WHOLE LIFE CARBON ASSESSMENT

For

Proposed Development of Hillingdon Water Sports Facility and Activity Centre

at

Broadwater Lake, Off Moorhall Road, Harefield, Uxbridge

By

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1.0 INTRODUCTION

1.1 Development Overview

This Whole Life Carbon Assessment has been prepared for the proposed development comprising of the construction of 3No detached buildings as illustrated in Figure 1.1 below. The buildings consist of an Operational Building with offices, viewing area and changing rooms, A Safety Zone building which consists of mainly storage areas with a small tea point and WC and a Camping Zone building which consists of changing rooms.

The report details the approach taken by the applicant and Design Team to address the Whole Life Cycle Carbon principles and to incorporate these within the development design to reduce the overall Whole Life Cycle Carbon Emissions.

Figure 1.1 Proposed Site Plan

1.2 Policy Requirements

The GLA London Plan 2021 Policy SI2 Minimising Greenhouse Gas Emissions states:

"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."

'Operational carbon emissions will make up a declining proportions 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, manufacturer 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 referrable to the Mayor. Major non-referable development should calculate unregulated emissions and are encouraged to undertake whole life cycle carbon assessments.'

This policy sets out the requirement for Whole Life Carbon Assessments in referable schemes and recommends them for non-referable schemes. The guidance document for completing a Whole Life Carbon Assessment was first published in October 2020 and updated in March 2022. This includes requirements for assessment at the pre-application, planning application and post-construction stage.

Additional guidance documents are also referred to in the policy and these are to be used to inform Whole Life Carbon Assessments, these documents are;

I. RICS Professional Statement. Whole Life Carbon Assessments for the Built Environment 1st Edition November 2017.
II. BS EN15978:2011- Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method.

1.3 Life Cycle Modules

The GLA guidance refers to the RICS Professional Statement and BS EN15978 which note that WLC assessments should be undertaken against the four stages of the typical building life cycle listed below.

- Module A1-A5- Product sourcing and construction stages
- Module B1-B7- Use stages
- Module C1-C4- End of life stages
- Module D- Benefits and loads beyond the system boundary

These are split down into their constituent parts in figure 1.3 below

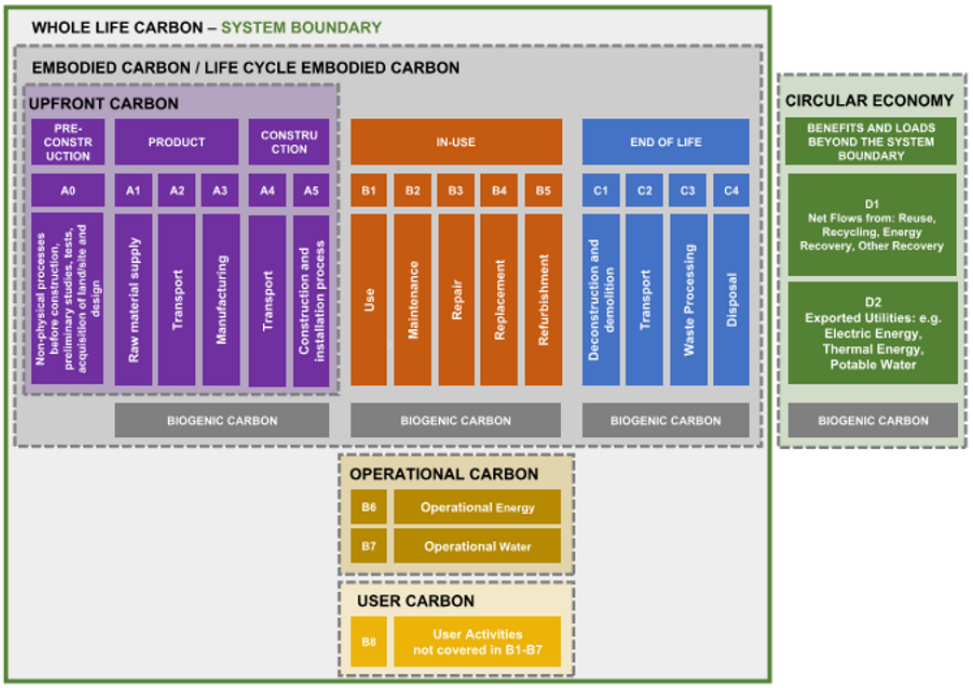

Figure 1.3 Life Cycle Modules

1.4 Methodology

This Whole Life Carbon Assessment has been carried out using the RICS nationally recognized assessment methodology. The report demonstrates the actions taken to reduce Whole Life Cycle Carbon Emissions and recommendations. The assessment covers the development's carbon emissions across all life cycle modules over its lifetime. This accounts for:

- Operational Carbon Emissions (regulated and unregulated)
- Embodied Carbon Emissions
- Any future potential carbon emission benefits post end of life including benefits from reuse and recycling of building structures and materials.

As the use type for the development is Leisure the GLA benchmark for a Sports Building has been used for comparison.

1.4.1 Operational

The calculated operational carbon emissions from energy and water consumption are calculated separately using the TM54 Evaluating operational energy use at design stage methodology are considered to represent current grid emissions, and these have been used in line with GLA requirements.

1.4.2 Embodied Carbon

OneClick LCA life cycle software has been used to model the proposed development based on estimated bills of quantities provided by the design team. OneClick LCA is an approved software tool recognized by the GLA and is a dedicated Life Cycle Assessment tool containing generic and average life cycle indicators representative of the typical UK supply chain. The tool allows the embodied impacts for all the specified materials to be modelled using OneClick's dedicated database which is integrated into the software.

All building elements have been included in the study in line with Table 6 of the RICS Professional Statement 2017. At this stage, exact data and specific material suppliers are not known in most instances. Therefore, the Whole Life Carbon Assessment is based on project estimates and default figures with the OneClick template library to give as accurate a baseline as possible. As a result, high level observations are given for reductions in embodies emissions.

1.5 Key Assumptions

The materials information and quantities have been assumed and estimated from the design drawings provided in addition to email information from the design team which details any changes to the information shown on the drawings. The general base build is steel frame construction with concrete block cavity wall and internal wall comprising of exposed lightweight concrete blocks with cavity insulation (for noise attenuation).

Building services comprise of water source heat pumps serving all 3 building with underfloor heating in the Operations building and Camp Zone. The Safety Zone is unheated.

Table 1.5 below sets out the key assumptions used within the study to determine the Whole Life Carbon Cycle of the proposed development.

Environmental Indicator	Embodied Carbon CO_{2eq}
Study Period	60 years in line with GLA guidance
Functional Units	$kgCO_{2e}/m^2$ GIA in line with GLA guidance
Assessment Scope	All materials used within the proposed developments boundary in line with RICS Professional Statement
Material Specification	All materials information included within the study is taken from the construction drawings and email information from the design team. Recycled content in materials has been included in line with RICS Professional Statement Table 6.
Modules B2-B3	Emissions for modules B2-B3 were calculated in line with paragraph 2.5.12 of the Whole Life Carbon Assessment Guidance.
Default Values	Where produce-specific data is not available, default values from the OneClick database were used unless specified.
Material Lifespans and Transport Distances	OneClick default material lifespans and transport distance are in line with RICS Professional Statement Table 7 and have been used unless specifically stated.
Operational Energy and Water	The estimated annual energy consumption has been taken from the Planning TM54 Assessment and multiplied for a 60-year building life.
Construction Site	OneClick default construction site impacts were used which are in line with RICS Professional Statement methodology.

Table 1.5 Key Assumptions

1.6 Limitations

Whole Life Cycle Carbon Assessments can be difficult to accurately apply and are only as good as the information available. This assessment has been completed in line with current industry best practice standards (RICS PS 2017 and BS EN 15978) however, the following limitations should be noted:

- This study has been made using the estimates provided at this stage of the project.
- The One-Click database includes standard assumptions for waste factors, life expectancy, recycled content and transport distances for each material type. These might not be reflective of the as-built data for this project. The Circular Economy Statement end of life scenarios have been used where possible.
- There is a degree of imprecision at this early stage, therefore the major impacts should be focused on for improvement.
- The embodied carbon of building services is still a new area within the industry and available data is limited. Approximations have therefore been used to represent the proposed systems using existing datasets within the software.

2.0 RESULTS

2.1 Baseline Results

The design information has been input into the OneClick LCA Software and the results have been extracted to the GLA Whole Life Carbon Assessment spreadsheet. The Results are shown in Table 2.1 below

Life Cycle Module	**Description**	**$kgCO_{2e}$ over 60 years**	**$kgCO_{2e}/m^2$ GIA**
Materials Embodied Carbon Module A1-A5 (excluding sequestration)	Construction Materials Transport Construction Site	1,192,572	343
In Use and End of Life Module B-C (Excluding B6 & B7)	Use Maintenance Repair Replace Refurbishment	1,112,683	320
A-C (excluding B6 & B7, including sequestration)	Construction Materials Transport Construction Site Re-use, recycling and disposal	2,305,256	664

Table 2.1 Whole Life Carbon Assessment Results

The Whole Life Carbon Assessment baseline results demonstrate that for the proposed development the highest contributors to overall emissions are the A1-A5 modules as expected.

2.2 Comparison with the GLA Benchmark

The Whole Life Carbon Assessment has been compared to the GLA Benchmarks for Educational buildings as this is the closest available benchmark.

	GLA Benchmark for Educational Buildings $kgCO_{2e}/m^2$ GIA over 60 years	**Aspirational GLA Benchmark for Educational Buildings $kgCO_{2e}/m^2$ GIA over 60 years**
Materials Embodied Carbon Module A1-A5 (excluding sequestration)	<750	<500
In Use and End of Life Module B-C (Excluding B6 & B7)	<250	<175
A-C (excluding B6 & B7, including sequestration)	<1000	<675

Table 2.2 Whole Life Carbon Assessment Benchmark

The results show that the building's design compares favourably to the GLA Benchmark and aspirational GLA benchmarks with modules A1-A5 achieving aspirational benchmarks and modules A-C slightly exceeding the aspirational benchmarks. Modules B-C are significantly above the aspirational benchmark of $175kgCO_2/m^2$.

3.0 DESIGN

3.1 Proposed Design

The highest contributors to the WLC carbon emissions are broken down by life-cycle stage in figure 3.1 below.

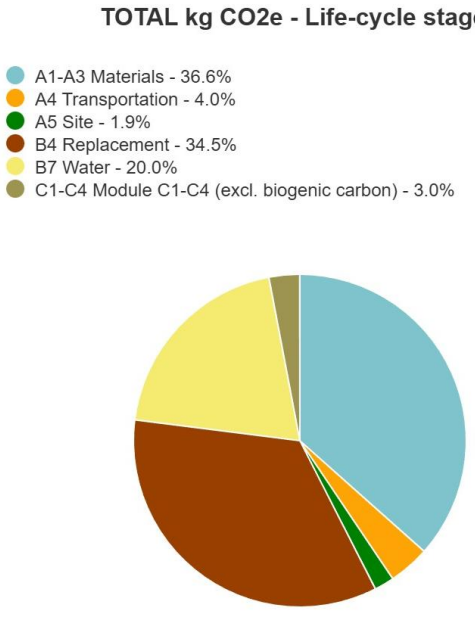

Figure 3.1 Life-cycle stages $kgCO_{2e}$

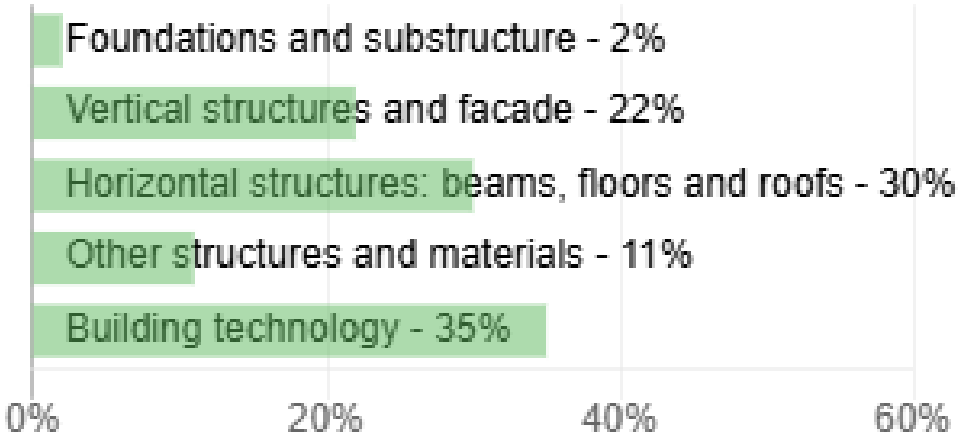

Figure 3.2 Embodied Carbon by Structure

The top 4 materials with the highest lifetime emissions to modules A1-A5 are;

- Lightweight Precast Concrete Block (17.9%)
- Photovoltaic Panels (12.9%)
- Precast Hollow Core Flooring (11.4%)
- Zinc Roofing with Standing Seam. (6.6%)

The results from the highest contributors show that the Lightweight Precast Concrete Blocks used in the external and internal walls account for nearly 18% of the lifetime emissions of the buildings, with the first floor slab of the Operations building contributing another 11%. Additionally, the Photovoltaic panels account for nearly 13% of the lifetime emissions. Therefore, the external wall and first floor slab be the elements with the highest focus for improvements as they will generate the largest reductions. It may also possible to achieve reductions by focusing on the solar photovoltaic panels.

The assessment has shown that these materials are the highest contributors to the overall Whole Life Cycle emissions of the proposed development. Priority should be given to reducing the emissions of these products.

4.0 CONCLUSIONS

This Whole Life Carbon Assessment has been produced in support of the planning application for the proposed development. The purpose of this assessment is to demonstrate that the proposed development is in line with GLA benchmarks and that a sustainable design has been considered and implemented.

The assessment has been prepared in line with the GLA's London Plan Policy SI2 and using the methodology detailed in GLA Whole Life Cycle Carbon Assessment Guide (March 2022), the RICS Professional Statement 2017 and BS EN15978:2011, The carbon emissions for the A1-A5 and B-C life cycle stages have been compared to the GLA benchmarks and are within the typical benchmark levels. The indicates that the proposed development incorporates the most feasible sustainable design options.

5.0 APPENDIX

WLCA Output

Result category	Biogenic carbon (kg CO2e)	A1-A3 Product Stage	A4 Transportation to site	A5 Site operations	B1 Use Phase	B2 Maintenance	B3 Repair	B4 Material replacement - materials	B5 Material refurbishment	B6 Operational Energy use - Regulated	B6 Operational Energy use - Unregulated	B7 Operational Water use	C1 Deconstruction / demolition	C2 Waste transportation	C3 Waste processing	C4 Waste disposal	TOTAL kg CO2e	D External impacts (not included in totals)
0.1 Toxic Mat.																		
0.2 Demolition																		
0.3 Supports																		
0.4 Groundworks																		
0.5 Diversion																		
1 Substructure		4769.97	3362.09	413.23										115.61	16.85	0.02	8677.77	-1487
2.1 Frame														3032.1	419.31		3451.41	-348843
2.2 Upper Floors		263540.20	51734.23	12182.82		7906.21	5270.80	356350.1						14795.11	38109.09	28.8	736740.4	-43769.6
2.3 Roof		67780.80	1040.96	695.54		2033.42	1355.62							693.97	37.88		70249.14	-76822.2
2.4 Stairs & Ramps		5274.56	671.14	118.24		158.24	105.49							40.26	5.72	0.0069	6109.93	-2575.47
2.5 Ext. Walls		148724.1	5093.34	8230.86		4461.72	2974.48	13168.5						7503.08	190.54	31.17	182941.6	-10321.3
2.6 Windows & Ext. Doors	-4250.6	46605.03	1831.65	0		1398.15	932.10	55595.92						328.53	4279.5	66.82	104472.9	-33178.7
2.7. Int. Walls & Partitions		102312.1	3977.45	5734.34		3069.36	2046.24	1574.53						4839.08	113.42	14.27	118565.2	-4556.59
2.8 Int. Doors	-5711.66	4976.39	237.98	0		149.29	99.53	8893.76						60.62	5760.04	38.33	14255.45	-2091.03
3 Finishes		24297.38	3006.28	1681.28		728.92	485.95	215023						286.36	805.19	0.39	245099.9	-11797.4
4 Fittings, furnishings & equipments																		
5 Services (MEP)	0	358310.1	40975.97	3048.36		10749.3	7166.2	317507.7		115579.98	40590.22	328900		745.30	11118.25	3.12	731708.8	-74035.4
6 Prefabricated																		
7 Existing bldg																		
8 Ext. works																		
Other or overall site construction				21946													21946	
Unclassified / Other																		
TOTAL kg CO2e	-9962.26	1026591	111931.1	54050.65		30654.62	20436.42	968113.5		115579.98	40590.22	328900		32439.92	60855.79	182.93	2244202.35	-609467

WLCA Output Continued

Estimated WLC emissions N.B. This forms the WLC baseline for the development. The green cells will automatically populate from the tables below							
	Module A1-A5 (excluding sequestered carbon)	**Modules B-C (excl B6 & B7)**	**Modules A-C (excluding B6-B7; including sequestered carbon)**	**Module B1-B5**	**Module B6-B7**	**Module C1-C4**	**Module D**
TOTAL kg CO_2e	1,192,572.46 kg CO2e	1,112,683.19 kg CO2e	2,305,255.648 kg CO2e	1,019,204.55 kg CO2e	485,070.20 kg CO2e	93,478.64 kg CO2e	-609,467 kg CO2e
TOTAL kg CO_2e/m^2 GIA	343.285	320.289	663.574	293.381	139.63	26.908	-175.437
Please select most appropriate benchmark from drop-down menu	Schools, Universities etc.						
WLC Benchmark	*<750*	*<250*	*<1000*				
Aspirational WLC Benchmark	*<500*	*<175*	*<675*				