PLON01

Prologis Park West,
Units DC5 and DC6
Iron Bridge Road North
West Drayton
Uxbridge UB11 1BT

Whole Life Carbon Assessment

Client	**Prologis UK CCCXXXVIII S.à r.l..**
Date	20 November 2025
File Ref	PLON01-RED-XX-XX-RP-Q-00006 – Whole Life Carbon Assessment
Revision	P01
Classification	☒ Public | ☐ Internal | ☐ Restricted | ☐ Confidential

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Revision

Revision	Revision details / Issue type	Page Nos	Document prepared by			Document checked by		
			Name	Signature	Date	Name	Signature	Date
P01	Final Issue	All	Rence Bacal		18/11/2025	Hope Amira Dalvina Chin		20/11/2025

Executive Summary

Red Engineering Design Ltd has been appointed by Prologis UK CCCXXXVIII S.à r.l. to report the Whole Life-Cycle Assessment (WLCA) of Project PLON01 at Prologis Park West, Units DC5 and DC6, Iron Bridge Road North, West Drayton, Uxbridge, UB11 1BT. This WLCA has been prepared in support of the Planning Application in accordance with Hillingdon Local Plan: Part 1 – Strategic Policies, Local Plan: Part 2 – Development Management Policies and the London Plan. The assessment has been carried out using One Click LCA software, following the requirements of RICS and EN 15804 +A2 standards.

Result summary

7,481,632,597
Total kg CO_2e – Non-decarbonised Scenario

	GWP
Product stage (A1-A3)	34,411,996
Transport to construction site (A4)	4,777,856
Installation/Assembly (A5)	7,508,803
Use stage (B1-B5)	43,335,782
Energy/Water use (B6-B7)	7,389,607,506
End of life stage (C1-C4)	2,004,779
Beyond the system boundary (D)	-25,490,762

1,133,432,877
Total kg CO_2e – Decarbonised Scenario

	GWP
Product stage (A1-A3)	34,411,996
Transport to construction site (A4)	4,777,856
Installation/Assembly (A5)	7,508,803
Use stage (B1-B5)	36,350,448
Energy/Water use (B6-B7)	1,048,768,835
End of life stage (C1-C4)	1,629,065
Beyond the system boundary (D)	-21,088,702

No direct comparison with national benchmark figures has been made, as benchmarks are not published for data centres projects and would not reflect their unique operational and material profile. Instead, this WLCA establishes a project-specific baseline for tracking carbon reduction.

A one-year reference service life analysis was undertaken to isolate and highlight the material impacts, which confirmed structural and façade systems as the dominant embodied carbon hotspots.

Commitment and Next Steps

- The WLCA will be refined at key design stages, using project-specific design data and supplier information.
- The project team will investigate further opportunities to reduce embodied carbon, including:
  - Low-carbon concrete mixes (e.g. GGBS, cement substitutes).
  - Recycled content in structural steel.
  - Alternative façade systems.
- Operational carbon will be addressed through energy efficiency measures and the potential integration of renewable energy solutions.

This WLCA provides a transparent and policy-compliant baseline for the Proposed Development. It demonstrates early-stage consideration of both embodied and operational carbon, identifies material hotspots, and establishes a framework for ongoing carbon reduction as the design develops, fully aligning with the requirements of the Hillingdon Local Plan: Part 1 – Strategic Policies, Local Plan: Part 2 – Development Management Policies and the London Plan.

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1.0 Introduction

RED Engineering Design Ltd has been appointed by Prologis UK CCCXXXVIII S.à r.l to report the WLCA in support of a planning application for the adaptation of the existing buildings including the installation of new gantry decks for plant and equipment to facilitate a 'data centre' operation.

1.1 Context

Climate change is one of the most important environmental challenges of this century. Global warming is becoming an increasingly potent issue resulting from the release of anthropogenic (man-made) greenhouse gas emissions into the atmosphere. While these emissions contain a wide range of chemicals, they are quantified and referred to as equivalent Carbon emissions. These emissions may have severe adverse environmental, economic, and social implications globally if temperatures continue to increase. International treaties and initiatives such as the Paris Agreement, adopted in 2015, aim to limit global temperature rise to 1.5°C by reducing Carbon emissions which are also associated with natural resource depletion and pollution.

Large quantities of Carbon emissions arise from the built environment and are attributable not only to the use of built assets (operational emissions) but also to their construction (embodied emissions). Operational emissions are attributable to the everyday running of a building whereas embodied emissions result from production, procurement and installation of the building's materials and components (construction). Embodied emissions (when looked at through the lens of a whole life-cycle assessment) also include lifetime emissions from maintenance repair, replacement, demolition, and disposal.

Operational emissions in data centre projects are categorised as either regulated or unregulated loads. Regulated loads typically include office HVAC, lighting, and domestic hot water, all of which are accounted for in local building regulation calculations. Unregulated loads encompass energy used by systems essential to the building's function—such as IT equipment, refrigeration, external lighting, and servers. In the context of data centres, both the IT and cooling loads fall under the unregulated category. The most widely used metric for evaluating unregulated energy consumption in data centres is Power Usage Effectiveness (PUE). An Energy Statement has been produced to report on energy strategy of the proposed development.

The principal benefits of conducting a whole life carbon, includes:

- Identifying and accounting for emission sources which is critical to achieve Carbon reduction goals.
- Achievement of resource efficiency and cost savings through the re-use of existing materials and the minimisation of waste through design principles.
- Identification of the Carbon benefits of using recycled material in addition to the benefits of designing for future recycling and reuse, reducing waste, and supporting the circular economy.
- Finding optimal and holistic solutions for the development over its lifetime by considering both operational and embodied emissions.
- Improving lifetime resource efficiency and costs by identifying the impact of maintenance, repair, and replacement of components over the building's life cycle, contributing to the future proofing of the asset's value.
- Encouragement of local sourcing of materials and short supply chains which will consequently have positive Carbon, social, and local economic benefits.
- Encouraging flexible design and durable construction, contributing to increased longevity and decreased obsolescence of buildings which also helps to reduce Carbon emissions associated with their demolition and new construction.

1.2 Site Context

The proposed development is located in Prologis Park West, within the London Borough of Hillingdon.

> Site Address:
> Units DC5 and DC6,
> Iron Bridge Road North,
> West Drayton,
> Uxbridge, UB11 1BT

The Site forms part of Prologis Park West which comprises a total of six, large scale industrial buildings. It is the eastern section of the estate and measures approximately 6.3 ha. The Site currently accommodates two warehouse buildings which were completed in 2023: Unit 1 (DC5 - Distribution Centre 5) and Unit 2 (DC6 - Distribution Centre 6). Unit 1 and Unit 2 are single-storey warehouse units measuring: 18,063 sq m (194,428 sq ft) and 13,290 sq m (143,052 sq ft) respectively. Each building has a clear haunch height of 15m and an overall building height of 18m.The existing buildings are currently vacant but benefit from the flexible use included within the following use classes: Classes B2, B8 and E(g)(iii).

Direct access to the Site is via Iron Bridge Road, which forms the western boundary and runs in a north-south direction from the Stockley Road roundabout to West Drayton. The Site is bounded to the east by Stockley Road (A408) and beyond that; Stockley Park which accommodates a series of large office buildings rising two to three storeys high. To the north is Horton Road and beyond that significant mature landscaping, including Stockley Country Park and Stockley Park Golf Course. To the south, between the Grand Union Canal and a mainline railway, lies a cluster of industrial yards that include carparking and storage facilities. Beyond that is the closest area of residential land use. To the west is Iron Bridge Road North, the remainder of the Prologis Park West Estate and further commercial uses.

Figure 1.1: Proposed Site.

1.3 Project summary

The following table outlines the details of the project with a high level set of assessment criteria considered in preparation of this report.

Table 1.1: Project Summary Information.

Project Name	Prologis UK CCCXXXVIII S.à r.l.
Sector and subsector	Data Centre
Location	London, UK
Life cycle stages scope	A1-A5; B1-B5 & C1-C4, D reported separately.
Reference Study Period (RSP)	60 years
Spatial Boundary	All construction works relating to the project, including external areas that are integral to its operations.
Gross Internal Area (GIA)	49,014 m^2
Datacentre Capacity (MW)	52 MW (IT Load 100%)
Name / Company of Assessor	Rence Bacal, Red Engineering
Date of Assessment	22/09/2025

Table 1.1 above shows a summary of key information at planning phase. It also should be noted that as the project advances and more detailed information becomes available these parameters are expected to evolve.

2.0 Policy review

This section reviews the planning policies that are relevant to this development.

2.1 London Plan (March 2021)

2.1.1 Policy SI 2 Minimising greenhouse gas emissions

A *Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:*

- *be lean: use less energy and manage demand during operation*
- *be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly*
- *be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site*
- *be seen: monitor, verify and report on energy performance.*

B *Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.*

C *A minimum on-site reduction of at least 35 % beyond Building Regulations is required for major development. Residential development should achieve 10 %, and non-residential development should achieve 15% through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either: 1) through a cash in lieu contribution to the borough's carbon offset fund, or 2) off-site provided that an alternative proposal is identified and delivery is certain.*

D *Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.*

E *Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.*

F *Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.*

2.2 Hillingdon Local Plan

2.2.1 Part 1 – Strategic Policies

A *Policy EM1 – Climate Change Adaptation and Mitigation*

- *Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.*

- *Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydro-electricity and a greater use of waste as a resource.*

B *Policy SO11 – Address the impacts of climate change, and minimise emissions of carbon and local air quality pollutants from new development and transport.*

2.2.2 Part 2 – Development Management Policies

A *Policy DMEI 2 – Reducing Carbon Emissions*

- *All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.*
- *All major development proposals must be accompanied by an energy assessment showing how these reductions will be achieved.*
- *Proposals that fail to take reasonable steps to achieve the required savings will be resisted. However, where it is clearly demonstrated that the targets for carbon emissions cannot be met onsite, the Council may approve the application and seek an off-site contribution to make up for the shortfall.*

B *Policy DMEI 3 – Decentralised Energy*

All major developments are required to be designed to be able to connect to a Decentralised Energy Network (DEN).

3.0 Life-cycle Carbon Assessment Methodology

3.1 Approach

A life-cycle Carbon assessment is an estimation of the quantity of all Carbon emissions expected to be emitted over the lifecycle of a built asset. Greater emission reduction could be achieved if an environmental Life-cycle Assessment (aka LCA, which includes other environmental emissions beyond Carbon, such as ozone depletion, eutrophication, impact on human health and much more) or life-cycle Carbon assessment (Carbon focus) is carried out at the early design stages. An early assessment means hotspots can be identified and rectified sooner in the design process. This results in a lower cost and reduced program impact on the overall project compared with an assessment being conducted at a later design stage.

3.2 Method Statement

This report covers the life-cycle Carbon system boundary (Module A1-C4) as per the RICS Professional Standard Life-cycle Carbon Assessment for the Built Environment, 2nd Edition (September 2023).

In the UK, the RICS WLCA standard is considered as an appropriate national Greenhouse Gases (GHG assessment methodology (which complies with the EN 15978 and EN17472) for GHG quantification as required in the Carbon management approach set out in PAS 2080:2023, where target setting, reduction, reporting and leadership are also considered.

This report could also cover other environmental impact categories such as, but not limited to: Ozone Depletion, Acidification and Eutrophication etc. to comply with both the ISO 14040/14044 and EN15804 reporting upon request.

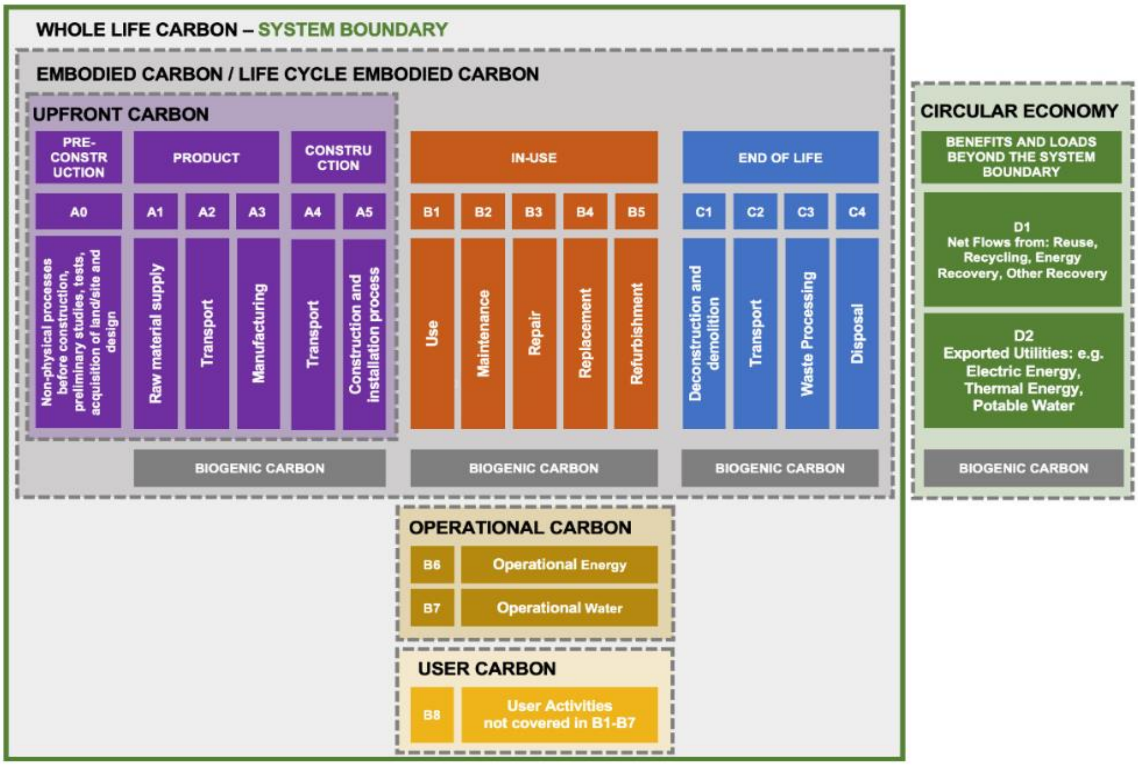

Figure 3.1: Building life-cycle stage boundaries as adapted from EN 15978, EN 17472 and EN 15643 (image extract from RICS WLCA Standard 2nd edition).

The four main life-cycle stages of the assessment are defined as follows:

- **Upfront Carbon** or **Module A**: comprises Product Stage (Module A1 – A3) and Construction Stage (Module A4 – A5). Pre-construction Stage (A0) is only applicable to infrastructure projects.
    - **Product Stage**: These modules include the Greenhouse Gases (GHGs) released during extraction, processing, manufacture (including prefabrication of components or elements) and transportation of materials between these processes, until the product leaves the factory gates to be taken to site. Note that recycled content of a product affects the GHGs released in modules A1-A3. Whether it is recycled after its end of life or not, does not affect the A1-A3 module, as this is taken into account in module D (beyond building or project life cycle) which is reported separately.
    - **Construction Stage**: These modules include the GHGs released during transportation of materials/products to site, energy usage due to activities on site (site huts, machinery use etc.) and the GHGs associated with the production, transportation, and end of life processing of materials used on site. It also includes the demolition of any previous structures.
- **In-Use Stage** or **Module B**: Comprises Use, Maintenance, Repair, Replacement and Refurbishment Stages (Module B1 – B5), Operational Energy (B6) and Operational Water (B7).
- **End of Life or Module C**: These modules include the GHGs released during decommissioning, stripping out, demolition, deconstruction, transportation of materials away from the site, waste processing and the disposal of materials.
- **Benefits and Loads Beyond the System Boundary** or **Module D:** Reported separately, this Module should be included in all LCA/WLCA. Module D estimates any net GHGs benefits of loads beyond the project's life cycle associated with but not limited to:
    - **Recycling of materials** e.g., use of scrap steel (rather than virgin iron) in steelmaking on future projects.
    - **Energy recovered from materials** e.g., energy generated by incinerating timber products.
    - **Full reuse of materials/products** when compared to the standard practice or product it would be replacing.

3.3 Software and Database

The assessment has been carried out with One Click LCA software and its RICS and GLA specific LCA module that automatically applies the Level(s) requirements and restrictions. A summary and guidance document of the scope can be found here: https://oneclicklca.zendesk.com/hc/en-us/articles/360020417600-UK-Whole-Life-Carbon-Assessment-RICS-GLA.

The database used in this tool is controlled by One Click LCA's database management process and complies with ISO 14040/14044 standards. For summary of One Click LCA's database management processes, read this: https://oneclicklca.com/en/resources/articles/how-we-work-with-data.

The metric for assessing the emissions is Global Warming Potential (GWP) which is expressed in units of Carbon Dioxide (CO_2) equivalent (CO_2e) of the emission source over 100 years.

3.4 Building Element within the scope and Material Quantity

The building elements related to DC01 & DC02 (DC5 and DC6) and Sitewide works listed in Table 3.1 below are within the scope of this LCA. The Stage 2 Cost Plan prepared by Rider Levett Bucknall (RLB) Cost Consultant was used as the primary source of material/equipment quantities.

Table 3.1: Building element within the scope of the assessment.

BUILDING ELEMENT GROUP	BUILDING ELEMENT	BASIS OF INFORMATION
1 Substructure	1. Foundations and piling	Stage 2 Cost Plan
2. Superstructure	2.1 - 2.4 Superstructure – Structural elements	Stage 2 Cost Plan
	2.5 – 2.6 Superstructure – Building Envelope	
	2.7 – 2.8 Superstructure – Internal elements	
3 Finishes	3 Finishes	Stage 2 Cost Plan
4. Services	4.1 Mechanical Equipment - HVAC	Assumptions were made using the GIA for typical data centres Construction Systems within One Click LCA
	4.2 Electrical Equipment	
	4.3 ICT Equipment & Fire Safety	
8. External Works	8. External works associated with the project (within boundary)	Stage 2 Cost Plan

3.5 Assumptions

This section states all assumptions and scenarios used to facilitate the LCA. For clarity and brevity, these assumptions are outlined in Table 3.2 below.

Table 3.2: Assumption & Scenarios for each life-cycle stage.

Life-cycle Stage	Assumptions & Scenarios
Product Stage (A1 – A3)	Calculated using EPDs information which align with the exact product and/or material specification or the most applicable similar product.
Transportation to site (A4)	Calculated using RICS default scenarios as follows: 20 km (locally sourced materials like ready-mix concrete) 50 km (locally sourced materials like aggregate, earth, asphalt) 80 km – 120 km (national sourced materials like plasterboard, insulation, blockwork) 1500 km (internationally sourced within the EU like CLT, Façade modules) 10,000 km by sea + 500 km by road (Globally manufactured e.g. specialist stone cladding).
Construction Process (A5)	Pre-construction demolition (A5.1) – N/A Construction activities (A5.2) – 40 $kgCO_2e/m^2$ GIA Waste and Waste Management (A5.3) – One Click LCA default values that are based on typical wastage ratios which vary based on construction process, building and design types (varies between 1-10%)
Use Stage (B1 – B5)	Use (B1) excluded from the calculations as no data was available at the time of assessment.

Life-cycle Stage	Assumptions & Scenarios
	Maintenance (B2) and Repair (B3) have been accounted for in the results, expressed as a % of material repaired per year. Replacement (B4) and Refurbishment (B5) are based on the RICS default service life.
Operational Energy Use (B6)	Sourced from the Energy Statement calculation
Operational Water Use (B7)	No source of data and therefore omitted from this assessment.
End of Life Stage (C1-C4)	Based on the End of Life (EoL) Market Scenarios (see End of Life Scenarios (Module D).
Benefits and Load Beyond System Boundaries (D)	Reported separately

3.6 End of Life (Module C) and Module D

Modules C1-C4 consider the EoL scenario. This is of particular significance on projects such as this which are taking benefit from biogenic storage. This assessment has been conducted based on the One Click LCA Market Scenarios approach which considers the waste management regulations in the country. If the country is considered to have highly regulated waste management with effective landfill taxes and recycling rates (e.g., most of Europe), materials are recycled by default.

3.7 Carbon Sequestration

RIBA Carbon targets permit the inclusion of Carbon sequestration. For instance, timber or agricultural crops are considered to be sustainable resources as unlike other mainstream construction materials, they are renewable. The British Standard definition of a renewable resource is a 'resource that is grown, naturally replenished or cleansed on a human time scale.' Sequestration is the term used to describe the Carbon absorbed from the atmosphere by trees during photosynthesis as they grow.

The production emissions of timber products, from harvesting, drying, and sawing are typically less than those for the production of steel and concrete, yet they still significantly contribute to module A emissions for a building. However, this can often be outweighed by the mass of Carbon absorbed by the tree and stored within the material itself. This is known as sequestered Carbon, Figure 3.2 illustrates a typical Carbon sequestration cycle. Conversely, biogenic Carbon is the Carbon released as a result of the combustion or decomposition of the organic material (in the instance timber). The storage of biogenic element over a typical building lifecycle is illustrated in Figure 3.3.

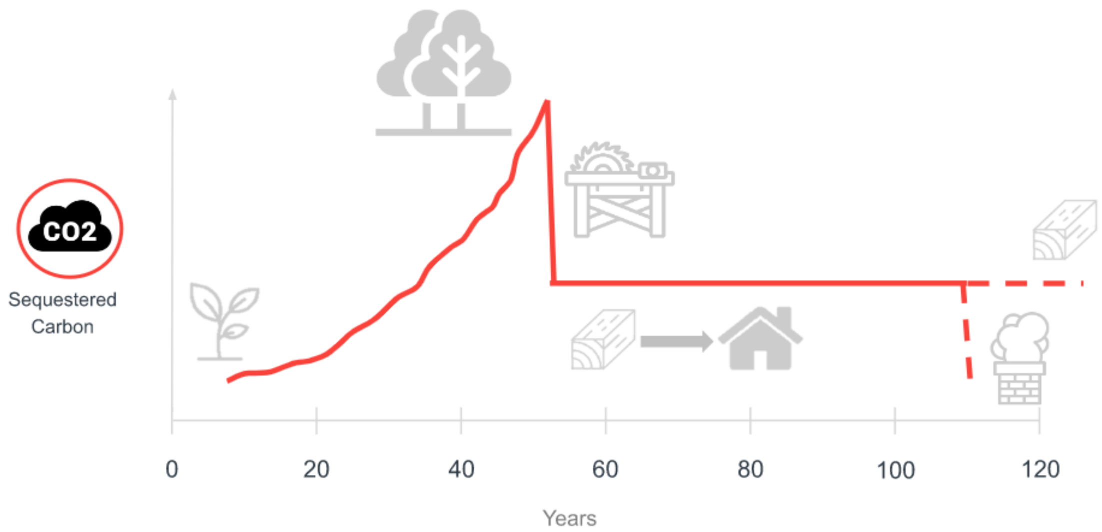

Figure 3.2: Typical Carbon sequestration cycle.

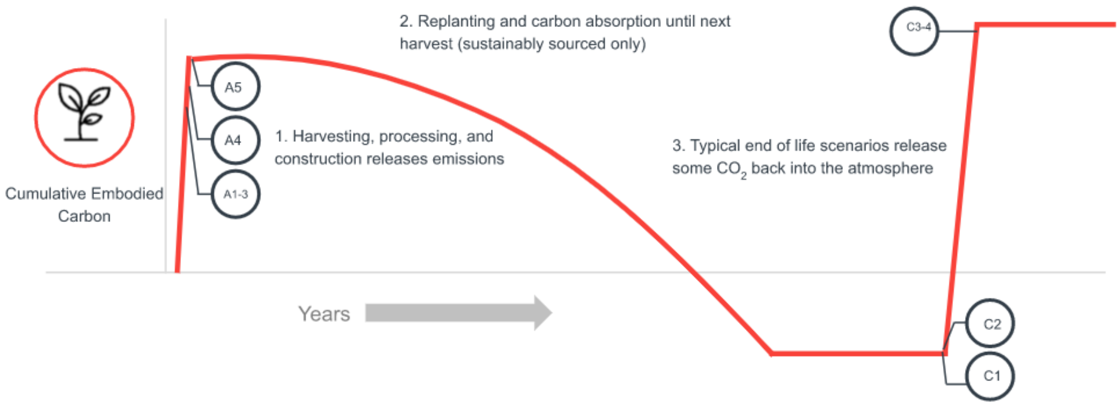

Figure 3.3: The storage of biogenic element over a typical building lifecycle.

The RICS LCA guidance, as used in this assessment, sets two requirements for the inclusion of benefits from sequestration:

- In order to claim the benefits of sequestration, the timber must be sustainably sourced and certified by FSC, PEFC or equivalent. This ensures that felled trees are substituted with a minimum number of the same species, and
- The assessment must include the End-of-Life impacts (Module C).

4.0 Result Summary

4.1 Whole life-cycle Carbon Emissions – 60 Years.

As seen from Table 4.1, almost 99% of the Carbon emissions from this project is linked to the operational energy use, specifically from the unregulated energy loads – IT Loads of the data centre.

Table 4.1: Whole life-cycle Carbon Assessment (60 yrs).

Life cycle stage	A1-A5	B1-B5	B6-B7	C1-C4	D (not included in totals)	Total
Unit for impacts	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e
0.1 Demolition	0	0	0	865,855	0	865,855
1 Substructure	4,269,356	0	0	297,049	-552,871	4,566,405
2 Superstructure	20,793,999	5,153,735	0	977,898	-8,181,162	26,925,632
3 Finishes	679,445	3,240,484	0	37,920	-709,671	3,957,849
5 Building services (MEP)	13,667,821	33,311,523	7,389,607,506	52,977	-15,395,107	7,436,639,826
8 External works	824,936	547,722	0	70,129	-651,952	1,442,786
Total	**40,235,556**	**42,253,464**	**7,389,607,506**	**2,301,828**	**-25,490,763**	**7,474,398,354**

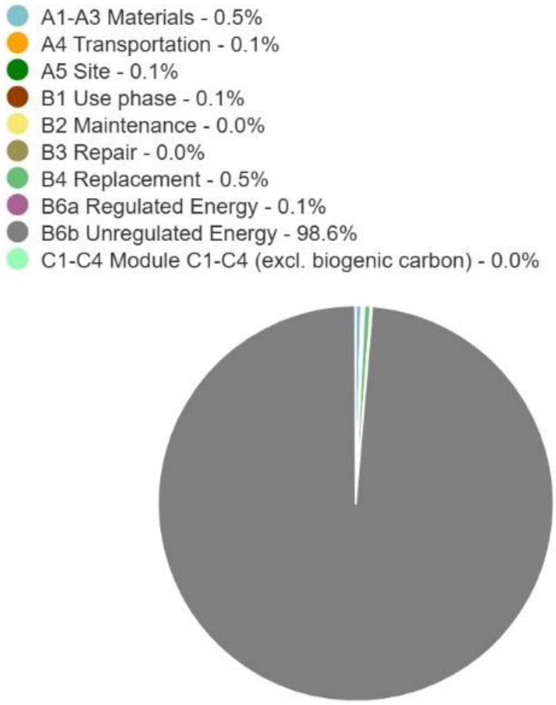

Figure 4.1: Graph showing the percentage (%) contribution for lifecycle stages (60 yrs).

Figure 4.2 below illustrates the percentage contribution of life cycle stages excluding modules B6a and B6b (regulated and unregulated operational energy use). Since approximately 99% of the project's carbon emissions are attributed to operational energy, this alternative view omits those modules to highlight the relative impact of other stages. In this view, module B4 – material replacement is the largest contributor at 42%, with modules A1-A3 following at 37%, and module A5 – site operations being the third largest contributor with 8%. While this approach does not represent the complete whole-life carbon profile, it provides useful insight into the distribution of emissions across the remaining stages.

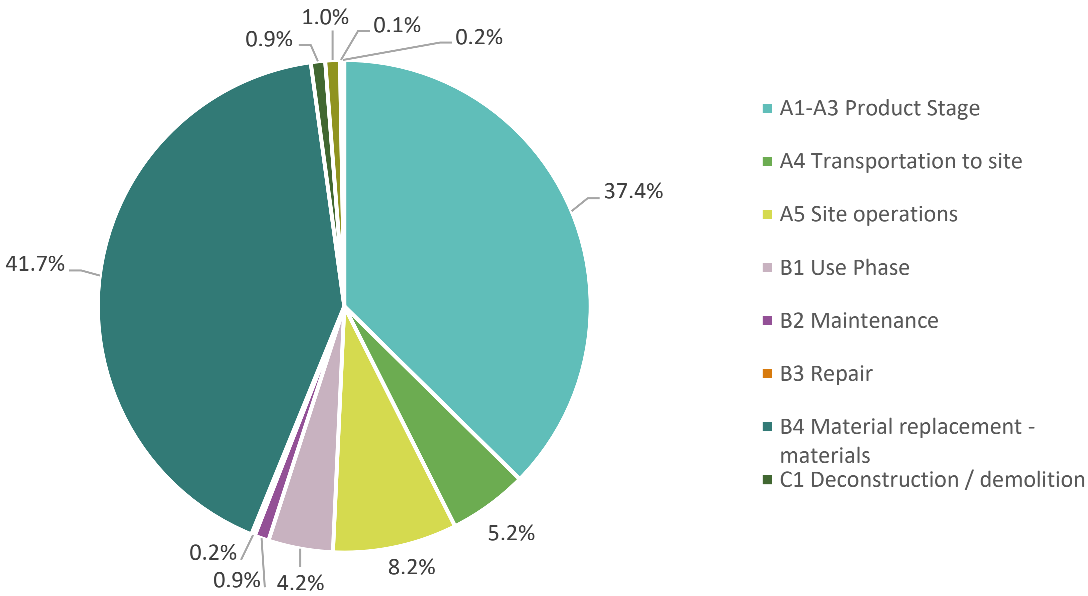

Figure 4.2: Graph showing the percentage (%) contribution for lifecycle stages (60yrs) excluding emissions from B6

4.2 Life-cycle Carbon Emissions – 1 year in operation.

To isolate the impact of materials from the overall carbon emissions, a reference service life of one year was analysed as shown in Table 4.2 and Figure 4.3.

As observed, even at a one-year reference period, the largest contributor remains Operational Energy Use (B6), accounting for over 71.2% of total emissions. This is primarily driven by the high IT and cooling loads inherent to data centre operations. In comparison, the Module A stages collectively account for approximately 27%, reflecting the upfront impacts of structural materials and construction processes. In line with London Plan Policy SI 2, these findings will inform the development of a targeted WLCC reduction strategy. This reduction strategy will have a dual focus on improving operational efficiency and minimising embodied carbon through material optimisation and low-carbon procurement as the design progresses and is detailed in this assessment.

Table 4.2: Life-cycle Carbon emission at 1 year in operation.

Life cycle stage	A1-A5	B1-B5	B6-B7	C1-C4	D (not included in totals)	Total
Unit for impacts	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e
0.1 Demolition	0	0	0	865,855	0	865,855
1 Substructure	4,269,356	0	0	297,049	-552,871	4,566,405
2 Superstructure	20,793,999	0	0	977,898	-8,016,475	21,771,897
3 Finishes	679,445	0	0	37,920	-262,575	717,365
5 Building services (MEP)	13,667,821	94,501	123,160,125	52,977	-4,502,028	136,975,424
8 External works	824,936	0	0	70,129	-294,783	895,065
Total	**40,235,556**	**94,501**	**123,160,125**	**2,301,828**	**-13,628,732**	**165,792,010**

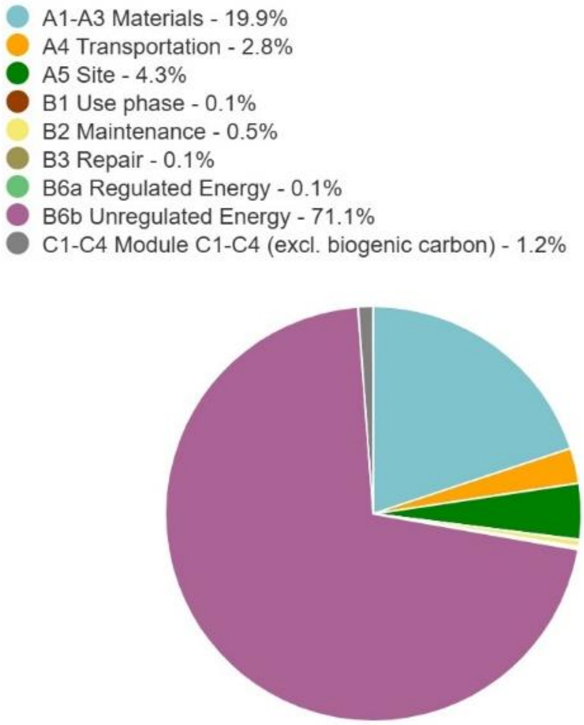

Figure 4.3: Graph showing the percentage (%) contribution for lifecycle stages (1 yr).

4.3 Whole Life-cycle Carbon Emissions – Decarbonised scenario – 60 Years.

Table 4.3 below shows that almost 93% of the Carbon emissions from this project is linked to the operational energy use, specifically from the unregulated energy loads – IT Loads of the data centre.

Table 4.3: Whole life-cycle Carbon Assessment (60 yrs) for Decarbonised scenario.

Life cycle stage	A1-A5	B1-B5	B6-B7	C1-C4	D (not included in totals)	Total
Unit for impacts	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e
0.1 Demolition	0	0	0	490,140	0	490,140
1 Substructure	4,269,356	0	0	297,049	-455,709	4,566,405
2 Superstructure	20,793,999	4,276,837	0	977,898	-6,735,253	26,048,735
3 Finishes	679,445	2,703,610	0	37,920	-584,502	3,420,975
5 Building services (MEP)	13,667,821	28,304,125	1,048,768,835	52,977	-12,773,545	1,090,793,757
8 External works	824,936	453,200	0	70,129	-539,693	1,348,265
Total	**40,235,556**	**35,737,772**	**1,048,768,835**	**1,926,113**	**-21,088,702**	**1,126,668,276**

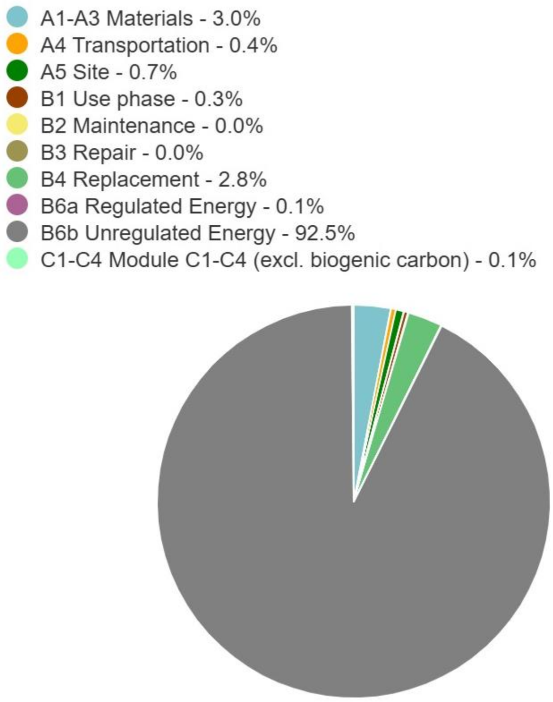

Figure 4.4: Graph showing the percentage (%) contribution for lifecycle stages (60 yrs) - Decarbonised Scenario.

4.4 Life-cycle Carbon Emissions – Decarbonised scenario (1 year in operation)

To isolate the impact of materials from the overall carbon emissions, a reference service life of one year was analysed as shown in Table 4.4 and Figure 4.5.

As observed, even at a one-year reference period, the largest contributor are Module A Stages accounting for over 70.2% of total emissions reflecting the upfront impacts of structural materials and construction processes. In comparison, the Operational Energy Use (B6), collectively accounts for approximately 26% which is the IT and cooling loads inherent to data centre operations. In line with London Plan Policy SI 2, these findings will inform the development of a targeted WLCC reduction strategy, with a dual focus on improving operational efficiency and minimising embodied carbon through material optimisation and low-carbon procurement as the design progresses.

Table 4.4: Life-cycle Carbon emission at 1 year in operation (Decarbonised scenario).

Life cycle stage	A1-A5	B1-B5	B6-B7	C1-C4	D (not included in totals)	Total
Unit for impacts	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e	kg CO_2e
0.1 Demolition	0	0	0	490,140	0	490,140
1 Substructure	4,269,356	0	0	297,049	-455,709	4,566,405
2 Superstructure	20,793,999	0	0	977,898	-6,599,174	21,771,897
3 Finishes	679,445	0	0	37,920	-216,035	717,365
5 Building services (MEP)	13,667,821	94,501	17,479,481	52,977	-3,733,671	31,294,779
8 External works	824,936	0	0	70,129	-243,512	895,065
Total	**40,235,556**	**94,501**	**17,479,481**	**1,926,113**	**-11,248,101**	**59,735,651**

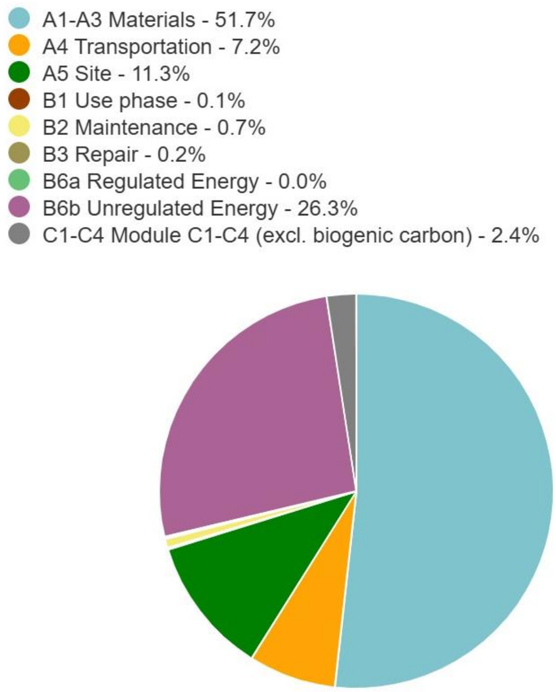

Figure 4.5: Graph showing the percentage (%) contribution for lifecycle stages (1 yr) - Decarbonised scenario.

5.0 Carbon Reduction Opportunities

5.1 Most contributing materials – Modules A

Figure 5.1 below shows the highest contributing materials are structural steel, concrete, and PVC pipe respectively. These elements dominate the embodied carbon profile due to their significant material volumes and relatively high carbon intensities compared with other building components.

Most contributing materials (TOTAL)

No.	Resource	Cradle to gate impacts (A1-A3)
1.	Steel frame, ?	9 319 tonnes CO_2e
2.	Polyvinyl chloride (PVC) pipe for drainage and sewerage networks, DN 50 mm (2 in), 1.46 kg/m, wall thickness: 5.54 mm ?	3 272 tonnes CO_2e
3.	Precast reinforced concrete pile, circular, 450 mm diameter, 386.47 kg/m, C55/67, cross-sectional area 0.16 m2, 2430 kg/m3 ?	2 884 tonnes CO_2e
4.	Structural steel sections (piles, beams, columns, joists), Steel trusses, framing element, posts ?	2 366 tonnes CO_2e
5.	Ready-mix concrete, generic, C25/30 (3625/4350 PSI), XC1, CEM II/A-S portland-slag cement 10% GGBS content, 2378 kg/m3 ?	1 930 tonnes CO_2e
6.	Ventilation ducting, per m linear, D: 500 mm (19.69 in) ?	1 609 tonnes CO_2e
7.	Air handling unit, with heat recovery through plate heat exchanger, 50 000 m3/h (29428.9 ft3/min), 5255 kg/unit (11585 lbs/unit) ?	1 506 tonnes CO_2e
8.	Polyvinyl chloride (PVC) pipe for drainage and sewerage networks, DN 25 mm (1 in), 0.63 kg/m, wall thickness: 4.55 mm ?	1 376 tonnes CO_2e

Figure 5.1: Most Contributing Materials - Modules A1 - A3.

5.2 Structural steel

The embodied Carbon factor (ECF) of steel differs depending on its production method and its recycled content. There are two methods of production, basic Oxygen furnace (BOF) or electric arc furnace (EAF). BOF is a largely fossil fuel-fired production process (derived from coal) that produces steel from high percentage of virgin Iron ore compared to scrap metal (typical value varies between 30% to 13% in the UK). On the other hand, EAF is a process powered by the electricity grid and can produce steel made with a very high percentage of recycled content (up to 100% to 97% in the UK). Therefore, EAF steel generally have lower Carbon emissions when compared to BOF steel.

Figure 5.2: An Image of an upper floor structural steel.

Given the timing of the assessment and the limited level of design detail available at this stage, it was not possible to confirm the exact embodied-carbon factor (ECF) for the structural steel specified for the proposed development. Therefore, the following assumptions have been applied:

Table 5.1: Assumption List for Structural Steel.

Structural Steel	Assumptions
Global Warming Potential (A1-A3)	2.11 - 1.41 kg CO_2e / kg
Transportation distance	10,000
Transportation method	Trailer combination, 40-ton capacity, 100% fill rate: 0.0383 kg CO_2e / ton km
Transportation distance - leg 2	200.0
Transportation method - leg 2	Carbon only - HGV (all diesel), All rigids, Average laden
Transportation distance reference	Based on: RICS professional standards and guidance, UK Life-cycle Carbon assessment for the built environment 2nd edition.
Wastage on site	1 %
Wastage on site reference	Wastage default values are set based on typical wastages, and they will vary based on construction process, building and design.
Waste treatment scenario	Steel recycling
Default waste treatment method	**C2:** Trailer combination, 40-ton capacity, 100% fill rate: 0.0383 kg CO_2e / ton km **C3:** Structural steel recycling, profiles shearing and handling: 0.0022 kg CO_2e / kg **D:** Reinforcement steel: 2.2 kg CO_2e / kg
Default service life	As building
Service life reference	Based on: RICS professional standards and guidance, UK Life-cycle Carbon assessment for the built environment 2nd edition.
Product-specific service life	As building

5.2.1.1 Recommendations

At this early RIBA Stage 2 planning submission, the structural design is still in its conceptual phase and the timeframe for the WLCA has limited the ability to model or incorporate detailed embodied-carbon reduction measures for structural steel. Nevertheless, the design team acknowledges the significant contribution of steelwork to the project's embodied carbon and intends to refine and reduce these impacts as the design progresses.

The strategies identified at this stage such as optimising structural grids, reducing over-specification, exploring higher recycled-content steel, and reviewing opportunities for rationalisation will be developed, assessed, and discussed with the structural engineer and wider design team during subsequent design stages. Accordingly, the below proposed reductions should be viewed as indicative, with definitive actions to be implemented and formalised at later RIBA stages as more detailed information becomes available.

Table 5.2: Optioneering for Structural Steel.

Building Element	Stage 4 Optioneering	Product Specification	Quantity	A1-A3 (kg CO_2e)	% Difference
Steel	Current Design	BOF Steel	1kg	2.11	Baseline
	Recommended	EAF	1kg	1.13	54%

5.3 Ready-mix Concrete

The ECF of concrete is significantly influenced by the quantity of Portland Cement (PC) contained within it. To reduce the Carbon emission, PC can partly be (or in some cases completely) substituted by other cementitious materials generally known as 'cement replacements', of which Ground Granulated Blast Furnace Slag (GGBS) is the most common, followed by Pulverised Fuel Ash (PFA), aka 'Fly Ash' and limestone.

Utilising a lower concrete strength grade will also reduce the amount of cementitious content needed and therefore, reduce the embodied Carbon impact.

Figure 5.3: An Image of a Concrete mixer truck.

It is important to note that the production of GGBS and PFA are the by-product of Carbon intensive industries (Iron and Steel industry & Coal burning power stations). Therefore, there are limited quantities available globally, and efforts to decarbonise energy supplies and steel production would result in decreased supplies in the future.

Given the timing of the assessment and the limited level of design detail available at this stage, it was not possible to confirm the exact ECF for the concrete specified for the proposed development. Therefore, the following assumptions have been applied.:

Table 5.3: Assumption List for Concrete.

Concrete	Assumptions
Global Warming Potential (A1-A3)	394 kg CO_2e / m^3
Transportation distance	50km
Transportation method	Concrete mixer truck, appr. 8 m^3, 100% fill rate: 0.13 kg CO_2e / ton km
Transportation distance reference	Based on: RICS professional standards and guidance, UK Life-cycle Carbon assessment for the built environment 2nd edition.
Wastage on site	5.0 %
Wastage on site reference	Wastage default values are set based on typical wastages, and they will vary based on construction process, building and design.
Waste treatment scenario	Concrete crushed to aggregate (for sub-base layers), Portland Cement 300 kg / m^3
Default waste treatment method	**C2:** Dumper truck, 19-ton capacity, 100% fill rate: 0.0732 kg CO_2e / ton*km **C3:** Concrete recycling, concrete crushing: 3.0E-4 kg CO_2e / kg **D:** Gravel from crushed concrete for foundations and internal walls: -0.0228 kg CO_2e / kg
Default service life	As building
Service life reference	Based on: RICS professional standards and guidance, UK Life-cycle Carbon assessment for the built environment 2nd edition.
Product-specific service life	As building

5.3.1.1 Recommendations

The quantity of PC stated in a concrete mix is a function of application-specific requirements for strength, durability, workability and curing speed. Therefore, the design of the concrete mix should be optimised to achieve the functional requirements with minimum embodied Carbon, by carefully considering the mix of essential materials.

At this early RIBA Stage 2 planning submission, the structural and civil design remains in its conceptual phase, and the timeframe for the WLCA has limited the ability to model or incorporate detailed embodied-carbon reduction measures for concrete. Nevertheless, the design team recognises the significant contribution of concrete to the project’s embodied carbon and intends to further refine and reduce these impacts as the design progresses.

The strategies identified at this stage, such as optimising concrete volumes, avoiding over-specification, reviewing opportunities for lower-carbon concrete mixes (e.g., GGBS, PFA, limestone fillers), and rationalising foundations and structural elements will be developed, assessed, and discussed with the structural engineer and wider design team during subsequent design stages.

Accordingly, the proposed reductions presented below should be considered indicative, with definitive actions to be implemented and formalised at later RIBA stages as more detailed information becomes available.

Table 5.4: Optioneering for Concrete.

Building Element	Stage 4 Optioneering	Product Specification	Quantity	A1-A3 (kg CO_2e)	% Difference
Concrete	Current Design	10% GGBS	1m³	394	Baseline
	Recommended	50% GGBS	1m³	330	84%

5.4 Building Servies – Pipes – (PVC)

PVC (polyvinyl chloride) pipework is commonly specified for civils applications such as below-ground drainage, sewer networks, ducting and stormwater systems due to its durability, resistance to corrosion, and comparatively long service life. While PVC manufacture is moderately energy-intensive and associated with process emissions from polymer production, PVC systems typically exhibit lower embodied-carbon impacts than higher-impact alternatives such as concrete or metal pipework. As a result, PVC can offer a lower-carbon solution where performance, loading and adoptable-standards requirements can be met.

Figure 5.4: PVC Pipes illustration.

PVC products can be manufactured using both virgin and recycled polymer feedstocks. Increasingly, suppliers are incorporating post-consumer and post-industrial recycled PVC (rPVC), supported by established recovery and reprocessing schemes within the European construction sector. This contributes to reduced life-cycle impacts, particularly in Modules A1–A3, by lowering the demand for virgin polymer. End-of-life recyclability also presents a notable carbon benefit, as PVC pipework can be mechanically recycled into new products, avoiding landfill disposal and reducing whole-life impacts across Modules C and D.

For the purposes of WLCA, embodied-carbon factors for PVC pipework should be based on product-specific, third-party verified Environmental Product Declarations (EPDs) where available. Many PVC pipe manufacturers supplying the UK civils market now provide Type III EPDs that allow for more accurate characterisation of life-cycle impacts. It is therefore recommended that the project specification requires contractors and suppliers to provide product-specific EPDs for all major PVC pipework elements to ensure robust data inputs and to refine results during later design stages as more detailed information becomes available.

An average embodied carbon factor (ECF) for PVC pipe was applied in the Stage 2 calculations, based on the assumptions outlined below:

Table 5.5: Assumption List for Plasterboard.

Plasterboard	Assumptions
Global Warming Potential (A1-A3)	4.3 kg CO_2e / m
Transportation distance	10,000 km
Transportation method	Carbon only – Cargo Ship, Container Ship, Average
Transportation distance - leg 2	200.0
Transportation method - leg 2	Carbon only - HGV (all diesel), All rigids, Average laden
Wastage on site	6 %
Transportation distance reference	Based on: RICS professional standards and guidance, UK Life-cycle Carbon assessment for the built environment 2nd edition.
Wastage on site reference	Based on: http://www.drywall-how-to.com/drywall-estimator.html
Waste treatment scenario	Pipes recycling
Default service life	15
Service life reference	Based on: RICS professional standards and guidance, UK Life-cycle Carbon assessment for the built environment 2nd edition.

5.4.1.1 Recommendations

To reduce the embodied carbon associated with PVC pipework, it is recommended that the project team prioritise products with high recycled PVC (rPVC) content and verified lower-impact manufacturing processes.

Where performance and adoptable-standards requirements allow, suppliers offering mechanically recycled post-consumer or post-industrial PVC should be selected to minimise upstream impacts in Modules A1–A3. The design team should also review opportunities to rationalise pipe diameters and lengths, avoid unnecessary over-specification, and optimise trench layouts to reduce total material demand.

Additionally, end-of-life recovery and recycling requirements should be included within contractor specifications to ensure PVC pipework is diverted from landfill, enabling Module D benefits. Product-specific Type III Environmental Product Declarations (EPDs) should be requested from all suppliers to support accurate embodied-carbon assessment and to demonstrate continuous improvement throughout later design stages.

6.0 Conclusion

This WLCA has been undertaken in support of the Planning Application for the Prologis UK CCCXXXVIII S.à r.l. in accordance with Hillingdon Local Plan: Part 1 – Strategic Policies, Local Plan: Part 2 – Development Management Policies and the London Plan.

The assessment demonstrates that in non-decarbonised scenario:

- Total lifecycle emissions are estimated at 7,480,787 tCO_2e over a 60-year reference period.
- The largest contributor is Operational Energy Use, accounting for almost 99% of annualised emissions, driven by the inherently high IT and cooling demands of data centre operations.
- Embodied carbon impacts from Modules A (product and construction) represent approximately 0.7%, with the most significant contributions arising from structural steel, concrete, and façade systems.
- Preliminary analysis using a one-year reference period has been undertaken to isolate material impacts, helping to identify structural and some mechanical elements as key hotspots for reduction.

The assessment demonstrates that in decarbonised scenario:

- Total lifecycle emissions are estimated at 1,133,433 tCO_2e over a 60-year reference period.
- The largest contributor is Operational Energy Use, accounting for almost 93% of annualised emissions, driven by the inherently high IT and cooling demands of data centre operations.
- Embodied carbon impacts from Modules A (product and construction) represent approximately 4.1%, with the most significant contributions arising from structural steel, concrete, and façade systems.
- Preliminary analysis using a one-year reference period has been undertaken to isolate material impacts, helping to identify structural and some mechanical elements as key hotspots for reduction.

At this early stage, results are based on indicative design parameters and benchmark datasets. Nevertheless, the analysis provides a transparent baseline against which future improvements can be measured.

In line with Hillingdon Local Plan: Part 1 – Strategic Policies, Local Plan: Part 2 – Development Management Policies and the London Plan, the project team commits to:

- Refining the WLCA as the design progresses through key design milestones.
- Investigating opportunities to reduce embodied carbon through material optimisation, specification of low-carbon concrete and steel, PVC pipe.
- Pursuing operational energy efficiency measures and integration of renewable energy solutions to reduce long-term emissions.

This WLCA therefore provides a compliant submission and demonstrates early consideration of lifecycle carbon, and establishes a framework for embedding carbon reduction strategies as the design evolves.

7.0 Performance against GLA Benchmark

The GLA Whole Life-Cycle Carbon benchmarks have not been applied to this assessment as no published benchmarks currently exist for data centres. The available benchmarks are based on more conventional building typologies such as residential, commercial offices, and mixed-use developments, which are not representative of the scale, operational intensity, or material composition of a data centre.

Applying these values would therefore provide a misleading comparison. Instead, this assessment establishes a transparent project-specific baseline that will be used to track carbon reduction opportunities as the design develops, in line with London Plan Policy SI 2.