Energy and Sustainability Statement

Bice Investment Ltd

For the site at:
27 Magdalen Road
Oxford
OX4 1RP

Oxford City Council

SRE

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	25.08.2023	Alaister Coffey	Findlay Matheson	Alaister Coffey
1	B	29.08.2023	Alaister Coffey		Alaister Coffey
2	A	08.12.2023	Alaister Coffey	-	Alaister Coffey
2	B	14.12.2023	Alaister Coffey	-	Alaister Coffey

The figures within this report may be based on indicative modelling and an assumed specification outlined within the relevant sections. Therefore, this modelling may not represent the as built emission or energy use of the Proposed Development and further modelling may need to be undertaken at detailed design stage to confirm precise performance figures. Please contact SRE should you have any questions, or should you wish further modelling to be undertaken post planning.

SRE Registered Office | Greenforde Farm

Stoner Hill Road | Froxfield

Petersfield | Hampshire | GU32 1DY

01730 710044

info@sre.co.uk

www.sre.co.uk

Contents

Executive Summary

Executive Summary

This Energy and Sustainability Statement has been written to demonstrate the proposed measures incorporated into the design of 27 Magdalen Road, Oxford (the Proposed Development). The development will deliver lower energy and water use, lower global warming potential (GWP) carbon dioxide equivalent (CO_2e) emissions and lower operational costs than a *Building Regulations 2021* compliant design.

The energy strategy has been developed by following the Energy Hierarchy of Lean, Clean, Green and Seen[1], as shown in Figure 3. The chosen energy strategy includes lean passive and active design measures and green low and zero carbon (LZC) technologies to reduce the GWP or CO_2e emissions as far as is practical and viable in line with Building Regulations 2021 Part L V1 and the Oxford City Council. The proposed energy strategy for the Proposed Development is summarised below:

Proposed Energy Strategy

- Passive and active design measures
- Enhanced thermal bridging
- High efficiency light-emitting diode (LED) lighting
- Mechanical ventilation with heat recovery (MVHR)
- Waste Water Heat Recovery (WWHR)
- All Electric Heating System; Panel Heaters and Hot Water Heat Pump (HWHP)

Figure 1 and Table 1 summarise the overall performance of the Proposed Development and associated CO_2e savings.

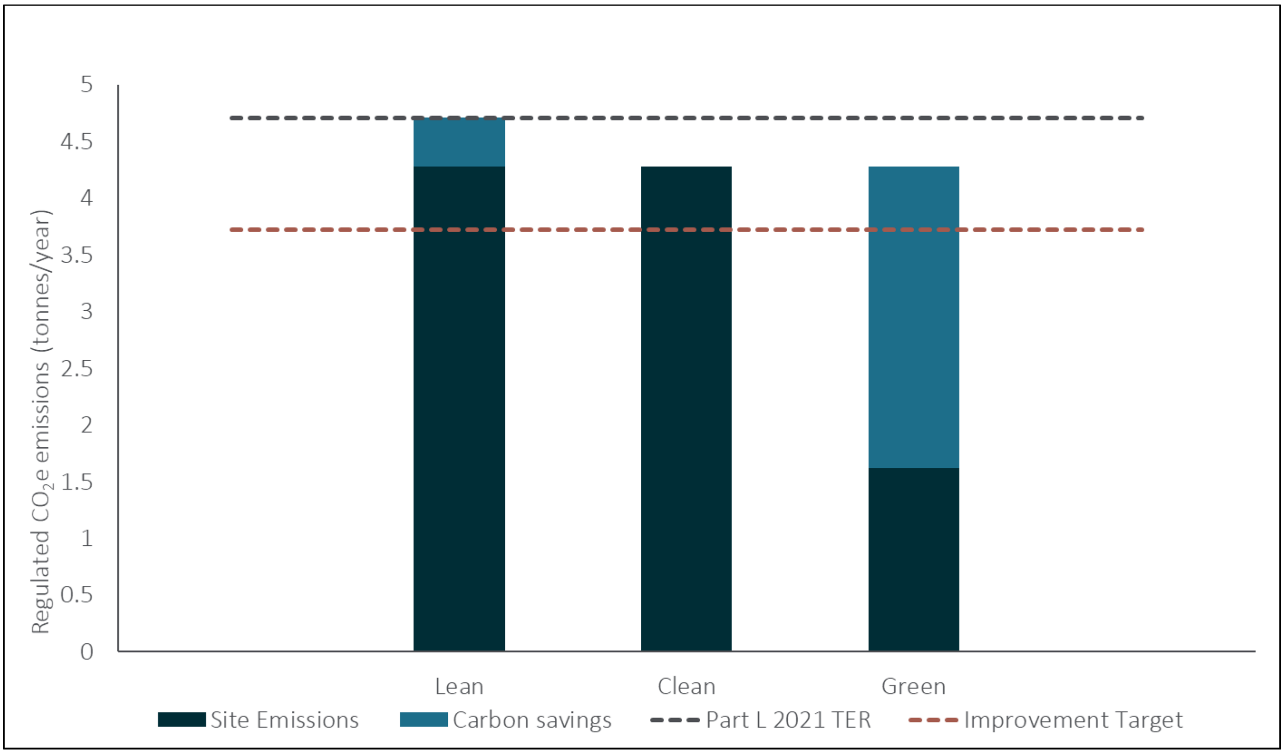


Figure 1 - Summary of regulated CO_2e savings

[1] Standard approach informed by regional UK policies (GLA)

Energy Scenario	Energy Hierarchy Category	Average Unit CO_2e emissions (t/yr)	Improvement (%)	Average Improvement over Baseline (%)
Site-wide	Baseline	4.71		
	Lean	4.28	9.14	9.14
	Clean	4.28	0.00	9.14
	Green	1.62	62.15	65.61

Table 1 – Summary of the site-wide CO_2e emissions, incremental improvement and improvement over Baseline

By applying the Energy Hierarchy, it is possible for the Proposed Development to achieve a 65.74% improvement in annual CO_2e emissions over a standard *Building Regulations 2021* compliant design and above the 40% improvement over *Building Regulations 2013* as per Oxford City Council planning requirements.

The sustainability assessment within section 3.0 demonstrates how the design of the Proposed Development benefits the surrounding area environmentally along with complying with Oxford City Council local policy.

Introduction

1.0 Introduction

This Energy and Sustainability Statement has been written by SRE Ltd on behalf of Bice Investments Limited (the Client) to demonstrate the measures incorporated into the design of the new residential development at 27 Magdalen Road, Oxford (the Proposed Development). The development will deliver lower energy and water use and lower associated carbon dioxide equivalent (CO_2e) emissions than that of a *Building Regulations 2021* compliant design.

The statement compares the predicted actual building energy requirement with a *Building Regulations 2021* compliant design, outlines passive and active design measures, and assesses the suitability of low and zero carbon (LZC) technologies specific to this site in order to address the relevant planning policy requirements.

This statement analyses how the Proposed Development will integrate with its surrounding environment considering the context of sustainability. This ensures it benefits the surrounding area socially, environmentally, and economically.

1.1 The Proposed Development

The Proposed Development involves the construction of 6 no. new 1 bed 2 person (1B2P) residential dwellings, located within the city of Oxford. Figure 2 shows the front elevation of the Proposed Development.

Figure 2 – Site Plan of the Proposed Development (RE-Format LLP).

Please see Appendix A for further architectural drawings of the scheme.

1.2 Planning Policy

The site is located within the Oxford City Council therefore the following planning policy, summarised in Table 2, is applicable to the site.

Planning Policy	Requirement
Oxford City Council – Oxford Local Plan 2036 (Adopted 2020)	**Policy RE1: Sustainable design and construction** Planning permission will only be granted where it can be demonstrated that the following sustainable design and construction principles have been incorporated, where relevant: a) Maximising energy efficiency and the use of low carbon energy b) Conserving water and maximising water efficiency c) Using recycled and recyclable materials and sourcing them responsibly d) Minimising waste and maximising recycling during construction and operation e) Minimising flood risk including flood resilient construction f) Being flexible and adaptable to future occupier needs g) Incorporating measures to enhance biodiversity value **Energy Statements** An Energy Statement will be submitted to demonstrate compliance with this policy for new-build residential developments (other than householder applications) and new-build non-residential schemes over 1,000m^2. The Energy Statement will include details as to how the policy will be complied with and monitored. **Carbon reduction in new-build residential developments (other than householder applications):** Planning permission will only be granted for development proposals for new build residential dwellinghouses or 1,000m^2 or more of C2 (including student accommodation), C4 House in Multiple Occupations (HMO) or Sui Generis HMO floorspace which achieve at least a 40% reduction in carbon emissions from a 2013 Building Regulations (or future equivalent legislation) compliant base case. This reduction is to be secured through on-site renewable energy and other low carbon technologies (this would broadly be equivalent to 25% of all energy used) and/ or energy efficiency measures. The requirement will increase from 31 March 2026 to at least a 50% reduction in carbon emissions. After 31 March 2030 planning permission will only be granted for development proposals for new build residential dwelling houses or 1,000m^2 or more of C2 (including student accommodation), C4 HMO or Sui Generis HMO floorspace that are Zero Carbon. **Heat networks** The City Council will encourage the development of city wide heat networks. If a heat network exists in close proximity to a scheme it is expected to connect to it and this will count towards the development's carbon reduction requirements. Evidence will be required to demonstrate why connection to the network is not possible. Water efficiency – residential development: Proposals for new residential developments are to meet the higher water efficiency standards within the 2013 Building Regulations (or

	equivalent future legislation) Part G2 water consumption target of 110 litres per person per day.
	Policy RE 3: Flood risk management Planning permission will not be granted for development in Flood zone 3b except where it is for water-compatible uses or essential infrastructure; or where it is on previously developed land and it will represent an improvement for the existing situation in terms of flood risk. All of the following criteria must be met: a) it will not lead to a net increase in the built footprint of the existing building and where possible lead to a decrease b) it will not lead to a reduction in flood storage (through the use of flood compensation measures) and where possible increase flood storage c) it will not lead to an increased risk of flooding elsewhere d) it will not put any future occupants of the development at risk New development will be directed towards areas of low flood risk (Flood Zone 1). In considering proposals elsewhere, the sequential and exception tests will be applied. Planning applications for development within Flood Zone 2, 3, on sites larger than 1 ha in Flood Zone 1 and, in areas identified as Critical Drainage Areas, must be accompanied by a Site Specific Flood Risk Assessment (FRA) to align with National Policy. The FRA must be undertaken in accordance with up to date flood data, national and local guidance on flooding and consider flooding from all sources. The suitability of developments proposed will be assessed according to the sequential approach and exceptions test as set out in Planning Practice Guidance. Planning permission will only be granted where the FRA demonstrates that: e) the proposed development will not increase flood risk on site or off site f) safe access and egress in the event of a flood can be provided g) details of the necessary mitigation measures to be implemented have been provided Minor householder extensions may be permitted in Flood Zone 3b, as they have a lower risk of increasing flooding. Proposals for this type of development will be assessed on a case by case basis, taking into account the effect on flood risk on and off site.

	Policy RE6: Air quality Planning permission will only be granted where the impact of new development on air quality is mitigated and where exposure to poor air quality is minimised or reduced. The exposure of both current and new occupants to air pollution during the development's operational and construction phases, and the overall negative impact that proposals may cause to the city's air quality, will be considered in determining planning applications. Where additional negative air quality impacts from a new development are identified, mitigation measures will be required to ameliorate these impacts. Sensitive uses including residential development, schools and nurseries should be located away from areas of poor air quality, with site layout designed to reduce impact and with any residual impact mitigated through air quality measures.

Table 2 – Summary of local planning policy requirements

1.3 Policy Interpretation

The Proposed Development will meet the requirements as set out above in the Oxford City Council Local Plan summarised in the following:

- A 40% reduction in CO_2e emissions against Building Regulations 2013
- A 25% reduction in energy use form renewable technologies
- Water use less than 110 litres per person per day
- Mitigate or reduce air quality pollution where possible
- Not developing on Flood Zone 3 areas

It is generally accepted that a 19% improvement over *Building Regulations 2013* is equal to compliance with *Building Regulations 2021.* As such, the Oxford City Council requirement is considered to be circa 20% improvement over current Building Regulations.

Energy

2.0 Energy

2.1 Method

The energy strategy design follows national policy guidance[2] and seeks to be Lean, Clean, Green and Seen, as shown in Figure 3.

Lean
Minimise the overall environmental impact and energy use through energy efficiency measures

Clean
Ensure that energy systems on-site (heat & power) are efficient & produce minimal CO_2e emissions

Green
Implement suitable technologies to provide renewable and emission free energy sources

Seen
Incorporate monitoring through SMART metering and accessible displays

Figure 3 – The Energy Hierarchy

As a residential new build construction, the Proposed Development is assessed under *Building Regulations 2021 Part L Volume 1*. The CO_2e Conversion Factors have been taken from the *Building Regulations 2021 Standard Assessment Methodology (SAP) Guidance*[3] and are outlined below in Table 3. Within the SAP10 modelling, the CO_2e conversion factor for electricity varies over the course of the year due to the changing mix of inputs to the electricity grid, i.e., increased solar PV generation in the summer months, and, as such, the values shown are normalised averages.

Energy Source	CO_2e Conversion Factor ($kgCO_2e/kWh$)
Electricity (mains)	0.136
Electricity (offset)	-0.136
Gas (mains)	0.210

Table 3 - CO_2e conversion factors by energy source

The energy modelling for the Proposed Development has been calculated using SAP10 software in accordance with *Building Regulations 2021 Part L V1*. The Baseline represents the minimum compliance levels in terms of Dwelling Emission Rate (DER), Dwelling Fabric Energy Efficiency (DFEE) and Dwelling Primary Energy Rate (DPER) for the Proposed Development, with all improvements measured from this level. The notional building is the

[2]The London Plan https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan
[3] The Government Standard Assessment Procedure for Energy Rating of Dwellings Version 10.2 (Table 12, Pg 182): https://files.bregroup.com/SAP/SAP%2010.2%20-%2017-12-2021.pdf

exact size and shape of the Proposed Development, but is based on notional U-values and heating specifications outlined in *Approved Document L*.

A total of 3 no. sample units have been modelled to represent how the Proposed Development will perform, this has been used to estimate the site-wide emissions. Table 4 shows the baseline values.

Energy Scenario	Scenario	CO_2e emissions (t/yr)	Fabric Energy Efficiency (kWh/m^2/yr)	Primary Energy Rate (kWh/m2/yr)
Site-wide	Baseline	4.71	38.91	83.80

Table 4 – Baseline CO_2e emissions

2.2 LEAN – Demand Reduction

Through passive and active design measures, the Proposed Development can achieve the following carbon reduction and meet the Fabric Energy Efficiency (FEE) requirements specified *in Building Regulations 2021 Part L* as shown in Table 5 and Table 6.

Energy Scenario	Scenario	CO_2e emissions (t/yr)	Improvement (%)
Site-wide	Baseline	4.71	
	Lean	4.28	9.14

Table 5 – Lean CO_2e emissions and improvement over Baseline.

Energy Scenario	Scenario	Fabric Energy Efficiency (kWh/m^2/yr)	Improvement (%)
Site-wide	Baseline	38.91	
	Lean	38.14	1.96

Table 6 - Lean FEE improvements over Baseline

2.2.1 Passive Design Measures

Passive design measures have been enhanced where possible to maximise building efficiency within the confines of the site and budget requirements. The Proposed Development has been positioned within the site to maximise the usable space, both for the building and the external space.

The design minimises energy use by maximising natural light and positive solar gains with glazing on all elevations provided to all dwellings. Solar gains will be further controlled through the use of low emissivity (low-E) glazing with a lower associated whole unit G-value of 0.40 to balance the positive solar gains in winter with the overheating risk in summer. Natural ventilation will also be provided through openable windows which will provide purge ventilation to the Proposed Development helping balance the overheating risks.

The construction method in the Proposed Development is masonry construction. The building will be very well insulated through all external elements, with a low air infiltration rate and triple-glazed windows. The U-Values will exceed *Building Regulations Part L V1* requirements, with the proposed U-Values summarised within Table 7 and further details outlined in the specification sheet in Appendix B. Thermal bridging will be considered in further detail at the detailed design stage.

Building Element	Proposed (U-Value unless otherwise stated)
External Walls	0.16
Sheltered Wall	0.20
Roof	0.10
Floors	0.13
Windows	1.00 (G-value=0.40)
External Doors	1.20
Air Tightness @ 50 N/m^2	3 m^3/hr/m^2
Thermal Bridge	Independently assessed

Table 7 - Fabric energy efficiencies

The high-quality design of the Proposed Development will reduce the energy demand of the building, lowering its Global Warming Potential (GWP) and reducing the operational cost for the building occupants.

2.2.2 Active Design Measures

The Proposed Development will utilise 100% low energy/light-emitting diode (LED) lighting, in excess of Building Regulation requirements. External lighting, where installed, will also be energy efficient, and will be positioned to avoid excessive light pollution. This will be supported by passive infrared (PIR)/daylight sensor and/or time controls to reduce operation times and subsequent energy use and emissions.

As part of the Lean scenario, high efficiency gas boilers are proposed to provide space heating and domestic hot water (DHW)[4] to demonstrate the passive and active measure improvements over the notional. It should be noted that the boiler is not proposed in the final strategy. The emitters are modelled to be radiators and controlled through time, temperature, and optimum start/stop controls. This will reduce the heat demand and wastage by allowing only specific areas to be heated while occupied.

In modern air-tight buildings, careful consideration needs to be given to the specification of ventilation systems to ensure moisture is removed from the building, ensuring ventilation standards are met and a healthy standard of internal air is maintained.

Mechanical Ventilation with Heat Recovery (MVHR) is proposed for the dwellings to provide continuous air changes with minimal heat loss. MVHR removes the warm, damp air from kitchens and bathroom spaces and passes this over a heat exchanger whereby incoming fresh air is prewarmed and distributed to the occupied spaces within the building. The system will run continuously – meaning that trickle ventilators are not required within the window units – and will be automatically controlled through a humidistat sensor. This will boost ventilation rates when and where needed. A summer bypass is also proposed whereby the heat exchanger is bypassed at times of high temperatures to provide fresh air directly to the habitable rooms. This, in conjunction

[4] The high efficiency gas boiler is proposed for modelling the Lean scenario. This system is not part of the final proposal.

with natural ventilation through window openings, will minimise the risk of overheating during times of high temperatures.

Details of the systems used in the modelling are specified in the specification sheet in Appendix B.

2.2.3 Wastewater heat recovery systems (WWHRS)

Instantaneous shower WWHRS are completely energy neutral and recover some of the heat held in the wastewater from showers. They rely on the wastewater flowing through a counter flow heat exchanger that pre-warms the cold water feed to a shower mixer, heating source or an unvented hot water cylinder. For heat to be recovered, there must be a simultaneous flow of wastewater and cold water through the heat exchanger and hence they can only recover wastewater from a shower and not, for example, a bath.

It is estimated that up to 79% of DHW is used for showering within the home[5]. Currently in the UK, the proposed SAP 10.2 suggests 40-60% depending on house type, but this is based on old data which is being revisited for SAP 11.

Within a well-insulated home, the Coefficient of Performance (COP) for a Heat Pump (HP) can be very high. However, it has been reported that for DHW the COP drops on average to 2.06[6]. With showering being such a large part of this demand, by ensuring that WWHRS is installed as a complementary technology to HPs, a large load reduction can be achieved.

With a WWHRS unit installed, the effective COP of the system (HP and WWHRS) for a 9 litre/min shower could be increased to 4.68 when showering and, if showering is 50% or 70% of total DHW load, this is an overall increase to 3.37 and 3.89 respectively. This is a large reduction to both the individual HP and the wider electric supply infrastructure.

2.2.4 Cooling

The cooling hierarchy has been used to ensure that passive building design has been optimised to reduce the cooling load for the Proposed Development, as shown in Table 8. No active cooling is proposed within the developments.

Cooling Hierarchy	Potential Design Measures
Reducing the amount of heat entering the building in summer	Low-E glass and internal blinds are to be provided to minimize solar gain. All walls are to be well insulated with a high level of air tightness to reduce heat entering the building.
Minimising internal heat generation through energy efficient design	All primary pipework to be insulated, therefore low system losses. High specification hot water cylinder installed with low heat loss. Low energy lighting throughout.

5 Methodology for Ecodesign of Energy-related Products (MEErP) Preparatory Study on Taps and Showers, 2014, p86
6 UK Green Building Council (UKGBC), Building the Case for Net Zero, Sept 2020, p24

Use of thermal mass and high ceilings to manage the heat	Thermal mass is anticipated to be low due to masonry construction method. High ceilings in upper floor rooms with pitched roof insulated at joists.
Passive Ventilation	Openable windows will be provided to all occupied rooms. Cross ventilation where possible.
Mechanical Ventilation	MVHR is proposed with automatic summer bypass.

Table 8 - Design measures following the cooling hierarchy

2.3 CLEAN – Heating Infrastructure

Connection to a district heat network is not currently possible nor proposed in the future as shown in Figure 4. This is therefore this is not currently a viable option for the Proposed Development. Community heating systems that utilise a communal plant to provide heating and Domestic Hot Water (DHW) have been deemed unfeasible for this site as, due to the nature of the systems and the losses associated with distribution of the heat, community heating is only efficient when scaled. Therefore, no further improvement over the Clean scenario has been recorded.

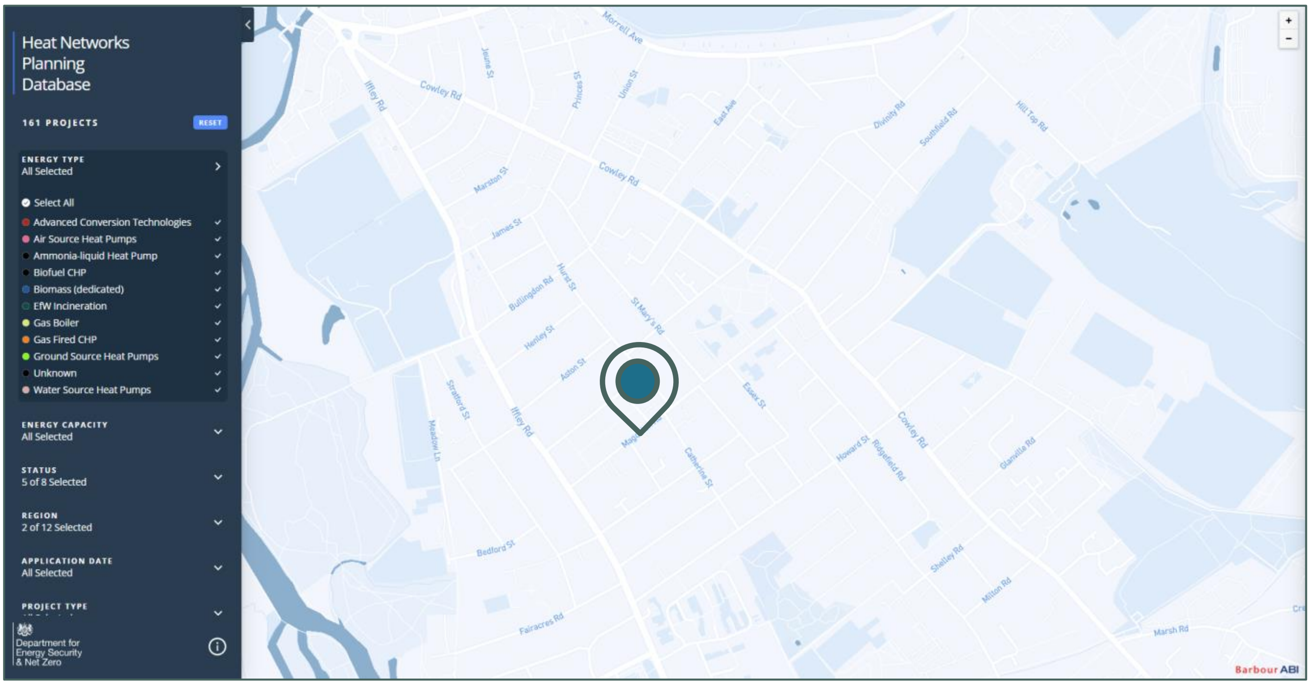


Figure 4 - Heating Networks Planning Database Map

Energy Scenario	Scenario	CO_2e emissions (t/yr)	Improvement (%)
Site-wide	Lean	4.28	
	Clean	4.28	0.00

Table 9 - Clean CO_2e emissions and improvement over Lean

2.4 GREEN – Low Carbon and Renewable Energy

The addition of Green or LZC technologies can provide a significant reduction in CO_2e emissions and enable the Proposed Development to minimise CO_2e emissions. The inclusion of a Hot Water Heat Pump (HWHP) and electric panel heaters will allow the proposed development to reach an overall improvement of 65.74% thus surpassing the desired 40% improvement over *Building Regulations 2013* as required by Oxford City Council.

Appendix C contains a list of unfeasible LZC technologies.

2.4.1 Hot Water Heat Pump (HWHP)

Similar to a traditional HP system, with a HWHP, electricity is consumed in order to generate heating with the caveat being only DHW is generated with HWHP and space heating needs to be supplemented through additional heating methods.

Unlike traditional HP systems, there is no external unit. Instead the HWHP is located on a hot water tank and an exhaust vent is connected to the external environment. The advantage of not having an external unit is that this enables developments with limited surrounding space to still make use of LZC hot water. In addition to this, areas that are particularly sensitive to increases in noise levels are relatively unaffected through this technology. Without an external unit, much less noise is generated compared to an ASHP which often requires the addition of an acoustic enclosure resulting in additional costs and planning.

To address space heating, electric panel heaters have been chosen to supplement the HWHP.

Through the use of high efficiency HWHP and electric panel heaters, the Proposed Development can achieve the following CO_2e (Table 10) and meet the Primary Energy Rate (PER) specified in *Building Regulations 2021 Part L* (Table 11).

Energy Scenario	Scenario	CO_2e emissions (t/yr)	Improvement (%)
Site-wide	Baseline	4.71	
	Green	1.62	65.61

Table 10 - Green CO_2e emissions and improvement over Baseline

Energy Scenario	Scenario	Primary Energy Rate (kWh/m^2/yr)	Improvement (%)
Site-wide	Baseline	83.80	
	Green	56.98	32.01

Table 11 - Building Primary Energy Rate and Improvement over Baseline

2.4.2 Photovoltaics (PV)

PV panels convert energy from daylight into direct (DC) electrical current. These are generally roof-mounted and provide electrical generation which can either be utilised directly on-site (or nearby), stored in batteries, or exported back to the National Grid.

The installation of PV could be used to offset electrical demand within the Proposed Development. The PV array would be connected into the electrical system via an inverter or series of inverters, depending on system size and setup.

PV may been considered at detailed design stage however at this stage PV has not been applied.

2.5 SEEN – In-use monitoring

The Proposed Development will be supplied with Smart Meters and a building energy management system (BEMS) along with associated internal energy displays. This will further improve energy efficiency by allowing building managers/occupants to observe their energy use in 'real time' and manage it more effectively.

2.6 Conclusions

The Proposed Development has considered efficiency at every stage of the design, and as a result will deliver passive and active energy demand reduction measures and LZC technologies to provide robust and long-lasting CO_2e emissions reductions in line with the Oxford City Council planning policies, through:

- Passive and active design measures
- Enhanced thermal bridging
- LED lighting
- MVHR
- WWHR
- All Electric Heating System; Panel Heaters and HWHPs.

The result is a high-performing, energy efficient development that exceeds the Oxford City Council standards by achieving 65.74% reduction in CO_2e emissions over *Building Regulations Part L 2021*. This performance is summarised in Table 12 and Figure 5.

Energy Scenario	Energy Hierarchy Category	Average Unit CO_2e emissions (t/yr)	Improvement (%)	Average Improvement over Baseline (%)
Site-wide	Baseline	4.71		
	Lean	4.28	9.14	9.14
	Clean	4.28	0.00	9.14
	Green	1.62	62.15	65.61

Table 12 - Summary of the site-wide CO_2e emissions, incremental improvement and improvement over Baseline

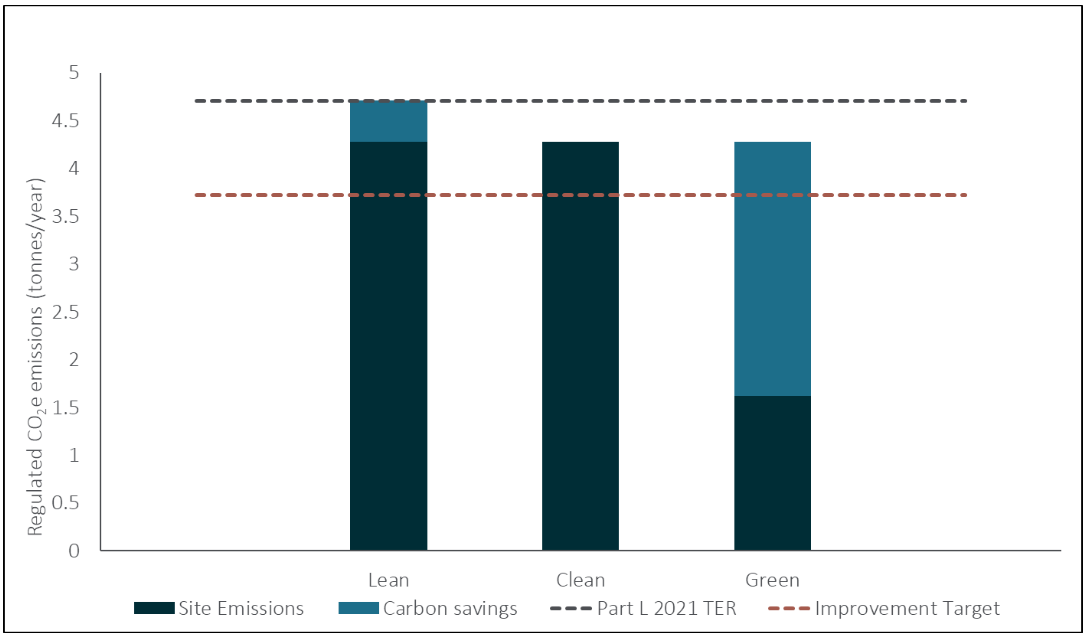


Figure 5 - Summary of regulated CO_2e savings

Sustainability

3.0 Sustainability

Sustainable Development - "meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development: Our Common Future[7]).

The planning system focuses on three objectives to achieve a sustainable development: economic, social, and environmental. These objectives mutually support each other and have been adapted in this statement to meet the objectives of the Oxford City Council. The current local plan prioritises promoting development that makes the best use of resources, increases the sustainability and is adaptable to climate change. Careful considerations have been taken to ensure the Proposed Development meets these expectations.

3.1 Climate Change

Since June 2019, the UK Official Development Assistance (ODA) has aligned with the Paris Agreement and is committed to limiting global warming to 1.5°C in comparison to pre-industrial levels. However, the UK Met Office estimates this level will be exceeded within the next 5 years.

The UK built environment is one of the largest contributors to greenhouse gas emissions (GHG), contributing approximately 42% to the total share of UK emissions according to the UK Green Building Council[8]. This includes emissions produced during the manufacturing of building materials, the construction of infrastructure as well as emissions associated with the transportation of workers and materials.

The *Oxford City Council Local Plan* emphasises a commitment to addressing the causes of climate change and encourages new development to minimise energy use - moving toward zero carbon development, prevent overheating, minimise waste and meet minimum requirements for water efficiency. Considerations have been made in the design and layout of the Proposed Development to ensure that it addresses these priorities. These include ensuring the layout of the Proposed Development maximises natural lighting, passive solar heating, ensuring the units are thoroughly insulated and have effective ventilation. As well as building fabric and structural considerations, technological factors such as, considering renewable energy technologies for inclusion in the development, selecting built-in appliances with energy efficiency in mind have been included. The installation of MVHR in dwellings along with the inclusion of HWHPs will reduce the energy demand for heating and cooling in the Proposed Development.

3.2 Pollution

3.2.1 Air

The Proposed Development is located within an Air Quality Management Area (AQMA), however it is not located in an area of special consideration as seen in Figure 6. The Proposed Development will aim to further limit its contribution to local air pollution by not installing a gas boiler. Instead the Proposed Development will install electric panel heaters and HWHP to provide space heating and DHW. Figure 7 shows that the Proposed Development is in an area of low nitrogen oxides (NO_x). Despite this, the Proposed Development will still aim to minimise NO_x. The panel heaters and HWHP will emit no on-site NO_x emissions, but consume grid electricity. As the NO_x emissions resulting from the production of electricity decreases at the national scale, the resulting theoretical emissions from the Proposed Development will also decrease. Figure 7 shows the UK Air Pollution from NO_x in the area of the Proposed Development.

[7] https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf
[8] https://www.ukgbc.org/climate-change-2/

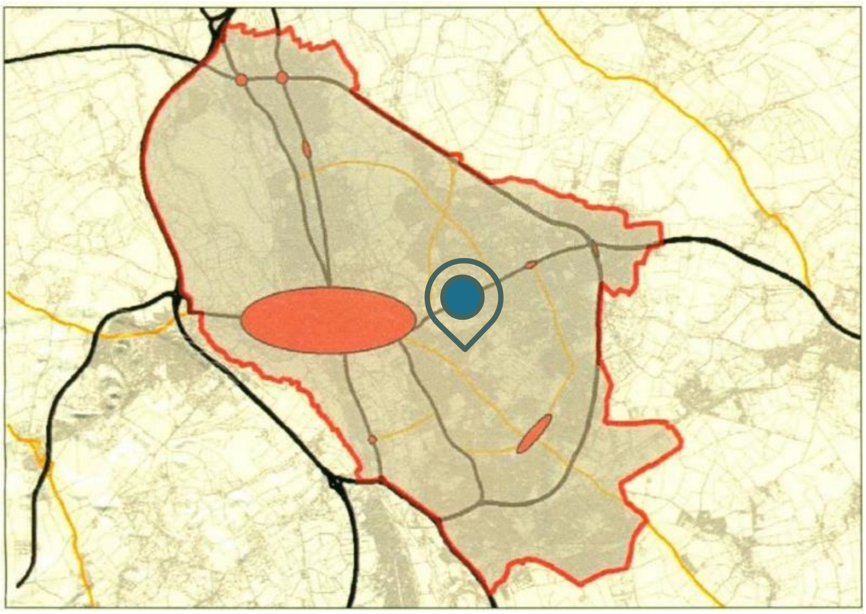


Figure 6 - Oxford AQMA with areas of concern in red (https://uk-air.defra.gov.uk/aqma/details?aqma_ref=666)

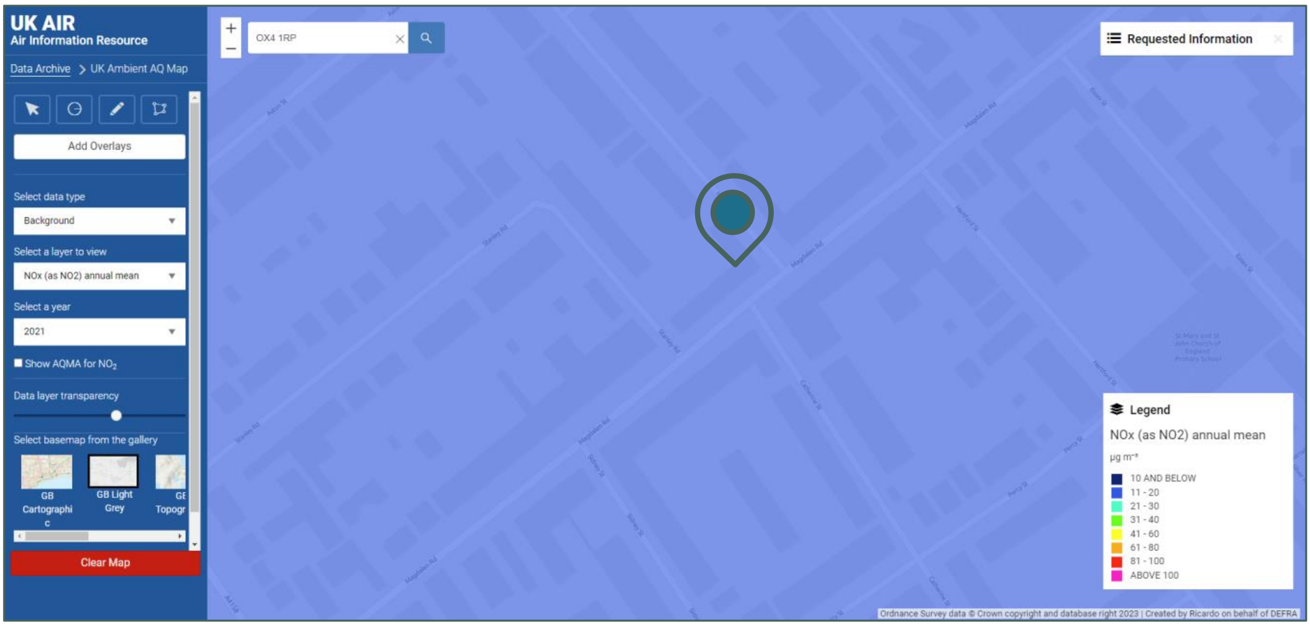


Figure 7 - UK Air Pollution Map showing pollution from NO_x as NO_2 (https://uk-air.defra.gov.uk/data/gis-mapping/)

The installation of MVHR will help maintain air quality within the buildings and further measures such as the careful placement of equipment and the selection of finishings and furnishings with minimal associated Volatile Organic Compounds (VOCs) emissions will also be instigated.

Air pollution will be reduced as much as practicable during construction and new materials will be sourced locally where possible to reduce air pollution associated with the transport of materials. Dust management will also be extremely important for controlling air quality on-site during construction and mitigation measures such as water suppression to damp down dust will be implemented where necessary. Figure 8 shows the UK Air Pollution from particulate matter 10 micrometres (PM10) in the area of the Proposed Development.

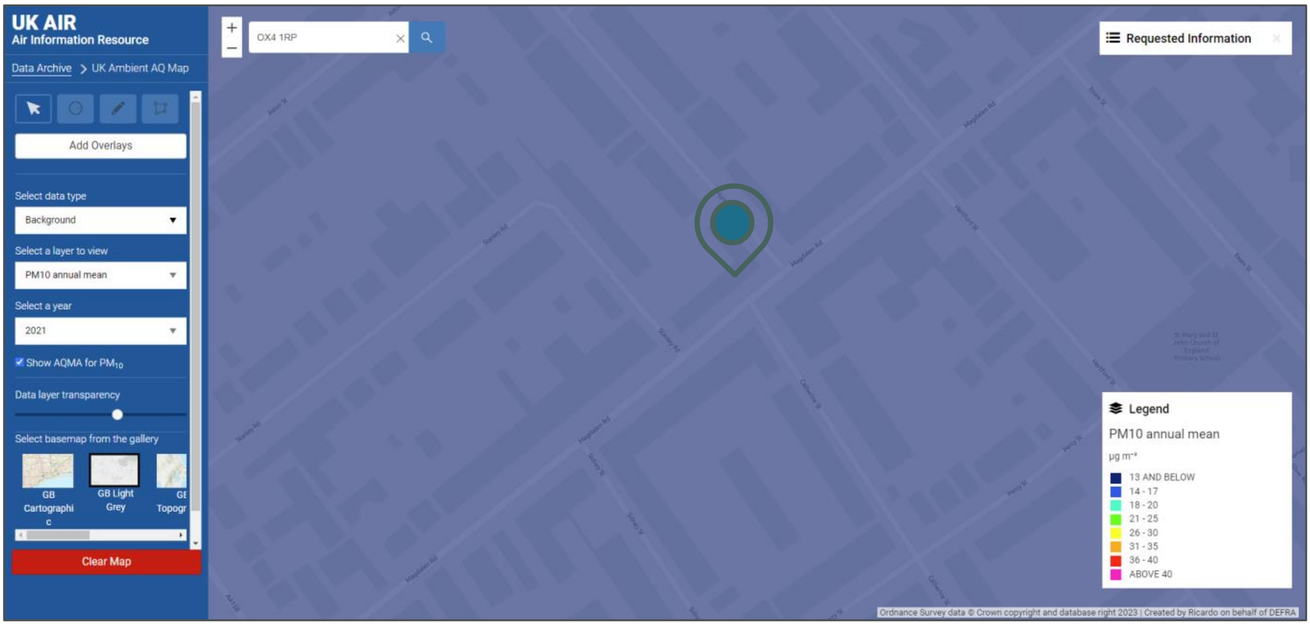


Figure 8 - UK Air Pollution Map showing pollution from PM10 (https://uk-air.defra.gov.uk/data/gis-mapping/)

3.2.2 Noise and Vibration

During its operational phase, the Proposed Development will be highly insulated with excellent airtightness. This will limit any noise pollution originating from inside the building and reduce the impact of external noise pollution on building occupants.

During the construction phase, quiet equipment and machinery will be deployed wherever possible and monitored to ensure that its quality does not deteriorate. Additional measures including acoustic screening will be implemented if necessary. Construction traffic can also contribute to increased levels of noise pollution. Vehicles travelling to the site will be managed with this in mind, along with working hours and activities conducted on-site.

3.2.3 Light

The design and layout of the site for practical use has been considered while trying to maximise internal daylight levels. All occupied rooms will have glazing to provide natural daylight, and light-coloured curtains or roller blinds will be provided to enable glare control and privacy.

Light pollution will be further minimised where possible through the careful specification and positioning of external lighting around the Proposed Development. Only the only the minimum necessary for security, safety, working or recreational purposes will be used to minimise the potential pollution from glare or spillage. All lighting for external space will be provided through low energy fittings and daylight controls, with security lighting being PIR and daylight/timer controlled. This will avoid negative impacts on the surrounding area and its wildlife.

3.3 Flood Risk

The Proposed Development is located in an area of very low flood risk from rivers and seas as shown in Figure 9. In addition to this, the Proposed Development is at a very low risk of flooding from surface run off as per Figure 10.

As the Proposed Development is located within Flood Zone 1 no further consideration has been made to reduce flood risk.

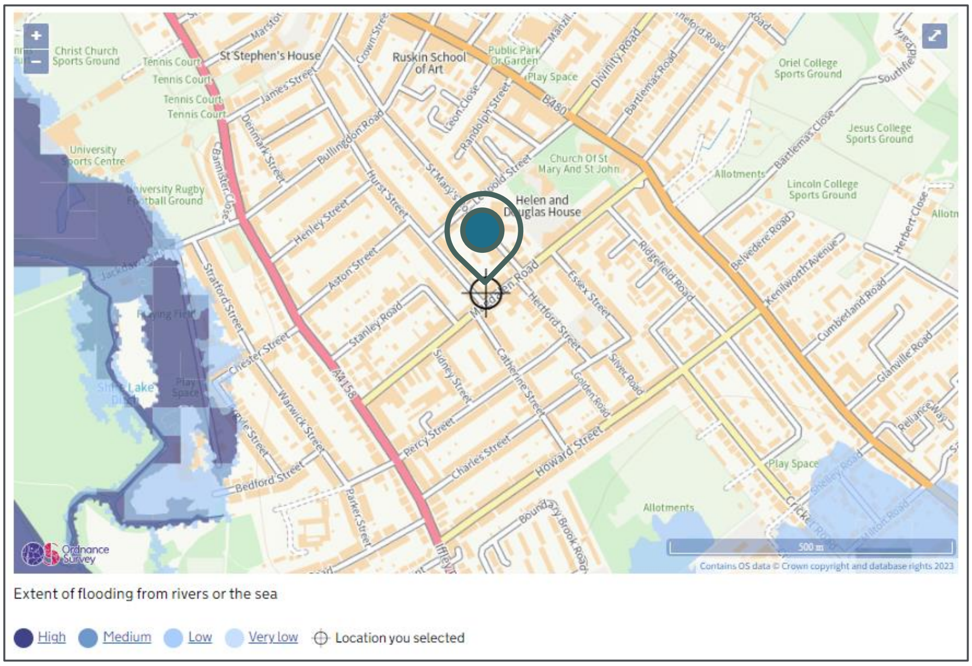


Figure 9 - Flood map showing risk of flooding from rivers or the sea

(https://flood-warning-information.service.gov.uk/long-term-flood-risk/map)

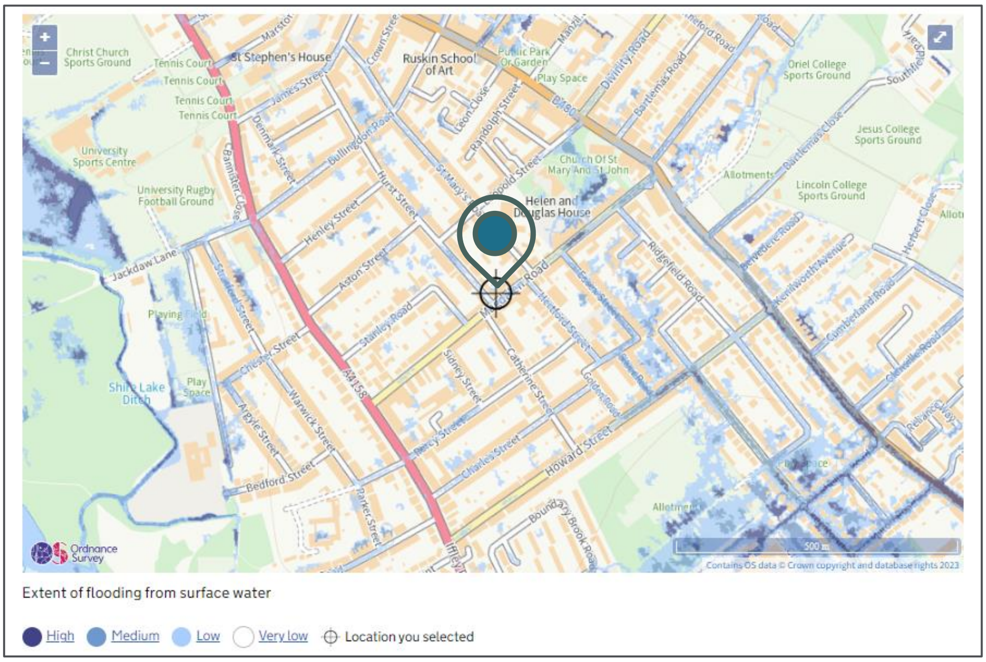


Figure 10 - Flood map showing risk of flooding from surface water (https://flood-warning-information.service.gov.uk/long-term-flood-risk/map)

3.4 Transport

Sustainable Transport – "Any efficient, safe and accessible means of transport with overall low impact on the environment, including walking and cycling, ultra-low and zero emission vehicles, car sharing and public transport." (National Planning Policy Framework 2021[9]).

3.4.2 Public Transport

The Proposed Development is located 0.3 miles from the Magdalen Road East and West bus stops, allowing easy access to the local Oxford area. In addition to this the Oxford Train Station is located 2 miles from the site, providing public transport between Oxford and London.

3.4.3 Parking & Electric Vehicle (EV) Charging

The Proposed Development will be a car free development and thus no consideration has been made for parking or EV charging spaces.

3.4.4 Cycle Storage

The Proposed Development will implement cycle storage facilities for all dwellings with there being a total of 16 covered and lockable cycle storage spaces for occupants with there being a further 2 spaces for visitors or larger cargo bikes.

3.5 Biodiversity

Biodiversity is defined as the variety of life forms within an ecosystem and their interactions, up to the global scale. The construction process disrupts flora and fauna, potentially leading to a loss of biodiversity. It is therefore important to protect and enhance biodiversity onsite wherever possible both during and post construction.

The Proposed Development will aim to reduce the negative effects on biodiversity by developing on a brownfields site. Further to this there will be a green blue roof over a single storey elements will improve the biodiversity of the site when compared with the existing.

3.6 Resource Efficiency

3.6.1 Construction Phase Waste Management

The Proposed Development will aim to minimise the waste produced from the site during the construction phase through a mix of site policies and effective and efficient design and construction processes.

A comprehensive Construction Environmental Management Plan (CEMP) will be implemented from the outset of site works and will follow the principles of the waste hierarchy. Targets have been set in relation to volume of construction waste and diversion from landfill, with performance monitored by the Contractor to ensure exceedance of these levels is achieved.

[9] https://www.gov.uk/government/publications/national-planning-policy-framework--2

The construction waste generated as part of the redevelopment will be segregated and monitored as per best practice, with suitable materials being recycled as part of this process, either to be reused on site or introduced back into the supply chain through recycling by a Licensed Contractor, therefore minimising the amount of waste being disposed of to landfill.

Reusing materials on site will reduce the embodied CO_2e (ECO_2e) of the development by eliminating the emissions arising during the cradle to gate (A1-A3) stages of the manufacture of new materials. Transportation of new material to the site will be reduced, reducing the CO_2e emissions associated with transportation during stage A4 of the Proposed Developments lifecycle.

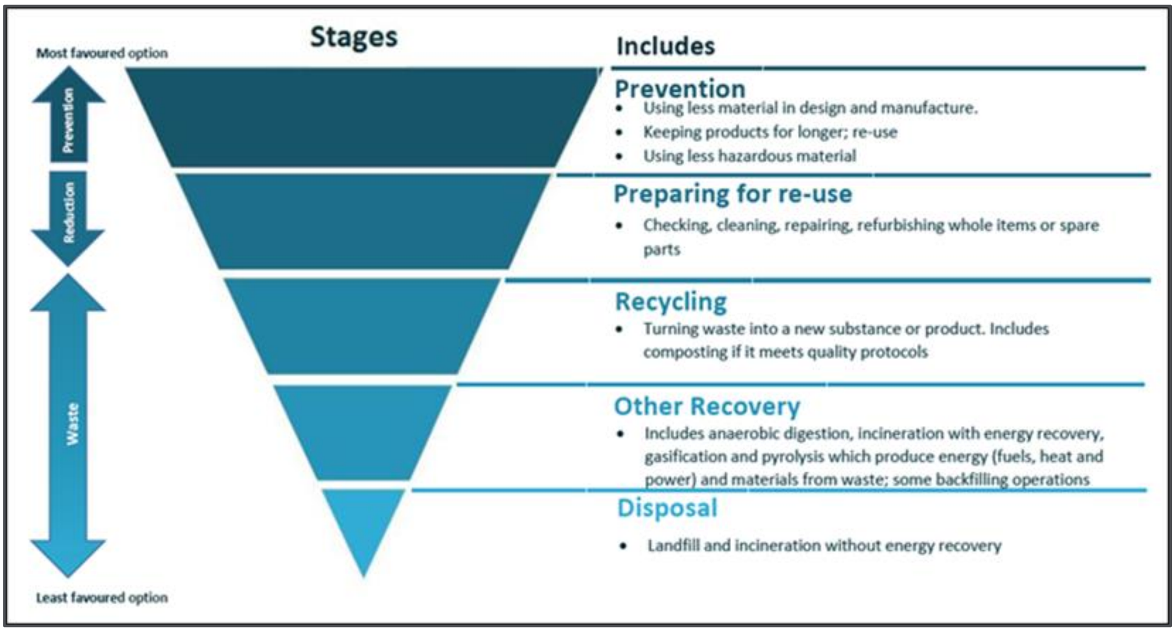


Figure 11 - The waste hierarchy

Where waste will need to be disposed of, this will be done in line with the Government's Waste Hierarchy, shown in Figure 11. As much waste as possible should be recycled, and the remainder should be dealt with through a specialist waste recycling contractor. Construction waste should not be sent to landfill or for incineration unless this is unavoidable due to the nature of the materials found on the existing site.

3.6.2 Resource Management

Policies will be put in place for management of site impacts such as air and water pollution in line with industry best practice. Monitoring and reporting on CO_2e emissions and water use from site related activities will take place in line with national benchmarks.

The Proposed Development will incorporate safe and accessible space to store and then present waste for collection.

3.6.3 Embodied Materials

The Zinc used in the roof will be fully recyclable thus reducing the overall whole life-cycle waste and associated CO_2e

All timber and timber-based products used on-site will be legally sourced from a reputable forest certification scheme, such as Forest Stewardship Council (FSC) with appropriate Chain of Custody certification to confirm this.

Where concrete is to be specified, it is worth noting that the UK concrete *Standards BS 8500 (Part 1 and Part 2)* are currently being updated and new ternary blend cements utilising limestone powder will be available. Compared to a standard CEM I mix design, they offer up to a 65% reduction in ECO_2e per cubic metre of concrete delivered to site.

The construction product manufacturers are continuing to innovate as the importance of ECO_2e becomes more recognised and several innovative low carbon materials are available. Alkali activated cementitious materials (AACMs) are increasingly being used to lower the ECO_2e of concrete by replacing the CEM I cementitious based binder systems in cast-in-situ and precast concrete units. Their use is now also extending into screeds, mortars, bricks and blocks. AACMs have the potential to lower the ECO_2e of the concrete by up to 95%.

Offsite steel construction technologies can improve the final quality of the building and its speed of construction. Steel is also a lightweight construction system which minimises loads on the foundations, and therefore saves on sub-structure costs, which can be important on ‘brownfield’ or infill sites or for building extensions.

Where steel is to be specified, it is worth noting that steel is predominantly manufactured by either of two process routes, namely the primary or basic oxygen steel-making route (BF-BOF) and the secondary, electric arc furnace (EAF) route. Typically, the EAF steel-making process has an ECO_2e of around 20% that of BF-BOF steelmaking and also utilises up to 100% recycled content, compared to BF-BOF, which incorporates up to 30% recycled content. Specifying EAF steel will significantly lower the ECO_2e of the development and increase the recycled material being used on site, supporting our transition to a circular economy. In addition to this where for the straight beams, recycled steel will be used.

All other materials sourced from suppliers who have an accredited Environmental Management System (EMS) certified through *ISO 14001* or the Eco-Management and Audit Scheme (EMAS) ensuring that any environmental impacts caused are managed and reduced. *BES 6001* certification should also be considered to ensure products have been made with constituent materials that have been responsibly sourced.

As standard industry best-practice, all insulation on the site will have a GWP of <5. Other ozone depletion materials will be avoided where feasible, including high VOC content paints and sealants, further minimising the Proposed Development’s effect on global Climate Change.

3.6.4 Water

Southeast England has been declared an area of ‘*serious water stress*’ by the Environment Agency[10]. Water is a vital resource and also has an associated CO_2e footprint with 0.344 $kgCO_2e/m^3$ [11] arising for mains water and efficient usage should be encouraged in all new buildings.

The Proposed Development therefore aims to significantly reduce mains water use through a combination of efficiency measures. These should include the use of fittings with a low capacity or flow restrictors.

Internal water use will be reduced in line with enhanced water standards in *Building Regulations Part G* with all residential dwellings achieving 110 l/person/day (including 5l/person/day external water use).

[10] https://www.gov.uk/government/publications/water-stressed-areas-2021-classification
[11] UK Government conversion factors for greenhouse gas reporting

3.7 Sustainability Conclusions

Careful considerations regarding sustainable design and construction have been made for the Proposed Development. These considerations have considered the impacts of climate change, looking to utilise natural ventilation and provide accommodation away from potential flood risk and will result in measures to reduce CO_2e emissions during its whole life cycle, through the application of a highly efficient energy strategy on-site.

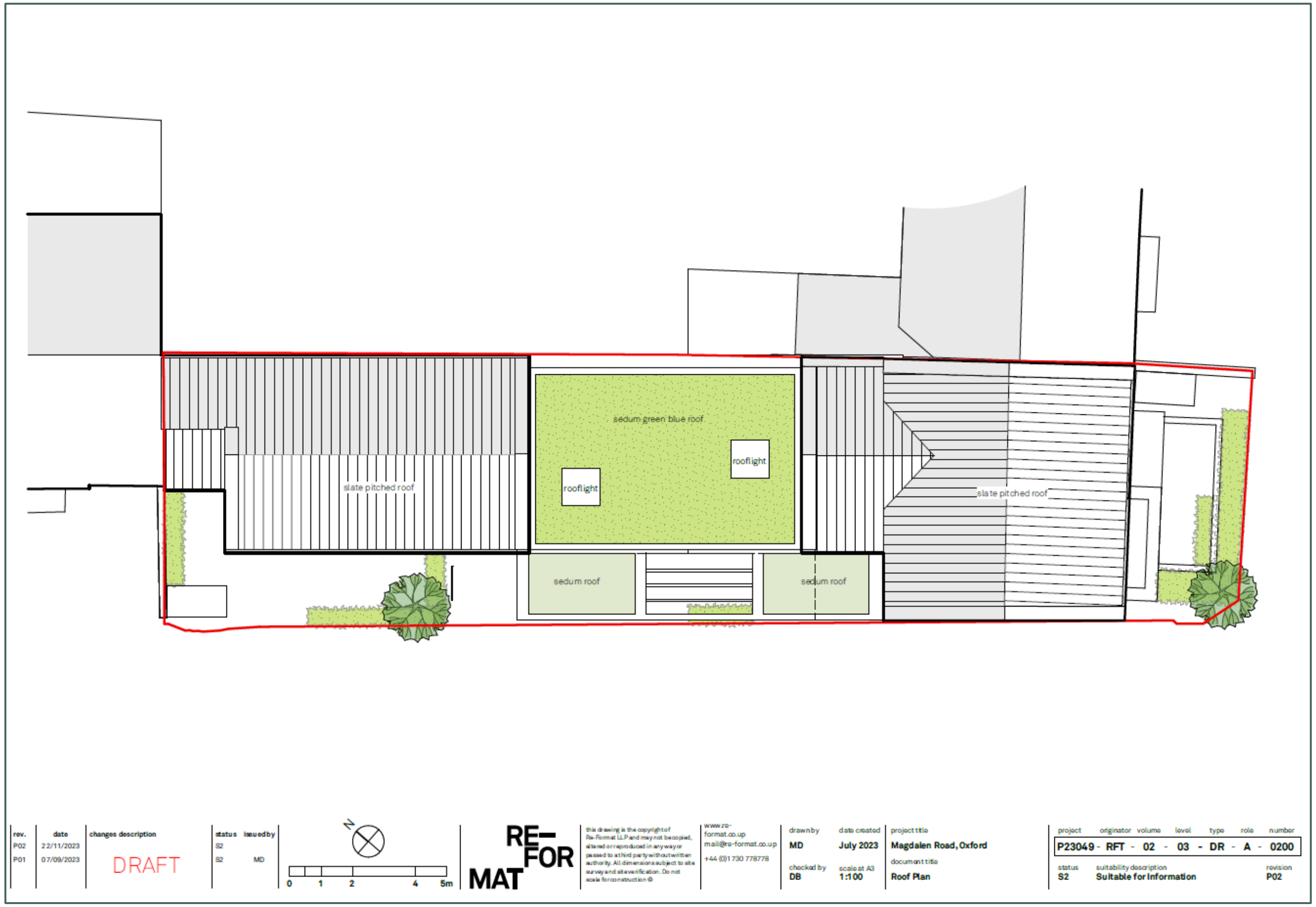
Low impact materials such as either repurposed steel sections or electric arc furnace (EAF) produced steel will be used where possible, with the incorporation of strong environmental design and rigorous site management policies and procedures, to ensure excellent airtightness and thermal insulation continuity. The Proposed Development will ensure that its impacts locally and globally are minimised as far as practicable during construction and operation.

Low pollutant emitting technologies will be used for space heating and DHW to limit the impact on the local air quality.

Through a considered approach to sustainability in the early design stages, the Proposed Development has aimed to reduce its impact on the environment at both construction and operational stages and will provide a sustainable addition to development on 27 Magdalen Road.

Appendices

Appendix A – Site Plans (RE-Format LLP)



Appendix B – SAP Specification Sheet

Magdalen Road, Oxford

BRegs L V1 2021

Rev

Option	External Wall	Sheltered Wall	Pitched Roof (Joists)	Flat Roof	Ground Floor	Windows & Glazed Doors	Composite Door	Main Heating	Heat Emitters	HW Cylinder	Renewables (PV)	Diverter	WWHR	Mechanical Ventilation	Air- Permeability	DER v TER improvement	DFEE vs TFEE improvement	DPER vs TPER improvement
Type	U Value	U Value	U Value	U Value	U Value	U Value	U Value	Make	Type	(litres)	(kWp)	Y/N	Y/N	Type	$m^3/hr/m^2$	%	%	%
Sample Units	0.16	0.20	0.10	0.10	0.13	1.00	1.20	Panel Heater + Edel Dimplex	Radiators	210.00	-	-	Y	MVHR	3.00	65.61	1.96	32.01

Element	U Values	Description
External Wall (Masonry outer)	**0.16**	102.5mm Brick outer leaf, 25mm Air gap, 120mm Kingspan K108 - or equiv (0.019 W/mK), plastic wall ties, 100mm concrete blockwork, 12.5mm plasterboard
Ground Wall (Concrete outer)	**0.16**	100mm concrete outer leaf, 25mm Air gap, 120mm Kingspan K108 - or equiv (0.019 W/mK), plastic wall ties, 100mm concrete blockwork, 12.5mm plasterboard
Sheltered Wall	**0.20**	12.5mm plasterboard, 100mm concrete, 190mm Mineral Wool Quilt - or equiv (0.04 W/mK), 100mm concrete blockwork, 12.5mm plasterboard
Pitched Roof (Insulation at Joists)	**0.10**	Zinc façade, well ventilated air space + timber battens, 100mm Kingspan K107 - or equiv (0.019 W/mK), 100mm Kingspan K107 - or equiv (0.019 W/mK) + timber battens, plasterboard
Flat Roof	**0.10**	Green Roof Structure, Vapour Control Layer, 220mm Ridgid Roof Board (0.022 W/mK), 100mm Beam and Block, 25mm Services Space on Timber Battens, 12.5mm Plasterboard
Ground Floor	**0.13**	65mm Screed, 110mm Kingspan K110 - or equiv (0.019 W/mK), 200mm beam and block concrete
Party Walls	**0.00**	Plasterboard, concrete blockwork, cavity, concrete blockwork, plasterboard
Internal Walls	**0.00**	Timber frame with plaster either side
Windows and Glazed Doors	**1.00**	Triple Glazed windows with a G-value of 0.4
Doors	**1.20**	Solid Door
Construction Details (PSI values)	-	Notional Psi Values used - Thermal Bridges to be independantly assessed at detailed design stage
Main Heating	-	Space Heating - Electric Panel Heaters, Hotwater Heating - Edel Dimplex
Controls	-	Programmer and appliance thermostats
HW Cylinder	-	210L, 1.6 kWh heat loss
Secondary Heating	-	n/a
Mechanical Ventilation	-	Balanaced MVHR (Modelled as Titon HRV4 Q Plus Eco), SFP 0.42, Efficiency 91%
Pressure Test Method	-	3 m3/hr/m2
Lighting	-	10W light fittings with a capcity of 1000lm
Electrical Tariff	-	Standard Electrcity Tariff
Cold Water Supply	-	Mains water supply
Shower Type	-	Unvented Shower connected the to WWHR - 9l/min
Waste Water Heat Recovery	-	Baxi Assure or equiv
Renewables	-	-
Battery Storage	-	-
Notes		-

Sign Off of details	Name	**PP M Maclean**	Date	**05.12.2023**	Client Sign Off	Name		Date	
	Sign	**(on behalf of SRE)**				Sign			

Appendix C – Unfeasible Low and Zero Carbon Technologies

Biomass Boiler

Biomass boilers generate heat from the burning of renewable or 'waste' fuels. They require a regular feed of fuel and regular heat demand to operate efficiently. A flue taller than the surrounding buildings must be incorporated into the design to minimise air pollution impacts at ground level from particulate emissions.

The use of a biomass boiler system to supply space heating and DHW has been deemed unsuitable due to the high level of particulates emitted from their use. The use of such a system would negatively impact the air quality of the surrounding area and furthermore, could impact the usability of the roof terrace amenity.

Wind Power

Wind power is a developed and productive method of renewable energy generation, however the main limiting factor to its implementation is opposition at a local public and local government level.

To generate a meaningful amount of electricity, large-scale turbines are required which have noise and the visual impacts for the local area. The use of wind turbines has therefore been deemed unsuitable.

Solar Water Heating

Solar Water Heating (SWH) can be used to offset a proportion of the DHW within a building.

However, due to the low DHW demand at the Proposed Development it is likely to provide minimal CO_2e emissions reductions, while takin up roof-space, better utilised for photovoltaics.

Ground Source Heat Pump

As with ASHPs, ground source heat pump (GSHP) systems consume electricity in order to operate.

Beyond 1m below ground level, an average temperature of 15^{o}C is maintained throughout the year. Because of the ground's high thermal mass, it stores heat from the sun during the summer. GSHP can transfer this heat from the ground into a building to provide space heating by a similar process to an air source system.

It is recommended that the ground conditions of the site be assessed in detail (through consultation with a GSHP manufacturer and/or purchase of a Ground Conditions report from the British Geological Survey) before a system is installed – the primary heat source that GSHP relies on is solar derived, and shading can affect the 're-charge' of the ground within which the ground loop is laid. This can affect year-on-year CoPs, steadily increasing running costs and reducing CO_2e offset.

Although GSHP can provide a greater efficiency performance than ASHP, it comes at a significantly higher capital cost, due to the extensive groundworks needed to install either 'slinky' ground loops or 50-100m deep boreholes.

The significantly higher capital costs of installing a GSHP system, it is not considered to be financially viable for the scheme. Alternative additional technologies will be considered for inclusion within the energy strategy at the site.

Air Source Heat Pumps (ASHPs)

HP systems consume electricity to operate – the CoP of the system is the ratio of electrical energy consumed, to heat energy emitted. Generally, a CoP of 3 or 4 can be achieved, meaning 3 or 4 units of thermal energy are produced for each unit of electricity consumed.

HPs will only deliver low grade heat (up to circa 50°C) efficiently, and therefore HP systems alone are generally relatively inefficient in providing hot water, as this requires additional electrical input (immersion or increased compressor use). It is also important to note that the flow temperatures for ASHP systems is typically <45°C which is lower than that of a gas boiler system, and therefore these generally perform better with underfloor heating or when radiators are over-sized. The use of an individual air source heat pump system has been proposed as a Green LZC technology to provide space heating and hot water via an air-to-water heat pump system. ASHPs efficiently extract energy from the external air and transfer it to internal air/water for heating.

Due to the limited space around the site, the use of the ASHP has been discounted due to the use of the Hot Water Heat Pump.

SRE Registered Office | Greenforde Farm
Stoner Hill Road | Froxfield
Petersfield | Hampshire | GU32 1DY
01730 710044
info@sre.co.uk
www.sre.co.uk