



Appendix 12.1

GREENHOUSE GAS CALCULATION INPUTS

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General project inputs

Table 1 General information

LCA timeline	60	years	BS EN 15978
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Table 2 Calculation area schedule for the proposed development

Schedule typology	Unit	Area										Total m ²
		2025	2026	2027	2028	2029	2030	2031	2032	2033		
Retail (including the sale of food and drink)	m ²	389	389	389	389	389	389	389	389	389	389	3,500
Hotel	m ²	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	10,000
Non-residential and leisure institutions, including nursery, medical or health services, indoor sport or fitness facilities, and creches and/or nurseries.	m ²	622	622	622	622	622	622	622	622	622	622	5,600
Halls and meeting places	m ²	133	133	133	133	133	133	133	133	133	133	1,200
Sui generis including (but not limited to) public houses, wine bars or drinking establishments	m ²	78	78	78	78	78	78	78	78	78	78	700
Secondary school	m ²	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267	11,400
Primary schools	m ²	933	933	933	933	933	933	933	933	933	933	8,400
Residential - private homes	m ²	17,917	17,917	17,917	17,917	17,917	17,917	17,917	17,917	17,917	17,917	161,250
Residential – affordable homes	m ²	5,972	5,972	5,972	5,972	5,972	5,972	5,972	5,972	5,972	5,972	53,750
Science Park	m ²	17,222	17,222	17,222	17,222	17,222	17,222	17,222	17,222	17,222	17,222	155,000

Embodied carbon (construction GHG emission) inputs

Table 3 Material embodied carbon benchmarks and low, medium, high assumptions

Schedule typologies	Embodied carbon benchmarks (RICS, 2014)	Low	Medium	High	Unit
		Buro Happold's past project experience (15% reduction)	RICS (2014) and WRAP (2017) benchmarks		
Retail (including the sale of food and drink)	Local/Neighbourhood retail centre	586.5	690	793.5	kgCO ₂ e/m ²
Hotel	City hotel	739.5	870	1000.5	kgCO ₂ e/m ²
Non-residential and leisure institutions, including nursery, medical or health services, indoor sport or fitness facilities, and creches and/or nurseries.	Leisure park (cinema, bowling, restaurant, amusements)	799	940	1081	kgCO ₂ e/m ²
Halls and meeting places	Public assembly	364.65	429	493.35	kgCO ₂ e/m ²

Sui generis including (but not limited to) public houses, wine bars or drinking establishments	Bars	556.75	655	753.25	kgCO ₂ e/m ²
Secondary school	Education	325.55	383	440.45	kgCO ₂ e/m ²
Primary schools	Education	325.55	383	440.45	kgCO ₂ e/m ²
Residential - private homes	Detached single family home	467.5	550	632.5	kgCO ₂ e/m ²
Residential – affordable homes	Medium Rise apartment/condo (6-10 storey building)	731	860	989	kgCO ₂ e/m ²
Science Park	Business Park	731	860	989	kgCO ₂ e/m ²

Table 4 Transport, construction, use and demolition embodied carbon benchmarks.

	Year	Low	Medium	High	Unit	Reference
Total on-site energy use	0	13,000	14,000	15,000	kgCO ₂ /£m	BRE SMART Waste KPI from RICS 2017 draft professional statement
Total site transport and delivery	0	2,441	2,910	3,379	kgCO ₂ /£m	BH past project monitored data
Use	15 onwards	80%	90%	100%	% of raw material embodied carbon	BH past project monitored data
Demolition	0 & end of life	3	3.5	4	kgCO ₂ /£m	RICS 2017 draft professional statement

Operational GHG emission calculation inputs

Table 5 Operational carbon based on benchmarks for the maximum office scenario

Schedule typologies	Fossil	Electric	Unit	Source
Retail (including the sale of food and drink)	0	165	kWh/m ² /y	CIBSE TM46
Hotel	330	105	kWh/m ² /y	CIBSE TM46
Non-residential and leisure institutions, including nursery, medical or health services, indoor sport or fitness facilities, and creches and/or nurseries.	330	95	kWh/m ² /y	CIBSE TM46
Halls and meeting places	105	20	kWh/m ² /y	CIBSE TM46
Sui generis including (but not limited to) public houses, wine bars or drinking establishments	105	20	kWh/m ² /y	CIBSE TM46
Secondary school	150	40	kWh/m ² /y	CIBSE TM46
Primary schools	150	40	kWh/m ² /y	CIBSE TM46
Residential - private homes	420	65	kWh/m ² /y	CIBSE TM46
Residential – affordable homes	420	65	kWh/m ² /y	CIBSE TM46
Science Park	200	70	kWh/m ² /y	CIBSE TM46

Table 6 BEIS (2022) and SAP (2016) emissions factors.

	kgCO ₂ /kWh	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050+
BEIS	Grid Domestic- BEIS projections (BEIS Measuring and reporting environmental impacts: guidance for businesses, 2022)	0.146	0.151	0.131	0.098	0.073	0.063	0.054	0.049	0.042	0.033	0.026	0.021	0.020	0.020	0.018	0.018	0.017	0.016	0.015	0.015	0.009	0.008	0.008	0.008	0.005	0.005	0.003	0.003

BEIS	Grid Commercial / Public sector- BEIS projections (BEIS Measuring and reporting environmental impacts: guidance for businesses, 2022)	0.143	0.149	0.129	0.096	0.072	0.062	0.053	0.049	0.041	0.032	0.025	0.020	0.020	0.019	0.018	0.018	0.017	0.016	0.015	0.014	0.009	0.008	0.008	0.008	0.005	0.005	0.003	0.002
BEIS	Grid Industrial- BEIS projections (BEIS Measuring and reporting environmental impacts: guidance for businesses, 2022)	0.140	0.146	0.127	0.095	0.070	0.061	0.052	0.048	0.040	0.032	0.025	0.020	0.019	0.019	0.018	0.017	0.016	0.015	0.015	0.014	0.009	0.008	0.008	0.007	0.005	0.005	0.003	0.002
SAP	Grid SAP 2016 Consultation	0.229	0.229	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183	0.183
SAP	Gas SAP 2016 Consultation	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208

Table 7 Benchmarks and conversion factors used for GHG emissions associated with operational water consumption for the Proposed Development

Schedule typologies	Benchmark name	Benchmark	Source
Science park expansion	Office	6 m ² per person	BRISA Rules of Thumb Edition for Building Services (5 th Edition)
	Offices with canteen	45 litres per person per day	
Retail (including the sale of food and drink)	Restaurants	3 m ² per person	BRISA Rules of Thumb Edition for Building Services (5 th Edition)
	Restaurants	7 litres per person per day	
Hotel	Bedrooms	8 m ² per person	BRISA Rules of Thumb Edition for Building Services (5 th Edition)
	Hotel 5*	200 litres per person per day	
Non-residential and leisure institutions, including nursery, medical or health services, indoor sport or fitness facilities, and creches and/or nurseries.	Assembly halls, dance floors or concert venues without fixed seating	0.5 m ² per person	BRISA Rules of Thumb Edition for Building Services (5 th Edition)
	District General Hospital	600 litres per person per day	
Halls and meeting places	Assembly halls, dance floors or concert venues without fixed seating	0.5 m ² per person	BRISA Rules of Thumb Edition for Building Services (5 th Edition)
	Galleries/libraries	6 litres per person per day	
Sui generis uses including (but not limited to) public houses, wine bars or drinking establishments	Restaurants	3 m ² per person	BRISA Rules of Thumb Edition for Building Services (5 th Edition)
	Restaurants	7 litres per person per day	
Secondary school	Secondary school	20 litres per person per day	BRISA Rules of Thumb Edition for Building Services (5 th Edition)
Primary schools	Primary school	15 litres per person per day	BRISA Rules of Thumb Edition for Building Services (5 th Edition)
All schedule typologies	Carbon factor for water supply	0.177 kg CO ₂ per m ³ of water supplied	Department for Business, Energy & Industrial Strategy Greenhouse Gas Reporting: Conversion Factors 2022
	Carbon factor for the treatment of foul water	0.201 kg CO ₂ per m ³ of water supplied	

Table 8 Assumptions and conversion factors used for GHG emissions associated with operational transport for the proposed development

Assumed mode of transport	Assumed Distance travelled (km)	Source of assumed distance travelled	Annual trips	Number of trips over 60-year lifecycle	Carbon factor (total kgCO ₂ e per km)	GHG emissions (tCO ₂ e)
Cars – baseline	14	Average commute: NimbleFins, Department for Transport Data, Available here .	398,215	23,892,900	0.16674	55,774.63
Cars – operational	14	Average commute: NimbleFins, Department for Transport Data, Available here .	3,906,960	234,417,600	0.16674	547,215.07