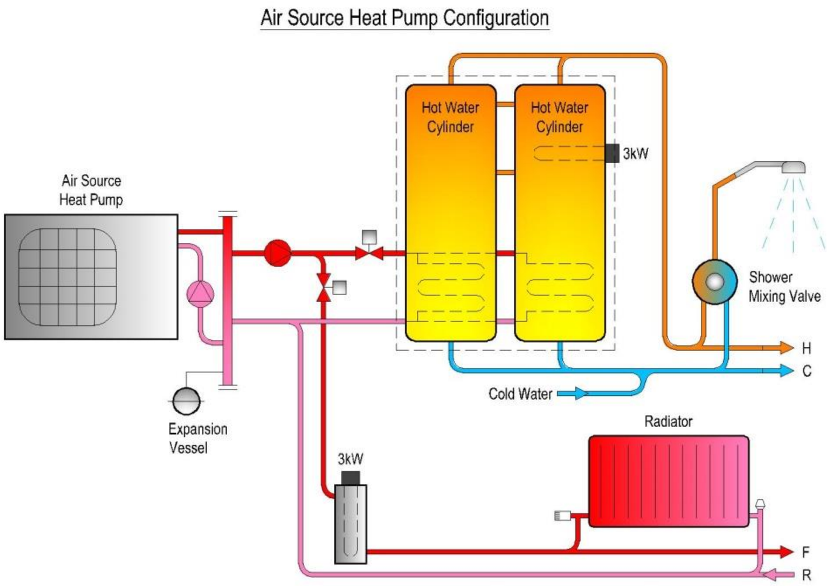

Figure 3.3 – Typical ASHP System Configuration

The external unit is a fully integrated package including the complete refrigerant circuit. A typical split cooling system would have an in-room evaporator unit. The advantage of the integrated approach is that the unit is supplied and pre-charged with refrigerant and skilled labour is not required; only a water pipework circuit needs to be connected.

ASHPs are a form of low carbon technology vs a fully renewable technology – as they require electricity to operate. However, the recent decarbonisation of the UK electricity grid has notably enhanced their resulting carbon performance over the last few years.

The seasonal coefficient of performance (SCoP) of an ASHP may achieve around 3.2 if serving a domestic hot water cylinder, noting that the storage temperature needs to be raised either by elevating the heat pump output or via an immersion heater.

Many heat pump boiler / ASHP installations feature de-frost functions on the coils and electric immersion heaters on the space heating circuits to overcome low ambient conditions. However, with appropriate control systems these direct electric functions should seldom be called upon.

Practical considerations for ASHPs include the location of the outdoor unit, as they may be considered an eye sore. Maximum pipe runs and access for maintenance may be constraints – particularly in apartment applications/ for dwellings with limited external space. Noise generation may also be an issue – although acoustic enclosures are available to address any concerns in this regards.

This technology is considered to be a potential appropriate form of LZC technology for the scheme to meet the thermal demands of the new homes.

3.4.3. Ground Source Heat Pumps

Ground source heat pumps (GSHPs) extract heat from the ground and upgrade it to a more useful temperature. The heat pump consists of a closed loop ground heat exchanger, a heat pump and a distribution system. The ground heat exchanger is a sealed loop of pipe buried either vertically or horizontally in the ground.

Horizontal arrays tend not to feasible on restricted sites, as the length of the loops can include multiples of pipework up to 50m in length.

Vertical arrays require a series of boreholes which accommodate the pipework and are infilled with a heat conducting grout. Environment Agency licences are not required, because it is a sealed, closed loop system. However, a ground investigation would be required as part of a detailed feasibility study.

GSHPs, like ASHPs, are a form of low carbon technology vs a fully renewable technology – as they require electricity to operate. However, the recent decarbonisation of the UK electricity grid has notably enhanced their resulting carbon performance over the last few years.

Heat pumps use electrical energy, usually grid supplied, to upgrade the energy collected by the ground loop; typically one unit of electricity will be produce 3 to 4 units of useful heat. However, the output temperature is normally limited to between 40 and 45°C, or the unit efficiency will drop considerably. Performance monitoring of GSHP has indicated that the claimed efficiency of GSHP installations are not being achieved in practice, resulting in higher energy consumption and running costs than anticipated.

As is the case for ASHPs, GSHPs are best suited to applications where the building heat load is small and the heat delivery system is either underfloor heating or air heating with coils sized to suit.

Domestic hot water (DHW) generation can pose a design challenge with GSHP. As outlined above, the heat pump output temperature must be limited to maximise the co-efficient of performance (CoP); this is incompatible with domestic hot water storage and distribution systems, which need to achieve 60°C to minimise the risk from Legionella. With individual dwellings, the DHW issue could be overcome by a stepped immersion heater – as is the case with ASHPs.

Factors to be considered on this project would be available ground area for lateral arrays, coordination with other buried services (drainage, tanks etc) and the geology in the area (borehole drilling).

Notably – the installation works associated with GSHP installations vs ASHP installations are significantly greater, as substantial groundworks will likely be required.

Overall we believe that GSHP is not the most appropriate solution for this scheme – an ASHP servicing strategy would be a more appropriate application of heat pump technology for the Application Site.

3.4.4. Photovoltaic Arrays

Photovoltaics are semiconductor devices that convert sunlight into direct current (DC) electricity. Groups of panels can be electrically configured into arrays which can be used to power a building's electrical load. A photovoltaic (PV) installation generally consists of panels, inverters, controls and wiring for integration into a building's main electrical distribution system.

A number of photovoltaic systems including monocrystalline, polycrystalline and thin film are available, generally made up into arrays using multiple panels or roof slate "substitutes", photovoltaic panels can also replace vertical cladding systems. The PV system considered for this study is based on comparatively efficient monocrystalline panels currently available.

One of the obvious benefits of a PV installation is that it is purely an electrical system, without the need for pipework distribution systems and storage vessels. The array can be sized to suit sustainability and renewables targets and could conceivably be increased in size at a later date. Additionally, PV systems are very low maintenance and are supplied with guarantees of between 20-25 years, although they should normally produce a high percentage of their original rating for some time afterwards.

Although solar photovoltaics are no longer eligible for the feed-in-tariff (FiT) incentive scheme which offered significant financial returns to array owners, the government has now brought in the Smart Export Guarantee (SEG). This new scheme offers some financial return on excess electricity that is exported back to the grid.

Another item that is critical in determining the suitability of this form of technology to a scheme is the available roof area. The floorplans, elevations and roof layouts of the proposed homes are still being developed in the case of this Development Site.

Overshadowing may significantly reduce the output of a solar photovoltaic system. In this instance, overshadowing is not deemed to pose a significant issue given the locality of the development and the low rise nature of the proposed dwellings.

As the design for the scheme progresses, and detailed proposals are developed for the various dwelling types, it is proposed that the feasibility for the integration of PV technology will be explored further.

3.4.5. Solar Thermal

The application of solar thermal to individual dwellings is relatively straightforward. The hot water cylinder in a standard system boiler configuration is replaced by a twin coil cylinder connected to a roof array, via a pumped circuit and supplemented by the main heating boiler.

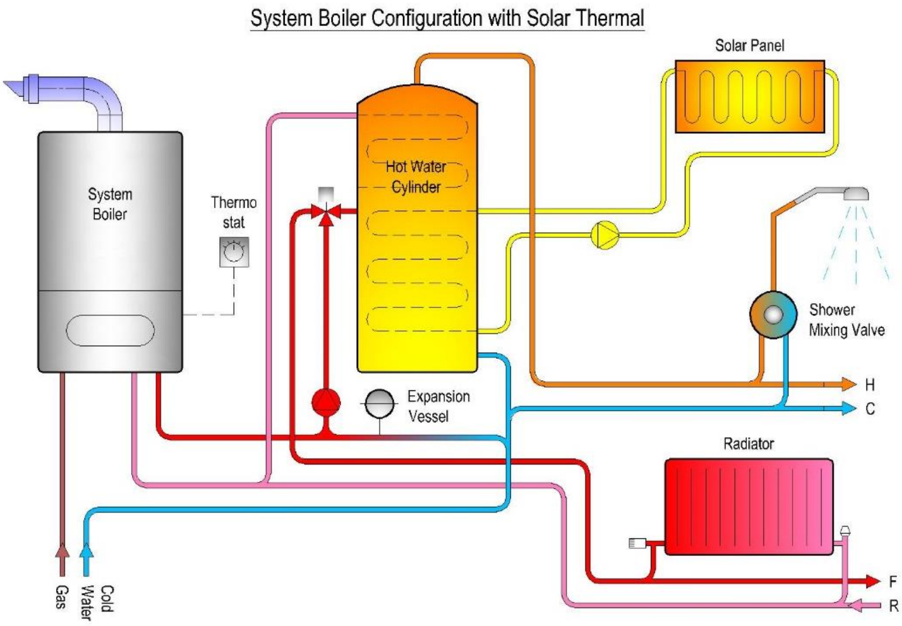

Figure 3.4 – Typical Solar Thermal System Configuration

Flat panel collectors can be integrated into the roof. The more efficient evacuated tube system has more versatility and orientation is less of an issue, although these arrays are more expensive than flat panel.

In the case of dwellings the available roof area, pitch and orientation are critical. Also, the proper integration of large sections of solar thermal panels into the roof can be difficult.

Increasing the area of solar thermal panels so that they contribute to the space heating incurs considerable cost with little energy benefit as the panels operate far below maximum efficiency during winter when they would be most required.

Additionally, there are significant issues in summer if an installation is over capacity; this may result in system stagnation, where there is insufficient demand for the energy produced, with separation of the glycol anti-freeze from the circulation medium, with major maintenance implications.

It should be noted that solar thermal's contribution to the reduction of CO_2 emissions can be smaller than expected, especially when accounting for all energy requirements in modern, well insulated dwellings, which comprise less of thermal loads and more of appliance and other electrical demands.

As for PV technology, another item that is critical in determining the suitability of this form of technology to a scheme is the available roof area. The floorplans, elevations and roof layouts of the proposed homes are still being developed in the case of this Development Site.

It is considered that PV would likely be the more appropriate form of roof mounted solar technology for this site – due to the higher anticipated electrical loads of the future homes and the lower maintenance costs/ risks associated with that form of technology. Due to these reasons, this form of technology has not been considered further for application to this site.

3.4.6. Wind

Wind turbines have the capability of harnessing the power of the wind in order to produce electricity through the circular motion of the turbine's blades. The electricity produced has zero associated carbon dioxide emissions. This technology therefore qualifies for the FiT initiative.

Wind turbines are normally mounted on columns remote from the main structures on site. However, they could also be building mounted and spaced at intervals to avoid interference with each other. However, the method of support and mounting height would need to be carefully considered to avoid vibration transmission and to maximise output, respectively. Small turbines usually need to be mounted at least twice as high as any local obstructions to work effectively.

Wind turbines may be considered to be an eye-sore. This could potentially cause a planning issue as the inclusion of wind turbines in the development may be viewed to be changing the landscape character. There would also be the risk that the future inhabitants of the Batchelors Farm development, and the owners of the neighbouring properties to the east of the site, may complain about the visual impact the inclusion of wind turbines on the development would make.

Wind turbines, whether roof or pole mounted, can also be noisy. Their inclusion may cause disturbance to the future residents of the site, in addition to potential vibration issues if the turbines are to be roof mounted. There is also a high capital cost associated with the installation of wind turbines, whether column or roof mounted, so this is unlikely to be the most financially viable solution.

The viability of wind turbines is largely determined by the site location, including average wind speed and the presence of obstructions (which produce undesired turbulence). The NOABL Wind Map has been accessed to obtain data for average wind speed in the area.

The following wind speeds were reported:

- at 10 metres: 4.9m/s;
- at 25 metres: 5.7m/s; and
- at 45 metres: 6.2m/s.

A turbine on this site would fall in the 10m bracket; a rule of thumb is that the rotor is located at twice the height of the nearest building.

Normally, a wind speed threshold of 5.0m/s is used to determine whether a site may be suitable for wind turbines. At a height of 10 metres on the Application Site, this criterion would not be met.

Due to the potential environmental impact of wind turbines on the Application Site, the average wind speed at a height of 10m and the financial viability of this technology, wind turbines have not been considered in any greater detail.

3.4.7. Summary of LZC Technologies

The findings of the low and zero carbon (LZC) assessment are summarised in Table 3.2, below.

Table 3.2 – Summary of LZC Technology Assessment

Technology	Preliminary Assessment	Applicable to Scheme?
Air Source Heat Pump	• Recent decarbonisation of UK electricity grid has improved carbon performance of this form of technology that requires electricity to operate • External units could be located in rear gardens • Relatively straightforward installation procedure (in comparison to GSHP)	To be explored further at detailed design stage
Ground Source Heat Pump	• Number and length of arrays/ boreholes to serve site considerable – significant groundworks would be required • High capital cost (in comparison to ASHP) • Efficiencies can be lower than predicted in reality, impacting on anticipated running costs and consumer bills	No
Photovoltaic Array	• Appropriate pitched / flat roofs required – TBC as detailed design develops • Potential for SEG payments • Would contribute to electrical demands of the new homes	To be explored further at detailed design stage
Solar Thermal	• Appropriate pitched / flat roofs required – TBC as detailed design develops • Less favourable payback (in comparison to PV) • Maintenance issues more likely than for an alternative PV array (i.e. stagnation, pumps breaking down)	No
Wind Turbines	• Average wind speed at 10m is lower than the 'rule of thumb' threshold for viability of 5m/s • Potentially detrimental to local amenity	No

3.5. Site Wide Energy Assessment

The energy performance of a representative sample of the new homes have been modelled using Elmhurst Design SAP 10 software. These calculations are very high level at this stage – and will be further informed by the developed floorplans and elevations for the scheme as the design progresses. At the completion of detailed design stage, a full set of SAP calculations will need to be completed and submitted to the Building Control Officer/ Approved Inspector on the scheme.

This assessment has been undertaken to assess compliance of the properties with the 3no. key Part L 2021 SAP performance metrics – the TER, TPER and TFEE. An example dwelling SAP calculation is included in Appendix A.

Table 3.3, on the next page, shows the preliminary Part L SAP results for a representative sample of dwelling types. These preliminary SAP calculations have incorporated the proposed passive measures and energy efficient building services proposals outlined in Section 3, and a preliminary application of ASHP technology to meet the thermal loads demands of the dwellings. The final servicing strategy for the scheme will be established at design stage for the dwellings, however, these preliminary calculations demonstrate that the outline strategy set out in this report would result in the proposed dwellings meeting the requirements of Part L 2021.

Table 3.3 – Summary of Sample Part L 2021 SAP Calculations

Dwelling	Dwelling Type	No. Of	Part L TER (kg CO_2/m^2)	Part L DER (kg CO_2/m^2)	**% pass beyond Part L Target**	Part L TPER ($kWh/m^2/yr$)	Part L DPER ($kWh/m^2/yr$)	**% pass beyond Part L Target**	Part L TFEE ($kWh/m^2/yr$)	Part L DFEE ($kWh/m^2/yr$)	**% pass beyond Part L Target**	**Overall Part L Compliance?**
Type 1	1 Bed GF	1	14.88	5.69	62%	78.29	60.66	23%	43.54	37.51	14%	Pass
Type 2	1 Bed FF	1	13.99	5.53	60%	73.50	59.07	20%	39.25	33.82	14%	Pass
Type 3	2 Bed Type 1	3	10.88	4.64	57%	56.63	49.43	13%	33.79	30.47	10%	Pass
Type 4	2 Bed Type 2	8	10.76	4.66	57%	56.02	49.65	11%	32.97	30.34	8%	Pass
Type 5	3 Bed Type 1	1	9.55	4.14	57%	49.55	44.21	11%	30.73	26.71	13%	Pass
Type 6	3 Bed Type 2	8	10.68	4.36	59%	55.62	46.39	17%	36.12	31.38	13%	Pass
Type 7	4 Bed House	4	11.23	4.36	61%	58.65	46.17	21%	41.52	35.69	14%	Pass

Total		26.0

4. RESOURCE EFFICIENCY

4.1. Overview

Resource efficiency means utilising the earth's limited natural resources in a sustainable manner and in turn mitigating negative environmental impacts. The management of waste is increasingly recognised by local authorities as an area that should be addressed in the development of design proposals. Policy DP39 dictates that efforts should be demonstrated to minimise waste and maximise recycling and reuse of materials through both the construction process and future occupation. This section of the report will outline a strategy for a resource efficient development at Batchelors Farm.

4.2. Waste Hierarchy

The Waste Hierarchy aids in identifying actions that can improve resource efficiency by prioritising waste management options in line with their relative impact.

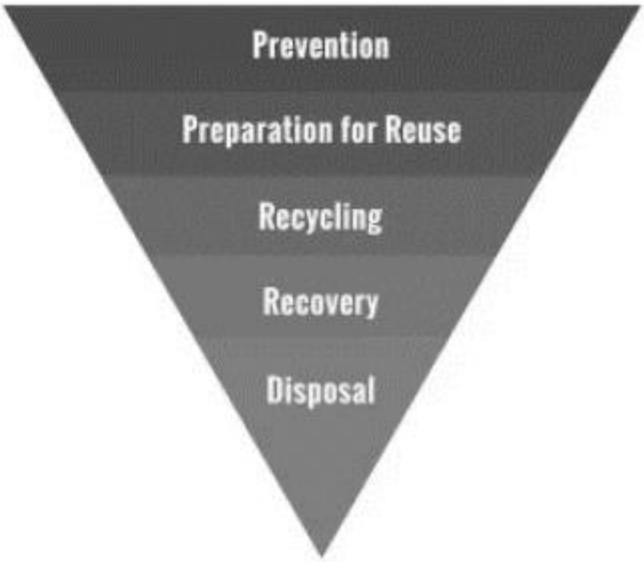

Figure 4.1 – The Waste Hierarchy (Original Source: BRE Website)

The Building Research Establishment (BRE) outline the following steps in identifying a route to resource efficiency:

- Where is waste being produced?
- What is the cause of this and is it avoidable?
- If not avoidable, what opportunities are there for this material to be used internally, or by another business through recycling or refurbishing?
- Can improvements be made to the way waste is currently handled?

4.3. Construction Waste

Construction waste can be minimised during the construction process via the effective and appropriate management of construction site waste.

It is proposed that this is implemented on the Batchelors Farm site through the production of a SWMP outlining procedures and good practice measures that can be adopted on Site.

It is proposed that a SWMP will be developed for the site in accordance with guidance from:

- DEFRA (Department for Environment, Food and Rural Affairs);
- BRE (Building Research Establishment);
- Envirowise;
- WRAP (Waste & Resources Action Programme); and
- Environmental performance indicators and / or key performance indicators (KPI) from Envirowise or Constructing Excellence.

The SWMP will outline the following:

- Target benchmarks for resource efficiency, i.e. m^3 of waste per $100m^2$ or tonnes of waste per $100m^2$ set in accordance with best practice;
- Procedures and commitments to minimize non-hazardous construction waste at design stage. Specify waste minimisation actions relating to at least 3 waste groups and support them by appropriate monitoring of waste;
- Procedures for minimising hazardous waste;
- Monitoring, measuring and reporting of hazardous and non-hazardous site waste production according to the defined waste groups; and
- Procedures to divert waste from landfill through re-use on site, re-use on other sites, reclaim for re-use, return to the supplier via a 'take-back' scheme, recovery and recycling using an approved waste management contractor or composting according the defined waste groups.

The defined waste groups referenced in the SWMP will include the following materials as defined in the European Waste Catalogue: bricks, concrete, insulation, packaging, timber, electrical and electronic equipment, canteen / office / ad hoc, asphalt & tar, tiles and ceramics, inert materials, metals, gypsum, plastics, floor coverings, soils, hazardous materials, architectural features and other / mixed materials.

The target benchmarks for resource efficiency will be set using best practice and will be reviewed throughout the construction process.

4.4. Built Fabric Resource Intensity

The resource intensity of the building fabric of the proposed dwellings can be addressed through the specification of 'resource light' construction and consideration of the end of life of the building.

Resource-light construction refers to the appropriate use of construction materials and building techniques to provide the most efficient response to the particular building requirements. 'Eco' materials will be considered for their applicability to the scheme as the architectural design progresses. Eco-materials are less resource intensive than alternative materials, and have a lower level of embodied carbon as a result of their sourcing, production process, delivery requirements etc. Examples of these materials are locally sourced eco-cement, wood, straw, clay etc. The application of these materials in the Proposed Development will be within the Site, economic and thermal performance constraints of the scheme.

The design of the scheme will also consider the end of life of the future dwellings. The following options will be explored as the scheme develops to maximise the end of life potential for the dwellings:

- The use of prefabricated components may make them easier to dismantle on demolition and therefore more appropriate for re-use;
- Utilising simple connections and avoiding non-standard connection details will allow for efficient deconstruction and will reduce the need for multiple tools;

- Designing with reusable and adaptable materials. Materials such as bricks, steel beams / columns and wood can be easily re-used / repurposed to avoid them going to landfill on demolition; and
- Resilience to climate change may extend the lifetime of the dwellings and therefore the economic life of the dwellings.

4.5. Recycling and Composting In-use

Encouraging the occupants of the development to recycle and compost biodegradable waste will aid in reducing the amount of waste being sent to landfill through the lifetime of the Batchelors Farm development.

It is proposed that the Home User Guide will include a section on Recycling and Waste to provide guidance on good practices to the future occupants.

It is proposed that this section of the Home User Guide will include the following:

- information about the Local Authority collection scheme;
- information on the Waste and Resource Action Programme (WRAP) which can offer guidance on recycling and sustainable waste disposal;
- information on the procedure to follow with items of waste not covered by the standard weekly Local Authority collection scheme – for example fridges / freezers, computer equipment, batteries and other potentially hazardous equipment; and
- information and location of local recycling facilities and waste tips.

5. WATER EFFICIENCY

5.1. Overview

With climate change and the consequential predicted reduction in rainfall for Southern England, water use and conservation are issues that should be considered in providing sustainable development. Methods and technologies that may be utilised include:

- rainwater harvesting;
- grey water re-use;
- composting toilets; and
- wastewater treatment via reed beds.

Composting toilets and reed beds are not considered suitable for most multi-residential developments, given site space constraints and the general availability of mains sewerage.

5.2. Rainwater Harvesting

Rainwater is relatively clean and is generally defined as 'soft' water and therefore it is relatively straightforward to treat and use in buildings.

Rainwater harvesting is a simple and effective method of reducing the consumption of mains water on a site. It is usually put to use where water of drinking water quality is unnecessary. For instance, rainwater can be utilised to provide supplies for the following:

- irrigation systems;
- WC flushing;
- laundry facilities, i.e. washing machines; and
- vehicle washing.

A rainwater harvesting system would normally consist of the following:

- pre-filters located in the downpipes or integrated into the below ground pipework;
- underground storage tank with calmed, filtered inlet and overflow;
- submersible pump with integral filter;
- control panel with pump pressure regulator;
- mains water make-up (into main or header tank);
- fine filter(s) in main distribution pipework (optional); and
- ultra-violet disinfection unit (optional).

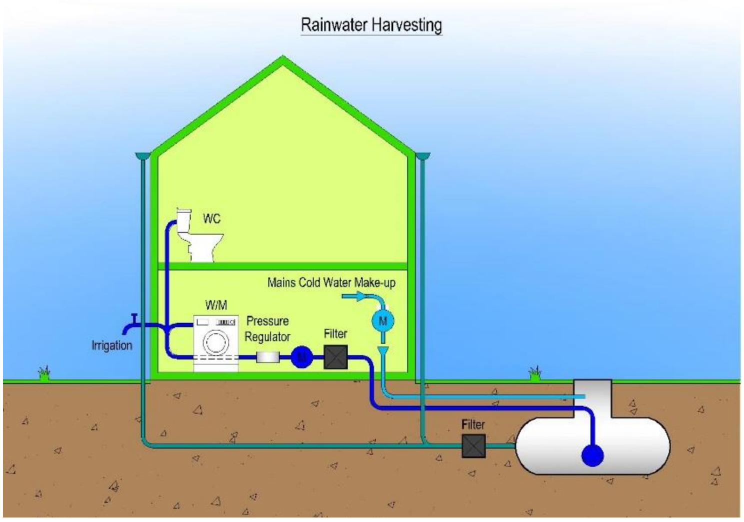

Figure 5.1 – Typical Rainwater Harvesting System Configuration

It is recommended that sanitary appliances are selected to be as efficient as possible, so that the use of rainwater can be maximised. Rainwater can be filtered and disinfected to provide water of drinking quality, but this is rare in the United Kingdom given the availability and quality of mains water.

Management of storm water is increasingly becoming an issue and rainwater harvesting can be utilised as part of an attenuation strategy.

Particular factors that need to be addressed when considering a rainwater harvesting system include:

- the supply of rainwater is unlikely to coincide with demand and therefore large volumes of storage may be necessary to compensate;
- compliance with the Water Regulations, including avoidance of backflow and cross connection into the mains water supply; and
- the additional expense of a centralised system and also of maintenance, although the works necessary are relatively straightforward.

5.3. Grey Water Re-Use

Grey water is defined as wastewater collected from sources with relatively low levels of contaminants, i.e. basins, baths, sinks, showers and, in some cases, washing machines. When filtered and disinfected it is primarily used in WC flushing.

Grey water is collected via a dedicated wastewater pipework system and stored in tanks. Screen filtering and settlement takes place in the tank, after which the water is filtered and disinfected.

Packaged systems are now available, but filtration and disinfection methods vary between manufacturers. Reverse osmosis, sand and cartridge filters may be utilised; ultra-violet lamps, bromine and chlorination may be used for disinfection purposes.

Storage of 'raw' grey water for long periods is not recommended and a grey water installation should address all the possible health and safety issues, i.e. labelling of outlets and pipework, avoidance of cross contamination with mains water, regular maintenance.

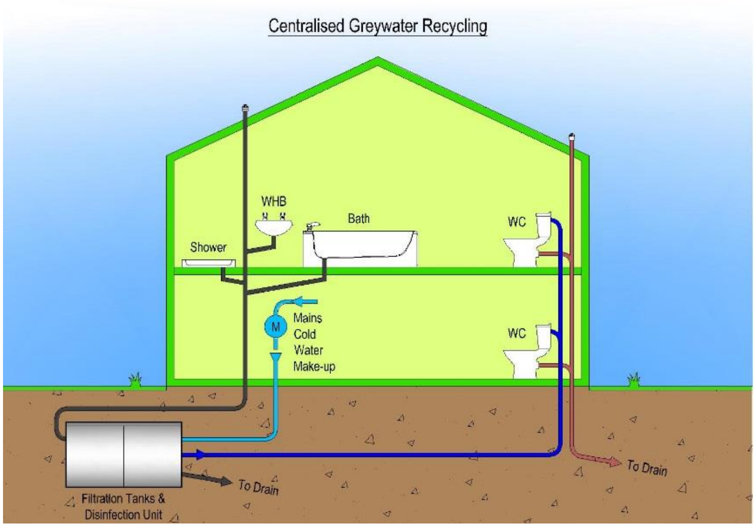

Figure 5.2 – Typical Greywater Harvesting System Configuration

Factors that need to be addressed when considering a grey water system include:

- compliance with the Water Regulations, including avoidance of backflow and cross connection into the mains water supply;
- the additional capital expense of a centralised system;
- ongoing maintenance, which is invariably expensive; and
- possibility of more concentrated effluent returned to the sewerage system.

Measures associated with the Water Regulations include clear identification of pipework and even a different pipework material to prevent confusion and to reduce the chance of connections to a potable water system.

One major advantage with grey water is that availability and supply closely match demand, i.e. the volume of grey water produced correlates with the WC flushing water demanded.

The overall cost of local grey water re-use systems can be significant once the IPS, equipment and controls, and wastewater pump are all accounted for.

5.4. Application of Water Management Systems

In line with the requirements of DP42: Water Infrastructure and the Water Environment, it is proposed for the development to achieve a water consumption standard of 110 l/p/day (including external water use).

For residential developments achieving this required reduction in the consumption of potable water can be addressed in several different ways which are recognised within the Water Efficiency Calculator for New Dwellings used for Part G of the Building Regulations. This calculation methodology takes a whole house approach; manufacturer's data for each appliance is inputted and the theoretical amount of water that the average person would use in a house fitted with those appliances is calculated.

One of the most straightforward approaches to reducing water consumption would be to specify water conservation appliances such as dual flush toilets, low flow taps and baths with a low capacity to overflow although this has the potential to conflict with user preferences.

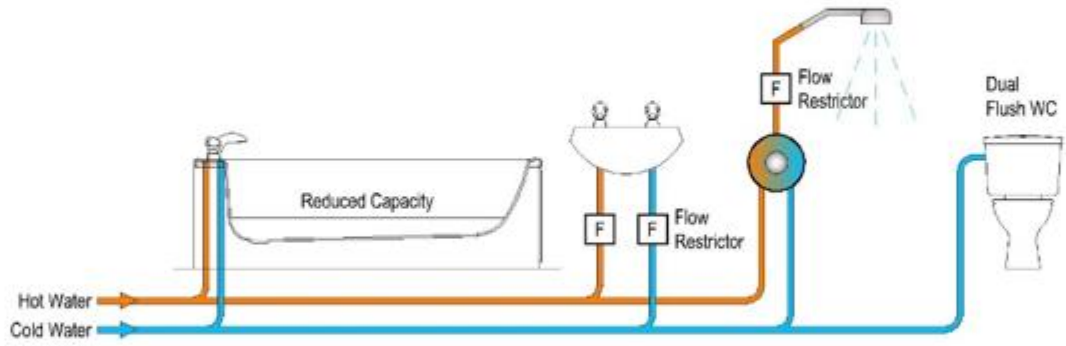

Figure 5.3 – Standard Approach to Reducing Water Consumption

An alternative approach is to consider integrating technology that reuses water onsite such as using rainwater or grey water recycling. It is important to note however that in isolation the use of rainwater or grey water recycling is unlikely to reduce water consumption sufficiently to achieve the minimum standards, although in combination with low flow appliances these levels should be achievable, as shown in the table below:

Table 5.1 – Summary of Routes to 105 l/p/day Water Consumption (Internal Usage Only)

	Appliance Only	Rainwater	Greywater
Toilet	Dual flush – 4.5 litres capacity full flush, 3 litres capacity half flush	Dual flush – 4.5 litres capacity full flush, 3 litres capacity half flush	Dual flush – 6 litres capacity full flush, 4 litres capacity half flush
Wash Hand Basin Taps	2.4l /min	2.4l /min	2.4l /min
Shower	8l/min	9 l/min	10 l/min
Bath	Capacity to overflow – 130 litres	Capacity to overflow – 130 litres	Capacity to overflow – 150 litres
Kitchen Taps	Flow – 4l/min	Flow – 4l/min	Flow – 6l/min
Washing Machine	49 litres/ cycle	49 litres/ cycle	49 litres/ cycle
Dishwasher	13 litres/ cycle	13 litres/ cycle	13 litres/ cycle
Water Consumption	104.37 l/p/day	102.46 l/p/day	104.20 l/p/day

This table is based on a two-bedroom dwelling and illustrates three different routes to achieving the 105l/p/day internal water usage target. It should be noted that this example makes several assumptions that may affect the overall water consumption such as the amount of rainwater that is i) collected and ii) reused in the dwelling.

This example is based on 9.9m^2 collection area per dwelling which receives 0.64 m/yr of rainfall and collects 33% of the rainwater that falls; the table above gives an indication of the likely impact on the types of appliances that can be specified to be used in conjunction with this technology to achieve the indoor water usage target of 105 l/p/day. An estimated 5 l/p/day external water usage estimate takes the usage to the total of 110 l/p/day overall usage.

In terms of costing, it is very difficult to establish how much achieving the overall water usage target of 110 l/p/day will cost in total as this will depend on the approach that is employed and the type of dwelling that it is used in. The table below gives an indication of how much the various routes may cost a developer, but should be used for guidance purposes only.

Table 5.2 – Indicative Cost Comparison of Routes to 105 l/p/day Water Consumption (Internal Usage Only)

Water Consumption	Potential Routes	Potential Additional Cost per Unit
≤120 l/p/day	Appliance Only	£0
≤105 l/p/day	Appliance Only	£140
	Appliance & Greywater	£2,700
	Appliance & Rainwater	£2,500

The cost of rainwater harvesting when applied to individual dwellings is relatively high, although connecting a terrace or block of houses to a single tank and pump system may reduce the cost per dwelling. Drawbacks with this type of solution include rights of access for maintenance, metering and management of the installation.

It can be seen from Table 5.2 that an appliance only route to meeting the 105 l/p/day internal water usage target is likely to be a substantially more cost-effective route than integrating a rainwater or greywater harvesting system.

5.5. Summary

Although not particularly desirable in terms of user satisfaction, the limiting of water flow rates and appliance capacity is the most practical and cost-effective solution for application to the Batchelors Farm development to meet the overall water usage target of 110 l/p/day.

A form of rainwater collection could additionally be provided in the form of above ground water butts for external irrigation to further improve the water usage efficiency of the scheme.

6. CONCLUSIONS

A sustainability strategy for the Batchelors Farm residential scheme has been developed to optimise the use of resources during design, construction and end use.

A sequential approach has been taken for the scheme energy strategy to minimise the potential carbon dioxide (CO_2) emissions from the site, firstly by passive measures and secondly by more active means. We believe that this has been achieved without unduly compromising the external appeal of the dwellings or the living areas and comfort of the occupants. The occupants will receive direct benefits in the provision of energy efficient dwellings. Demand for heating and mechanical cooling will be significantly reduced, with a consequent decrease in carbon emissions. In terms of running costs, the residents and users will see the benefit through financial savings.

Detailed calculations regarding the predicted energy demand and carbon dioxide emissions will be undertaken at detailed design development stage. However, based on the preliminary calculation exercises carried out for this report, the Building Regulations (Part L 2021) energy targets will be met and exceeded through a combination of passive measures, energy efficient fixed services and LZC technologies.

Energy savings and subsequent reduction in CO_2 emissions have been targeted through implementation of the following:

- exceeding good or best practice standards for thermal insulation of opaque and glazed elements;
- achieving air permeability of $3.0m^3/h.m^2$ at 50Pa in dwellings;
- high efficiency LED lighting to be provided throughout;
- high efficiency heat recovery ventilation systems;
- boiler plant efficiency >89%;
- integration of water conservation appliances such as low flow fittings to reach a target water usage of 110 l/p/day; and
- An initial appraisal of applicable LZC technologies has identified ASHP and PV as the likely most appropriate forms of technology for the scheme – this will be explored further as the design for the scheme progresses.

Further to the proposed energy and water resource efficiency measures, an outline resource efficiency strategy has been set out for the site – including mitigating construction waste via the implementation of a Site Waste Management Plan, reducing resource intensity of the proposed building fabric elements and providing waste management guidance to future occupants within Home User Guides.

This report has set out a route map for the future design development of the Batchelor Farm site proposals to meet the sustainability guidelines outlined in the Mid Sussex Local Plan.

7. APPENDIX A SAMPLE SAP CALCULATION

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 24 Apr 2023 08:41:05

Project Information			
Assessed By	Jessica Juhler	Building Type	House, End-terrace
OCDEA Registration	EES/021491	Assessment Date	2023-04-24

Dwelling Details			
Assessment Type	As designed	Total Floor Area	75 m^2
Site Reference	2 Bed End	Plot Reference	00001_Copy_Copy_Copy_Copy
Address			

Client Details	
Name	Temple Group
Company	Temple Group
Address	-, -, -

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

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.76 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.66 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.02 kWh_{PE}/m^2*	
Dwelling primary energy	49.65 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*33.0 kWh/m^2*	
Dwelling fabric energy efficiency	30.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Walls (1) (0.15)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.13	Heatloss Floor 1 (0.13)	OK
Roofs	*0.16*	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	*1.6*	0.83	Door (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	16	0.15
Party wall: Party Wall (1)	72	0 (!)
Ground floor: Heatloss Floor 1, Heatloss Floor 1	37.5	0.13
Exposed roof: Roof (1)	37.5	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Door, Door	2	East	N/A	1.2
E Windows, Window	12	East	0.7	0.8 (!)
W Windows, Window	6	West	0.7	0.8 (!)
S Windows, Window	12	South	0.7	0.8 (!)

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - **Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.05	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.05	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0 (!)	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m³/hm²*	
Dwelling air permeability at 50Pa	3 m³/hm², Design value (!)	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	249.9%
Emitter type	Radiators
Flow temperature	35°C
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	150 litres
Declared heat loss	N/A
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer, room thermostat and TRVs	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	TBC
Model	TBC

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.46 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	88%	OK
Manufacturer/Model	HRV10.25 Q Plus Eco	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

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