APPENDIX

Appendix 9-1 – Project Level Summary

Asset		Carbon per life cycle stage Decarbonised*																						
		Upfront Carbon									In Use						Operational Carbon		User Carbon	End of Life				Info beyond the construction works and life cycle	
		Pre-construction	Product					Construction																	
		A0	A1		A2		A3		A4	A5			B1		B2-B3	B4	B5		B6	B7	B8	C1	C2	C3	C4	D1	D2
		Pre-construction stage (Nonphysical process before construction, preliminary studies, tests and design	**Raw Material Supply** Product stage excl. sequestered biogenic carbon	**Raw Material Supply** Sequestered biogenic carbon within installed materials/ products	**Transport** Product stage excl. sequestered biogenic carbon	**Transport** Sequestered biogenic carbon within installed materials/ products	**Manufacturing** Product stage excl. sequestered biogenic carbon	**Manufacturing** Sequestered biogenic carbon within installed materials/ products	**Transport** to and from site	**A5.1-A5.3 Pre-construction Demolition, Construction Activities and Waste Management**	**A5.4 Transport** of construction workers	**B1.1 In-use material emissions and removals** (release from materials / reabsorbtion into products)	**B1.2 In-use fugitive emissions** (refrigerants) leakage	**B2-B3 Maintenance and repair**	**B4.1-B4.2 Replacement** of construction products, components, systems and industrial systems	**Refurbishment/** planned changes excl. sequestration (where relevant)	**Refurbishment/**planned changes-related Sequestered biogenic carbon (where relevant)	**B6.1-B6.3 Operational Energy use**	**B7.1-B7.3 Operational Water use**	**B8.1-B8.3 User activities** (transport of persons to and from asset, goods associated with activities for intended building use, user activities associated with civil engineering works)	**Deconstruction/demolition** process	**Transport** to waste processing or disposal facilities	**Waste processing** for reuse, recycling and/or energy recovery and disposal	**Waste disposal**	Potential net benefits/loads from **reuse, recycling, energy recovery** and/or other recovery	Potential benefits/loads from **exported utilities**
Asset Totals	**tCO2e**	***0***	**8,880**						**86**	**561**		**0**	**0**	**0**	**0**	**0**	**0**	**424,320**	**0**	**874,094**	**58**	**8**			**0**	**0**

Total Upfront Carbon	tCO2e	9,527
Total In Use Carbon	tCO2e	-
Total Operational Carbon	tCO2e	424,320
Total User Carbon	tCO2e	874,094
Total End of Life Carbon	tCO2e	66
Total Beyond Scope Carbon	tCO2e	-
Asset Total	**tCO2e**	1,308,007

*Interpreted from RICS[1]

[1] Whole Life Carbon Assessment for the Built Environment, 2nd Edition, RICS Professional Standard (2023) available at: Whole life carbon assessment (WLCA) for the built environment (rics.org) Accessed: December 2023

Appendix 9-2 – A1-A3 Calculations

Material	Quantity of Materials (Tonnes)	ICE Database V3.0 Embodied Carbon (kgCO2e/kg)[2]	Emissions (tCO2e)	ICE Database V3.0 Description	ICE DB V3.0 Notes
Steel	3,200	2.46	7,872	Steel, Plate	World average steel. A flat steel sheet rolled on a hot rolling mill. It can be found on the market in sheets and is further processed into finished products by the manufacturers. Heavy plate is used in a large number of sectors: structural steels, shipbuilding, pipes, pressure vessels, boilers, heavy metal structures, offshore structures etc. Typical thickness between 2 to 20 mm. The maximum width is 1860 mm. System expansion was used on the steel, e.g. for blast furnace slag and other co-products. The influence of system expansion to the GWP for steel products is 3 to 7% lower GWP. Contact Worldsteel for more information. At an EOL recovery rate of 85%. Module D impact of -1.16 kg CO2e per kg ('-' magnitude is a benefit, '+' magnitude a burden). This gives a net life cycle inc Mod D, of 1.3 kg CO2e per kg.
Crushed Stone	3,000	0.079	237	Stone, General	ICE database average
Concrete*	1,920	0.138	265	In-Situ Concrete, 32/40 Mpa	Assumed 360 kg cementitious content per m3 concrete.
Rebar	200	1.99	398	Steel, Rebar	World average steel. For European rebar see seperate data. A steel reinforcing bar is rolled on a hot rolling mill. It can be found on the market for direct use or is further processed into finished products by the manufacturers. This product is used to strengthen concrete in highway and building construction also as primary product for the wire rod process. System expansion was used on the steel, e.g. for blast furnace slag and other co-products. The influence of system expansion to the GWP for steel products is 3 to 7% lower GWP. Contact Worldsteel for more information. At an EOL recovery rate of 85%. Module D impact of -0.79 kg CO2e per kg ('-' magnitude is a benefit, '+' magnitude a burden). This gives a net life cycle inc Mod D, of 1.2 kg CO2e per kg.
Cable	30	2.71	81	Copper, EU Tube & Sheet	EU production data, estimated from Kupfer Institut LCI data. 37% recycled content (the 3 year world average). World average data is expected to be higher than these values.
Rockwool Insulation	20	1.12	22	Rockwool	Cradle to grave
Refractory**	10	0.45	5	Brick, Single Brick	Average UK brick weighs 2.13 kg per brick [Source: The Brick Development Association].
Total	**8,380**		**8,880**		

*RICS recommended C32/40 in-situ ready-mix for piling, foundations and structural concrete[3]
**ICE single brick factor used as proxy

[2] Circular Ecology Embodied Carbon – The ICE Database V3.0 (2019) available at: Embodied Carbon Footprint Database - Circular Ecology Accessed: December 2023

[3] Whole Life Carbon Assessment for the Built Environment, 2nd Edition, RICS Professional Standard (2023) available at: Whole life carbon assessment (WLCA) for the built environment (rics.org) Accessed: December 2023

Appendix 9-3 – A4 Calculations

Material	Mode of Transport	Quantity of Material (Tonnes)	Scenario	Distance (km)	Tonnes.km*	Emission Factor Outward (kgCO2e/tonne.km)	Empty Running Factor**	Emission Factor Return (kgCO2e/tonne.km)	Emissions (tCO2e)
Steel	Road	3200	National	120	384,000	0.09696	43%	0.096957467	**53**
Crushed Stone	Road	3000	Locally-General	50	150,000	0.09696	43%	0.096957467	**21**
Concrete	Road	1920	Locally-Concrete	20	38,400	0.09696	100%	0.096957467	**7**
Rebar	Road	200	National	120	24,000	0.09696	43%	0.096957467	**3**
Cable	Road	30	National	120	3,600	0.09696	43%	0.096957467	**0**
Rockwool Insulation	Road	20	Regional	80	1,600	0.09696	43%	0.096957467	**0**
Refractory	Road	10	Regional	80	800	0.09696	43%	0.096957467	**0**
								Total	**86**

*tonne.km is a measurement of quantity and traffic of transportation
**based on RICS default baseline for UK[4]
Emissions factors: DEFRA, UK Government[5]

[4] Whole Life Carbon Assessment for the Built Environment, 2nd Edition, RICS Professional Standard (2023) available at: Whole life carbon assessment (WLCA) for the built environment (rics.org) Accessed: December 2023

[5] Department for Environment, Food and Rural Affairs (DEFRA), (2022). UK Government GHG Conversion Factors for Company Reporting,2022. Available at: Greenhouse gas reporting: conversion factors 2022 - GOV.UK (www.gov.uk) Accessed: March 2023

Appendix 9-4 – A5 Calculations

A5.1	A5.2	A5.3	A5.4*	Total
203.035	232.04	126	0	**561**

*Not calculated

A5.1

Area (m2)**	Emission Factor (kgCO2e/m2)***	tCO2e
5,801	35	203

** From Development Plan (D1 = 2,963sqm, D2 = 2,563 sqm, D3 = 275 sqm
*** RICS 2023 baseline assumption[6]

A5.2

Area (m2)**	Emission Factor (kgCO2e/m2)***	tCO2e
5,801	40	232

** From Development Plan (D1 = 2,963sqm, D2 = 2,563 sqm, D3 = 275 sqm
*** RICS 2023 baseline assumption

A5.3

Material	Emissions (tCO2e) (from A1-4 and C1-4)	Waste Rate (%)***	tCO2e
Steel	7929	1%	79
Crushed Stone	261	10%	26
Concrete	274	5%	14
Rebar	402	1%	4
Cable	82	1%	1
Rockwool Insulation	23	7%	2
Refractory	5	6%	0
		Total	**126**

*** RICS 2023 baseline assumption

[6] Whole Life Carbon Assessment for the Built Environment, 2nd Edition, RICS Professional Standard (2023) available at: Whole life carbon assessment (WLCA) for the built environment (rics.org) Accessed: December 2023

Appendix 9-5 – C1-C4 Calculations

C1

A5.2 Emissions (tCO2e)	Scenario assumption*	C1 Emissions (tCO2e)
232	BAU	**58.01**

*RICS BAU scenario proportion applied[7]

C2-C4

Material	Tonnes	Reuse***	Recycling***	Incineration with/without energy from waste***	Disposal (landfill and losses)***	Landfill Emission Factor (kgCO2e/Tonne)	Recycling Emission Factor (kgCO2e/Tonne)	tCO2e
Steel	3,200	15%	71%	0%	14%	1.2643491	0.984911723	3
Crushed Stone	3,000	0%	97.5%	0%	2.5%	1.2643491	0.984911723	3
Concrete**	1,920	0%	97.5%	0%	2.5%	1.2643491	0.984911723	2
Rebar	200	0%	98%	0%	2%	1.2643491	0.984911723	0
Cable	30	0%	50%	0%	50%	1.2643491	0.984911723	0
Rockwool Insulation	20		<1%		99%	1.2643491	0.984911723	0
Refractory	10	<1%	97.5%	0%	2.5%	1.2643491	0.984911723	0
Total	**8,380**							**8**

**RICS recommended C32/40 in-situ ready-mix for piling, foundations and structural concrete
***RICS default end-of-life routes
Emissions factors: DEFRA, UK Government[8]

[7] Whole Life Carbon Assessment for the Built Environment, 2nd Edition, RICS Professional Standard (2023) available at: Whole life carbon assessment (WLCA) for the built environment (rics.org) Accessed: December 2023

[8] Department for Environment, Food and Rural Affairs (DEFRA), (2022). UK Government GHG Conversion Factors for Company Reporting,2022. Available at: Greenhouse gas reporting: conversion factors 2022 - GOV.UK (www.gov.uk) Accessed: March 2023

Appendix 9-6 – Operational Energy

Baseline Year Operational Energy

Source	Value	Unit	Unit Conversion Factor	Energy (TJ)	Emission Factor**	Emissions tCO2e
Diesel	9	TJ	0.000037	9	73.30000	657
LPG	2	TJ	0.000025	2	63.69000	157
Gas	119	TJ	0.0036	119	56.66000	6,731
Bark	655	Tonnes	0.0058	4	40.58114	27
Purchased Wood Fuel	59,441	Tonnes	0.0106	632	40.58114	2,412
Chip fines	26,265	Tonnes	0.0042	111	40.58114	1,066
Sander Dust + Trim Waste	24,639	Tonnes	0.0164	405	40.58114	1,000
Electricity*	394	TJ	0.0000036	394	92.22000	36,353

*calculated from 2% of daily electricity = 6,000kWh
**SEAI conversion factors[9]

Assessment Year Operational Energy

Source	Value	Unit	Unit Conversion Factor	Energy (TJ)	Emission Factor **	Emissions tCO2e
Diesel	9	TJ	0.000037	9	73.3	657
LPG	2	TJ	0.000025	2	63.69	157
Gas	0	TJ	0.0036	0	56.66	9
Bark	1,098	Tonnes	0.0058	6	40.58114	45
Purchased Wood Fuel	99,604	Tonnes	0.0106	1,058	40.58114	4,042
Chip fines	44,011	Tonnes	0.0042	185	40.58114	1,786
Sander Dust + Trim Waste	41,286	Tonnes	0.0164	679	40.58114	1,675
Electricity*	402	TJ	0.0000036	402	92.22	37,080

*calculated from 2% of daily electricity = 6,000kWh
**SEAI conversion factors

[9] Sustainability Energy Authority of Ireland (SEAI) Conversion and Emissions Factors (2023) available at: Conversion Factors | SEAI Statistics | SEAI Accessed: December 2023

Appendix 9-7 – Coillte Biomass Emissions

Current Operations and Proposed Development

Source	Tonnes of Wood	% from Coillte	Tonnes of Wood from Coillte Forests	tCO_2e/Tonne wood	tCO_2e from Coillte Forests
Current Operations	111,000	50%	55,500	0.0104	575
Proposed Development	186,000	70%	130,200	0.0104	1,349

Coillte Group Activity Data – Annual Report 2022

	Revenue (€'000)	% Revenue	Emissions Based on % Revenue (tCO_2e)
Group	478,722	100%	70,813
Land	4,979	1%	736
Forest	139,701	29%	20,663
Medite Smartply	334,092	70%	49,414

Emissions from Forests and Land (tCO_2e)	Wood Removals from publicly-owned Forests (Tonnes)	tCO2e/Tonne Wood
21,399	2,065,000	0.01