



**Ashflame Properties Ltd**

# **Land East of the Calne Road, Lyneham, Wiltshire**

Embodied Carbon Report

3040956-1(1)



## RSK GENERAL NOTES

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**Author:** Bethany Downes

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Senior Consultant

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*B Downes*

---

**Date:** 19/11/2025

**Technical Reviewer:** Jamie Blunden

---

Principal Consultant

---

*J Blunden*

---

**Date:** 19/11/2025

**Quality Reviewer:** Andy Greenall

---

Director

---

*A Greenall*

---

**Date:** 21/11/2025

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# 1 INTRODUCTION

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## 1.1 Purpose of assessment

The purpose of this assessment is to quantify the upfront embodied carbon emissions (Modules A1 – A5) associated with construction of the proposed development and to demonstrate how the proposal aligns with national and local planning policy objectives on climate change and sustainable construction. These modules cover the extraction and production of construction materials (A1–A3), their transport to site (A4), and the construction/installation process (A5). In-use (B modules) and end-of-life (C modules) emissions are excluded from this outline assessment.

Early optioneering provides an understanding of the scale of embodied carbon emissions associated with key building elements, allowing for identification of carbon hotspots within the design and to explore opportunities to reduce emissions through intelligent design, material selection and an efficient construction approach.

## 1.2 Project description

The key project information is outlined in Table 1.1 below. The development proposals include an outline planning application for up to 200 residential dwellings (Use Class C3), provision of public open space, and associated infrastructure on land east of the Calne Road, Lyneham.

It has been assumed for the purposes of this assessment that the proposed dwellings comprise 4-bed, two-storey houses with a Gross Internal Area (GIA) of 97 m<sup>2</sup>, in line with the minimum national space standards<sup>1</sup>. These assumptions have been applied consistently across the model to establish a representative baseline for embodied-carbon calculations.

**Table 1.1: Project information**

| Category              | Data               |
|-----------------------|--------------------|
| Building Address      | Lyneham, Wiltshire |
| Development type      | Residential        |
| GIA (m <sup>2</sup> ) | 19,400             |
| Number of Dwellings   | 200                |
| Project Stage         | Outline planning   |
| Software Used         | One Click LCA Tool |

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<sup>1</sup> [Minimum Space Standards for New Homes \[2025 Update\] - Urbanist Architecture - Small Architecture Company London](#)

## 1.3 Policy Context

This assessment aligns to the following national and local planning policy objectives:

- *National Planning Policy Framework* (NPPF, 2023 draft update)
- *UK Net Zero Strategy* (BEIS, 2021)
- *Building Regulations* (Future Homes Standard, 2025)
- *Net Zero Whole Life Carbon Roadmap* (UKGBC 2021)
- *Wiltshire Core Strategy* (Wiltshire Council, 2015)
- *Draft Wiltshire Local Plan* (Wiltshire Council, 2023)
- *Lyneham and Bradenstoke Neighbourhood Development Plan* (Wiltshire Council, 2021)

### 1.3.1 NPPF

The assessment responds to the National Planning Policy Framework, which requires planning decisions to support the transition to a low-carbon future (paragraph 156), including reduction of GHG emissions through design and construction.

### 1.3.2 UK Net Zero Strategy (2021) & Future Homes Standard (2025)

The UK Government's Net Zero Strategy and the forthcoming Future Homes Standard together emphasise reducing both operational and embodied carbon in the built environment.

### 1.3.3 Net Zero Whole Life Carbon Roadmap (UKGBC 2021)

Provides a national trajectory toward net-zero embodied carbon in the construction industry by 2050.

### 1.3.4 Wiltshire Core Strategy (2015)

The Wiltshire Core Strategy (2015) forms part of the adopted Development Plan. Core Policy 41 (Sustainable Construction and Low Carbon Energy) encourages development to reduce greenhouse gas emissions and support the transition to a low-carbon future.

### 1.3.5 Draft Wiltshire Local Plan

The emerging Wiltshire Local Plan places greater emphasis on climate mitigation and the reduction of carbon emissions across all stages of development.

### 1.3.6 Lyneham and Bradenstoke Neighbourhood Development Plan (2020 – 2030)

The Lyneham & Bradenstoke Neighbourhood Development Plan forms part of the adopted Development Plan and supports high-quality, sustainable development that reflects local character and uses appropriate materials.

## 1.4 Industry guidance and benchmarks

This assessment has been undertaken in accordance with:

- **BS EN 15978:2011** – Sustainability of Construction Works: Assessment of Environmental Performance of Buildings
- **RICS Whole Life Carbon Assessment for the Built Environment (2023)** – Professional Statement
- **LETI Embodied Carbon Primer (2020)** – Benchmark Targets
- **LETI Climate Emergency Design Guide** – Building design guidance and benchmark targets
- **RIBA and Industry Targets** - The RIBA 2030 Climate Challenge
- **PAS 2080:2023 Carbon Management In Infrastructure**

### 1.4.1 RICS 2023

RICS Whole Life Carbon Assessment for the Built Environment provides key guidance for undertaking whole life carbon assessments within the built environment. The guidance outlines a methodology for calculating emissions, including assessment scope, data sources and dealing with uncertainty, for example. This assessment has been undertaken in line with RICS methodology, and assesses emissions using the RICS modular structure.

### 1.4.2 LETI Embodied Carbon Primer

The LETI Embodied Carbon Primer (2020) is a widely cited guidance document. It defines best-practice targets and “business-as-usual” benchmarks for different building types. LETI specifically includes housing archetypes (small-scale residential up to 3 storeys) and provides target values for upfront embodied carbon (product & construction stages A1–A5) for new homes. LETI’s guidance calls for reducing upfront embodied carbon for residential buildings to ~625–800 kgCO<sub>2</sub>e/m<sup>2</sup> by 2025 and ≤300 kgCO<sub>2</sub>e/m<sup>2</sup> by 2030 (50% reduction).

### 1.4.3 LETI Climate Emergency Design Guide

LETI’s Climate Emergency Design Guide (LETI, 2020) outlines how to design buildings in line with a net zero future. The guide focuses on four key building archetypes – small and medium housing, schools and commercial offices. In tandem, they represent 75% of new buildings likely to be constructed between now and up to 2050. The guidance also includes a number of aspirational carbon benchmarks, incorporating RICS life cycle stages for each of the key building types. These benchmarks can be used to understand whole life carbon performance, and have therefore been applied in this assessment.

### 1.4.4 RIBA and Industry Targets

The Royal Institute of British Architects (RIBA) has set out a 2030 Climate Challenge embodied carbon target for new-build housing of ≤625 kgCO<sub>2</sub>e/m<sup>2</sup> by 2025 and ≤300 kgCO<sub>2</sub>e/m<sup>2</sup> by 2030, outlining a very ambitious goal requiring substantial material efficiency and low-carbon design.

## 2 METHODOLOGY

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The embodied carbon assessment has been prepared in accordance with the RICS Whole Life Carbon Assessment for the Built Environment (2nd Edition, 2023), which aligns with the European standard BS EN 15978:2011 for the assessment of environmental performance of buildings.

### 2.1 Software and data sources

This assessment was undertaken using One Click LCA, an industry-recognised whole life carbon assessment platform. One Click LCA follows the principles of EN 15978 and is aligned with the RICS Whole Life Carbon Assessment for the Built Environment methodology (BSI, 2011). One Click LCA applies a stage-appropriate data quality rating and an uncertainty uplift at concept stage to account for missing data and benchmarking assumptions, ensuring conservative reporting.

The model was populated using generic material quantities estimated from outline design information, typical housing typologies and benchmarks. EPDs were not available, data was sourced from ICE Database v3.0 for embodied carbon factors and default values provided by One Click LCA.

## 2.2 Scope

This assessment has been undertaken using the RICS modular structure as displayed in Figure 1.1.

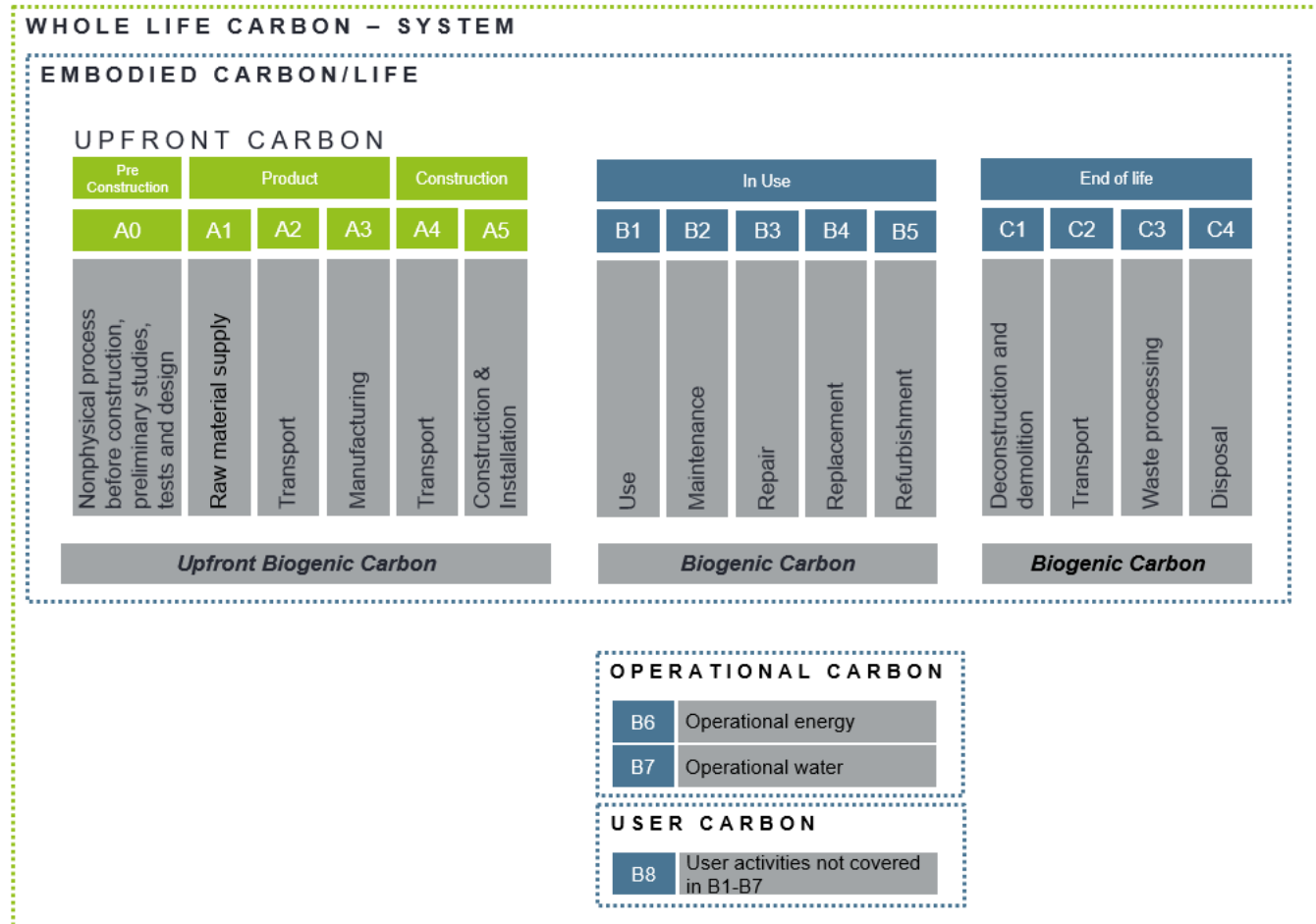


Figure 2.1 RICS Modular Structure

An overview of the modules are outlined below:

- **A1-3 Product Stage:** this category includes the embodied carbon emissions of materials used to construct the development. It includes the emissions associated with raw material extraction, transport to manufacturing site and manufacturing emissions.
- **A4 Transport:** this comprises the emissions associated with the transport of materials from the manufacturing site to the construction site.
- **A5 Construction and Installation:** this source includes 4 sub-categories which include emissions from pre-construction demolition (if applicable) (A5.1), construction activities (such as equipment fuel use) (A5.2), material wastage (A5.3) and construction worker transport (A5.4).
- **B1 In-use emissions:** emissions associated with refrigerant gas leaks (if applicable) and emission release from products or reabsorption into products (such as sequestration from timber).
- **B2-5 Maintenance, Repair, Replacement and Refurbishment:** this includes emissions associated with routine maintenance (B2), repair (B3), replacement of materials (B4) and any planned refurbishment (B5).
- **B6 Operational Energy:** energy used during the operation of the asset.
- **B7 Operational Water:** water used during the operation of the asset.
- **B8 User activities not covered in B1-7:** emissions may include transport of persons to and from the asset during operation, for example.
- **C1-4 End of Life:** this category includes deconstruction and demolition emissions (C1), transport of waste materials from the site to disposal centres (C2), waste processing for recycling (C3) and disposal emissions from landfill (C4).

A summary of the assessment scope can be seen in Table 1.2. The following modules have been excluded from or defined as not applicable for the assessment:

**Table 2.1 Emissions scope**

| Included                                                                                                                                                                                                                                                                                                                       | Excluded                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• A1-3: Product stage – raw material supply, transport and manufacturing</li> <li>• A4: Transport to site – <i>calculated using benchmark transport distances and mode</i></li> <li>• A5: Construction stage – construction processes, including pre-construction demolition</li> </ul> | <ul style="list-style-type: none"> <li>• A5.4: Transport of construction workers</li> <li>• B1 - B5: In-use phase</li> <li>• C1 – C4 and D1: End of life phase</li> </ul> |

## 2.3 Building/Infrastructure elements

This section outlines the building and infrastructure elements that form the basis of the embodied carbon assessment for the proposed development. It describes the principal construction components, materials, and systems considered within the project's current design stage, along with the assumptions used to estimate their associated embodied carbon emissions.

**Table 2.2 Building elements**

| Level 1 Group element                                              | Level 2 Element                                |
|--------------------------------------------------------------------|------------------------------------------------|
| <b>Treatment and demolition works</b><br><b>Facilitating works</b> | 0.1.1 Demolition works                         |
| <b>1.Substructure</b>                                              | 1.1 Foundations and piling                     |
| <b>2. Superstructure</b>                                           | 2.1 Ground slab                                |
|                                                                    | 2.2 Frame                                      |
|                                                                    | 2.3 Upper floors                               |
|                                                                    | 2.4 Roof                                       |
|                                                                    | 2.5 Stairs and ramps                           |
|                                                                    | 2.6 External envelope including roof finishes  |
|                                                                    | 2.7 Windows and external doors                 |
|                                                                    | 2.8 Internal Walls and Partitions              |
|                                                                    | 2.9 Internal doors                             |
| <b>3. Finishes</b>                                                 | 3.1 Wall finishes                              |
|                                                                    | 3.2 Floor finishes                             |
|                                                                    | 3.3 Ceiling finishes                           |
| <b>4. Fittings. Furnishings and equipment</b>                      | 4. FF&E                                        |
| <b>5. Services</b>                                                 | 5.1 Water systems                              |
|                                                                    | 5.2 Heating and cooling                        |
|                                                                    | 5.3 Electrical installations                   |
|                                                                    | 5.4 Fuel installations                         |
|                                                                    | 5.5 Builders work in connections with services |

## 2.4 Assumptions

This Whole Life Carbon Assessment has been prepared at outline planning stage using a combination of project information, benchmark material quantities, and generic environmental data. At this early stage of design, some assumptions are necessary to complete a A1–A5 assessment in line with BS EN 15978 and the RICS Whole Life Carbon Assessment (2023) guidance. The following assumptions have been made:

- The dwellings have been assumed to be a 4-bed, two-storey dwelling with a Gross Internal Area (GIA) of 97m<sup>2</sup>. This floor area aligns with the recognised minimum space standards for dwellings of this type<sup>1</sup>. The assumption provides a standardised basis for material quantities, construction elements and resulting embodied-carbon estimates
- Quantities based on benchmark typologies and GIFA-derived estimates rather than full bill of quantities
- Default transport modes and distances used for imported materials aligned to the requirements of the RICS PS (e.g., Cross Laminated Timber (CLT) assumed to be delivered from EU suppliers by road/sea)
- Uncertainty uplift applied: 15% to A1 – A5 emissions to account for missing or underestimated material quantities and data availability
- Where project-specific EPDs were unavailable, UK/EU average datasets from the One Click LCA database and ICE Database v3.0 have been applied
- Assumed design life of the development is 60 years
- Main estate roads are assumed to be 5.5 meters wide, minor estate roads are assumed to be 4.5 meters wide, (Gloucestershire County Council, 2019)
- It is assumed that 2 metre pavement is required for all main estate roads (Gloucestershire County Council, 2019)

### 3 RESULTS

Table 2.1 shows the assessment results by life cycle stage. The estimated upfront embodied carbon emissions (A1 – A5) for the proposed development is in the region of 667 kgCO<sub>2</sub>e/m<sup>2</sup>. This is aligned with the LETI 2020 – 2025 upfront embodied carbon targets for new build housing of approximately 625–800 kgCO<sub>2</sub>e/m<sup>2</sup>.

**Table 3.1 Whole life carbon results summary (non-decarbonised scenario)**

| Scope                                 | kgCO <sub>2</sub> e/m <sup>2</sup> GIA | Development tCO <sub>2</sub> e |
|---------------------------------------|----------------------------------------|--------------------------------|
| <b>Residential properties</b>         |                                        |                                |
| Cradle to practical completion (A1-5) | 667                                    | 12,939                         |
| Cradle to grave (A1-5, B1-5, C1-4)    | 1,023                                  | 19,843                         |
| <b>Estate infrastructure</b>          |                                        |                                |
| Demolition                            | N/A                                    | 3.5                            |
| Highways infrastructure               | N/A                                    | 571                            |

Embodied carbon per m<sup>2</sup> tends to be higher for a traditional brick and block masonry unit due to the heavier materials used and more carbon intensive practices. This is aligned with the upfront carbon emissions for this assessment (667 kgCO<sub>2</sub>e/m<sup>2</sup>) and is aligned with RIBA (2021) and LETI (2020) industry benchmarks for new-build housing at this stage in design.

Table 2.2 provides the results broken down by building element and life cycle stage for the predicted footprint of the development. The results highlight embodied carbon of materials A1-A3 are likely the largest contributor to overall carbon emissions and should be targets as a priority for reduction.

**Table 3.2 Whole life carbon results by building element (tCO<sub>2</sub>e)**

| Building Element  | RICS Module |     |     | Total |
|-------------------|-------------|-----|-----|-------|
|                   | A1 – A3     | A4  | A5  |       |
| Substructure      | 1,901       | 59  | 116 | 2,076 |
| Superstructure    | 1,137       | 251 | 49  | 1,438 |
| External envelope | 2,819       | 202 | 157 | 3,178 |
| Internal walls    | 1,421       | 813 | 69  | 2,303 |

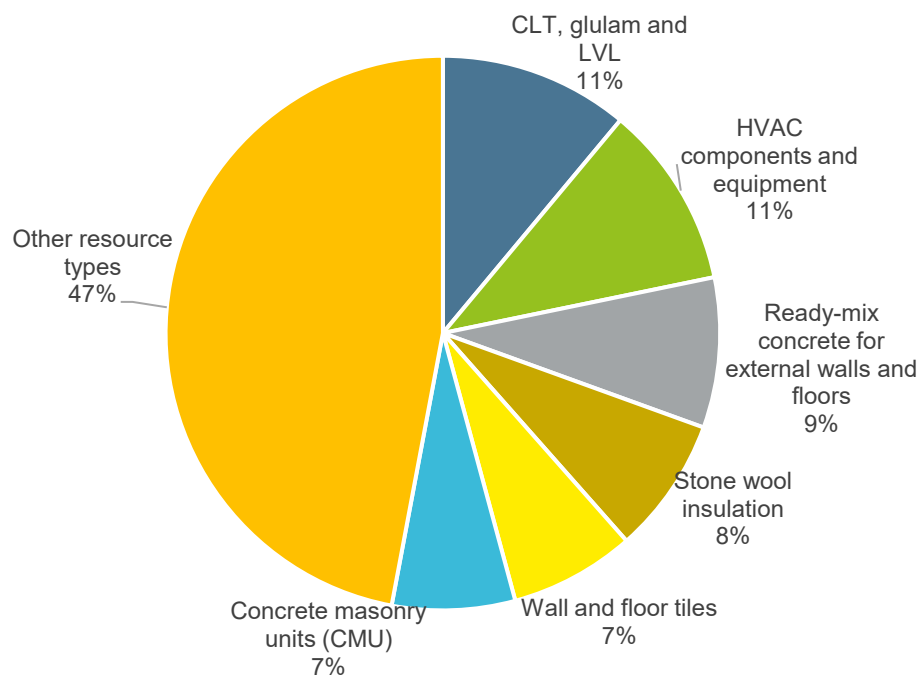
|                   |              |              |              |               |
|-------------------|--------------|--------------|--------------|---------------|
| Finishes          | 414          | 43           | 19           | 476           |
| Building services | 926          | 57           | -            | 984           |
| Not classified    | -            | -            | 776          | 776           |
| <b>Total</b>      | <b>8,620</b> | <b>1,426</b> | <b>1,186</b> | <b>11,231</b> |

### 3.1 Hotspot Analysis

The LCA model indicates that the majority of A1–A3 embodied carbon emissions arise from a small number of high-impact materials and resources. The top six contributors, accounting for 53% of total A1 – A3 emissions (Figure 2.1) to product-stage emissions are:

- CLT, glulam and LVL – although CLT stores biogenic carbon, the emissions from kiln drying and lamination still contribute notably to A1–A3 impacts
- HVAC Systems – include complex assemblies of materials made from metals which require energy-intensive manufacturing processes.
- Ready mix concrete – associated with substructure foundations and ground slabs, accounting for the single largest share of product-stage emissions due to the high clinker content of standard mixes.
- Stone wool insulation – significant contributor owing to energy-intensive manufacturing processes for mineral fibres.
- Wall and floor tiles – contribute significantly due to the energy-intensive firing, glazing and processing involved in their production.
- Concrete masonry units (CMU) – dense blockwork used for external walls contributes materially due to cement content and high volumes across the scheme

Together, these six categories make up the majority of the development's upfront embodied carbon footprint. Focusing carbon reduction strategies on these areas offers the greatest potential for impact. Recommended measures include optimising CLT volumes, adopting low-carbon concrete mixes, specifying high-recycled-content metals for HVAC systems, minimising site waste, and reviewing alternative insulation materials.



**Figure 3.1 Key emissions resources**

## 3.2 Emission reduction options

### 3.2.1 Embodied carbon

Table 2.3 outlines the potential design changes which could be considered to reduce embodied emissions.

**Table 3.3 Embodied emission reduction options**

| Element      | Resource                                       | Embodied carbon reduction                                                                                                                                       |
|--------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Substructure | Reinforced concrete foundations for hard soils | Where ground condition allows, opt for a lower carbon concrete mix utilising cement replacements such as fly ash or Ground Granulated Blast-furnace Slag (GGBS) |

| Element                               | Resource                                                                                                                                                                                                                              | Embodied carbon reduction                                                                                                                                                                                                                                                           |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Superstructure                        | Concrete ground slab, wooden joist floor, unheated pitched roof with wooden joist loft floor, plasterboard, flooring, concrete roof tiles, timber beam, wooden stud interior walls, timber column, interior paint, wood interior door | Specify materials with low upfront carbon. Opt for a lower carbon concrete mix utilising cement replacements such as fly ash or GGBS.<br><br>Design efficiency to reduce material volume, and to avoid production of waste.                                                         |
| Façade (external walls)               | Block and render finish masonry cavity wall with partial fill and aircrete block                                                                                                                                                      | Consider blocks with recycled aggregates and high GGBS content. Consider lightweight timber cladding as a resource alternative                                                                                                                                                      |
| Other structures & building materials | Stairs, steel connecting parts, wooden external door, triple glazed windows                                                                                                                                                           | Prioritise suppliers with verified EPDs                                                                                                                                                                                                                                             |
| Building systems and installations    | Energy distribution and water supply, circulation and wastewater drainage                                                                                                                                                             | Design for adaptability and easy replacement of components with lower material intensity.                                                                                                                                                                                           |
| Highways                              | Hot mix asphalt, aggregate subbase                                                                                                                                                                                                    | Where specification allows consider the use of warm mix asphalt and recycled binder content.<br><br>Consider alternative construction materials such as permeable pavers for minor estate roads to provide additional sustainability features (i.e. improved stormwater management) |

### 3.2.2 Construction reduction options

Measures to mitigate the impacts of the GHG emissions generated by the construction of the proposed scheme are summarised below:

- Minimise transport-related inefficiencies, including with respect to material deliveries, business travel and staff commuting to and from site and other relevant locations. Where possible, transport should be avoided unless necessary, e.g., through proactive measures such as car pooling etc.
- Incentivise use of local suppliers with a view to shorten project supply chains and environmental footprint.

- Encourage contractor partners to obtain grid connections as early as possible for construction office and welfare facilities, removing the need for generators, if possible. Where grid connections are not possible hybrid generators using solar power or Hydrotreated Vegetable Oil (HVO) should be used to reduce consumption of fossil fuels.
- All plant should investigate the option of using HVO fuels or electric versions where possible.
- Require main contractors to report on energy data, water usage and waste disposal and their GHG emissions as part of the scheme's Construction Environmental Management Plan (CEMP).

## 4 SUMMARY

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This report outlines potential sustainable construction practices aimed at reducing greenhouse gas emissions and environmental impact for the proposed development of up to 200 dwellings at Land East of Clane Road, Lyneham.

The proposed development should consider how best to include the highlighted measures as the design progresses. These measures include the use of warm mix asphalt, recycled materials, permeable pavers, and local suppliers, alongside minimising transport inefficiencies and encouraging early grid connections or hybrid generators to reduce the embodied carbon impact of the scheme.

Contractors could be incentivised to adopt greener fuels and to report energy, water, waste, and emissions data as part of the Construction Environmental Management Plan (CEMP), supporting a holistic approach to sustainability and compliance with industry standards.

The recommendations presented in this report align with the requirements of existing and emerging local planning policy.

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