Appendix I - Assumptions Used in Calculations

Table I-1: Material Assumptions

Materials	Density	Travel Distance	Wastage	EE	EC	EC (biomass)	EC (Sequestration)	End of Life	Emission Factor Assumptions	
Sources	ICEv2.0 & wikipedia			*ICE v2.0*	*ICE v2.0*	*ICE v2.0*			*DEFRA*	
Units	(kg/m3)	*(km)*	*(%)*	*(MJ/kg)*	*(kgCO2e/kg)*	*(kgCO2e/kg)*	*(kgCO2e/kg)*		*(kgCO2e/t)*	
Aggregate	2,240	14	0%	0.08	0.01			Closed loop	1.00	including wet sand 19kN/m3
Aluminium, general	2,700	100	2%	155.00	9.16			Closed loop	1.00	
Asphalt, 6% binder	2,300	100	2%	3.93	0.08			Closed loop	1.00	
Bitumen	2,400	100	5%	51.00	0.49			Open loop	1.00	
Blocks (Dense - 10.5MPa)	1,950	100	2%	0.67	0.08			Open loop	1.00	
Blocks (Medium - 7MPa)	1,600	100	2%	0.59	0.06			Open loop	1.00	
Blocks (Aerated)	750	100	2%	3.50	0.33			Open loop	1.00	
Blockwork, 100mm thk	1,620	100	2%	0.63	0.07			Open loop	1.00	
Blockwork, 215mm thk	1,633	100	2%	0.66	0.08			Open loop	1.00	
Bricks	1,700	100	2%	3.00	0.24			Open loop	1.00	
Cement	1,860	100	5%	4.50	0.74			Landfill	2.00	
Cement render (1:3 cement sand)	1,860	14	5%	1.33	0.22			Landfill	2.00	
Clay, aerated	1,000	100	0%	3.00	0.24			Landfill	2.00	
Concrete, plain	2,300	14	5%	0.78	0.11			Open loop	1.00	30N20
Concrete, precast	2,400	155	0%	2.33	0.24			Open loop	1.00	RC40/50 with 80kg/m3
Concrete, reinforced	2,400	14	0%	1.61	0.17			Open loop	1.00	80kg/m3 rebar
Copper	8,600	100	1%	42.00	2.71			Closed loop	1.00	
Fibre cement panels, uncoated	1,650	100	5%	10.40	1.16			Landfill	2.00	
Fibre cement panels, coated	1,650	100	5%	15.30	1.36			Landfill	2.00	
GRP/Fibreglass	1,530	100	3%	100.00	8.59			Landfill	2.00	Assume fibreglass membrane is 3mm thk
Hempcrete	330	836	0%	5.56	0.71		-0.75	Reuse	1.00	
Insulation, cellulose blown	30	30	0%	2.12	-		-1.83	Closed loop	1.00	
Insulation, cellulose injected	60	30	0%	2.12	-		-1.83	Closed loop	1.00	
Insulation, glasswool	23	100	0%	28.00	1.43			Landfill	2.00	
Insulation, polyisocyanurate (PIR)	45	100	2%	101.50	4.26			Landfill	2.00	
Insulation, polystyrene expanded	12	100	0%	88.60	3.29			Landfill	2.00	
Lead, general	11,340	100	2%	25.21	1.67			Closed loop	1.00	
Lime	1,201	100	5%	5.30	0.78		-0.24	Open loop	1.00	
Membrane	1,250	100	5%	134.00	4.45			Landfill	2.00	Ethylene propylene diene monomer, assume 1mm thk
Mortar (1:1:6)	1,900	100	2%	1.11	0.17			Landfill	2.00	
Nylon (Polyamide) 6 Polymer	960	100	2%	120.50	9.14			Landfill	2.00	
Paint, waterborne triple coat (per m2)		100	1%	26.58	1.14			Landfill	2.00	
Paperboard	480	100	2%	24.80	1.37			Landfill	851.00	
Plasterboard	1,100	100	5%	6.75	0.39			Landfill	71.95	
Plaster, gypsum	1,120	100	5%	1.80	0.13			Landfill	71.95	
Plastic, LDPE film	925	100	5%	89.30	2.60			Landfill	2.00	
Polyethylene, General	950	100	5%	83.10	2.54			Landfill	2.00	
Polypropylene, Orientated film	901	100	5%	99.20	3.43			Landfill	2.00	
PVC, Pipe	1,380	100	2%	67.50	3.23			Landfill	2.00	
PVC, general	1,380	100	2%	77.20	3.10			Landfill	2.00	
Sealant, mastic	2,329	100	2%	131.00				Landfill	2.00	i.e. Silicon
Slate, imported	2,750	2,600	2%	0.55	0.04			Closed loop	1.00	Imported from Spain
Slate, reused	2,750	-	0%	-	-			Closed loop	1.00	
Soil, imported	1,940	45	0%	0.45	0.02			Closed loop	1.49	assume 19kN/m3
Stainless Steel	7,850	100	2%	56.70	6.52			Closed loop	1.00	e.g. wall ties
Steel, rebar	7,800	100	0%	17.40	1.40			Closed loop	1.00	
Mortar	1,860	14	5%	1.33	0.22			Landfill	2.00	
Timber, General	600	100	3%	10.00	0.31	0.41	-1.83	Combustion	21.00	50% of wood is carbon x44/12
Timber, Glulam	600	100	0%	12.00	0.42	0.45	-1.83	Combustion	21.00	50% of wood is carbon x44/12
Timber, Hardwood	750	100	1%	10.40	0.24	0.63	-1.83	Combustion	21.00	50% of wood is carbon x44/12
Timber, OSB	620	100	3%	15.00	0.45	0.54	-1.83	Combustion	21.00	50% of wood is carbon x44/12
Timber, Plywood	620	100	3%	15.00	0.45	0.65	-1.83	Combustion	21.00	50% of wood is carbon x44/12
Timber, Softwood	563	100	3%	7.40	0.20	0.39	-1.83	Combustion	21.00	50% of wood is carbon x44/12

Water	1,000	-	0%	0.01	0.00				
Windows, 3-IV glazing (per m2)			0%	920.00	56.90		Closed loop	2.49	from KBOB / eco-bau / IPB 2009/1 (July 2012)
Windows, wooden frame (per m2)			0%	4,730.00	132.00		Combustion	19.20	from KBOB / eco-bau / IPB 2009/1 (July 2012)
Windows, PVC frame (per m2)			0%	5,850.00	246.00		Combustion	132.00	from KBOB / eco-bau / IPB 2009/1 (July 2012)

Table I-2: Speficied Product Assumptions

Product	Description	Distance (km)	Origin
ProClima Intello Plus Vapour Check membrane	0.2mm thk polyethylene copolymer membrane containing a polypropylene reinforcement l	1,521	Schwetzingen, Germany
SIGA airtight tape	reinforced speciality paper, splash-water resistant due to a PE coating, with SIGA high-perfc	1,718	Ruswil, Switzerland
DuPont Tyvek UV Facade UV resistant breather membrane	195g/m2, high density polyethylene and polypropylene	1,302	DuPont de Nemours, Luxembourg
Optigreen pre-cultivated sedum vegetation with decomposable carrier	Assume 25mm thk, sedum w/traces of herbage and grasses in predominantly rottable carri	1,217	Holland
100mm Optigreen extensive substrate type E, assume type "heavy"	Lava, pumice, manure, lawn cuttings (0rganic 3-8%)	1,668	Krauchenwies-Göggingen, Germany
Optigreen drainage mat type 800, 5% laps	"100% sythetic fibre", assume Nylon (Polyamide) 6 Polymer	1,668	Krauchenwies-Göggingen, Germany

Table I-3: Other Assumptions used in Calculations

Transport Factors								
All HGVs (kgCO2e/t.km)	0.14977							
MJ/t.km	1.76544							
Lifespan								
% replacement at end of typical lifespan	20%							
life cycle duration	100	years						
BER rating	kWh/m2/yr	MJ/m2/yr	kgCO2e/m2/yr					
D2	256.02	921.67	14.21					
Total floor area	80.4							
Electricity 2012	0.528	gCO2/kWh		SEAI factor				
Contractor's Energy	hours	litres per hour	Litres	kWh/litre	kWh	MJ	kgCO2e/kWh	kgCO2e
Generator petrol (up to end March)			10.00	9.35	93.48	336.53	0.25	23.56
JCB (up to end March)	10	6	60.00	10.17	610.14	2,196.50	0.26	161.08
Total					703.62	2,533.03	0.52	184.63
Double qtys, say, to completion					1,407.24	**5,066.06**	1.03	**369.27**

Appendix II - Analysis by Schedule of Works (NEES)

Kevin Gartland Architect's Schedule of Work (Tender 2nd Aug 2013)

Item	Title	Description	Qty	Unit	Material	Density (kg/m3)	Mass (kg)	CRADLE-TO-GATE EE (MJ/kg)	EE (MJ)	EC (Fossil) (kgCO2e)	EC (Biomass) (kgCO2e)	EC (Sequestr) (kgCO2e)	CONSTRUCTION WASTE Mass kg	EE MJ	EC (Fossi kgCO	EC (Bio kgCO	EC (Sequ kgCO	TRANSPORT TO SITE km	t.km	EE MJ	EC (kgCO2e	End-of-Life EC kgCO2e,	EC kgCO2e
	New Extension																						
1	**Demolition & Alterations**	Refer to Contractor's questionnaire for energy & waste resource treatment																					
2	**Substructure**																						
	2.1	6no. 900x900x300mm deep grade 30N20 concrete pads, with	1.458	m3	Concrete, pla	2,300	3,353	0.78	2,616	379	-	-	168	131	19	-	-	14	48	84	7	1	4
		1no. Layer of A393 mesh (6.16kg/m2)	4.860	m2	Steel, rebar	7,800	30	17.40	521	42	-	-	-	-	-	-	-	100	3	5	0	1	0
		6no. 250mm dia RC columns (3x740mm+3x1110mm=5550mm)	0.272	m3	Concrete, pla	2,300	626	0.78	489	71	-	-	31	24	4	-	-	14	9	16	1	1	1
		Reinforcement, say 300kg/m3	81.689	kg	Steel, rebar	7,800	82	17.40	1,421	114	-	-	-	-	-	-	-	100	8	14	1	1	0
3	**External Wall Structure**																						
	3.1-3.2	I-Joist - Plywood web (241dp plywood web studs @ 400c/c)	0.379	m3	Timber, Plyw	620	235	15.00	3,523	106	153	- 431	7	106	3	5	- 13	100	24	43	4	21	5
	3.1-3.2	I-Joist - Softwood flanges (241dp plywood web studs @ 400c/c)	0.447	m3	Timber, Softv	563	251	7.40	1,861	50	98	- 461	8	56	2	3	- 14	100	26	46	4	21	5
	3.4-3.5, 3.8-3.9,3.13	Other Timber - softwood (2no. 100x44 sole plates, trim openings & form top plate with 225x44mm, form link walls, parapet upstand and hang below floor level with 175x44m)	3.164	m3	Timber, Softv	563	1,781	7.40	13,181	356	695	- 3,266	53	395	11	21	- 98	100	183	324	27	21	39
	3.6-3.7	Other Timber - OSB (22mm boarding externally, 18mm internally)	3.126	m3	Timber, OSB	620	1,938	15.00	29,072	872	1,047	- 3,553	58	872	26	31	- 107	100	200	352	30	21	42
	3.12	Other Timber - Plywood (20mm marine plywood to top of parapet)	0.126	m3	Timber, Plyw	620	78	15.00	1,172	35	51	- 143	2	35	1	2	- 4	100	8	14	1	21	2
		Other Timber - Hardwood	-	m3	Timber, Hard	750	-	10.40	-	-	-	-	-	-	-	-	-	100	-	-	-	21	-
	3.7	Silicon Sealant to OSB joints (say 6no. 310ml tubes @ 10m each)	0.002	m3	Sealant, mast	2,329	4	131.00	567	-	-	-	0	11	-	-	-	100	0	1	0	2	0
	3.7	Exclude SIGA air tight tape over Silicon Sealant, as unknown weight/thickness/material proportions	42.000	m																			
		DuPont Tyvek UV Facade UV resistant breather membrane (195g/m2)	102.000	m2	Polyethylene	950	20	83.10	1,653	51	-	-	1	83	3	-	-	1,302	27	48	4	2	0
	3.10-3.11	240mm cellulose insulation from Ecocel	14.710	m3	Insulation, ce	60	883	2.12	1,871	-	-	- 1,618	-	-	-	-	-	30	26	47	4	1	1
4	**External Wall Completion**																						
	4.1-4.7	Glazing - Windows & Doors area (iroko hardwood [one primer coat, one mid coat and two top coats in shop], 6mm outer glazing, 16mm argon fill, 4mm inner glazing, toughened glass if below 800mm above floor level)	20.162	m2	Windows, 3-l	-	-	920.00	18,549	1,147	-	-	-	-	-	-	-	-	-	-	-	2	50
		Wooden frame	20.162	m2	Windows, wooden fra		-	4,730.00	95,367	2,661	-	-	-	-	-	-	-	-	-	-	-	19	387
	4.8	300mm EPDM membrane Windows & Doors perimeter (assume 1mm thk)	0.014	m3	Membrane	1,250	17	134.00	2,290	76	-	-	1	115	4	-	-	100	2	3	0	2	0
5	**External Wall Finish**																						
	5.1-5.4	Other Timber - Hardwood (102m2 Western red cedar cladding; 150x50mm hardwood to head, jamb & cills to all windows/doors; 150x50mm hardwood to 6no. Vertical corners east & west elevations (2no.11m , 2no. 8m, 2no. 7m high = 52m))	5.322	m3	Timber, Hard	750	3,991	10.40	41,510	958	2,515	- 7,318	40	415	10	25	- 73	100	403	712	60	21	85
		Copper nails (2no. Nails per 2,869 shingles = 5,738 nails & 240 nails per kg)	5,738.000	# of n	Copper	8,600	24	42.00	1,004	65	-	-	0	10	1	-	-	100	2	4	0	1	0
	5.5-5.6	Fibreglass (4m2, assume 3mm thick)	0.012	m3	GRP/Fibregla	1,530	18	100.00	1,836	158	-	-	1	55	5	-	-	100	2	3	0	2	0
		Other Timber - Softwood (50x25mm softwood battens horizontally @200c/c & vertically @ 400c/c)	0.956	m3	Timber, Softv	563	538	7.40	3,984	108	210	- 987	16	120	3	6	- 30	100	55	98	8	21	12
		Other Timber - Plywood (20mm marine plywood)	0.080	m3	Timber, Plyw	620	50	15.00	744	22	32	- 91	1	22	1	1	- 3	100	5	9	1	21	1
6	**Internal Wall Structure**																						
	6.1	Other Timber - Softwood (100x44mm timber studs)	0.669	m3	Timber, Softv	563	377	7.40	2,786	75	147	- 690	11	84	2	4	- 21	100	39	68	6	21	8
7	**Internal Wall Completion**																						
	7.1-7.3	Exclude Doors with birch ply facing, as not building envelope	6.000	no.																			
8	**Internal Wall Finish**																						
		Other Timber - Softwood (50x25mm softwood battens vertically @ 400c/c, 100x20mm skirting and angle beads)	0.181	m3	Timber, Softv	563	102	7.40	755	20	40	- 187	3	23	1	1	- 6	100	11	19	2	21	2
		12.5mm plasterboard to inside face of external walls (single layer, 49m2)	0.613	m3	Plasterboard	1,100	674	6.75	4,548	263	-	-	34	227	13	-	-	100	71	125	11	72	51
		12.5mmx2 double plasterboard to inside face of external walls (33m2, second l	0.825	m3	Plasterboard	1,100	908	6.75	6,126	354	-	-	45	306	18	-	-	100	95	168	14	72	69
		12.5mm plasterboard to both sides of internal stud partitions (61m2)	0.763	m3	Plasterboard	1,100	839	6.75	5,662	327	-	-	42	283	16	-	-	100	88	155	13	72	63

	12.5mm moisture resistant plasterboard to walls of bathroom (23m2)	0.288	m3	Plasterboard	1,100	316	6.75	2,135	123	-	-	16	107	6	-	-	100	33	59	5	72	24
	Bags of skim coat (23 bags, based on above quantities, assume 25kg bags)	23.000	bags	Plaster, gypsı	1,120	575	1.80	1,035	75	-	-	29	52	4	-	-	100	60	107	9	72	43
8.3,8.4,8.6	Excluded 12mm birch ply to 03 Porch and 05 Hall, T&G cedar panelling for 06 Bathroom, & touchened laminated glass shower screen in 06 Bathroom, as no details to quantify																						
9	**Floor & Stairs Structure**																						
9.1	I-Joist - Glulam (2no. 9.35m long Glulam beams)	0.426	m3	Timber, Glula	600	255	12.00	3,065	107	115	-	468	-	-	-	-	-	100	26	45	4	21	5
	Exclude 6no. Fabricated steel shoes to connect glulam to RC column, as no details																						
9.2-9.3	I-joist - Plywood web (24no. 241dp I-joists @ 400c/c)	0.220	m3	Timber, Plyw	620	136	15.00	2,044	61	89	-	250	4	61	2	3	-	7	100	14	25	2	21	3
	I-joist - Softwood flanges (24no. 241dp I-joists @ 400c/c)	0.259	m3	Timber, Softv	563	146	7.40	1,080	29	57	-	268	4	32	1	2	-	8	100	15	27	2	21	3
	Exclude 48no. Joist hangers as not specified																						
9.4,9.9	Other Timber - Softwood (175x44mm Noggings)	0.785	m3	Timber, Softv	563	442	7.40	3,272	88	172	-	811	13	98	3	5	-	24	100	46	80	7	21	10
9.5-9.6	Other Timber - OSB (18mm topside)	0.843	m3	Timber, OSB	620	523	15.00	7,838	235	282	-	958	16	235	7	8	-	29	100	54	95	8	21	11
	12mm Aquapanel cement board to underside of floor structure, 38m2	0.456	m3	Fibre cement	1,650	752	10.40	7,825	869	-	-	38	391	43	-	-	100	79	139	12	2	2
	DuPont Tyvek UV Facade UV resistant breather membrane (195g/m2)	40.000	m2	Polyethylene	950	8	83.10	648	20	-	-	0	32	1	-	-	1,302	11	19	2	2	0
	Exclude Air tight tape to perimieter (non T&G joints)	26.000	m																				
	Silicon Sealant to OSB joints (say 5no. tubes @ 10m each)	0.002	m3	Sealant, mast	2,329	4	131.00	473	-	-	-	0	9	-	-	-	100	0	1	0	2	0
9.7-9.8	240mm Ecocel cellulose insulation	8.639	m3	Insulation, ce	30	259	2.12	549	-	-	-	475	-	-	-	-	-	30	8	14	1	1	0
10	**Floor & Stair Finish**																						
10.1 Bedroom	Exclude 150x22mm engineered oak floor boards (20m2) as finishes																						
	Exclude 2 layers of 50x25mm battens @ 400c/c (20m2) as finishes																						
10.2 Bathroom	Exclude 300x600mm tiles (10.7m2). Grout & adhesive as finishes																						
	Exclude 20mm OSB (10.7m2) as finishes																						
	Exclude 44x44 Softwood battens (10.7m2) as finishes																						
10.4	Hardwood to cills (assume 225x20mm)	0.054	m3	Timber, Hard	750	41	10.40	424	10	26	-	75	0	4	0	0	-	1	100	4	7	1	21	1
11	**Roof Structure**																						
11.1-11.2	I-joist - plywood web (25no. 406x59 I-joists @ 400c/c)	0.386	m3	Timber, Plyw	620	239	15.00	3,587	108	155	-	438	7	108	3	5	-	13	100	25	43	4	21	5
	I-joist - Softwood flanges (25no. 406x59 I-joists @ 400c/c)	0.400	m3	Timber, Softv	563	225	7.40	1,667	45	88	-	413	7	50	1	3	-	12	100	23	41	3	21	5
	Exclude, 50 joist hangers																						
11.7-11.8	Other Timber - Softwood (100x44mm rafters, angle fillet, 175x44mm rafters & firring pieces to link)	0.756	m3	Timber, Softv	563	426	7.40	3,149	85	166	-	780	13	94	3	5	-	23	100	44	77	7	21	9
11.3-11.4	Other Timber - OSB (22mm boarding outside, 18mm inside)	1.562	m3	Timber, OSB	620	968	15.00	14,527	436	523	-	1,775	29	436	13	16	-	53	100	100	176	15	21	21
	Other Timber - Plywood (20mm marine)	0.900	m3	Timber, Plyw	620	558	15.00	8,370	251	363	-	1,023	17	251	8	11	-	31	100	57	101	9	21	12
	DuPont Tyvek UV Facade UV resistant breather membrane (195g/m2)	44.000	m2	Polyethylene	950	9	83.10	713	22	-	-	0	36	1	-	-	1,302	12	21	2	2	0
	Exclude Air tight tape to perimieter (non T&G joints)	25.000	m																				
	Silicon Sealant to OSB joints (say 5no. tubes @ 10m each)	0.002	m3	Sealant, mast	2,329	4	131.00	473	-	-	-	0	9	-	-	-	100	0	1	0	2	0
11.5-11.6	400mm Ecocel cellulose insulation	13.993	m3	Insulation, ce	60	840	2.12	1,780	-	-	-	1,539	-	-	-	-	-	30	25	44	4	1	1
12	**Roof Finish**																						
12.1	Optigreen pre-cultivated sedum herb grass vegetation mat with decomposable carrier (44m2, assume 12.5mm thk)	0.550	m3	Soil, importe	1,940	1,067	0.45	480	26	-	-	-	-	-	-	-	-	1,217	1,299	2,292	194	1	2
	100mm Optigreen extensive substrate type E (44m2)	4.400	m3	Clay, aerated	1,000	4,400	3.00	13,200	1,056	-	-	-	-	-	-	-	-	1,668	7,339	12,957	1,099	2	9
	Optigreen drainage mat type 800 (44m2, assume 1mm thk)	0.044	m3	Nylon (Polyar	960	42	120.50	5,090	386	-	-	1	102	8	-	-	1,668	72	127	11	2	0
12.3	Fibreglass membrane (44m2, assume 3mm thk)	0.132	m3	GRP/Fibregla	1,530	202	100.00	20,196	1,734	-	-	6	606	52	-	-	100	21	37	3	2	0
12.4-12.5	Fibreglass to upstand and across parapet (6.2m2, assume 3mm thk)	0.019	m3	GRP/Fibregla	1,530	28	100.00	2,846	244	-	-	1	85	7	-	-	100	3	5	0	2	0
12.9	Fibreglass to link roof and dress up under cedar cladding (11m2, assume 3mm	0.033	m3	GRP/Fibregla	1,530	50	100.00	5,049	434	-	-	2	151	13	-	-	100	5	9	1	2	0
12.8	Black PVC gutter to northern elevation (subcontractor supply and fit; 9m @ ass	9.000	m	PVC, general	1,380	5	77.20	354	14	-	-	0	7	0	-	-	100	0	1	0	2	0
12.6-12.8	Other Timber - Hardwood (fascia board to nothern elevation; 20mm Cedar clad	0.140	m3	Timber, Hard	750	105	10.40	1,092	25	66	-	193	1	11	0	1	-	2	100	11	19	2	21	2
13	**Ceilings**																						
13.1	Other Timber - Softwood (50x25mm treated battens to inside face of external v	0.106	m3	Timber, Softv	563	60	7.40	443	12	23	-	110	2	13	0	1	-	3	100	6	11	1	21	1
	2 layers of 12.5mm plasterboard to inside face of external walls (33.5m2)	0.838	m3	Plasterboard	1,100	921	6.75	6,218	359	-	-	46	311	18	-	-	100	97	171	14	72	70
	Bag of skim coat (based on above quantities, 6bags @assume 25kg each)	6.000	bags	Plaster, gypsı	1,120	150	1.80	270	20	-	-	8	14	1	-	-	100	16	28	2	72	11
	Exclude 20mm birch plywood as accounted for in plasterboard area																						
Existing House																							
14.1 Demolition	Refer to Contractor's questionnaire for energy & waste resource treatment																						
14.2	**Substructure**																						
14.2.2	Exclude perforated land drain & soakaway as no details provided																						
14.3	**External Wall Structure**																						
14.3.1	Precast concrete lintels (4no. 100x65x1600mm long over 4no. Windows + 4no. 100x100x3400mm long over W02, say)	0.302	m3	Concrete, pre	2,400	726	2.33	1,691	176	-	-	-	-	-	-	-	155	112	199	17	1	1
14.3.2	Increase height of rubble wall with blockwork (215mm wide x 200mm high, say)	1.368	m3	Blockwork, 2	1,633	2,235	0.66	1,469	173	-	-	45	29	3	-	-	100	228	402	34	1	2

14.3.4	Precast concrete lintels (4no. 100x100x3300mm long over new doorway, say)	0.132	m3	Concrete, pre	2,400	317	2.33	738	77	-	-	-	-	-	-	-	155	49	87	7	1	0
14.4	**External Wall Completion**																						
14.4.1-14.4.6	Glazing - Windows & Doors area (iroko hardwood [one primer coat, one mid coat and two top coats in shop], 6mm outer glazing, 16mm argon fill, 4mm inner glazing, toughened glass if below 800mm above floor level)	16.708	m2	Windows, 3-l	-	-	920.00	15,371	951	-	-	-	-	-	-	-	-	-	-	-	2	42
	Wooden frame of above	16.708	m2	Windows, wc	-	-	4,730.00	79,029	2,205	-	-	-	-	-	-	-	-	-	-	-	19	321
14.4.7	300mm EPDM membrane Windows & Doors perimeter (38m, assume 1mm thk)	0.011	m3	Membrane	1,250	14	134.00	1,910	63	-	-	1	95	3	-	-	100	1	3	0	2	0
14.5	**External Wall Finish**																						
	250mm thickness of hemp lime sprayed onto external wall, 77m2 (Revised spe	19.250	m3	Hempcrete	330	6,353	5.56	35,336	4,504	-	-	4,766	-	-	-	-	-	836	5,310	9,374	795	1	6
	25mm lime plaster externally, 77m2 - 1/4 lime	0.481	m3	Lime	1,201	578	5.30	3,063	451	-	-	139	29	153	23	-	- 7	100	61	107	9	1	1
	25mm lime plaster externally, 77m2 - 3/4 sand	1.444	m3	Aggregate	2,240	3,234	0.08	268	17	-	-	-	-	-	-	-	-	14	44	77	7	1	3
	275mm wide strip foundation of thermalite blocks, 27m2 (Revised spec, KG email 13/3/14)	7.425	m3	Blocks (Aerat	750	5,569	3.50	19,491	1,815	-	-	-	111	390	36	-	-	100	568	1,003	85	1	6
14.6	**Internal Wall Structure**																						
14.6.1	Other Timber - softwood (450mm high x 3m long balustrade wall)	0.042	m3	Timber, Softv	563	24	7.40	176	5	9	-	44	1	5	0	0	- 1	100	2	4	0	21	1
14.7	**Internal Wall Completion**																						
14.7.1	Exclude 2 birch ply faced doors																						
14.8	**Internal Wall Finish**																						
14.8.1	Dry line walls with 25mm hemp lime plaster (61m2)	1.525	m3	Hempcrete	330	503	5.56	2,799	357	-	-	378	-	-	-	-	-	836	421	743	63	1	1
14.8.3	Ditt to reveals (19m2)	0.475	m3	Hempcrete	330	157	5.56	872	111	-	-	118	-	-	-	-	-	836	131	231	20	1	0
14.8.4	12.5mm plasterboard to shallow height balustrade to r02 (5m2)	0.063	m3	Plasterboard	1,100	69	6.75	464	27	-		-	3	23	1	-	-	100	7	13	1	72	5
14.8.4	Bag of skim coat for balustrade (1 bag @ 25kg)	1.000	bags	Plaster, gypsı	1,120	25	1.80	45	3	-		-	1	2	0	-	-	100	3	5	0	72	2
14.8.2	Other Timber - Plywood (20mm Birch plywood to jambs and head at doors D01 and D02)	0.074	m3	Timber, Plyw	620	46	15.00	684	21	30	-	84	1	21	1	1	- 3	100	5	8	1	21	1
14.9	**Floor Structure**	**(Revised spec, KG email 13/3/14)**																					
14.9.1-2	Other Timber - Softwood (175x44mm joists @ 400c/c w/ 1 line of noggings; 3n	1.801	m3	Timber, Softv	563	1,014	7.40	7,502	203	395	-	1,859	30	225	6	12	- 56	100	104	184	16	21	22
	Other Timber - OSB (18mm T&G Smart Ply 3 OSB deck to top of joists & 12mm	1.337	m3	Timber, OSB	620	829	15.00	12,432	373	448	-	1,519	25	373	11	13	- 46	100	85	151	13	21	18
	Breather membrane (195g/m2)	42.400	m2	Polyethylene	950	8	83.10	687	21	-		-	0	34	1	-	-	1,302	11	20	2	2	0
	175mm deep cellulose insulation	6.226	m3	Insulation, ce	30	187	2.12	396	-	-	-	342	-	-	-	-	-	30	6	10	1	1	0
14.9.3	Slate hearthstone, 900x900x50mm deep	0.041	m3	Slate, import	2,750	111	0.55	61	4	-		-	2	1	0	-	-	2,600	295	521	44	1	0
14.10	**Floor & Stair Finish**																						
14.10.1	Exclude 150x22mm engineered oak floor boards (41.7m2) as not building envelope																						
	Exclude 2 layers of 50x25mm battens @ 400c/c (41.7m2) as not building envelope																						
14.10.2	Other Timber - Plywood (Mezzanine floor 20mm birch plywood to top of joists)	0.232	m3	Timber, Plyw	620	144	15.00	2,158	65	93	-	264	4	65	2	3	- 8	100	15	26	2	21	3
14.10.3	Other Timber - Hardwood (cills)	0.075	m3	Timber, Hard	750	56	10.40	586	14	35	-	103	1	6	0	0	- 1	100	6	10	1	21	1
14.11	**Roof Structure**																						
	Exclude holding down galvanised metal straps as unknown quantity																						
14.11.1	Other Timber - Softwood (new 44x175mm rafters @ 400c/c on top of existing rafters, new wall plate, timber battens to u/s rafters to take plasterboard, 4no. 44x44 diagonal bracing timbers)	1.947	m3	Timber, Softv	563	1,096	7.40	8,110	219	427	-	2,009	33	243	7	13	- 60	100	113	199	17	21	24
	DuPont Tyvek UV Facade UV resistant breather membrane (195g/m2)	80.000	m2	Polyethylene	950	16	83.10	1,296	40	-		-	1	65	2	-	-	1,302	21	38	3	2	0
	ProClima Intello Plus Vapour Check membrane (1 roll) (55m2, 0.2mm thk)	0.011	m3	Polyethylene	950	10	83.10	868	27	-		-	1	43	1	-	-	1,521	17	29	2	2	0
	Exclude Air tight tape to perimieter (non T&G joints)	31.000	m																				
	Silicon Sealant to OSB joints (say 6no. 310ml tubes @ 10m each)	0.002	m3	Sealant, mast	2,329	4	131.00	567	-	-		-	0	11	-	-	-	100	0	1	0	2	0
	Other Timber - Plywood (8no. 20mm thk x2.5m long plywood collars)	0.080	m3	Timber, Plyw	620	50	15.00	744	22	32	-	91	1	22	1	1	- 3	100	5	9	1	21	1
14.11.4-5	375mm Ecocel cellulose insulation	24.345	m3	Insulation, ce	60	1,461	2.12	3,097	-	-	-	2,678	-	-	-	-	-	30	44	77	7	1	1
14.12	**Roof Finish**																						
14.12.1	Other Timber - Softwood (25x50mm timber battens horizontally & vertically)	0.500	m3	Timber, Softv	563	282	7.40	2,083	56	110	-	516	8	62	2	3	- 15	100	29	51	4	21	6
	Other Timber - Hardwood (assume 200x20mm thick)	0.148	m3	Timber, Hard	750	111	10.40	1,154	27	70	-	204	1	12	0	1	- 2	100	11	20	2	21	2
	Exclude Tegral aluminium verge trim to gables	15.000	m																				
14.12.2	Glazing - M04 velux rooflight, top hung, white, double glazed (assume Triple gl	0.764	m2	Windows, 3-l	-	-	920.00	703	43	-		-	-	-	-	-	-	-	-	-	-	2	2
	Wood frame as above	0.764	m2	Windows, wc	-	-	4,730.00	3,616	101	-		-	-	-	-	-	-	-	-	-	-	19	15
14.12.3	Black PVC gutter (subcontractor supply and fit, 22m @ assume 0.51kg/m)	22.000	m	PVC, general	1,380	11	77.20	866	35	-		-	0	17	1	-	-	100	1	2	0	2	0
	Black PVC downpipes (subcontractor supply and fit) (6m @ assume 0.576kg/m	6.000	m	PVC, general	1,380	3	77.20	267	11	-		-	0	5	0	-	-	100	0	1	0	2	0
	Swanneck (subcontractor supply and fit)	2.000	no.	PVC, general	1,380	2	77.20	154	6	-		-	0	3	0	-	-	100	0	0	0	2	0
	Shoe (subcontractor supply and fit)	2.000	no.	PVC, general	1,380	1	77.20	77	3	-		-	0	2	0	-	-	100	0	0	0	2	0
	salvages slates - reused																						
14.13	**Ceilings**																						

14.13.1	Exclude T&G timber panelling as plasterboarding allowed for throughout																						
14.13.2	Exclude Birch ply as plasterboard finish assumed																						
	12.5mm plasterboard to sloped/horizontal ceiling (1 layers, 67m2)	0.838	m3	Plasterboard	1,100	921	6.75	6,218	359	-	-	46	311	18	-	-	100	97	171	14	72	70
	Bag of skim coat (based on above quantities, 6bags @ 25kg each)	6.000	bags	Plaster, gypsı	1,120	150	1.80	270	20	-	-	8	14	1	-	-	100	16	28	2	72	11
14.13.3	12.5mm Plasterboard to underside of mezzanine floor (11.6m2)	0.145	m3	Plasterboard	1,100	160	6.75	1,077	62	-	-	8	54	3	-	-	100	17	30	3	72	12
Totals						**57,050**		**581,395**	**27,849**	**8,761**	**- 43,433**	**1,145**	**8,968**	**460**	**205**	**- 776**		**18,676**	**32,971**	**2,797**		**1,657**
Option 1: Septic Tank + Gravel Reed Bed (50m2) + Percolation Area																							
Septic Tank	3800L spherical GRP septic tank	1.000	unit	GRP/Fibregla	1,530	140	100.00	14,000	1,202	-	-	-	-	-	-	-	100	14	25	2	2	0
	200mm concrete encasement to GRP tank (approx 2.75mx 3.14x2^2/4 x 0.2mt	1.727	m3	Concrete, pla	2,300	3,972	0.78	3,098	449	-	-	199	155	22	-	-	14	56	99	8	1	4
Gravel reed bed	Gravel (50m2 x0.7mdp)	35.000	m3	Aggregate	2,240	78,400	0.08	6,507	408	-	-	-	-	-	-	-	14	1,058	1,869	159	1	78
	0.5mm LDPE geotextile liner w/ 10% laps	0.028	m3	Polyethylene	950	26	83.10	2,171	66	-	-	1	109	3	-	-	100	3	5	0	2	0
	exclude plants																						
Percolation	Percolation area	35.000	m3	Aggregate	2,240	78,400	0.08	6,507	408	-	-	-	-	-	-	-	14	1,058	1,869	159	1	78
						160,938		**32,284**	**2,533**	**-**	**-**	**200**	**263**	**26**	**-**	**-**		**2,190**	**3,866**	**328**		**161**
Option 2: Septic Tank + Constructed Wetland (100m2) + Percolation Area																							
Septic Tank	3800L spherical GRP septic tank	1.000	unit	GRP/Fibregla	1,530	140	100.00	14,000	1,202	-	-	-	-	-	-	-	100	14	25	2	2	0
	200mm concrete encasement to GRP tank (approx 2.75mx 3.14x2^2/4 x 0.2mt	1.727	m3	Concrete, pla	2,300	3,972	0.78	3,098	449	-	-	199	155	22	-	-	14	56	99	8	1	4
Constructed Wet	Gravel, 1 tonne	1.000	tonne	Aggregate	2,240	1,000	0.08	83	5	-	-	-	-	-	-	-	14	14	24	2	1	1
	0.5mm LDPE geotextile liner w/ 10% laps	0.055	m3	Polyethylene	950	52	83.10	4,342	133	-	-	3	217	7	-	-	100	5	10	1	2	0
	exclude plants																						
	exclude soil as use soil on site																						
Percolation	Percolation area	35.000	m3	Aggregate	2,240	78,400	0.08	6,507	408	-	-	-	-	-	-	-	14	1,058	1,869	159	1	78
						83,564		**28,030**	**2,196**	**-**	**-**	**201**	**372**	**29**	**-**	**-**		**1,148**	**2,026**	**172**		**84**
Option 3: Septic Tank + Willow Facility (6mx35m =210m2)																							
Septic Tank	3800L spherical GRP septic tank	1.000	unit	GRP/Fibregla	1,530	140	100.00	14,000	1,202	-	-	-	-	-	-	-	100	14	25	2	2	0
	200mm concrete encasement to GRP tank (approx 2.75mx 3.14x2^2/4 x 0.2mt	1.727	m3	Concrete, pla	2,300	3,972	0.78	3,098	449	-	-	199	155	22	-	-	14	56	99	8	1	4
Willow Facility	Sand, 1 tonne	1.000	tonne	Aggregate	2,240	1,000	0.08	83	5	-	-	-	-	-	-	-	14	14	24	2	1	1
	0.5mm LDPE geotextile liner w/ 10% laps	0.116	m3	Polyethylene	950	110	83.10	9,118	279	-	-	5	456	14	-	-	100	12	20	2	2	0
	exclude plants																						
	exclude soil as use soil on site																						
						5,222		**26,299**	**1,935**	**-**	**-**	**204**	**611**	**36**	**-**	**-**		**95**	**168**	**14**		**6**

Appendix III - Analysis by Schedule of Works (Conventional)

Kevin Gartland Architect's Schedule of Work (Tender 2nd Aug 2013)

Item	Title	Description	Qty	Unit	Material	Density (kg/m3)	Mass (kg)	CRADLE-TO-GATE Conversion Factor (MJ/kg)	EE (MJ)	EC (kgCO2e/kg)	EC (Biomass) (kgCO2e/kg)	EC (Carbon (kgCO2e/kg	EC (kgCO2e)	EC (Biomass) (kgCO2e)	EC (Carbon Seq) (kgCO2e)	CONSTRUCTION WASTE %	kg	EE MJ	EC kgCO	EC (bio kgCO	EC (sequ kgCO	TRANSPORT TO SITE km	t.km	EE MJ	EC (kgCO2e	End-of-Life kgCO2e,	kgCO2e
	New Extension																										
1	**Demolition & Alterations**	Refer to Contractor's questionnaire for energy & waste resource treatment																									
2	**Substructure**																										
		800x600mm deep trench foundation (assume 26m long in perimeter, grade 30N20 concrete)	12.480	m3	Concrete, pla	2,300	28,704	0.78	22,389	0.11	-	-	3,244	-	-	5%	1,435	1,119	162	-	-	14	407	718	61	1	30
		hardcore compacted in layers no exceeding 200mm (max overall hardcord depth 1400mm) (assume plan area of 8.4mx3.5 by a depth of between 0.74m and 1.1m)	27.048	m3	Aggregate	2,240	60,588	0.08	5,029	0.01	-	-	315	-	-	0%	-	-	-	-	-	14	818	1,444	123	1	61
		50mm sand blinding	1.470	m3	Aggregate	2,240	3,293	0.08	273	0.01	-	-	17	-	-	0%	-	-	-	-	-	14	44	78	7	1	3
3	**External Wall Structure**																										
		2 skins of 100mm thk blockwork (assume 78m2)	15.600	m3	Blockwork, 1	1,620	25,267	0.63	15,920	0.07	-	-	1,808	-	-	2%	505	318	36	-	-	100	2,577	4,550	386	1	26
		stainless steel wall ties (Cavity with B.S.1243 20 x 3 flat vertical twist stainless steel, 4/m2 built in)	78.000	m2	Stainless Stee	7,850	33	56.70	1,875	6.52	-	-	216	-	-	2%	1	37	4	-	-	100	3	6	1	1	0
		215mm expanded polystyrene insulation (assume 78m2)	16.770	m3	Insulation, po	12	193	88.60	17,087	3.29	-	-	634	-	-	0%	-	-	-	-	-	100	19	34	3	2	0
		DPM full perimeter (assume 350mm x 26m perimeter; LDPE Film; assume 407g/m2 with 4% laps)	9.464	m2	Plastic, LDPE	925	4	89.30	344	2.60	-	-	10	-	-	5%	0	17	1	-	-	100	0	1	0	2	0
4	**External Wall Completion**																										
		Glazing - Windows & Doors area (PVC, 6mm outer glazing, 16mm argon fill, 4n	20.162	m2	Windows, 3-l	-	-	920.00	18,549	56.90	-	-	1,147	-	-	0%	-	-	-	-	-	-	-	-	-	2	50
		PVC frames	20.162	m2	Windows, PVC frame (		-	5,850.00	117,948	246.00	-	-	4,960	-	-	0%	-	-	-	-	-	-	-	-	-	132	2,661
		Precast concrete cills (say 12.5 m of 215x65 cill)	0.175	m3	Concrete, pre	2,400	419	2.33	977	0.24	-	-	101	-	-	0%	-	-	-	-	-	155	65	115	10	1	0
		300mm EPDM membrane Windows & Doors perimeter (assume 1mm thk)	0.014	m3	Membrane	1,250	17	134.00	2,290	4.45	-	-	76	-	-	5%	1	115	4	-	-	100	2	3	0	2	0
5	**External Wall Finish**																										
		18mm cement render externally (78m2)	1.404	m3	Cement rend	1,860	2,611	1.33	3,473	0.22	-	-	577	-	-	5%	131	174	29	-	-	14	37	65	6	2	5
		Painting (Mist coat, two full coats emulsion paint, assume 2.22m2 per kg of	78.000	m2	Paint, waterb	-	-	26.58	2,073	1.14	-	-	89	-	-	1%	-	21	1	-	-	100	-	-	-	2	-
6	**Internal Wall Structure**																										
	6.1	Other Timber - Softwood (100x44mm timber studs)	0.669	m3	Timber, Softv	563	377	7.40	2,786	0.20	0.39	- 1.83	75	147	- 690	3%	11	84	2	4	- 21	100	39	68	6	21	8
7	**Internal Wall Completion**																										
	7.1-7.3	Exclude Doors with birch ply facing, as not building envelope	6.000	no.																							
8	**Internal Wall Finish**																										
		15mm wet gypsum plaster to inside face of external walls (single layer, 49m2)	0.735	m3	Plaster, gypsi	1,120	823	1.80	1,482	0.13	-	-	107	-	-	5%	41	74	5	-	-	100	86	153	13	72	62
		15mm wet gypsum plaster to inside face of external walls (33m2, second layer	0.495	m3	Plaster, gypsi	1,120	554	1.80	998	0.13	-	-	72	-	-	5%	28	50	4	-	-	100	58	103	9	72	42
		12.5mm plasterboard to both sides of internal stud partitions (61m2)	0.763	m3	Plasterboard	1,100	839	6.75	5,662	0.39	-	-	327	-	-	5%	42	283	16	-	-	100	88	155	13	72	63
		12.5mm moisture resistant plasterboard to walls of bathroom (23m2)	0.288	m3	Plasterboard	1,100	316	6.75	2,135	0.39	-	-	123	-	-	5%	16	107	6	-	-	100	33	59	5	72	24
		Bags of skim coat (10 bags, based on above quantities, assume 25kg bags)	10.000	bags	Plaster, gypsi	1,120	250	1.80	450	0.13	-	-	33	-	-	5%	13	23	2	-	-	100	26	46	4	72	19
	8.3,8.4,8.6	Excluded 12mm birch ply to 03 Porch and 05 Hall, T&G cedar panelling for 06 Bathroom, & touchened laminated glass shower screen in 06 Bathroom, as no details to quantify																									
9	**Floor & Stairs Structure**																										
		Radon barrier membrane (assume 38m2; LDPE Film; assume 407g/m2 with 4%	39.520	m2	Plastic, LDPE	925	16	89.30	1,436	2.60	-	-	42	-	-	5%	1	72	2	-	-	100	2	3	0	2	0
		160 mm rigid insulation (assume 38m2)	6.080	m3	Insulation, po	45	274	101.50	27,770	4.26	-	-	1,166	-	-	2%	5	555	23	-	-	100	28	49	4	2	1
		20mm perimeter insulation (assume 26m)	0.078	m3	Insulation, po	45	4	101.50	356	4.26	-	-	15	-	-	2%	0	7	0	-	-	100	0	1	0	2	0
		125mm concrete slab	4.750	m3	Concrete, pla	2,300	10,925	0.78	8,522	0.11	-	-	1,235	-	-	5%	546	426	62	-	-	14	155	273	23	1	11
		1 layer of A393 mesh (6.16kg/m2, +10% for laps)	41.800	m2	Steel, rebar	7,800	257	17.40	4,480	1.40	-	-	360	-	-	0%	-	-	-	-	-	100	26	45	4	1	0
		25mm screed	0.950	m3	Concrete, pla	2,300	2,185	0.78	1,704	0.11	-	-	247	-	-	5%	109	85	12	-	-	14	31	55	5	1	2
10	**Floor & Stair Finish**																										
	10.1 Bedroom	Exclude 150x22mm engineered oak floor boards (20m2) as finishes Exclude 2 layers of 50x25mm battens @ 400c/c (20m2) as finishes																									
	10.2 Bathroom	Exclude 300x600mm tiles (10.7m2). Grout & adhesive as finishes Exclude 20mm OSB (10.7m2) as finishes Exclude 44x44 Softwood battens (10.7m2) as finishes																									
	10.4	Hardwood to cills (assume 225x20mm)	0.054	m3	Timber, Hard	750	41	10.40	424	0.24	0.63	- 1.83	10	26	- 75	1%	0	4	0	0	- 1	100	4	7	1	21	1
11	**Roof Structure**																										
		25no. 200x44 softwoood joists @ 400c/c, 4.5m long Exclude, 50 joist hangers	0.990	m3	Timber, Softv	563	557	7.40	4,125	0.20	0.39	- 1.83	111	217	- 1,022	3%	17	124	3	7	- 31	100	57	101	9	21	12
		Other Timber - Softwood (angle fillets, 175x44mm rafters & firring pieces to link)	0.281	m3	Timber, Softv	563	158	7.40	1,169	0.20	0.39	- 1.83	32	62	- 290	3%	5	35	1	2	- 9	100	16	29	2	21	3
		Other Timber - OSB (22mm inside)	0.726	m3	Timber, OSB	620	450	15.00	6,752	0.45	0.54	- 1.83	203	243	- 825	3%	14	203	6	7	- 25	100	46	82	7	21	10
		Other Timber - OSB (22mm marine outside)	0.990	m3	Timber, OSB	620	614	15.00	9,207	0.45	0.54	- 1.83	276	331	- 1,125	3%	18	276	8	10	- 34	100	63	112	9	21	13
		ProClima Intello Plus Vapour Check membrane (1 roll) (44m2, 0.2mm thk)	0.009	m3	Polyethylene	950	8	83.10	695	2.54	-	-	21	-	-	5%	0	35	1	-	-	100	1	2	0	2	0

	DuPont Tyvek UV Facade UV resistant breather membrane (195g/m2)	44.000	m2	Polyethylene	950	9	83.10	713	2.54	-	-	22	-	-	5%	0	36	1	-	-	1,302	12	21	2	2	0
	Exclude Air tight tape to perimieter (non T&G joints)	25.000	m																							
	Silicon Sealant to OSB joints (say 5no. tubes @ 10m each)	0.002	m3	Sealant, mas	2,329	4	131.00	473	-	-	-	-	-	-	2%	0	9	-	-	-	100	0	1	0	2	0
	175mm rigid insulation (4x9.1m roof area)	6.370	m3	Insulation, pc	45	287	101.50	29,095	4.26	-	-	1,221	-	-	2%	6	582	24	-	-	100	29	52	4	2	1
	200mmx20mm rigid PIR insulation upstand against parapet (2x4.1m +8.6m = 16.8m)	0.067	m3	Insulation, pc	45	3	101.50	307	4.26	-	-	13	-	-	2%	0	6	0	-	-	100	0	1	0	2	0
12	**Roof Finish**																									
12.3	Fibreglass membrane (44m2, assume 3mm thk)	0.132	m3	GRP/Fibregla	1,530	202	100.00	20,196	8.59	-	-	1,734	-	-	3%	6	606	52	-	-	100	21	37	3	2	0
12.4-12.5	Fibreglass to upstand and across parapet (6.2m2, assume 3mm thk)	0.019	m3	GRP/Fibregla	1,530	28	100.00	2,846	8.59	-	-	244	-	-	3%	1	85	7	-	-	100	3	5	0	2	0
12.9	Fibreglass to link roof and dress up under cedar cladding (11m2, assume 3mm	0.033	m3	GRP/Fibregla	1,530	50	100.00	5,049	8.59	-	-	434	-	-	3%	2	151	13	-	-	100	5	9	1	2	0
12.8	Black PVC gutter to northern elevation (subcontractor supply and fit; 9m @ as	9.000	m	PVC, general	1,380	5	77.20	354	3.10	-	-	14	-	-	2%	0	7	0	-	-	100	0	1	0	2	0
12.6-12.8	Other Timber - Hardwood (fascia board to nothern elevation; 20mm Cedar cla	0.140	m3	Timber, Hard	750	105	10.40	1,092	0.24	0.63	- 1.83	25	66	- 193	1%	1	11	0	1	- 2	100	11	19	2	21	2
13	**Ceilings**																									
13.1	Other Timber - Softwood (50x25mm treated battens to inside face of external	0.106	m3	Timber, Softv	563	60	7.40	443	0.20	0.39	- 1.83	12	23	- 110	3%	2	13	0	1	- 3	100	6	11	1	21	1
	2 layers of 12.5mm plasterboard to inside face of external walls (33.5m2)	0.838	m3	Plasterboard	1,100	921	6.75	6,218	0.39	-	-	359	-	-	5%	46	311	18	-	-	100	97	171	14	72	70
	Bag of skim coat (based on above quantities, 6bags @assume 25kg each)	6.000	bags	Plaster, gyps	1,120	150	1.80	270	0.13	-	-	20	-	-	5%	8	14	1	-	-	100	16	28	2	72	11
	Exclude 20mm birch plywood as accounted for in plasterboard area																									
	Existing House																									
14.1	**Demolition** Refer to Contractor's questionnaire for energy & waste resource treatment																									
14.2	**Substructure**																									
14.2.2	Exclude perforated land drain & soakaway as no details provided																									
14.3	**External Wall Structure**																									
14.3.1	Precast concrete lintels (4no. 100x65x1600mm long over 4no. Windows + 4no. 100x100x3400mm long over W02, say)	0.302	m3	Concrete, pre	2,400	726	2.33	1,691	0.24	-	-	176	-	-	0%	-	-	-	-	-	155	112	199	17	1	1
14.3.2	Increase height of rubble wall with blockwork (215mm wide x 200mm high, say)	1.368	m3	Blockwork, 2	1,633	2,235	0.66	1,469	0.08	-	-	173	-	-	2%	45	29	3	-	-	100	228	402	34	1	2
14.3.4	Precast concrete lintels (4no. 100x100x3300mm long over new doorway, say)	0.132	m3	Concrete, pre	2,400	317	2.33	738	0.24	-	-	77	-	-	0%	-	-	-	-	-	155	49	87	7	1	0
14.4	**External Wall Completion**																									
14.4.1-14.4.6	Glazing - Windows & Doors area (PVC, 6mm outer glazing, 16mm argon fill, 4n	16.708	m2	Windows, 3-l	-	-	920.00	15,371	56.90	-	-	951	-	-	0%	-	-	-	-	-	-	-	-	-	2	42
	PVC frames	16.708	m2	Windows, PV	-	-	5,850.00	97,742	246.00	-	-	4,110	-	-	0%	-	-	-	-	-	-	-	-	-	132	2,205
	Precast concrete cills (say 7.5 m of 215x65 cill)	0.105	m3	Concrete, pre	2,400	252	2.33	586	0.24	-	-	61	-	-	0%	-	-	-	-	-	155	39	69	6	1	0
14.4.7	300mm EPDM membrane Windows & Doors perimeter (38m, assume 1mm thk)	0.011	m3	Membrane	1,250	14	134.00	1,910	4.45	-	-	63	-	-	5%	1	95	3	-	-	100	1	3	0	2	0
14.5	**External Wall Finish**																									
	Allow for 18mm of cement render finish externally (77m2)	1.386	m3	Cement rend	1,860	2,578	1.33	3,429	0.22	-	-	570	-	-	5%	129	171	28	-	-	14	37	65	5	2	5
14.6	**Internal Wall Structure**																									
14.6.1	Other Timber - softwood (450mm high x 3m long balustrade wall)	0.042	m3	Timber, Softv	563	24	7.40	176	0.20	0.39	- 1.83	5	9	- 44	3%	1	5	0	0	- 1	100	2	4	0	21	1
14.7	**Internal Wall Completion**																									
14.7.1	Exclude 2 birch ply faced doors																									
14.8	**Internal Wall Finish**																									
	Allow for 15mm of cement render scratch coat internally (61+19=80m2)	1.200	m3	Cement rend	1,860	2,232	1.33	2,969	0.22	-	-	493	-	-	5%	112	148	25	-	-	14	32	56	5	2	5
	50x25mm SW battens @ 400c/c (61+19=80m2)	0.250	m3	Plaster, gyps	1,120	280	1.80	504	0.13	-	-	36	-	-	5%	14	25	2	-	-	100	29	52	4	72	21
	40mm PIR insulation board (80m2)	3.200	m3	Insulation, pc	45	144	101.50	14,616	4.26	-	-	613	-	-	2%	3	292	12	-	-	100	15	26	2	2	0
	DuPont Tyvek UV Facade UV resistant breather membrane (195g/m2, 80m2)	80.000	m2	Polyethylene	950	16	83.10	1,296	2.54	-	-	40	-	-	5%	1	65	2	-	-	1,302	21	38	3	2	0
14.8.1	12.5mm plasterboard (61m2)	0.763	m3	Plasterboard	1,100	839	6.75	5,662	0.39	-	-	327	-	-	5%	42	283	16	-	-	100	88	155	13	72	63
14.8.3	Ditto to reveals (19m2)	0.238	m3	Plaster, gyps	1,120	266	1.80	479	0.13	-	-	35	-	-	5%	13	24	2	-	-	100	28	49	4	72	20
14.8.4	12.5mm plasterboard to shallow height balustrade to r02 (5m2)	0.063	m3	Plasterboard	1,100	69	6.75	464	0.39	-	-	27	-	-	5%	3	23	1	-	-	100	7	13	1	72	5
14.8.4	Bag of skim coat for balustrade (1 bag @ 25kg)	1.000	bags	Plaster, gyps	1,120	25	1.80	45	0.13	-	-	3	-	-	5%	1	2	0	-	-	100	3	5	0	72	2
14.8.2	Other Timber - Plywood (20mm Birch plywood to jambs and head at doors D01 and D02)	0.074	m3	Timber, Plyw	620	46	15.00	684	0.45	0.65	- 1.83	21	30	- 84	3%	1	21	1	1	- 3	100	5	8	1	21	1
14.9	**Floor Structure** **(Revised spec, KG email 13/3/14)**																									
	Other Timber - Softwood (175x44mm joists @ 400c/c w/ 1 line of noggings; 3r	1.801	m3	Timber, Softv	563	1,014	7.40	7,502	0.20	0.39	- 1.83	203	395	- 1,859	3%	30	225	6	12	- 56	100	104	184	16	21	22
	Other Timber - OSB (18mm T&G Smart Ply 3 OSB deck to top of joists & 12mm	1.337	m3	Timber, OSB	620	829	15.00	12,432	0.45	0.54	- 1.83	373	448	- 1,519	3%	25	373	11	13	- 46	100	85	151	13	21	18
	Breather membrane (195g/m2)	42.400	m2	Polyethylene	950	8	83.10	687	2.54	-	-	21	-	-	5%	0	34	1	-	-	1,302	11	20	2	2	0
	120mm rigid insulation between joists	4.494	m3	Insulation, pc	45	202	101.50	20,526	4.26	-	-	861	-	-	2%	4	411	17	-	-	100	21	36	3	2	0
	Slate hearthstone, 900x900x50mm deep	0.041	m3	Slate, import	2,750	111	0.55	61	0.04	-	-	4	-	-	2%	2	1	0	-	-	2,600	295	521	44	1	0
14.10	**Floor & Stair Finish**																									
14.10.1	Exclude 150x22mm engineered oak floor boards (41.7m2) as not building envelope																									
	Exclude 2 layers of 50x25mm battens @ 400c/c (41.7m2) as not building envelope																									
14.10.2	Other Timber - Plywood (Mezzanine floor 20mm birch plywood to top of joists)	0.232	m3	Timber, Plyw	620	144	15.00	2,158	0.45	0.65	- 1.83	65	93	- 264	3%	4	65	2	3	- 8	100	15	26	2	21	3
14.10.3	Other Timber - Hardwood (cills)	0.075	m3	Timber, Hard	750	56	10.40	586	0.24	0.63	- 1.83	14	35	- 103	1%	1	6	0	0	- 1	100	6	10	1	21	1
14.11	**Roof Structure**																									
	Exclude holding down galvanised metal straps as unknown quantity																									
14.11.1	Other Timber - Softwood (new 44x175mm rafters @ 400c/c on top of existing rafters, new wall plate, timber battens to u/s rafters to take plasterboard, 4no. 44x44 diagonal bracing timbers)	1.947	m3	Timber, Softv	563	1,096	7.40	8,110	0.20	0.39	- 1.83	219	427	- 2,009	3%	33	243	7	13	- 60	100	113	199	17	21	24
	DuPont Tyvek UV Facade UV resistant breather membrane (195g/m2)	80.000	m2	Polyethylene	950	16	83.10	1,296	2.54	-	-	40	-	-	5%	1	65	2	-	-	1,302	21	38	3	2	0
	ProClima Intello Plus Vapour Check membrane (1 roll) (55m2, 0.2mm thk)	0.011	m3	Polyethylene	950	10	83.10	868	2.54	-	-	27	-	-	5%	1	43	1	-	-	1,521	17	29	2	2	0
	Exclude Air tight tape to perimieter (non T&G joints)	31.000	m																							

		Silicon Sealant to OSB joints (say 6no. 310ml tubes @ 10m each)	0.002	m3	Sealant, mas	2,329	4	131.00	567	-	-	-	-	-	-	2%	0	11	-	-	-	100	0	1	0	2	0
		Other Timber - Plywood (8no. 20mm thk x2.5m long plywood collars)	0.080	m3	Timber, Plyw	620	50	15.00	744	0.45	0.65 -	1.83	22	32 -	91	3%	1	22	1	1 -	3	100	5	9	1	21	1
		120mm rigid insulation between rafters & 50mm below rafters	11.412	m3	Insulation, p	45	514	101.50	52,124	4.26	-	-	2,188	-	-	2%	10	1,042	44	-	-	100	52	92	8	2	1
14.12	**Roof Finish**																										
	14.12.1	Other Timber - Softwood (25x50mm timber battens horizontally & vertically)	0.500	m3	Timber, Soft	563	282	7.40	2,083	0.20	0.39 -	1.83	56	110 -	516	3%	8	62	2	3 -	15	100	29	51	4	21	6
		Other Timber - Hardwood (assume 200x20mm thick)	0.148	m3	Timber, Hard	750	111	10.40	1,154	0.24	0.63 -	1.83	27	70 -	204	1%	1	12	0	1 -	2	100	11	20	2	21	2
		Exclude Tegral aluminium verge trim to gables	15.000	m																							
	14.12.2	Glazing - M04 velux rooflight, top hung, white, double glazed (assume Triple g	0.764	m2	Windows, 3-l	-	-	920.00	703	56.90	-	-	43	-	-	0%	-	-	-	-	-	-	-	-	-	2	2
		PVC frame as above	0.764	m2	Windows, PV	-	-	5,850.00	4,472	246.00	-	-	188	-	-	0%	-	-	-	-	-	-	-	-	-	132	101
	14.12.3	Black PVC gutter (subcontractor supply and fit, 22m @ assume 0.51kg/m)	22.000	m	PVC, general	1,380	11	77.20	866	3.10	-	-	35	-	-	2%	0	17	1	-	-	100	1	2	0	2	0
		Black PVC downpipes (subcontractor supply and fit) (6m @ assume 0.576kg/m	6.000	m	PVC, general	1,380	3	77.20	267	3.10	-	-	11	-	-	2%	0	5	0	-	-	100	0	1	0	2	0
		Swanneck (subcontractor supply and fit)	2.000	no.	PVC, general	1,380	2	77.20	154	3.10	-	-	6	-	-	2%	0	3	0	-	-	100	0	0	0	2	0
		Shoe (subcontractor supply and fit)	2.000	no.	PVC, general	1,380	1	77.20	77	3.10	-	-	3	-	-	2%	0	2	0	-	-	100	0	0	0	2	0
		salvages slates - reused																									
14.13	**Ceilings**																										
	14.13.1	Exclude T&G timber panelling as plasterboarding allowed for throughout																									
	14.13.2	Exclude Birch ply as plasterboard finish assumed																									
		12.5mm plasterboard to sloped/horizontal ceiling (1 layers, 67m2)	0.838	m3	Plasterboard	1,100	921	6.75	6,218	0.39	-	-	359	-	-	5%	46	311	18	-	-	100	97	171	14	72	70
		Bag of skim coat (based on above quantities, 6bags @ 25kg each)	6.000	bags	Plaster, gyps	1,120	150	1.80	270	0.13	-	-	20	-	-	5%	8	14	1	-	-	100	16	28	2	72	11
	14.13.3	12.5mm Plasterboard to underside of mezzanine floor (11.6m2)	0.145	m3	Plasterboard	1,100	160	6.75	1,077	0.39	-	-	62	-	-	5%	8	54	3	-	-	100	17	30	3	72	12
	Totals						**157,356**		**630,270**				**34,373**	**2,766 -**	**11,021**		**3,560**	**10,282**	**723**	**79 -**	**319**		**6,549**	**11,561**	**981**		**5,845**
	Option 1: Septic Tank + Biofilter + Percolation Area																										
	Septic Tank	3800L spherical GRP septic tank	1.000	unit	GRP/Fibregla	1,530	140	100.00	14,000	8.59	-	-	1,202	-	-	0%	-	-	-	-	-	100	14	25	2	2	0
		200mm concrete encasement to GRP tank (approx 2.75mx 3.14x2^2/4 x 0.2mt	1.727	m3	Concrete, pla	2,300	3,972	0.78	3,098	0.11	-	-	449	-	-	5%	199	155	22	-	-	14	56	99	8	1	4
	Biofilter	2.5 cubic metres biofilter medium compacted	2.500	m3	Soil, importe	900	2,250	0.45	1,013	0.02	-	-	54	-	-	0%	-	-	-	-	-	45	101	179	15	1	3
		PE container, say 100kg	1.000	unit	Polyethylene	950	100	83.10	8,310	2.54	-	-	254	-	-	0%	-	-	-	-	-	100	10	18	1	2	0
		290kg cubic metre precast concrete sump for pump	1.000	unit	Concrete, pre	2,400	290	2.33	676	0.24	-	-	70	-	-	0%	-	-	-	-	-	155	45	79	7	1	0
		2 concrete lintels, say 100x65 x2.8m long	0.036	m3	Concrete, pre	2,400	87	2.33	204	0.24	-	-	21	-	-	0%	-	-	-	-	-	155	14	24	2	1	0
		3.5mx3mx0.2mdp aggregate beneath biofilter	2.100	m3	Aggregate	2,240	4,704	0.08	390	0.01	-	-	24	-	-	0%	-	-	-	-	-	14	64	112	10	1	5
	Percolation	Percolation area	35.000	m3	Aggregate	2,240	78,400	0.08	6,507	0.01	-	-	408	-	-	0%	-	-	-	-	-	14	1,058	1,869	159	1	78
							89,943		**34,198**				**2,482**	**-**	**-**		**199**	**155**	**22**	**-**	**-**		**1,362**	**2,404**	**204**		**91**
	Option 2: Fixed Film Reactor + Percolation Area																										
	Reactor	Precast concrete tank	1.000	unit	Concrete, pre	2,400	9,000	2.33	20,970	0.24	-	-	2,178	-	-	0%	-	-	-	-	-	155	1,395	2,463	209	1	9
	Percolation	Percolation area	35.000	m3	Aggregate	2,240	78,400	0.08	6,507	0.01	-	-	408	-	-	0%	-	-	-	-	-	14	1,058	1,869	159	1	78
							87,400		**27,477**				**2,586**	**-**	**-**		**-**	**-**	**-**	**-**	**-**		**2,453**	**4,331**	**367**		**87**
	Value of retaining existing walls																										
	If replaced, would need		Volume (m3)																								
	Mass concrete strip foundations (800x600 mass concrete x 30m)		14.4		Concrete, pla	2,300	33,120	0.78	25,834	0.11	-	-	3,743	-	-	5%	1,656	1,292	187	-	-	14	469	829	70	1	35
	Blockwork walls (2no. 100mm thk skins x 77m2)		15.4		Blockwork, 1	1,620	24,943	0.63	15,716	0.07	-	-	1,785	-	-	2%	499	314	36	-	-	100	2,544	4,492	381	1	25
	stainless steel wall ties (Cavity with B.S.1243 20 x 3 flat vertical twist stainless steel, 4/m2 built in)		77.000	m2	Stainless Ste	7,850	33	56.70	1,851	6.52	-	-	213	-	-	2%	1	37	4	-	-	100	3	6	0	1	0

Appendix IV - Analysis by Material Type (NEES)

	Cradle-to-Gate					CONSTRUCTION WASTE					TRANSPORT TO SITE			End-of-Life
Material Type	Mass	EE	EC	EC (biomass)	EC (sequestrati	Mass	EE	EC (Fossil)	EC (Biomass)	EC (Sequestr		EE	EC	EC
	kg	MJ	kgCO2e	kgCO2e	kgCO2e	kg	MJ	kgCO2e	kgCO2e	kgCO2e	t.km	MJ	(kgCO2e)	kgCO2e
Aggregate	3,234	268	17	-	-	-	-	-	-	-	44	77	7	3
Aluminium, general	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asphalt, 6% binder	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bitumen	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blocks (Dense - 10.5MPa)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blocks (Medium - 7MPa)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blocks (Aerated)	5,569	19,491	1,815	-	-	111	390	36	-	-	568	1,003	85	6
Blockwork, 100mm thk	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blockwork, 215mm thk	2,235	1,469	173	-	-	45	29	3	-	-	228	402	34	2
Bricks	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cement	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cement render (1:3 cement sand	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clay, aerated	4,400	13,200	1,056	-	-	-	-	-	-	-	7,339	12,957	1,099	9
Concrete, plain	3,980	3,104	450	-	-	199	155	22	-	-	56	100	8	4
Concrete, precast	1,043	2,429	252	-	-	-	-	-	-	-	162	285	24	1
Concrete, reinforced	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	24	1,004	65	-	-	0	10	1	-	-	2	4	0	0
Fibre cement panels, uncoated	752	7,825	869	-	-	38	391	43	-	-	79	139	12	2
Fibre cement panels, coated	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GRP/Fibreglass	299	29,927	2,570	-	-	9	898	77	-	-	31	54	5	1
Hempcrete	7,013	39,007	4,972	-	- 5,262	-	-	-	-	-	5,861	10,348	878	7
Insulation, cellulose blown	446	945	-	-	- 818	-	-	-	-	-	13	24	2	0
Insulation, cellulose injected	3,183	6,748	-	-	- 5,835	-	-	-	-	-	95	169	14	3
Insulation, glasswool	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insulation, polyisocyanurate (PIF	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insulation, polystyrene expandec	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead, general	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lime	578	3,063	451	-	- 139	29	153	23	-	- 7	61	107	9	1
Membrane	31	4,200	140	-	-	2	210	7	-	-	3	6	0	0
Mortar (1:1:6)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nylon (Polyamide) 6 Polymer	42	5,090	386	-	-	1	102	8	-	-	72	127	11	0
Paint, waterborne triple coat (pe	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paperboard	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plasterboard	4,807	32,447	1,875	-	-	240	1,622	94	-	-	505	891	76	363
Plaster, gypsum	900	1,620	117	-	-	45	81	6	-	-	95	167	14	68
Plastic, LDPE film	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polyethylene, General	71	5,866	179	-	-	4	293	9	-	-	99	175	15	0
Polypropylene, Orientated film	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PVC, Pipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PVC, general	22	1,719	69	-	-	0	34	1	-	-	2	4	0	0
Sealant, mastic	16	2,081	-	-	-	0	42	-	-	-	2	3	0	0
Slate, imported	111	61	4	-	-	2	1	0	-	-	295	521	44	0
Slate, reused	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil, imported	1,067	480	26	-	-	-	-	-	-	-	1,299	2,292	194	2
Stainless Steel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steel, rebar	112	1,942	156	-	-	-	-	-	-	-	11	20	2	0
Mortar	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Timber, General	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Timber, Glulam	255	3,065	107	115	- 468	-	-	-	-	-	26	45	4	5
Timber, Hardwood	4,304	44,766	1,033	2,712	- 7,891	43	448	10	27	- 79	435	768	65	91
Timber, OSB	4,258	63,868	1,916	2,299	- 7,806	128	1,916	57	69	- 234	439	774	66	92
Timber, Plywood	1,535	23,025	691	998	- 2,814	46	691	21	30	- 84	158	279	24	33
Timber, Softwood	6,763	50,048	1,353	2,638	- 12,399	203	1,501	41	79	- 372	697	1,230	104	146
Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Windows, 3-IV glazing (per m2)	-	34,624	2,141	-	-	-	-	-	-	-	-	-	-	94
Windows, wooden frame (per m	-	178,011	4,968	-	-	-	-	-	-	-	-	-	-	723
Windows, PVC frame (per m2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**57,050**	**581,395**	**27,849**	**8,761**	**- 43,433**	**1,145**	**8,968**	**460**	**205**	**- 776**	**18,676**	**32,971**	**2,797**	**1,657**

Appendix V - Analysis by Material Type (Conventional)

	Cradle-to-Gate					CONSTRUCTION WASTE					TRANSPORT TO SITE			End-of-Life
Material Type	**Mass**	**EE**	**EC**	**EC (biomass)**	**EC (sequestrat**	**Mass**	**EE**	**EC (Fossil)**	**EC (Biomass)**	**EC (Sequestr)**		**EE**	**EC**	**EC**
	kg	**MJ**	**kgCO2e**	**kgCO2e**	**kgCO2e**	**kg**	**MJ**	**kgCO2e**	**kgCO2e**	**kgCO2e**	**t.km**	**MJ**	**(kgCO2e)**	**kgCO2e**
Aggregate	63,880	5,302	332	-	-	-	-	-	-	-	862	1,522	129	64
Aluminium, general	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asphalt, 6% binder	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bitumen	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blocks (Dense - 10.5MPa)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blocks (Medium - 7MPa)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blocks (Aerated)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blockwork, 100mm thk	25,267	15,920	1,808	-	-	505	318	36	-	-	2,577	4,550	386	26
Blockwork, 215mm thk	2,235	1,469	173	-	-	45	29	3	-	-	228	402	34	2
Bricks	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cement	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cement render (1:3 cement sana	7,421	9,870	1,640	-	-	371	494	82	-	-	105	186	16	16
Clay, aerated	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete, plain	41,814	32,615	4,725	-	-	2,091	1,631	236	-	-	593	1,046	89	44
Concrete, precast	1,713	3,992	415	-	-	-	-	-	-	-	266	469	40	2
Concrete, reinforced	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fibre cement panels, uncoated	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fibre cement panels, coated	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GRP/Fibreglass	281	28,091	2,412	-	-	8	843	72	-	-	29	51	4	1
Hempcrete	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insulation, cellulose blown	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insulation, cellulose injected	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insulation, glasswool	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Insulation, polyisocyanurate (PIR	1,427	144,795	6,077	-	-	29	2,896	122	-	-	146	257	22	3
Insulation, polystyrene expandec	193	17,087	634	-	-	-	-	-	-	-	19	34	3	0
Lead, general	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lime	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Membrane	31	4,200	140	-	-	2	210	7	-	-	3	6	0	0
Mortar (1:1:6)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nylon (Polyamide) 6 Polymer	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paint, waterborne triple coat (pe	-	2,073	89	-	-	-	21	1	-	-	-	-	-	-
Paperboard	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plasterboard	4,065	27,435	1,585	-	-	203	1,372	79	-	-	427	753	64	307
Plaster, gypsum	2,499	4,497	325	-	-	125	225	16	-	-	262	463	39	189
Plastic, LDPE film	20	1,780	52	-	-	1	89	3	-	-	2	4	0	0
Polyethylene, General	67	5,556	170	-	-	3	278	8	-	-	83	147	12	0
Polypropylene, Orientated film	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PVC, Pipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PVC, general	22	1,719	69	-	-	0	34	1	-	-	2	4	0	0
Sealant, mastic	8	1,040	-	-	-	0	21	-	-	-	1	1	0	0
Slate, imported	111	61	4	-	-	2	1	0	-	-	295	521	44	0
Slate, reused	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil, imported	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainless Steel	33	1,875	216	-	-	1	37	4	-	-	3	6	1	0
Steel, rebar	257	4,480	360	-	-	-	-	-	-	-	26	45	4	0
Mortar	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Timber, General	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Timber, Glulam	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Timber, Hardwood	313	3,256	75	197	- 574	3	33	1	2	- 6	32	56	5	7
Timber, OSB	1,893	28,391	852	1,022	- 3,470	57	852	26	31	- 104	195	344	29	41
Timber, Plywood	239	3,585	108	155	- 438	7	108	3	5	- 13	25	43	4	5
Timber, Softwood	3,567	26,393	713	1,391	- 6,539	107	792	21	42	- 196	367	649	55	77
Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Windows, 3-IV glazing (per m2)	-	34,624	2,141	-	-	-	-	-	-	-	-	-	-	94
Windows, wooden frame (per m.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Windows, PVC frame (per m2)	-	220,162	9,258	-	-	-	-	-	-	-	-	-	-	4,968
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**157,356**	**630,270**	**34,373**	**2,766**	**- 11,021**	**3,560**	**10,282**	**723**	**79**	**- 319**	**6,549**	**11,561**	**981**	**5,845**

Appendix VI - NEES Best Practice vs Conventional Comparison

	CRADLE-TO-GATE					CONSTRUCTION WASTE					TRANSPORT TO SITE		End-of-Life	Typical Lifespan			Maintenance				operation		Grand Total					
	Mass	EE	EC (Fossil)	EC (Biomass)	EC (Sequestr)	Mass	EE	EC (Fossil)	EC (Biomass)	EC (Sequestr)	EE	EC		100			Mass	EE	EC (Fossil)	EC (Biomass)	EC (Sequestr)			Mass	EE	EC (Fossil)	EC (Biomass)	EC (Sequestr)	
	(kg)	(MJ)	(kgCO2e)	(kgCO2e)	(kgCO2e)	kg	MJ	kgCO2e	kgCO2e	kgCO2e	MJ	(kgCO2e)	kgCO2e				(kg)	(MJ)	(kgCO2e)	(kgCO2e)	(kgCO2e)			(kg)	(MJ)	(kgCO2e)	(kgCO2e)	(kgCO2e)	
1. Timber Frame																													
NEES	13,094.08	114,805.96	4,433.00	4,052.74	- 15,038.00	477.06	3,557.69	153.31	118.13	- 437.09	1,838.59	155.98	183.23	50	2E. External Wall Structure: Softwood Stud		5,428	48,081	1,970	1,668	- 6,190			19,000	168,283	6,896	5,839	- 21,665	lower mass, higher EE, lower EC, esp allowing for sequestration
Conventiona	133,072.04	85,105.65	8,157.82	853.52	- 3,262.06	2,652.00	2,793.08	300.12	25.61	- 97.86	7,520.45	637.99	172.42	50	2E. External Wall Structure: rendered blockwork		54,290	38,168	3,707	352	- 1,344			190,014	133,587	12,976	1,231	- 4,704	
2. Hempcrete																													
NEES	16,393.23	61,829.74	7,254.37	-	- 5,400.31	140.27	542.98	58.84	-	- 6.94	11,534.53	978.53	16.53	40	3A. Wall Finishes: insitu finishes: roughcast coating: 1!		8,267	36,954	4,154	-	- 2,704			24,800	110,861	12,462	-	- 8,111	Higher mass, higher energy, higher emissions even if allowing for sequestration
Conventiona	6,354.31	28,953.97	2,114.16	-	-	313.40	1,009.22	87.30	-	-	440.64	37.38	115.04	50	2E. External Wall Structure: rendered blockwork		2,667	12,162	942	-	-			9,335	42,565	3,295	-	-	
3. Cellulose																													
NEES	3,628.80	7,693.05	-	-	- 6,652.79	-	-	-	-	-	192.19	16.30	3.63	100	http://www.nahb.org/fileUpload_details.aspx?contentI		726	1,577	4	-	- 1,331			4,355	9,462	24	-	- 7,983	Higher mass, lower energy, lower emissions
Conventiona	1,619.41	161,882.18	6,711.61	-	-	28.53	2,895.90	121.54	-	-	290.93	24.68	3.30	100	http://www.nahb.org/fileUpload_details.aspx?contentI		330	33,014	1,372	-	-			1,978	198,083	8,233	-	-	
4. Triple glazing with wood frames																													
NEES	-	212,634.78	7,109.15	-	-	-	-	-	-	-	-	-	816.29	40	2F. Windows: Hardwood: purpose made frame: roun		-	106,317	3,963	-	-			-	318,952	11,888	-	-	Lower energy, lower emissions
Conventiona	-	254,785.40	11,399.48	-	-	-	-	-	-	-	-	-	5,061.46	30	2F. Windows: PVCu Casement		-	169,857	10,974	-	-			-	424,642	27,435	-	-	
5. Green roof																													
NEES	5,509.24	18,770.07	1,467.68	-	-	0.84	101.80	7.72	-	-	15,376.25	1,304.44	10.47	30	1.5 x "2C. Roof, Pitched roof covering: glass fibre: tran		3,673	22,832	1,860	-	-			9,183	57,080	4,651	-	-	Higher mass, energy & emissions as it is an add on
Convetional														20	2C. Flat Roof coverings: high performance polyester-b		-	-	-	-	-			-	-	-	-	-	
6. Reed bed (PE of 5)																													
NEES	160,938.23	32,283.63	2,532.60	-	-	199.91	263.46	25.76	-	-	3,866.04	327.97	161.31	25	6B. Drainage indicated 50 years for below groudn PVI		128,911	29,130	2,438	-	-	-	-	290,049	65,544	5,486	-	-	higher mass, slightly higher Energy, slightly lower emissions
Conventiona	89,943.46	34,197.62	2,482.35	-	-	198.61	154.91	22.44	-	-	2,404.43	203.98	91.48	50	6B Drainage, Drainage below Ground: PVCu: Pipes and		36,057	14,703	1,120	-	-	13,140	1,927	126,199	64,600	5,848	-	-	
Totals																													
NEES	199,563.57	448,017.23	22,796.80	4,052.74	- 27,091.11	818.09	4,465.92	245.63	118.13	- 444.03	32,807.59	2,783.22	1,191.46											347,387	730,182	41,406	5,839	- 37,759	Higher mass (because of reed bed), lower energy, lower emission, esp so is sequestration counted
Conventiona	230,989.22	564,924.82	30,865.43	853.52	- 3,262.06	3,192.54	6,853.12	531.41	25.61	- 97.86	10,656.46	904.04	5,443.70											327,525	863,477	57,787	1,231	- 4,704	
% of NEES to	92%	73%	75%	46%	62%	61%	48%	51%	58%	57%	89%	89%	66%											92%	73%	75%	43%	58%	
% of Conv to	93%	85%	84%	31%	30%	85%	66%	71%	32%	31%	76%	76%	92%											98%	81%	83%	30%	29%	
Grand total																								includes cradle-to-gate, construction waste, transport to site, end-of-life & maintenance, wastewater operation; excludes installation and building operation					
NEES	217,988.28	613,678.51	30,381.86	8,761.43	- 43,432.55	1,344.71	9,231.69	485.57	205.16	- 776.44	36,836.66	3,125.02	1,817.87											375,618	1,006,528	55,075	13,477	- 65,144	
Conventiona	247,299.92	664,467.38	36,855.15	2,765.67	- 11,021.06	3,759.02	10,437.32	745.36	79.03	- 319.15	13,965.76	1,184.78	5,936.39											333,054	1,063,948	69,993	4,132	- 16,439	

Appendix VII - Analysis by Part / Generation of Profiles

NEES	Floor area	80.40							Mass	EE	EC	EC (bioma	EC (sequestr)		Charts	Mass	EE	EC (fossil (	EC (fossil (	EC (seques
internal floor area			years	kg	EE	EC	EC (biomass)	EC (sequestr)	kg/m2/yr	MJ/m2/yr	kgCO2e/m	kgCO2e/m	kgCO2e/m2/yr		years	kg/m2/yr	kWh/m2/y	kgCO2e/m	kgCO2e/m	kgCO2e/m
38	New Exten	Substructure	100	4,290	5,321	639	-	-	0.53	0.66	0.08	-	-		100	0.53	0.18	0.08	0.08	-
		Floor	55	2,642	28,534	1,516	759 -	3,373	0.60	6.45	0.34	0.17 -	0.76		55	0.60	1.79	0.51	0.34 -	0.76
		External Walls	30	10,018	222,183	6,877	4,893 -	18,208	4.15	92.12	2.85	2.03 -	7.55		30	4.15	25.59	4.88	2.85 -	7.55
		Internal Walls	37	3,970	24,828	1,357	192 -	904	1.33	8.35	0.46	0.06 -	0.30		37	1.33	2.32	0.52	0.46 -	0.30
		Roof & Ceiling	30	10,438	107,950	6,756	1,425 -	6,410	4.33	44.76	2.80	0.59 -	2.66		30	4.33	12.43	3.39	2.80 -	2.66
42.4	Existing Ho	Floor	55	2,412	25,448	778	1,000 -	4,198	0.55	5.75	0.18	0.23 -	0.95		55	0.55	1.60	0.40	0.18 -	0.95
		External Walls	40	19,211	170,285	11,451	- -	4,912	5.97	52.95	3.56	- -	1.53		40	5.97	14.71	3.56	3.56 -	1.53
		Internal Walls	50	830	6,095	611	40 -	626	0.21	1.52	0.15	0.01 -	0.16		50	0.21	0.42	0.16	0.15 -	0.16
		Roof & Ceiling	20	4,385	32,689	1,122	657 -	5,578	2.73	20.33	0.70	0.41 -	3.47		20	2.73	5.65	1.11	0.70 -	3.47
	Gravel reed bed		25	161,138	36,413	2,886	-	-	80.17	18.12	1.44	-	-		25	80.17	5.03	1.44	1.44	-
	BER - D2 Rating		1							921.67	14.21				1	-	256.02	14.21	14.21	-
	Gravel reed bed operation		1												1	-	-	-	-	-
			Total	219,333	659,747	33,992	8,967 -	44,209	101	1,173	27	4 -	17			100.57	325.74	30.26	26.76 -	17.37
			Building	58,195	623,334	31,106	8,967 -	44,209												
			Check	58,195	623,334	31,106	8,967 -	44,209												
Conventional																				
internal floor area			years	kg	EE	EC	EC (biomass)	EC (sequestr)	kg/m2/yr	MJ/m2/yr	kgCO2e/m	kgCO2e/m	kgCO2e/m2/yr							
38	New Exten	Substructure	100	94,020	31,051	3,928	-	-	11.69	3.86	0.49	-	-		100	11.69	1.07	0.49	0.49	-
		Floor	60	14,364	46,277	3,211	26 -	75	2.98	9.59	0.67	0.01 -	0.02		60	2.98	2.66	0.67	0.67 -	0.02
		External Walls	30	29,183	185,992	10,099	-	-	12.10	77.11	4.19	-	-		30	12.10	21.42	4.19	4.19	-
		Internal Walls	50	3,310	14,716	822	151 -	711	0.82	3.66	0.20	0.04 -	0.18		50	0.82	1.02	0.24	0.20 -	0.18
		Roof & Ceiling	20	3,736	92,186	4,936	970 -	3,667	2.32	57.33	3.07	0.60 -	2.28		20	2.32	15.92	3.67	3.07 -	2.28
42.4	Existing Ho	Floor	55	2,431	46,016	1,659	1,000 -	3,855	0.55	10.41	0.38	0.23 -	0.87		55	0.55	2.89	0.60	0.38 -	0.87
		External Walls	30	6,295	124,055	6,285	-	-	2.61	51.43	2.61	-	-		30	2.61	14.29	2.61	2.61	-
		Internal Walls	37	4,131	28,189	1,695	40 -	131	1.39	9.48	0.57	0.01 -	0.04		37	1.39	2.63	0.58	0.57 -	0.04
		Roof & Ceiling	20	3,448	83,631	3,442	657 -	2,900	2.14	52.01	2.14	0.41 -	1.80		20	2.14	14.45	2.55	2.14 -	1.80
	Package treatment		50	90,142	36,757	2,709	-	-	22.42	9.14	0.67	-	-		50	22.42	2.54	0.67	0.67	-
	BER - D2 Rating									921.67	14.21				0	-	256.02	14.21	14.21	-
	Package treatment operation									1.63	0.24				0	-	0.45	0.24	0.24	-
			Total	251,059	688,870	38,785	2,845 -	11,340	59	1,207	29	1 -	5			59.03	335.37	30.72	29.43 -	5.19
			Building	160,917	652,113	36,077	2,845 -	11,340												
			Check	160,917	652,113	36,077	2,845 -	11,340												

Appendix VIII - Volumetric Calculations of I-Joists

Cutting List (Source: Cork Roof Truss Ltd, cutting list dwg dated 31/1/2014)

Item	Description	Qty	Overall Depth (mm)	Length (mm)	Flange Depth (mm)	Flange Width (mm)	Plywood Vol (m^3)	Softwood Vol (m^3)	Glulam (m^3)
A	North Elevation	17	241	2409	30	45	0.0938	0.1106	
B	North Elevation - window	5	241	1582	30	45	0.0181	0.0214	
C	East Gable Elevation	1	241	4111	30	45	0.0094	0.0111	
		1	241	3963	30	45	0.0091	0.0107	
		1	241	3814	30	45	0.0087	0.0103	
		1	241	3665	30	45	0.0084	0.0099	
		1	241	3516	30	45	0.0080	0.0095	
		1	241	3483	30	45	0.0080	0.0094	
		1	241	3472	30	45	0.0079	0.0094	
		1	241	3238	30	45	0.0074	0.0087	
		1	241	3227	30	45	0.0074	0.0087	
		1	241	3206	30	45	0.0073	0.0087	
		3	241	900	30	45	0.0062	0.0073	
D	West Gable Elevation	1	241	727	30	45	0.0017	0.0020	
		1	241	876	30	45	0.0020	0.0024	
		1	241	1026	30	45	0.0023	0.0028	
		1	241	1174	30	45	0.0027	0.0032	
		1	241	1322	30	45	0.0030	0.0036	
		1	241	1471	30	45	0.0034	0.0040	
		1	241	1620	30	45	0.0037	0.0044	
E	South Elevation	14	241	4120	30	45	0.1321	0.1557	
F	South Elevation - Over linkg	5	241	1599	30	45	0.0183	0.0216	
G	South Elevation - Over windo	4	241	1074	30	45	0.0098	0.0116	
H	Floor - I-joists	24	241	4000	30	45	0.2198	0.2592	
K	Floor - Glulam	2	253	9348		90			0.4257
J	Roof	25	406	4000	30	59	0.3857	0.3540	
	Roof overhang	25		521	30	59	0.0000	0.0461	
	Totals						0.9843	1.1060	0.4257

Totals

By Building Element			
Plywood V	Softwood V	Glulam	
(m^3)	(m^3)	(m^3)	
0.3788	**0.4467**	**0.0000**	**Walls**
0.2198	**0.2592**	**0.4257**	**Floor**
0.3857	**0.4001**	**0.0000**	**Roof**
0.9843	**1.1060**	**0.4257**	**Totals**

Assumptions

9.5 mm ply we	Webs	plywood not OSB
	Flanges	Structural softwood not laminate

Appendix IX - Volumetric Calculations of all Other Timber

Timber BoQ (Sourc		Revision							Softwood	OSB	Plywood	Hardwood
Ref	Sch of W	RFI 20.0	Description	Qty	Unit	Depth	Width		Vol	Vol	Vol	Vol
						(mm)	(mm)		(m^3)	(m^3)	(m^3)	(m^3)
			Floors									
			New Extension - Ground floor									
BQ/1/A			175x44mm noggings betwween I-joists	34	m	175	44		0.2618			
BQ/1/B			18mm T&G SmartPly OSB3 to top of joists	38	m2	18				0.6840		
BQ/1/C		Yes	12mm Aquapanel cement board to underside	38	m2							
BQ/1/D			DuPont Tyvek UV Facade UV resistant breathe	40	m2							
BQ/1/E			Air tight tape to perimieter (non T&G joints)	26	m							
			New Extension - Attic Sotre floor, Room 08									
BQ/1/F			175x44mm floor joists	50	m	175	44		0.3850			
BQ/1/G			3no. Sheets of OSB	3	sheets	18				0.1588		
			Link between Extension and Existing House									
BQ/1/H			175x44mm floor joists	18	m	175	44		0.1386			
			Existing House									
		KG ema	25no. 225x44mmx4.5m long timber joists @ 4(	112.5	m	225	44		1.1138			
		KG ema	1 line of 225x44 noggings, assumed	8.1	m	225	44		0.0802			
		KG ema	3no. Timber sole plates (assume 100x100x9.2r	27.6	m	100	100		0.2760			
		KG ema	18mm T&G Smart Ply 3 OSB deck to top of jois	42.4	m2	18				0.7632		
		John Eg	Assume 12mm OSB bewtween joists to suppor	47.8	m2	12				0.5736		
	14.9.2		Mezzanine floor (13no. 150x44mm x 2.5m long	36.9	m	150	44		0.2435			
	14.9.2		Mezzanine floor (44x225 double trimmer x4.4r	8.8	m	225	44		0.0871			
			Floor Finishes									
			New Extension									
	10.4		Cills (assume 225x20mm hardwood)	12.075	m	20	225					0.054338
			Existing House									
	14.10.3		Cills (assume 525x20mm hardwood)	7.15	m	20	525					0.075075
	14.10.2		Mezzanine floor 20mm birch plywood to top o	11.6	m2	20					0.232	
			External Walls									
			External Wall of Extension									
BQ/2/A			Plywood web joists by others									
BQ/2/B			Trim out openings w/ 225x44mm double trimn	78	m	225	44		0.7722			
BQ/2/C			225x44mm timbers (form wall plate with doub	59	m	225	44		0.5841			
BQ/2/D			175x44mm timbers (formation of upstand para	109	m	175	44		0.8393			
BQ/2/E			22mm T&G SmartPly OSB3 to outside face of s	102	m2	22				2.2440		
BQ/2/F			DuPont Tyvek UV Facade UV resistant breathe	102	m2							
BQ/2/G			18mm T&G SmartPly OSB3 to insude face of st	49	m2	18				0.8820		
BQ/2/H			Air tight tape to perimieter (non T&G joints)	42	m							
BQ/2/J			20mm marine plywood to top of parapet, appr	18	m	20	350					0.1260
BQ/2/K			175x44mm timber stud wall (hang below floor	76	m	175	44		0.5852			
		Yes	2no. 100x44 timber sole plates	27.78	m	44	200		0.2445			
			Wall Frame between extension and existing house									
BQ/2/L			175x44mm timber studs to link walls between	18	m	175	44		0.1386			
			Internal Walls									
			Internal Walls of Extension									
BQ/3/A			100x44mm timber studs	152	m	100	44		0.6688			
			Existing House Internal Walls									
	14.6.1		100x44mm timber studs for 450mm high x 3m	9.6	m	100	44		0.0422			
			Roof Structure									
			Extension Roof Structure									
BQ/4/A			Plywood web joists by others									
BQ/4/B			22mm T&G SmartPly OSB3 to outside face of r	44	m2	22				0.9680		
BQ/4/C			DuPont Tyvek UV Facade UV resistant breathe	44	m2							
BQ/4/D			18mm T&G SmartPly OSB3 to inside face of roc	33	m2	18				0.5940		
BQ/4/E			Air tight tape to perimieter (non T&G joints)	25	m							
BQ/4/F			100x44mm timber rafters	108	m	100	44		0.4752			
BQ/4/G			20mm marine plywood	41	m2	20						0.8200
BQ/4/H			Angle fillet	9	m				0.016875			

Sch of Works Ref	Softwood Vol (m^3)	OSB Vol (m^3)	Plywood Vol (m^3)	Hardwood Vol (m^3)
Extension				
3 External Walls Structure	3.164	3.126	0.126	-
5 External Wall Finish	0.956	-	0.080	5.322
6 Internal Wall Structure	0.669	-	-	-
8 Internal Wall Finish	0.181	-	-	-
9 Floor Structure	0.785	0.843	-	-
10 Floor Finish	-	-	-	0.054
11 Roof Structure	0.756	1.562	0.900	-
12 Roof Finish	-	-	-	0.140
13 Ceilings	0.106	-	-	-
Existing	(m3)	(m3)	(m3)	(m3)
14.3 External Wall Structure				
14.5 External Wall Finish	-	-	-	-
14.6 Internal Walls Structure	0.042	-	-	-
14.8 Internal Walls Finish	-	-	0.074	-
14.9 Floor Structure	1.801	1.337	-	-
14.10 Floor Finish	-	-	0.232	0.075
14.11 Roof Structure	1.947	-	0.080	-
14.12 Roof Finish	0.500	-	-	0.148
14.13 Ceilings	-	-	-	-
Totals	10.907	6.868	1.492	5.739
Check	10.907	6.868	1.492	5.739

Assumptio	battens to	0.2	m c/c
	battens to	0.4	m c/c

Calculation Step	Qty	Source
Western red cedar (m3)	4.69	Origin, Vancouver
Density (kg/m3)	380	http://www.engineeringtoolbox.com/wood-density-d_40.html
WR cedar (kg)	1,784	
Nautical miles	8,390	via Panama Canal, http://www.sea-distances.org/
kilometres	15,538	http://www.digitaldutch.com/unitconverter/
tonne.km	27,715	
conversion factor (DEFRA)	0.01315	General cargo ship, average emissions
Additional kgCO2e	364.5	

			Link Roof									
BQ/4/J			175x44mm timber joists	28	m	175	44	0.2156				
BQ/4/K			Firring pieces	15	m	100	44	0.0330				
BQ/4/L			20mm marine plywood	4	m2	20				0.0800		
BQ/4/M			Angle fillet	8.1	m			0.015188				
			Existing House Roof Structure									
BQ/4/N			New Wall Plate (assume 174x44)	21	m	175	44	0.1617				
BQ/4/P			Plyweb joists by others									
BQ/4/Q		Yes	Omit sarking boards/22mm T&G SmartPly OSB	80	m2							
BQ/4/R			DuPont Tyvek UV Facade UV resistant breathe	80	m2							
BQ/4/S			ProClima Intello Plus Vapour Check membrane	55	m2							
BQ/4/T			Air tight tape to perimieter (non T&G joints)	31	m							
BQ/4/U			25x44 timber battens to underside of rafters (t	55	m2	25	44	0.1513				
		Yes	Add 4no. 44x44 bracing timbers, 2no. each side	42	m	44	44	0.0813				
	14.11.1		2x28no. 44x175mm rafters @ 400c/c on top of	201.6	m	175	44	1.5523				
			8no. 20mm thk x2.5m long plywood collars	20	m	200	20			0.08		
			Wall Finishes Externally									
			Wall Finishes Extnerally - Extension									
BQ/5/A			50x25mm treated battens (horizontal and vert	102	m2	50	25	0.9563				
BQ/5/B			Cladding by Client - Western red cedar claddin	102	m2	20						4.59
			150x50mm hardwood to head, jamb & cills to a	45.58	m	50	150					0.34185
			150x50mm hardwood to 6no. Vertical corners	52	m	50	150					0.39
			Link Walls									
BQ/5/C			50x25mm treated battens (taken above)		m2	50	25					
BQ/5/D			20mm marine plywood	4	m2	20				0.0800		
BQ/5/E			Fibreglass membrane to walls (subcontractor -	4								
			Wall Finishes Externally - Existing House									
BQ/5/F		Change	External EPS Insulation - approx 800mm (belov	27	m2							
BQ/5/G			Ditt but above ground level	77	m2							
			Wall Finishes Internally									
			Wall Finishes Internally - Extension									
BQ/6/A			50x25mm treated battens to inside face of ext	49	m2	50	25	0.1531				
BQ/6/B			12.5mm plasterboard to inside face of externa	49	m2							
BQ/6/C			12.5mm plasterboard to inside face of externa	33	m2							
BQ/6/D			12.5mm plasterboard to both sides of internal	61	m2							
BQ/6/E			12.5mm moisture resistant plasterboard to wa	23	m2							
BQ/6/F			Bags of skim coat (based on above quantities)	23	bags							
BQ/6/G			100x20 skirting to room 07	10	m	100	20	0.0200				
BQ/6/H			Angle beads	40	m	20	10	0.0080				
			Wall Finishes Internally - Existing House									
BQ/6/J			Dry line walls with 50mm hemp lime plaster	61	m2							
BQ/6/K			Ditt to reveals	19	m2							
BQ/6/L			12.5mm plasterboard to shallow height balusti	5	m2							
BQ/6/M			Bag of skim coat for balustrade	1	bags							
	14.8.2		20mm Birch plywood to jambs and head at doo	3.675	m2	20				0.0735		
			Ceiling Finishes									
			Ceiling Finishes - Extension									
BQ/7/A			50x25mm treated battens to inside face of ext	34	m2	50	25	0.1063				
BQ/7/B			12.5mm plasterboard to inside face of externa	67	m2							
BQ/7/C			Bag of skim coat (based on above quantities)	6	bags							
			Ceiling Finishes - Existing House									
BQ/7/D			12.5mm plasterboard to sloped/horizontal ceil	67	m2							
BQ/7/E			Bag of skim coat (based on above quantities)	6	bags							
			Roof Finishes									
			Roof Finishes - Extension									
BQ/8/A			Sedum grass mat, drainage mat by others									
BQ/8/B			Fibreglass to plywood (subcontractor supply a	44	m2							
BQ/8/C			Fibreglass to upstand and across parapet	6.2	m2							
BQ/8/D			Fibreglass to link roof and dress up under ceda	11	m2							
BQ/8/E			Black PVC gutter to northern elevation (subcor	9	m							
BQ/8/F			Hardwood fascia board to nothern elevation	9	m	200	20					0.0360

	12.6-12.7	20mm Cedar cladding to soffit of northern elev	5.2	m2	20					0.1040
		Roof Finishes - Existing House								
BQ/8/G		25x50mm battens vertically to roof	80	m2	25	50	0.25			
BQ/8/H		50x25mm counter battens horizontally to roof	80	m2	50	25	0.25			
BQ/8/J		Tegral aluminium verge trim to gables	15	m						
BQ/8/K		M04 velux rooflight, top hung, white, double g	1	no.						
BQ/8/L		Black PVC gutter (subcontractor supply and fit)	22	m						
BQ/8/M		Black PVC downpipes (subcontractor supply ar	6	m						
BQ/8/N		Swanneck (subcontractor supply and fit)	2	no.						
BQ/8/P		Shoe (subcontractor supply and fit)	2	no.						
BQ/8/Q		Hardwood fascia board	37	m	200	20				0.1480
		Totals					**10.91**	**6.87**	**1.49**	**5.74**

Appendix X - Derivation of Hempcrete Factors

Assumptions used in generating factors below

Density of hempcrete	330	kg/m3
tCO2e/MJ	0.00008	Miskin from Cherret et al (2005); to convert Miskin MJ/kg into Miskin kgCO2e/kg
Irish Electricity	0.5280	kgCO2e/kWh
Irish Electricity	0.1467	kgCO2e/MJ
Transport (DEFRA)	0.1498	kgCO2e/t.km
Transport (derived from DEFRA)	1.7654	MJ/t.km

	EE	EE	EE	EE	EC	EC	EC	Comments
Hemp Shiv (Cradle-to-Gate)	**MJ/kg**	**MJ/kg**	**MJ/kg**	**MJ/kg**	**kgCO2e/kg**	**kgCO2e/kg**	**kgCO2e/kg**	
Source	*1. Carus et al*	*2. Miskin*	*2. Miskin*	*2. Miskin*	*2. Miskin*	*2. Miskin*	*2. Miskin*	*Miskin: reproduced from Cherret et al (2008), based on UK farming practices with processing at Hemp Technology facility*
Production method	Hemp fibre	Organic	Monoculture	Low Impact	Organic	Monoculture	Low Impact	Assume conservatively monoculture (crop imported from France)
Fertiliser	1.95	-	6.5959	-	-	0.5277	-	Miskin: p.32 section 5.1
Farm machinery	1.28	1.5089	1.5089	-	0.1207	0.1207	-	Miskin: p.32 section 5.1
Fibre Processing	0.94	0.5400	4.1400	0.5400	0.0432	0.3312	0.0432	Miskin: p.32 section 5.1
Transports	0.8	0.1300	0.1300	-	0.0104	0.0104	-	Miskin: p.32 section 5.1
Subtotal	*4.97*	*2.1789*	*12.3748*	*0.5400*	*0.1743*	*0.9900*	*0.0432*	
N20 Fertiliser Emissions						0.0660		p.37, Section 5.5 - Assumes 1.25% of nitrogen released as N2O to atmosphere
Per kg of hemp shiv (50% of total)		**1.089**	**6.187**	**0.270**	**0.0872**	**0.5610**	**0.0216**	
Carbon sequestration per kg of hemp						- 1.8333		p.36 - Assuming that the dry weight of hemp is 50% carbon (Broadmeadow and Matthews, 2003; Pervaiz and Sain, 2003), 1.83 tonnes of carbon dioxide is sequestered for every tonne of hemp
Carbonation per kg of lime						- 0.2400		p.38 - assume 50% of CO2 release during burning of lime reabsorbed during carbonation of hempcrete (lime binder); ignore carbonation of OPC
Hempcrete (Installation)								
Concrete Mixer (13.2 MJ/m3)			0.0400			0.0059		Miskin: p.34, Section 5.3
Spraying (unknown)								
Fans & Dehumidifiers, if needed (48.5 MJ/m3)			0.1470			0.0216		Miskin: p.34, Section 5.3 - Assume not needed at Cloyne
Hempcrete (Use to End-of-Life)								
Maintenance (77MJ/m3 & 8kgCO2e/m3)			0.2333			0.0242		Miskin: p.44 Table 5.9
End-of-Life (60MJ/m3 & 4kgCO2e/m3)			0.1818			0.0121		Miskin: p.44 Table 5.9

Source 1: Haufe, Juliane & Carus, Michael (nova-Institut, Germany),
Hemp Fibres for Green Prodcuts / An assessment of life cycle studies on hemp fibre applications
(European Industrial Hemp Association, June 2011) Fig 2 (Carus et al 2008)

Source 2: Miskin, Naomi
The Carbon Sequestration Potential of Hemp-binder/ A study of embodied carbon in hemp-binder compared with dry lining solutions for insulating solid walls
(Msc thesis, Jan 2010) Graduate School of the Environment, Centre for Alternative Technology, Powys, Wales

Other sources quoted in Miskin, p.26 Table 3.1

Source	Hemp-lime (kgCO2/m3)
Rhydwen (2009)	-358 to 62
Bevan & Woolley (2008)	-108
Busbridge (2009)	-35
Wilkinson (2009)	-177 to -18

Table 3.1: Embodied carbon of hemp-binder from previous studies (Cradle-to-Gate)
Miskin Functional Unit 1 (FU1) external:
'a sufficient thickness of insulation materials for 1m2 area of solid wall in a UK domestic house to a u-value equivalent to 0.35 w/m2k; to include repair, refurbishment or replacement for a period of 60 years
Miskin Functional unit 2 (FU 2) internal is defined as:
' a 100mm thickness of insulation (and supporting) materials for 1m2 area of solid wall in a UK domestic house; to include repair, refurbishment or replacement for a period of 60 years'

1m3 of Steve Allin Mix		**Cradle-to-Gate**				**Sequestration**		**Transport**				**Cradle-to-Site**						
Material	Weight	Factor	Factor	EE	EC	EC	EC	Origin	Distance to Cloyne	Energy	Emissions	EE	EC	EC less Biogenic				
Units	(kg)	(MJ/kg)	($kgCO_2e$/kg)	(MJ)	($kgCO_2e$)	($kgCO_2e$/kg)	($kgCO_2e$)		(km)	(MJ)	($kgCO_2e$)	(MJ)	($kgCO_2e$)	($kgCO_2e$)	t.km/m3	t.km/kg	km	
Hemp	110	6.187	0.561	680.61	61.71	- 1.83	- 201.67	LCDA in the	1,390	270	23	950.55	84.61	- 117.06	152.90	1.39	1390	
Hydrated Lime	125	5.3	0.78	662.50	97.50	- 0.24	- 30.00	Ireland	100	22	2	684.57	99.37	69.37	12.5	0.1	100	
NHL5	62.5	5.3	0.78	331.25	48.75	- 0.24	- 15.00	Germany (I	1,700	188	16	518.83	64.66	49.66	106.25	1.7	1700	
Cement	31.25	4.5	0.74	140.63	23.13			Ireland	100	6	0	146.14	23.59	23.59	3.125	0.1	100	
Water (1kg = 1 litre)	55	0.01	0.00106	0.55	0.06			Ireland	-	-	-	0.55	0.06	0.06	0	0	0	
Totals	**328.75**			**1,815.54**	**231.14**		**- 246.67**			**485**	**41**	**2,300.64**	**272.30**	**25.63**	**274.775**	0.8358175	**835.8175**	**Equivalent Transport Factor**

Hempcrete Factors	(MJ/kg)	($kgCO_2e$/kg)
cradle-to-gate	5.5226	0.7031
transport	1.4756	0.1252
Installation (concrete mixer)	0.0400	0.0059
Maintenance	0.2333	0.0242
End-of-Life	0.1818	0.0121
Total	**7.4533**	**0.8705**
sequestration	-	0.7503
Net	7.4533	0.1202
For cloyne use cradle-to-gate and install (mixer)	**5.5626**	**0.7090**
Sequestration	-	**0.7503**
Equivalent Transport Factor (km)		**835.8**

Steve Allin Calc	kg	kgCO2e/kg	kgCO2e	
Hemp	110	-1.84	-202.4	Does not include EE & EC of hemp shiv
Lime, Cement, Water	220	0.43	94	
Totals	330		-108.4	
Steve Allin Net factor		-	**0.3285**	
Equivalent (cradle-to-site) factor from Miskin data		-	0.0414	

Equiv distance check	kg	*t.km*	MJ	kgco2e	
Hempcrete cloyne	7013	*5861.59*	10,348	878	
Check	***%***	***kg***	***t.km***	***MJ***	***kgCO2e***
Hemp	***33%***	***2,347***	***3,262***	***5,758.34***	***488.51***
Hydrated Lim	***38%***	***2,667***	***267***	***470.76***	***39.94***
NHL5	***19%***	***1,333***	***2,267***	***4,001.46***	***339.46***
Cement	***10%***	***667***	***67***	***117.69***	***9.98***
Water (1kg = 1 litre)			-	-	-
	100%	***7,013***	***5,862***	***10,348***	***878***
		0.835817 tkm/kg		1.475582	0.12518 per kg
				1.7654356	0.14977 per t.km
				1.7654356	0.14977 check