DECEMBER 2023

Whole Life Carbon Assessment

Ariel Hotel, Hayes, UB3 5AH

Iceni Projects Limited on behalf of
R Ariel Hotel Opco Limited

December 2023

ICENI PROJECTS LIMITED ON BEHALF OF R ARIEL HOTEL OPCO LIMITED

Whole Life Carbon Assessment
ARIEL HOTEL, HAYES, UB3 5AH

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1. EXECUTIVE SUMMARY

1.1 Iceni Projects Ltd was commissioned by R Ariel Hotel Opco Limited to produce a Whole Life Carbon Assessment for the proposed redevelopment of the Ariel Hotel, Hayes, UB3 5AH.

1.2 This document outlines the whole life carbon (WLC) associated with the proposed development, and the measures adopted embedded within the design of the scheme to reduce this over its lifetime.

1.3 This application proposes the redevelopment of the site to provide a two-storey upward extension to the existing hotel to deliver 113 new hotel rooms, in addition to the provision of a new 98-unit apart-hotel to the rear of the site, that would be operated in conjunction with the existing hotel.

1.4 The Whole Life Carbon Assessment (WLCA) for the proposed development has been undertaken using industry best practice methodology, and therefore represents best practice in meeting the required standards of whole life carbon assessment and reduction. A summary of the estimated whole life carbon emissions is provided below.

Table 1.1 Estimated Whole Life Carbon Emissions

Building Element	**Carbon Emissions ($kgCO_2e$)**
0 Demolition	-
1 Substructure	203,521
2.1 – 2.4 Superstructure	1,601,522
2.5 – 2.6 Superstructure	1,049,831
2.7 – 2.8 Superstructure	16,968
3 Finishes	1,373,566
4 Fittings, furnishings & equipment	902,691
5 Services (MEP)	359,542
6 Prefabricated buildings and building units	-
7 Work to existing building	2,115
8 External works	107,296
Other materials – TOTAL	-
Site energy and water	36,879,523
TOTAL $kgCO_2e$	**42,496,574**

1.5 The WLCA presented here demonstrates that the proposed development will achieve a Whole Life Carbon Intensity of 84.8 $kgCO_2e/m^2$/year, and an Embodied Carbon Intensity of 11.2 $kgCO_2e/m^2$/year.

1.6 The actions to be taken to reduce whole life carbon emissions include:

- **Energy Strategy:** The Energy Strategy for the proposed development is a key mechanism for reducing whole life carbon. In addition to a passive design approach, a strategy has been proposed that utilises highly efficient heat pumps to serve both the space heating and cooling and water heating demands of the proposed development, which will take advantage of the projected decarbonisation of the national grid.

- **Circular Economy:** The proposed development has taken care to consider circular economy principles in its design. The Circular Economy Statement, submitted in support of this planning application, details the strategy for recovery of materials in line with the circular economy model.

2. INTRODUCTION

2.1 Iceni Projects Ltd was commissioned by R Ariel Hotel Opco Limited to produce a Whole Life Carbon Assessment for the proposed redevelopment of the Ariel Hotel, Hayes, UB3 5AH.

Report Objective

2.2 This document details the whole life carbon assessment undertaken for the proposed development and gives an overview of the interventions that will be applied to within the design of the scheme to reduce its whole life carbon over its lifetime.

2.3 The report is structured as follows:

- Section 3 discusses the planning context and policies which are relevant to whole life carbon;
- Section 4 presents the methodology of the assessment, including the scope of the assessment and data sources;
- Section 5 presents the inputs of the whole life carbon assessment;
- Section 6 presents the results of the whole life carbon assessment; and
- Section 7 summarises the findings of the whole life carbon assessment.

Site and Surroundings

2.4 The application site (Appendix A1) is located within the London Borough of Hillingdon, to the north of London Heathrow Airport. The site is bounded by Marlborough Crescent to the north, the Courtyard by Marriot hotel to the east, and High Street Harlington (A437) to the west. The southern boundary of the site is formed by Bath Road, with London Heathrow Airport located beyond.

2.5 The application site itself currently comprises the Ariel Hotel, with associated car parking and hard surfaces. The surrounding area is characterised by a mix of uses, with residential dwellings located to the north, additional hotel uses to the east and west, and London Heathrow Airport and associated buildings and car parking to the south.

The Proposed Development

2.6 The description of development is as follows:

"Reconfiguration, alteration and extension of existing hotel (providing additional hotel rooms), together with erection of a new apart-hotel building on car park land to the north."

2.7 The proposed extension to the existing Ariel Hotel comprises of the following number of hotel rooms on each floor.

Table 2.1 Hotel rooms within proposed refurbishment and extension of the Ariel Hotel

Hotel Room Size	Number
Ground Floor	12
Fourth Floor	51
Fifth Floor	50
Total	**113**

2.8 The proposed new-built apart-hotel will deliver the following mix of apart-hotel rooms:

Table 2.2 Apart-hotel mix

Apart-hotel Type	Number
1-bed	81
2-bed	17
Total	**98**

2.9 The images below show selected elevations and plans of the scheme, based on the information provided by Ackroyd Lowrie.

Figure 2.1 South elevation – Ariel Hotel

Figure 2.2 North elevation – Ariel Hotel

Figure 2.3 West elevation – Ariel Hotel

Figure 2.4 East elevation – Ariel Hotel

Figure 2.5 South elevation – Apart-hotel

Figure 2.6 North elevation – Apart-hotel

Figure 2.7 West (left) and east (right) elevations – Apart-hotel

Figure 2.8 Ground floor – Ariel Hotel

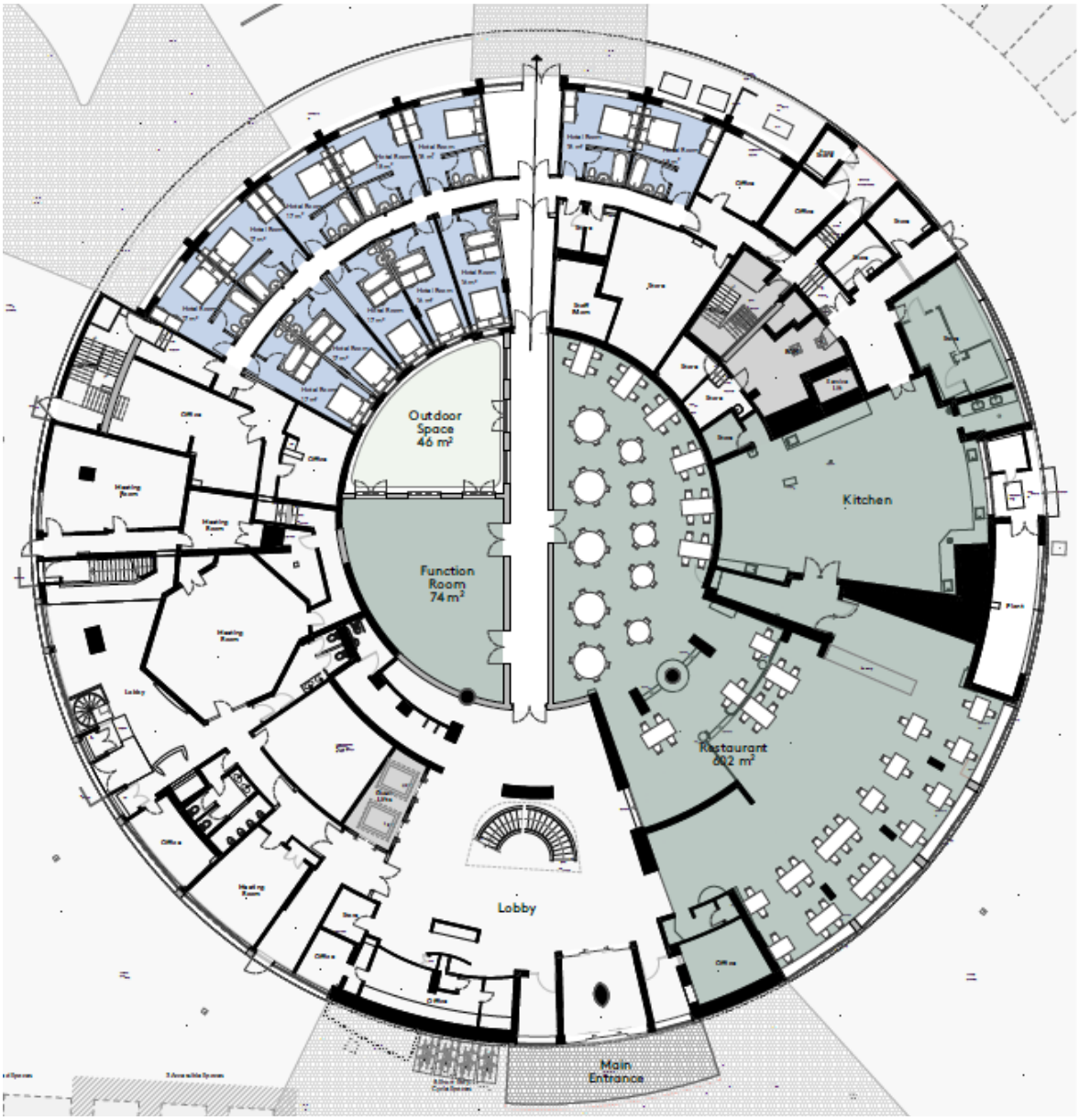


Figure 2.9 Fourth floor – Ariel Hotel

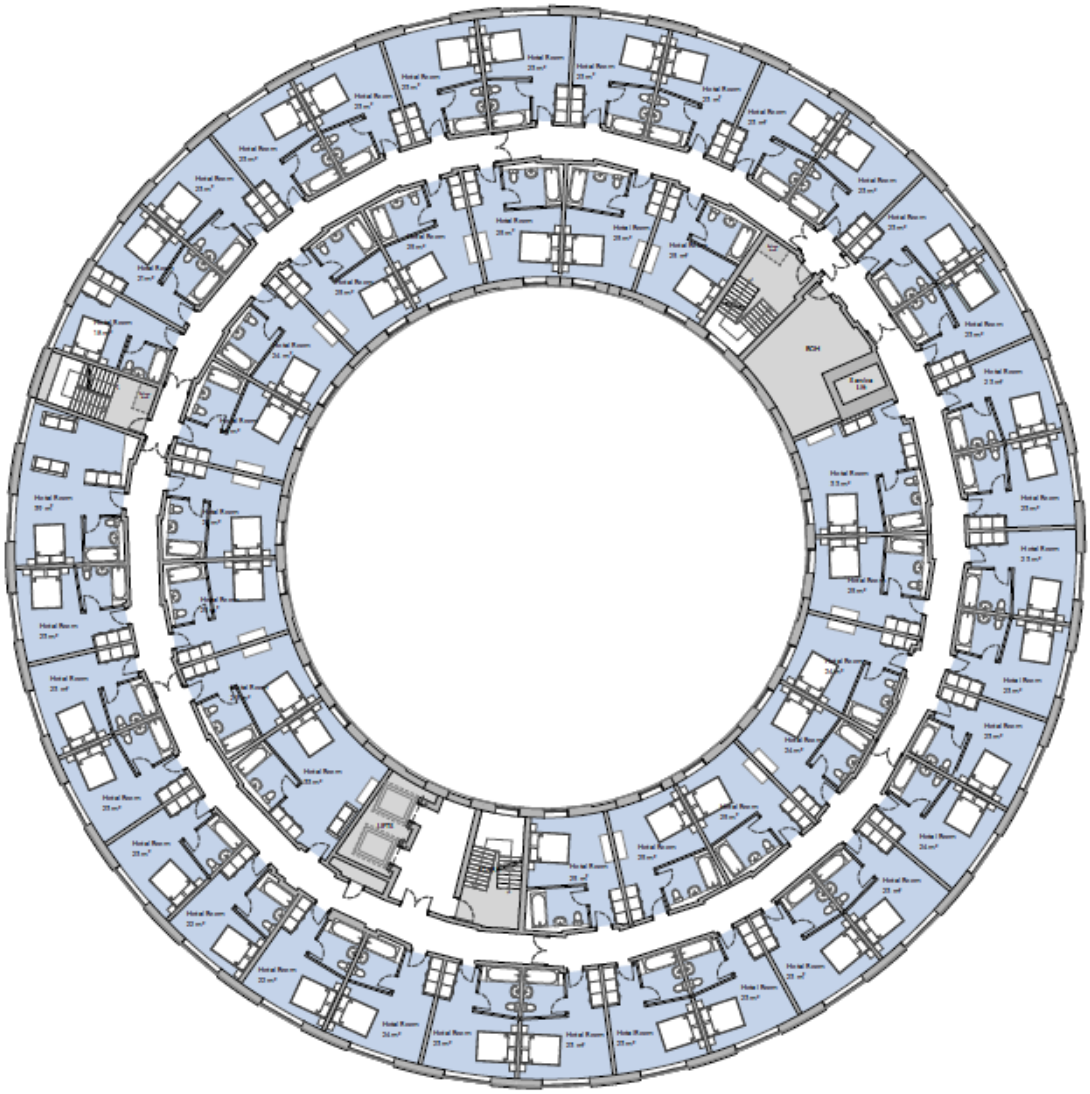


Figure 2.10 Fifth floor – Ariel Hotel

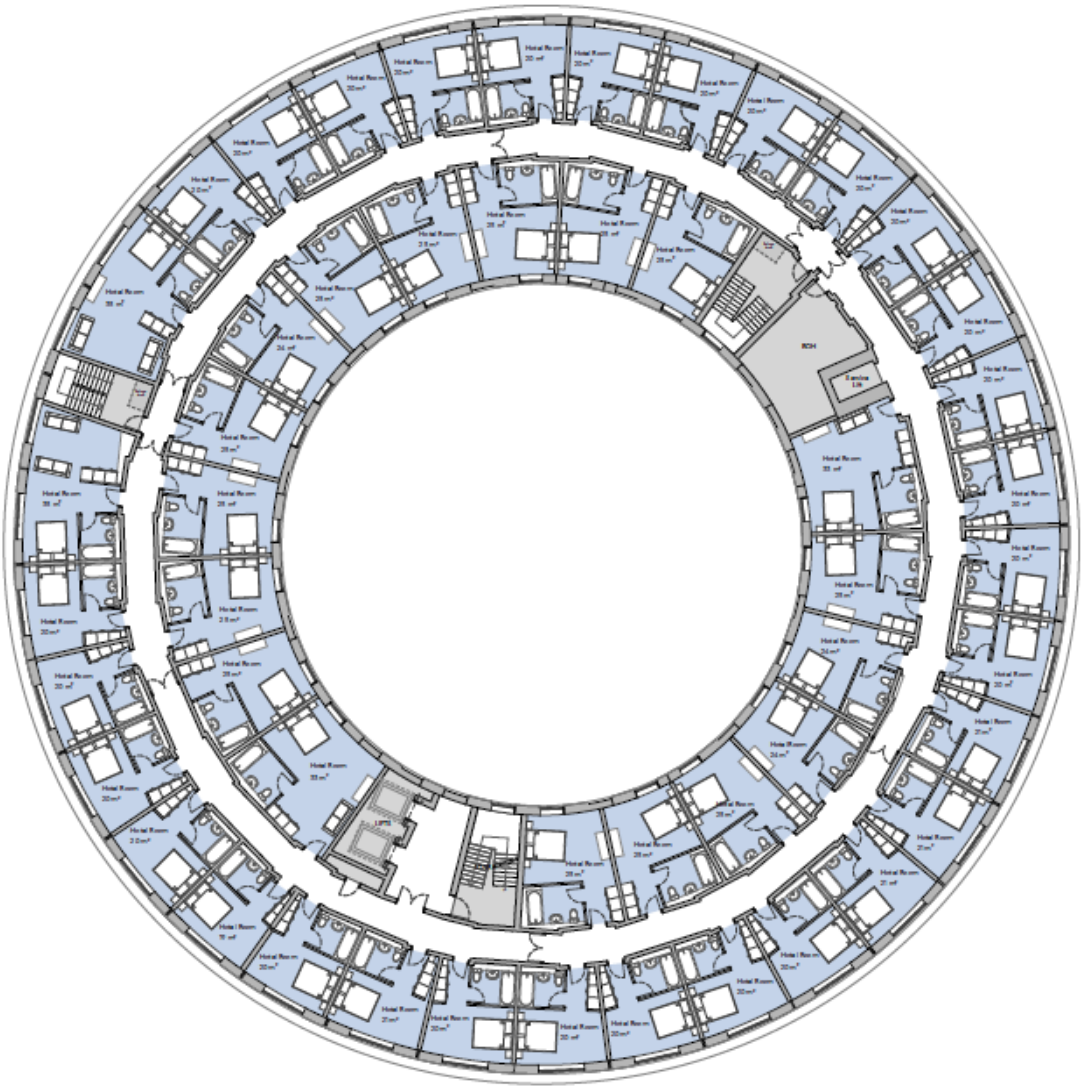


Figure 2.11 Ground floor – Apart-hotel

Figure 2.12 First and second floor – Apart-hotel

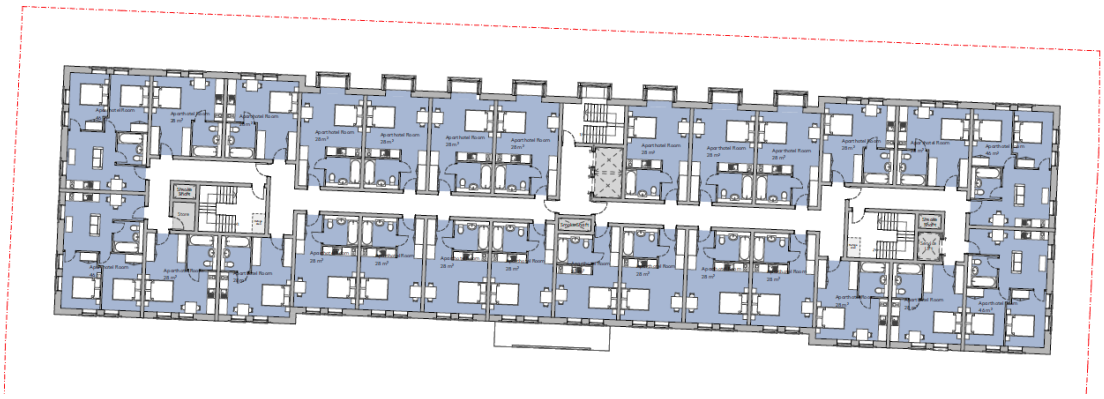
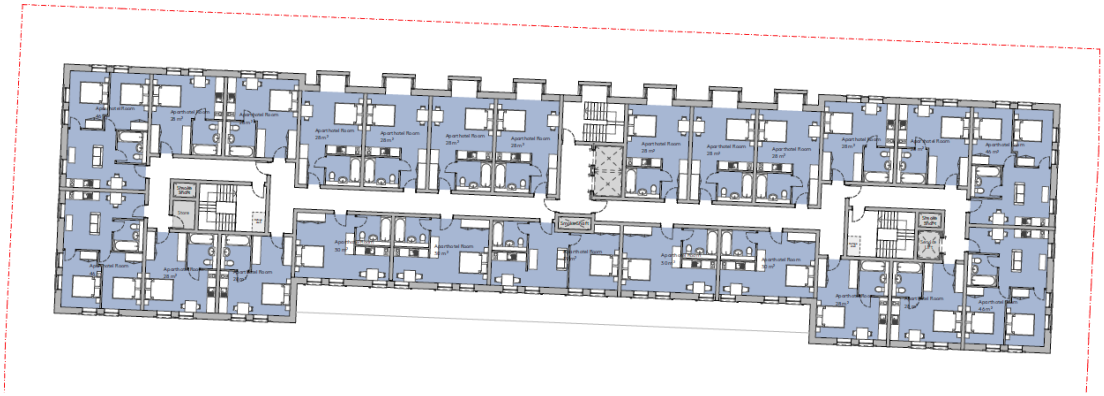


Figure 2.13 Third floor – Apart-hotel



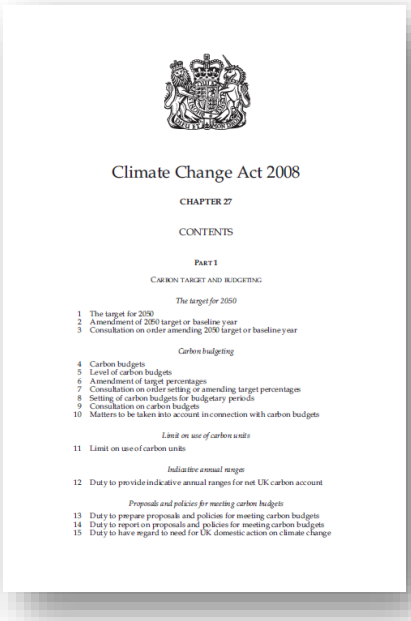
3. PLANNING AND REGULATORY CONTEXT

3.1 Built environment embodied carbon emissions are incorporated within policy and regulation at a national and local level, as set out below.

National

Climate Change Act 2008

3.2 On 26th November 2008, the UK Government published the Climate Change Act 2008; the world's first long-term legally binding framework to mitigate against climate change. Within this framework, the Act sets legally binding targets to increase greenhouse gas emission reductions through action in the UK and abroad from the 60% target set out in the Energy White Paper, to 80% by 2050.



Climate Change Act 2008

CHAPTER 27

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PART 1

CARBON TARGET AND BUDGETING

The target for 2050

1 The target for 2050
2 Amendment of 2050 target or baseline year
3 Consultation on order amending 2050 target or baseline year

Carbon budgeting

4 Carbon budgets
5 Level of carbon budgets
6 Amendment of target percentages
7 Consultation on order setting or amending target percentages
8 Setting of carbon budgets for budgetary periods
9 Consultation on carbon budgets
10 Matters to be taken into account in connection with carbon budgets

Limit on use of carbon units

11 Limit on use of carbon units

Indicative annual ranges

12 Duty to provide indicative annual ranges for net UK carbon account

Proposals and policies for meeting carbon budgets

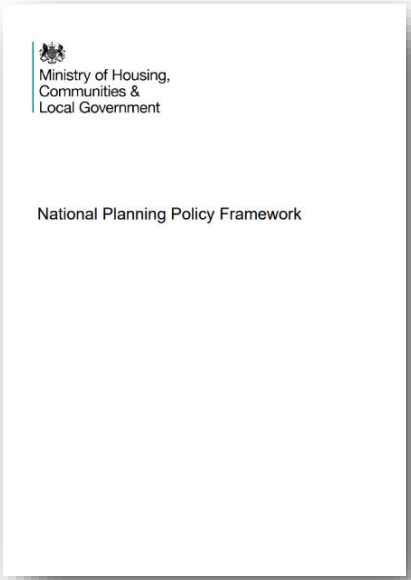
13 Duty to prepare proposals and policies for meeting carbon budgets
14 Duty to report on proposals and policies for meeting carbon budgets
15 Duty to have regard to need for UK domestic action on climate change

3.3 As required under Section 34 of the Climate Change Act, the Sixth Annual Carbon Budget was accepted by the Government in April 2021. This sets out a budget for UK emissions for the period 2033 – 2037.

3.4 Following a commitment in June 2019, the Climate Change Act has been amended to target net zero carbon emissions by 2050.

National Planning Policy Framework

3.5 The Ministry of Housing, Communities & Local Government determines national policies on different aspects of planning and the rules that govern the operation of the system. Accordingly, the National Planning Policy Framework (NPPF), which came into force in March 2012 and was updated in February 2019, aims to strengthen local decision making. Additional updates have since been made through the latter half of 2020 and in January and July 2021 to reflect changes related to use classes, permitted development rights, the calculation of housing need, and requirements to achieve beauty alongside sustainability. A further update was made in September 2023 with respect to onshore wind development.



Ministry of Housing, Communities & Local Government

National Planning Policy Framework

3.6 Paragraphs 10 and 11 of the NPPF confirm that at the heart of this document is a “presumption in favour of sustainable development”, and that development proposals that accord with an up-to-date development plan should be approved without delay.

3.7 Paragraph 7 states that the purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.

3.8 Achieving sustainable development means that the planning system has three overarching activities, which are interdependent and need to be pursued in mutually supportive ways, so that opportunities can be taken to secure net gains across each of the different objectives:

- **An Economic Role** – ensuring the provision of land and infrastructure needed to help build a strong, responsive and competitive economy.

- **A Social Role** – supplying the required amount of housing while at the same time ensuring and building strong, vibrant and healthy communities. Ensuring that the built environment is sited around accessible local services which help support a community’s health, social and cultural well-being.

- **An Environmental Role** – ensuring development contributes to the protection and enhancement of the natural, built and historic environment through the improvement of biodiversity, minimising the use of natural resources and production of pollution / waste, and guaranteeing sufficient adaptation to climate change.

Regional

3.9 Within Greater London, key sustainable development principles for economic, environmental and social improvement are set out below:

The London Plan (March 2021)

3.10 The London Plan is the overall strategic plan for London and includes policies for sustainable development and energy within Chapter 9 (London's response to climate change). Key policies of relevance to this scheme are as follows:

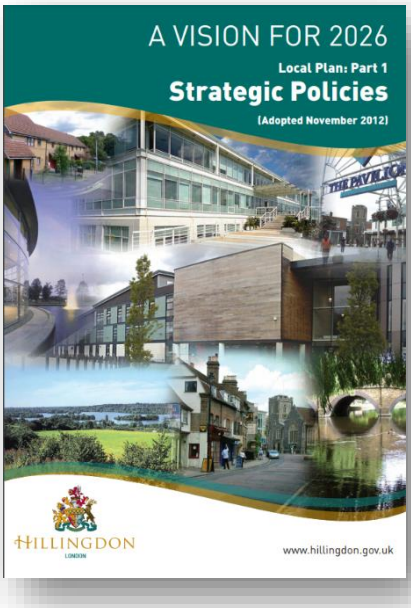
- Policy SI2 Minimising Greenhouse Gas Emissions. This states that development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment, and demonstrate actions taken to reduce life-cycle carbon emissions.

3.11 The accompanying text states that operational carbon emissions will make up a declining proportion of a development's whole life-cycle carbon emissions as operational carbon targets become more stringent. To fully capture a development's carbon impact, a whole life-cycle approach is needed to capture its unregulated emissions (i.e. those associated with cooking and small appliances), its embodied emissions (i.e. those associated with raw material extraction, manufacture and transport of building materials and construction), and emissions associated with maintenance, repair and replacement, as well as dismantling, demolition and eventual material disposal. Whole life-cycle carbon emission assessments are therefore required for development proposals referable to the Mayor. Major non-referable development should calculate unregulated emissions and are encouraged to undertake whole life-cycle carbon assessments. The approach to whole life-cycle carbon emissions assessments, including when they should take place, what they should contain, and how information should be reported, will be set out in guidance.

Local

3.12 In determining the local context, the London Borough of Hillingdon Local Plan Part 1 Strategic Policies (November 2012) and the Local Plan Part 2: Development Management Policies (January 2020) set out policy relevant to sustainable development.

London Borough of Hillingdon Local Plan Part 1: Strategic Policies (November 2012)



3.13 The Local Plan: Part 1 sets out the planning vision and strategy for London Borough of Hillingdon. It identifies how the borough will guide future development in terms of the effective choice of housing, jobs and supporting infrastructure such as schools, health, leisure and community facilities, as well as ensuring places in the borough become vibrant, safe and welcoming. Policies and objectives of relevance to this project in the context of whole life carbon are as follows:

- **Strategic Objective 11:** Address the impacts of climate change, and minimise emissions of carbon and local air quality pollutants from new development and transport.

- **Policy EM1: Climate Change Adaption and Mitigation.** The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

    - Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.

    - Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.

    - Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.

    - Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.

    - 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.

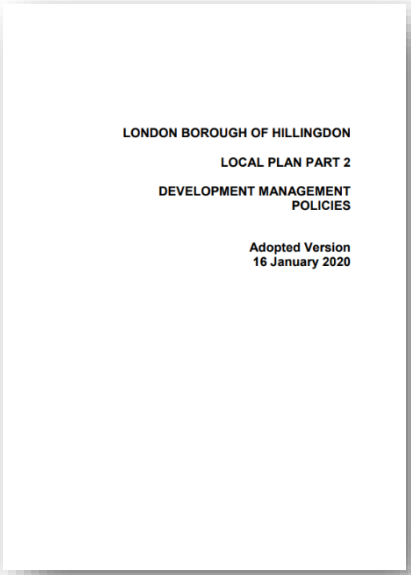
- Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation as part of their proposals.

- 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, hydroelectricity and a greater use of waste as a resource.

The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:

- Giving preference to development of previously developed land to avoid the loss of further green areas.

London Borough of Hillingdon Local Plan Part 2: Development Management Policies (January 2020)



3.14 The purpose of the Local Plan Part 2: Development Management Policies is to provide policies that will form the basis of the decision making on individual planning applications. The document contains policies relating to new development and environmental protection and enhancement. Policies of relevance are as follows:

- **Policy DMEI 2: Reducing Carbon Emissions.**

A. All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.

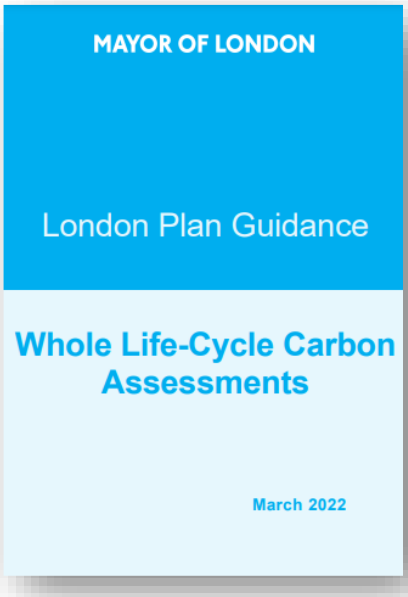
B. All major development proposals must be accompanied by an energy assessment showing how these reductions will be achieved.

C. 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.

Other Considerations

Whole Life-Cyle Carbon Assessments Guidance (March 2022)

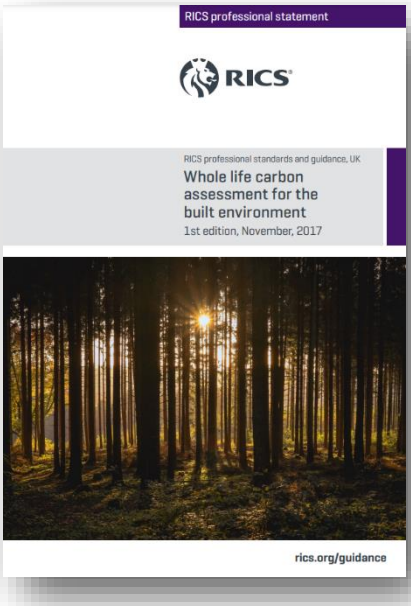
3.15 The guidance note provides further detail on addressing the requirements related to Whole Life Carbon, as per Policy SI2DB of the London Plan through the provision of a Whole Life Carbon Assessment to accompany planning applications. The document explains how to calculate Whole Life Carbon emissions and the information that needs to be submitted to comply with the policy. It also includes information on design principles and Whole Life Carbon benchmarks to aid in designing buildings that have low operational carbon and low embodied carbon.



3.16 3.16 The Whole Life-Cycle Carbon Assessments Guidance states that Policy SI2DB applies to planning applications which are referred to the Mayor, but that Whole Life Carbon Assessments are also supported and encouraged on major applications which are not referable to the Mayor.

RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment (2017)

3.17 The RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment was written with the intention to standardise whole life carbon assessment and enhance consistency in outputs by providing specific practical guidance for the interpretation and implementation of the methodology in EN 15978 in carbon calculations.



3.18 The specific objectives of the RICS professional statement are to:

- provide a consistent and transparent whole life carbon assessment implementation plan and reporting structure for built projects in line with EN 15978;
- enable coherence in the outputs of whole life carbon assessments to improve the comparability and usability of results;

- make whole life carbon assessments more ‘mainstream’ by enhancing their accessibility and therefore encourage greater engagement and uptake by the built environment sector;
- increase the reliability of whole life carbon assessment by providing a solid source of reference for the industry;
- promote long-term thinking past project practical completion, concerning the maintenance, durability and adaptability of building components and the project as a whole; and
- promote circular economic principles by encouraging future repurposing of building components, as well as of the project as a whole, through quantifying their recovery, reuse and/or recycling potential.

4. METHODOLOGY

4.1 The whole life carbon assessment for the proposed development has been undertaken in line with the Greater London Authority's (GLA) methodology set out in the London Plan and associated guidance documents. This approach is consistent with the required by the London Borough of Hillingdon, and therefore represents best practice in meeting the required standards for the undertaking of whole life carbon assessments.

4.2 The methodology of the whole life carbon undertaken for the proposed development is outlined below. The assessment has been undertaken in line with the GLA guidance for whole life carbon assessments, and is therefore in compliance with the Royal Institution of Chartered Surveyors (RICS) Professional Statement: Whole Life Carbon Assessment for the Built Environment.

Assessment Scope

4.3 The assessment of whole life carbon (WLC) emissions consists of the following sections: total operational carbon emissions (regulated plus unregulated); embodied carbon emissions; and any future potential carbon emissions 'benefits', post end-of-life, including benefits from reuse and recycling of building structure and materials.

Operational Carbon Emissions

4.4 In line with the GLA guidance, the operational carbon emissions have been calculated based on the Part L assessments undertaken as part of the Energy Strategy prepared for the proposed development, and which accompanies this submission. This encompasses carbon emissions related to both regulated and unregulated energy uses, in line with the Part L definitions, across a 60-year study period.

Embodied Carbon Assessment and End-of-Life Emissions

4.5 To assess the embodied carbon for the project, a Life Cycle Assessment (LCA) tool, eTool LCD, has been employed to allocate anticipated material quantities as part of an inventory analysis. The materials are represented within the model by using materials with associated Environmental Product Declarations (EPDs). EPDs are produced by manufacturers and identify the carbon emissions of a product. By scheduling the materials proposed for the development, the overall carbon emissions can be approximated.

4.6 It should be noted, the LCA tool employed has a limited database. Therefore, where a material is not included within the database, a material of similar composition has been selected instead. It should also be noted that the LCA tool employed here the tool satisfies the criteria set out within the Whole Life-Cycle Carbon Assessments Guidance:

- It follows BS EN 15978.
- The scope covers modules A – C. Whilst noted that many available tools do not include module D at this time, the tool employed here does also include module D.
- The database from which the life-cycle assessment information is sourced is based on EPDs that reflect the country of origin of the material selected.

4.7 The LCA process and results included within this report have been carried out in accordance with BS 15978:2011 and the RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment. All EPDs used as part of the assessment have been produced in line with the requirements of BS EN 15804:2012. Each material has been assessed the following lifecycles stages:

- A1 – A3 Product stage
- A4 Material transportation to site
- B4 – B5 Replacement and maintenance
- C1 – C4 End of life

4.8 The contribution of life stage A5 – Installation into the building – has also been explored separately, in order to give an estimate of the emissions related to construction.

4.9 The following elements have been included within the assessment:

- Demolition
- Facilitating works
- Substructure
- Superstructure – including frame, upper floors, roof, stairs and ramps, external walls, windows and external doors, internal wall and partitions, and internal doors.
- Finishes
- Fittings, furnishings and equipment
- Building services
- Prefabricated buildings and building units
- External works – including hard and soft landscaping, fencing, fixtures, drainage and services

Life Cycle Assessment Impacts

4.10 A building LCA considers a range of environmental indicators that assess the relevant overall impacts of the materials selected. Whilst an LCA would ideally consider all environmental impacts associated with a product or material, this is not always possible. This is due to a lack of available information in some cases, or a lack of consensus within the industry in terms of how to calculate key performance indicators.

4.11 Standard ratios are used to convert greenhouse gas emissions into equivalent amounts of carbon dioxide (CO_2). These ratios are based on the global warming potential (GWP) of each gas, which is a relative measure of the estimated contribution a gas has to global warming over a given time period, typically set at 100 years. It is expressed relative to CO_2, which is set as the baseline against which other gases are compared, and therefore has a GWP value of 1.

4.12 This assessment reports on the embodied carbon of the development in terms of GWP, using the annotation carbon dioxide equivalent, CO_2e.

Data Sources

4.13 There are a number of approaches to undertaking an LCA for a building, therefore flexibility is required when utilising a dataset of product-specific environmental product declarations and other, more generic data calculated within the LCA tool. Examples of the types of data required when undertaking an LCA are displayed in Table 4.1, below.

Table 4.1 Types of data required for a WLC Assessment

Quantity Data	Material Data	Comments
Cost Plan	Cost Plan	Cost plans can be useful for calculation of uncertain quantities which are not product specific, however an allowance is often made at early design stages that may reduce accuracy.
Architectural Drawings and Area Schedules	Architectural Build-ups	A more traditional and slower approach to determining quantity of building elements, if build-ups are available to support.

4.14 At this stage, the assessment has been based on information provided by Ackroyd Lowrie, based on the plans and drawings submitted as part of the planning application for which this assessment has been undertaken.

4.15 Due to the early stage in the design process, details on the internal fittings, furnishing and equipment, and some internal structures, including internal doors, associated with the proposed development

are limited, therefore the carbon emissions calculated for these building elements have been based on the following assumptions:

- Internal fittings, furnishing and equipment emissions have been calculated by assuming each aparthotel unit will be provided with “standard” kitchen and bathroom fittings and lighting, based on the templates available within the LCA Tool employed for the assessment. Similarly, it has been assumed that each hotel room will be provided with “standard” bathroom and lighting systems. Note that due to the data available within the LCA Tool, the inclusion of internal fittings within the Whole Life Carbon Assessment calculation are limited to the bathrooms and kitchens of the proposed spaces, and fittings associated with other spaces, such as the proposed gym at the lower-ground floor, have been omitted.

- The number of internal doors to be provided has been estimated based on the indicative internal floorplans prepared by Ackroyd Lowrie. For the purposes of this assessment, it has been assumed that all internal doors are solid timber, and are 2.1m high and 0.8m wide.

4.16 At this stage of the design process, therefore, the carbon dioxide emissions presented here associated with internal fittings, furnishings and equipment, and internal doors are an estimate only. It is intended that, as the design of the proposed development continues to be developed, and information regarding these elements becomes available, the calculation of the embodied and whole life carbon associated with the proposed development will be updated to reflect these changes in the information available.

5. INPUTS TO THE WHOLE LIFE CARBON ASSESSMENT

5.1 This section presents the inputs to the whole life carbon assessment undertaken for the proposed development.

Operational Carbon Assessment

5.2 Operational carbon emissions have been estimated using templates provided within eTool LCD, based on the projected energy loads calculated as part of the Energy Strategy, produced by Iceni Projects. The template provided within eTool LCD is based on the benchmarks provided within CIBSE TM46 relating to residential dwellings.

Embodied Carbon and End-of-Life Assessment

5.3 Table 5.1 below lists the building elements considered as part of the whole life carbon assessment, in line with the RICS Professional Statement: Whole Life Carbon Assessment for the Built Environment. A list of the inputs to the eTool LCD tool are provided in Appendix A2.

5.4 The details of the Life Cycle Modules considered within the Whole Life Carbon Assessment, alongside a brief commentary on the data source employed, are provided in Appendix A3.

Table 5.1 Data used in the embodied carbon assessment – building elements

Building element group	Building element (NRM Level 2)	Included in Scope?
Demolition	0.1 Toxic / hazardous / contaminated material treatment	N/A – not anticipated to be present
	0.2 Major demolition works	No – existing building present on site is to be retained, retrofitted and extended as part of the proposed development
0 Facilitating works	0.3 & 0.5 Temporary / enabling works	No – relevant information not available
	0.4 Specialist groundworks	N/A – accounted for within substructure
1 Substructure	1.1 Substructure	Yes – calculated using information provided
2 Superstructure	2.1 Frame	Yes – calculated using information provided

Building element group	Building element (NRM Level 2)	Included in Scope?
	2.2 Upper floors, including balconies	Yes – calculated using information provided
	2.3 Roof	Yes – calculated using information provided
	2.4 Stairs and ramps	Yes – calculated using assumptions based on proposed elevations
	2.5 External walls	Yes – calculated using information provided
	2.6 Windows and external doors	Yes – calculated using information provided
	2.7 Internal walls and partitions	Yes – calculated using information provided
	2.8 Internal doors	Yes – calculated using assumption based on proposed internal plans
3 Finishes	3.1 Wall finishes	Yes – calculated by the eTool LCD tool, based on assumptions built into the tool
	3.2 Floor finishes	
	3.3 Ceiling finishes	
4 Fittings, furnishings and equipment (FF&E)	4.1 Fittings, furnishings & equipment including building-related and non-building-related	Yes – calculated using assumptions based on the house types to be delivered and the internal plans
5 Building Services / MEP	5.1 – 5.14 Services including building-related and non-building-related	Yes – calculated by the eTool LCD tool, based on assumptions built into the tool
6 Prefabricated Buildings and Building Units	6.1 Prefabricated buildings and building units	Yes – calculated using plans provided, however included within the relevant areas of the building listed above
7 Work to Existing Building	7.1 Minor demolition and alteration works	Yes – calculated by the eTool LCD tool, based on assumptions built into the tool
8 External Works	8.1 Site preparation works	Yes – calculated using plans provided
	8.2 Roads, paths, paving and surfacing	
	8.3 Soft landscaping and irrigation systems	
	8.4 Fencing, railings and walls	

Building element group	Building element (NRM Level 2)	Included in Scope?
	8.5 External fixtures	
	8.6 External drainage	
	8.7 External services	
	8.8 Minor building works and ancillary buildings	N/A – no minor building works or ancillary buildings are applicable

5.5 Potential end-of-life scenarios are considered within Appendix A4 of this Whole Life Carbon Assessment.

6. WHOLE LIFE CARBON ASSESSMENT RESULTS

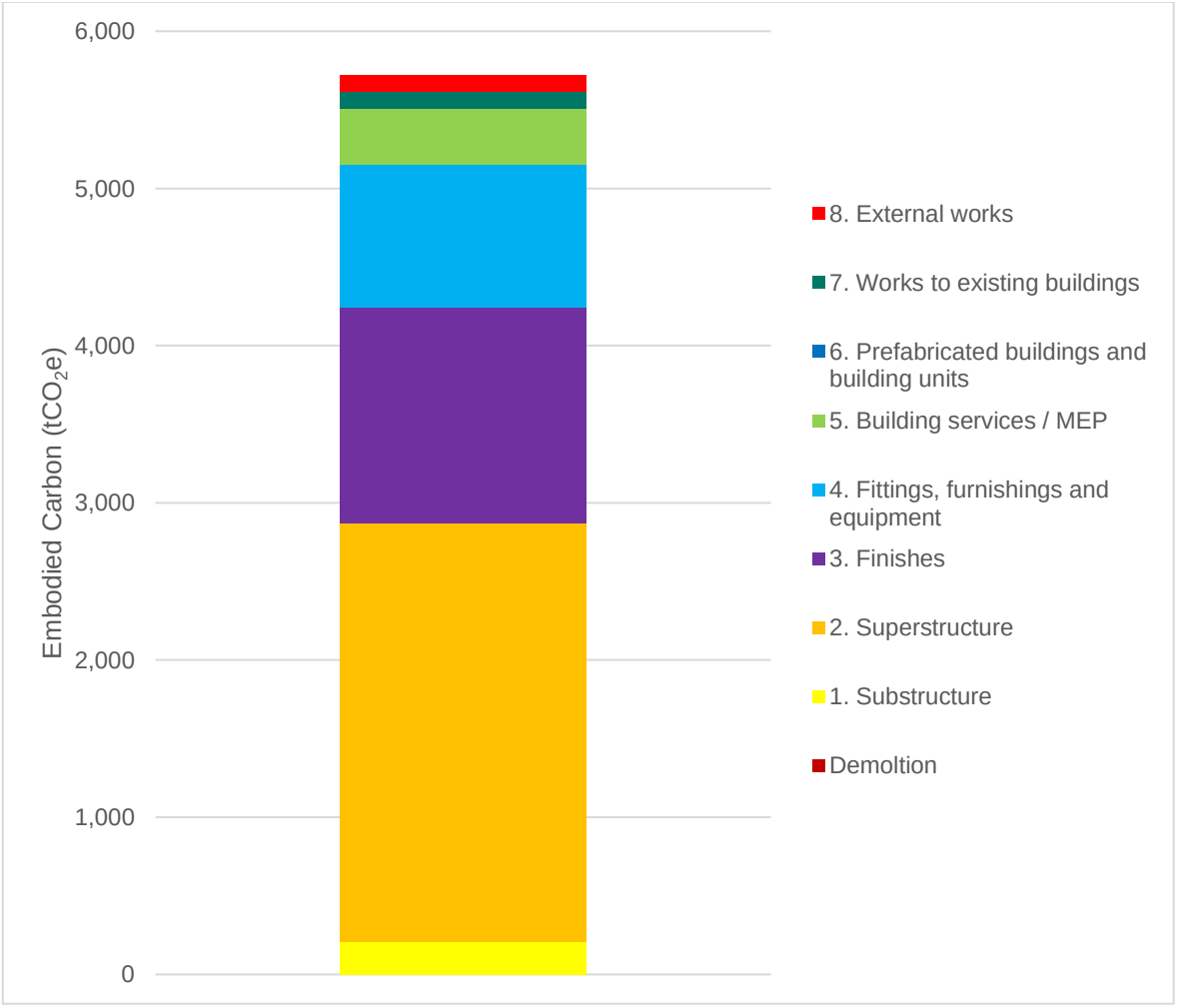
6.1 As detailed above, a Whole Life Carbon Assessment has been undertaken for the proposed redevelopment of the Ariel Hotel. Hayes using the eTool LCD tool. This section details the results of the assessment, with the following results addressed separately:

- Embodied carbon emissions
- Operational carbon emissions
- Whole life carbon emissions

Embodied Carbon Emissions

6.2 The estimated embodied carbon for the proposed development is provided in Figure 6.1 below, broken down according to the main building element categories described above. Embodied carbon emissions across scopes A1 – A5 (Product Stage and Transport), B1 – B5 (Use Stage) and C1 – C4 (Demolition and End-of-Life) have been accounted for in the results displayed below.

Figure 6.1 Embodied carbon emissions



Operational Carbon Emissions

6.3 The total operational carbon emissions have been calculated over a 60-year study period, based on two sets of carbon factors, in line with industry best practice. The results have been calculated using the projected annual energy demand of the proposed development, based on the outputs of the indicative energy modelling undertaken as part of the energy assessment included within the Sustainability, Energy & Overheating Statement, prepared by Iceni Projects. The projected energy demands of the proposed development are shown in the table below.

Table 6.1 Annual energy demand

Energy Demand (kWh/year)					
Space heating	Hot Water	Lighting	Auxiliary	Cooling	Unregulated loads*
33,180	1,669,997	17,572	54,202	10,357	722,699

*At this stage, unregulated loads have not been calculated using the CIBSE TM46 template included within eTool LCD. It is anticipated that, should unregulated loads be re-calculated during subsequent design stages, the information contained within this Whole Life Carbon Assessment will be updated to reflect this, if required.

6.4 The estimated total operational carbon emissions, including regulated and unregulated energy uses, over the 60-year study period are presented in Table 6.2 below.

Table 6.2 Total operational carbon emissions

Total Operational Carbon Emissions (tCO_2)
42,497

Whole Life Carbon Emissions

6.5 The whole life carbon emissions calculated over the 60-year study period are provided in Table 6.3 below.

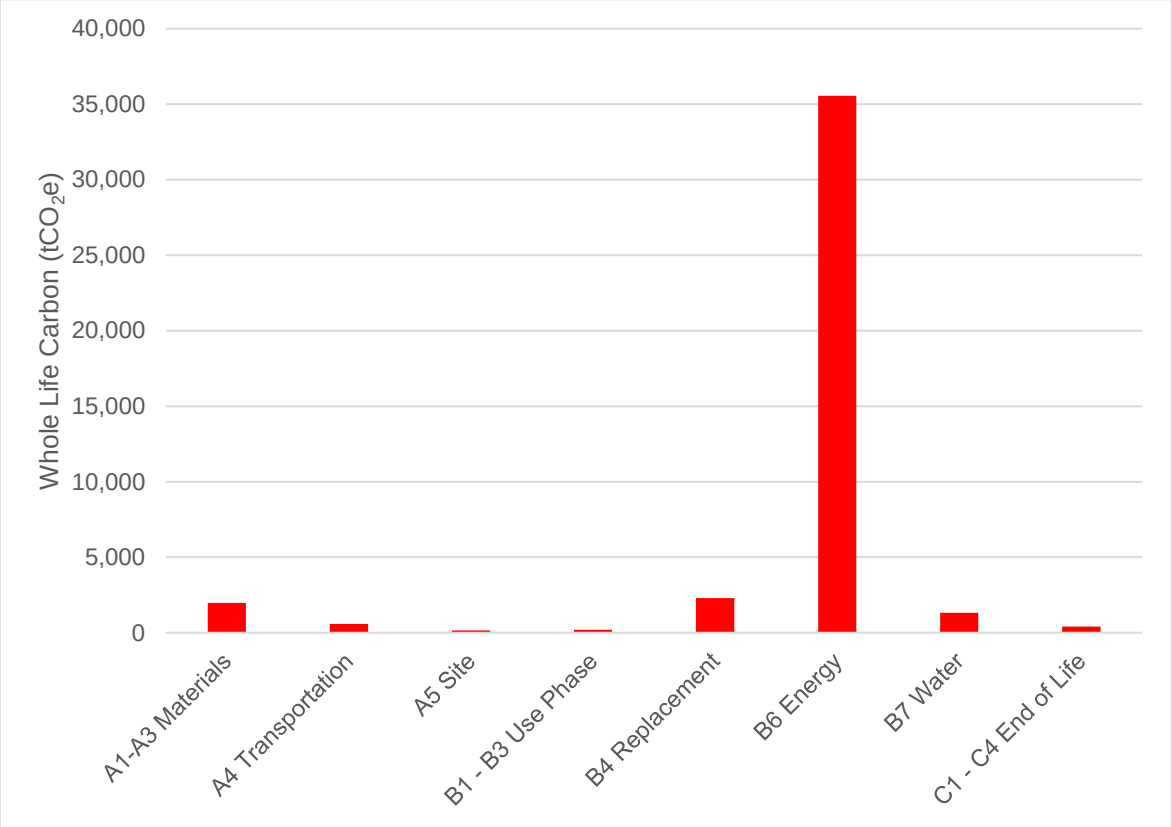
6.6 Figure 6.2 below shows a breakdown of the whole life carbon emissions by life cycle stage.

Table 6.3 Total whole life carbon emissions by life-cycle stage

	Whole Life Carbon Emissions (tCO_2e)
A1 – A3: Materials	1,972
A4: Transportation	582
A5: Site	162
B1 – B3: Use Phase	197
B4: Replacement	2,302
B6: Energy	35,551

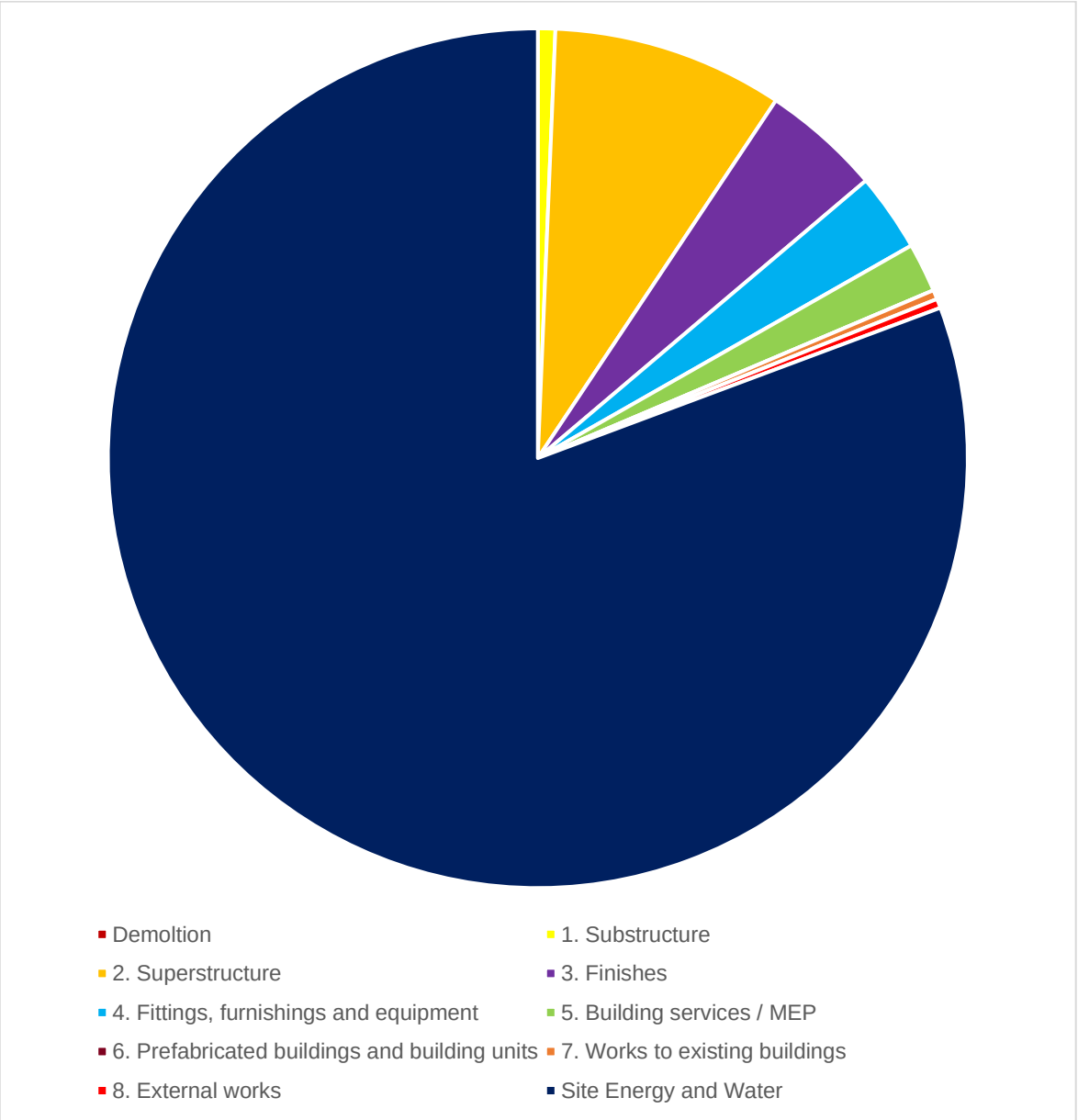
	Whole Life Carbon Emissions (tCO_2e)
B7: Water	1,328
C1 – C4: End of Life	402
Total	**42,497**

Figure 6.2 Total whole life carbon emissions by life-cycle stage



6.7 Figure 6.3 below shows the proportional contribution of each building element to the total whole life carbon emissions of the proposals.

Figure 6.3 Contribution of each building element to total whole life carbon emissions



6.8 The information presented above demonstrates that the Whole Life Carbon emissions associated with the proposed development will be approximately 42,496,574 kgCO_2e over a projected lifetime of 60 years. This is equivalent to a Whole Life Carbon Intensity of 84.8 kgCO_2e/m^2/year, and an Embodied Carbon Intensity of 11.2 kgCO_2e/m^2/year. It is expected that, as the national electricity grid continues to decarbonise, the carbon emissions associated with the operation of the proposed development will fall, therefore resulting in a decrease in the whole life carbon emissions of the scheme.

7. SUMMARY AND CONCLUSIONS

7.1 This Whole Life Carbon Assessment provides an estimate of the whole life carbon emissions associated with the proposed redevelopment of the Ariel Hotel, Hayes and gives an overview of the measures adopted embedded within the design of the scheme to reduce this over its lifetime.

7.2 The Whole Life Carbon Assessment (WLCA) for the proposed development has been undertaken using industry best practice methodology, and therefore represents best practice in meeting the required standards of whole life carbon assessment and reduction.

7.3 A summary of the estimated whole life carbon emissions is provided below.

Table 7.1 Estimated Whole Life Carbon Emissions

Building Element	**Carbon Emissions ($kgCO_2e$)**
0 Demolition	-
1 Substructure	203,521
2.1 – 2.4 Superstructure	1,601,522
2.5 – 2.6 Superstructure	1,049,831
2.7 – 2.8 Superstructure	16,968
3 Finishes	1,373,566
4 Fittings, furnishings & equipment	902,691
5 Services (MEP)	359,542
6 Prefabricated buildings and building units	-
7 Work to existing building	2,115
8 External works	107,296
Other materials – TOTAL	-
Site energy and water	36,879,523
TOTAL $kgCO_2e$	**42,496,574**

7.4 The WLCA presented here demonstrates that the proposed development will achieve a Whole Life Carbon Intensity of 84.8 $kgCO_2e/m^2$/year, and an Embodied Carbon Intensity of 11.2 $kgCO_2e/m^2$/year.

7.5 The actions to be taken to reduce whole life carbon emissions include:

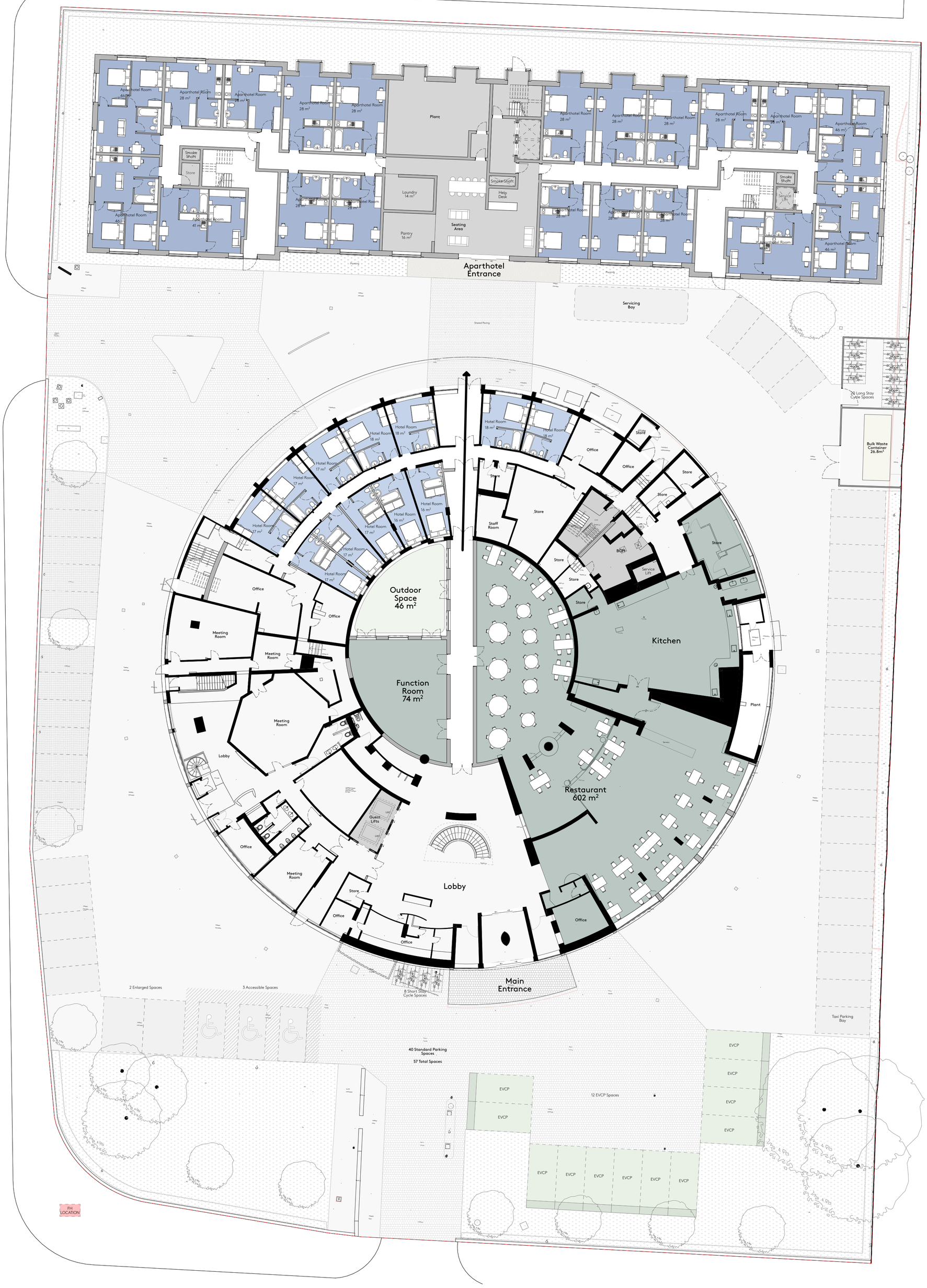
- **Energy Strategy:** The Energy Strategy for the proposed development is a key mechanism for reducing whole life carbon. In addition to a passive design approach, a strategy has been

proposed that utilises highly efficient heat pumps to serve both the space heating and cooling and water heating demands of the proposed development, which will take advantage of the projected decarbonisation of the national grid.

- **Circular Economy:** The proposed development has taken care to consider circular economy principles in its design. The Circular Economy Statement, submitted in support of this planning application, details the strategy for recovery of materials in line with the circular economy model.

7.6 As the detailed design of the proposed redevelopment of the Areil Hotel, Hayes continues, opportunities to further reduce the embodied and whole life carbon emissions will be explored, accounting for the recommendations set out within this Whole Life Carbon Assessment.

A1. SITE PLAN



Proposed Site Plan 1:200

Ackroyd Lowrie

23 Vyner Street, London E2 9DG
Ph: 0203 770 9780
www.ackroydlowrie.com

NOTE

DO NOT SCALE FROM THIS DRAWING.

DO NOT USE ANY AREAS INDICATED FOR EITHER VALUATION, PURCHASE SALE OR ANY OTHER FORM OF LEGALLY BINDING CONTRACT.

KEY

Site boundary

0 5 10m
1:200

N

LOCATION

ISSUE

Rev.	Date	Change No.	Change Name
P1	31/08/2023		

PROJECT

NAME
1041 - Ariel Hotel

CLIENT
R Heathrow Ariel Opco Limited

DRAWING NO.
1041-099

DRAWING
Proposed Site Plan

REVISION
P1

Drawn	Checked	Scale	Current Stage	Date
JM	AB	1:200@A1	Planning	31/08/2023

A2. INFORMATION INPUT TO ETOOL LCD

ElementProcessName	Total Mass (kg)
Bricks, Blocks and Pavers | Clay Bricks and Pavers | Recycled	95398.05
Bulk Aggregates Sands and Soils | Sand | Unspecified	217190.4
Carpets and Floor Coverings | Carpet	11470.5
Cementitious Binders | Mortars and Renders | 1 cement : 4 sand	47068.1574
Ceramics | Porcelain	38606
Ceramics | Tiles | Ceramic Tiles	36740
Concrete | Portland Cement Blends	4278101.914
Ferrous Metals | Steel	429447.558
Finished Products | Electrical Goods	111.2
Gases | Refrigerants | R-410A (Puron, AZ-20)	8.8128
Glazing | Glass and Films	63949.2
Insulation | Blankets and Batts	4649.562
Insulation | Rigid Foams and Boards	12234.298
Metals (Non-Ferous) | Aluminium	15986.112
Metals (Non-Ferous) | Copper	8140.048
Metals (Non-Ferous) | Zinc	1800
Paints and Finishes	1690.7128
Plant Based Products (non Timber) | Mulch | Green Waste	380.88
Plaster and Mineral Derived Products | Gypsum	159915.06
Plastics	20166.62126
Resins and Adhesives	7661.03
Rock and Stone | Polished | Granite / Basalt / Marble	32653.6
Rubber | Synthetic	645.92
Timber | Sustainably Sourced	182121.8039

A3. LIFE CYCLE MODULES

Table A3.1 Life Cycle Modules

Module	Description	Commentary on Data Source
A1 – A3 Construction Materials	Raw material supply (A1) includes emissions generated when raw materials are taken from nature, transported to industrial units for processing and processed. Loss of raw material and energy are also taken into account. Transport impacts (A2) include exhaust emissions resulting from the transport of all raw materials from suppliers to the manufacturer's production plant, as well as impacts of production of fuels. Production impacts (A3) cover the manufacturing of the production materials and fuels used by machines, as well as handling of waste formed in the production processes at the manufacturer's production plants until end-of-waste state.	eTool LCD allows the reporting of timber sequestration in Modules A1 – A3, as well as timber decomposition in Module C4. eTool LCD background data follows the EN 16449 formula for biogenic carbon stored in timber elements. A comprehensive database of construction products is available within eTool LCD, meaning the carbon emissions attributable to the product stage (Modules A1 – A3) may be calculated by assigning suitable embodied carbon factors to the given elemental material quantities.
A4 Transportation to Site	A4 includes exhaust emissions resulting from the transport of building products from manufacturer's production plant to building site, as well as the environmental impacts of production of the used fuel.	Transport distances were estimated based on typical average transport distances according to material types and project location, as provided by eTool LCD.
A5 Construction / Installation Processes	A5 covers the exhaust emissions resulting from using energy during the site operations, the environmental impacts of production processes of fuel, energy and water, as well as handling of waste until the end-of-waste state.	eTool LCD allows the quantification of detailed construction processes, including the energy use of equipment and plant and the transport of equipment and plant to and from the site. eTool LCD also accounts for waste generated during Module A5, with the waste percentage being configurable, as well as the disposal method and recycling rate of the material.

B1 – B5 Maintenance and Material Replacement	The environmental impacts of maintenance and material replacements (B1 – B5) include environmental impacts related to the replacement of building products after they reach the end of their service life. The emissions cover impacts from raw material supply, transportation and production of the replaced new material as well as the impacts from manufacturing the replace material and handling of waste until the end-of-waste state.	For Module B1, eTool LCD is currently limited to carbonation of concrete. For Module B2, eTool LC allows detailed accounting of maintenance and cleaning activities. eTool LCD allows for detailed accounting of repair activities under Module B3. Replacement activities under Module B4 are allowed for within eTool LCD. Reporting under Module B5 is not undertaken as standard within eTool LCD.
B6 Energy Use	The considered use phase energy consumption (B6) impacts include exhaust emissions from any building level energy production as well as the environmental impacts of production processes of fuel and externally produced energy. Energy transmission losses are also taken into account.	Energy consumption taken from SAP and Energy Assessment calculations undertaken for the two scenarios, in line with GLA requirements.
B7 Water Use	The considered use phase water consumption (B7) impacts include the environmental impacts of the production processes of fresh water and the impacts from wastewater treatment.	Using default eTool LCI Sources allows for both water use and treatment to be accurately quantified within eTool LCD.

C1 – C4 Deconstruction	The impacts of deconstruction include impacts for processing recyclable construction waste flows for recycling (c3) until the end-of-waste state or the impacts of pre-processing and landfilling for waste streams that cannot be recycled (C4) based on type of material. Additionally, deconstruction impacts include emissions caused by waste energy recovery.	A range of equipment can be selected within eTool LCD to model end of life demolition activities under Module C1, and carbon emissions associated with the transport of materials arising during Module C2 are included. Within eTool LCD, it is assumed that the end of waste state for commonly recycled construction products is met before the product leaves the site. However, where processing required for a material to achieve value, the disposal method will include impacts under Module C3. For most products considered under Module C4, a range of disposal methods are available to accurately model the disposal emissions.
D External Impacts / End-of-Life Benefits	External benefits for re-used or recycled material types include the positive impact of replacing virgin-based material with recycled material and the benefits of the energy which can be recovered from the materials.	eTool LCD accounts for the following Module D benefits or burdens: - Operational Energy Exports (Module D1) - Closed Loop Recycling (Module D2) - Open Loop Recycling (Module D3) - Materials Energy Recovery (Module D4)

A4. END-OF-LIFE SCENARIOS

Material group	End-of-life scenario	Materials included	C3 – C4, waste processing and landfilling	D, recycling benefits
Mineral building materials	Recycling for ground works	Concrete*, cement*, bricks, porcelain, plaster, clay products, stone, ceramics, asphalt	C3: Construction waste preparation for recycling	Recycling benefit from replacing the primary gravel
Metals	Metal preparation and recycling**	Aluminium, steel, stainless steel, galvanised steel copper coated, copper uncoated, brass, zinc, lead	C3: Metal waste preparation	Recycling benefits for replacing virgin metal
Biobased materials with heating value	Incineration and energy recovery	Wood, wood products	C3: Construction waste incineration for energy recovery	Recovered energy
Other materials with heating value	Incineration and energy recovery	Plastics	C3: Construction waste incineration for energy recovery	Recovered energy
Other materials that can be landfilled in construction waste site	Disposal / landfilling of inert material	Coatings, synthetic materials, panels and boards***, insulating materials***, glass, window and façade components***	Disposal of inert construction waste	-

* Taking into account concrete carbonatization.

** Recycling potential can only be reported for metals with shares of primary manufacturing, i.e. if a product is made of recycled material, it no longer has recycling potential. 5% of losses is assumed for recycling (the remaining 95% are recycled).

*** When not included in above groups.

A5. GENERAL NOTES

A5.1 The report is based on information available at the time of the writing and discussions with the client during any project meetings. Where any data supplied by the client or from other sources have been used it has been assumed that the information is correct. No responsibility can be accepted by Iceni Projects Ltd for inaccuracies in the data supplied by any other party.

A5.2 The review of planning policy and other requirements does not constitute a detailed review. Its purpose is as a guide to provide the context for the development and to determine the likely requirements of the Local Authority.

A5.3 No site visits have been carried out, unless otherwise specified.

A5.4 This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in guidance may necessitate a re-interpretation of the report in whole or in part after its original submission.

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