

C Climate and
Climate Change
and Greenhouse Gas





Greenhouse Gas Calculations





Greenhouse Gas Emissions Calculator - Alpha Rail

CONSTRUCTION

Raw Materials	Value	Units	Total Value (Q)	Units	Scope 1 Emission Factor (EF)	Scope 2 Emission Factor (EF)	Scope 3 Emission Factor (EF)	Total Emission Factor (EF)	Units	Source	Method	Scope 1 Emissions (t CO2-e)	Scope 2 Emissions (t CO2-e)	Scope 3 Emissions (t CO2-e)	Total Emissions (t CO2-e)	Proportion of Total Inventory %	Proportion of Total Inventory %
Sand (Common)	2,209,100	m ³	3,538,978	t	0.000	0.000	0.0169	0.0169	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	59,809	59,809	2.76%	0.71%
Gravel (Common)	2,209,100	m ³	3,362,250	t	0.000	0.000	0.0170	0.0170	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	57,158	57,158	2.63%	0.68%
Crushed Aggregate (Common)	2,209,100	m ³	4,550,746	t	0.000	0.000	0.0041	0.0041	t CO ₂ -e/t	EcolInvent Unit Process	Q x EF	0	0	18,613	18,613	0.86%	0.22%
Crushed rock (Rock)	5,627,300	m ³	9,014,935	t	0.000	0.000	0.0169	0.0169	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	152,352	152,352	7.02%	1.80%
Sand (Borrow material for general fill)	2,437,167	m ³	3,904,341	t	0.000	0.000	0.0169	0.0169	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	65,983	65,983	3.04%	0.78%
Gravel (Borrow material for general fill)	2,437,167	m ³	3,709,368	t	0.000	0.000	0.0170	0.0170	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	63,059	63,059	2.91%	0.74%
Crushed Aggregate (Borrow material for general fill)	2,437,167	m ³	5,020,563	t	0.000	0.000	0.0041	0.0041	t CO ₂ -e/t	EcolInvent Unit Process	Q x EF	0	0	20,534	20,534	0.95%	0.24%
Sand (General fill)	6,233,333	m ³	9,985,800	t	0.000	0.000	0.0169	0.0169	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	168,760	168,760	7.78%	1.99%
Gravel (General fill)	6,233,333	m ³	9,487,133	t	0.000	0.000	0.0170	0.0170	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	161,281	161,281	7.43%	1.91%
Crushed Aggregate (General fill)	6,233,333	m ³	12,840,667	t	0.000	0.000	0.0041	0.0041	t CO ₂ -e/t	EcolInvent Unit Process	Q x EF	0	0	52,518	52,518	2.42%	0.62%
Crushed Aggregate (Top capping layer)	815,500	m ³	1,679,930	t	0.000	0.000	0.0041	0.0041	t CO ₂ -e/t	EcolInvent Unit Process	Q x EF	0	0	6,871	6,871	0.32%	0.08%
Gravel (Ballast)	751,800	m ³	1,144,240	t	0.000	0.000	0.0170	0.0170	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	19,452	19,452	0.90%	0.23%
Concrete (Sleepers)			247,500	t	0.000	0.000	0.1410	0.1410	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	34,898	34,898	1.61%	0.41%
Steel (Sleepers)			5,400	t	0.000	0.000	1.8574	1.8574	t CO ₂ -e/t	RMIT	Q x EF	0	0	10,030	10,030	0.46%	0.12%
Gravel (Maintenance Track)	1,113,750	m ³	1,695,128	t	0.000	0.000	0.0170	0.0170	t CO ₂ -e/t	Simapro Australian Database	Q x EF	0	0	28,817	28,817	1.33%	0.34%
Total Raw Materials Embodied Emissions												0	0	920,136	920,136	42.41%	10.87%

Transportation of Materials to Site

Sand (Common)	3,538,978	t					14.700	14.7000	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	52,023	52,023	2.40%	0.61%
Gravel (Common)	3,362,250	t					14.700	14.7000	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	49,425	49,425	2.28%	0.58%
Crushed Aggregate (Common)	4,550,746	t					14.700	14.7000	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	66,896	66,896	3.08%	0.79%
Crushed rock (Rock)	9,014,935	t					14.700	14.7000	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	132,520	132,520	6.11%	1.57%
Sand (Borrow material for general fill)	3,904,341	t					2.450	2.4500	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	9,566	9,566	0.44%	0.11%
Gravel (Borrow material for general fill)	3,709,368	t					2.450	2.4500	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	9,088	9,088	0.42%	0.11%
Crushed Aggregate (Borrow material for general fill)	5,020,563	t					2.450	2.4500	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	12,300	12,300	0.57%	0.15%
Sand (General fill)	9,985,800	t					2.450	2.4500	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	24,465	24,465	1.13%	0.29%
Gravel (General fill)	9,487,133	t					2.450	2.4500	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	23,243	23,243	1.07%	0.27%
Crushed Aggregate (General fill)	12,840,667	t					2.450	2.4500	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	31,460	31,460	1.45%	0.37%
Crushed Aggregate (Top capping layer)	1,679,930	t					14.700	14.7000	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	24,695	24,695	1.14%	0.29%
Gravel (Ballast) - Merinda	286,060	t					16.195	16.1945	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	4,633	4,633	0.21%	0.05%
Gravel (Ballast) - Collinsville	286,060	t					35.280	35.2800	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	10,092	10,092	0.47%	0.12%
Gravel (Ballast) - Eaglefield	286,060	t					79.625	79.6250	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	22,778	22,778	1.05%	0.27%
Gravel (Ballast) - Gregory Hwy	286,060	t					121.030	121.0300	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	34,622	34,622	1.60%	0.41%
Cement (Sleepers)		t					47.775	47.7750	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	0	0	0.00%	0.00%
Steel (Sleepers)	5,400	t					280.280	280.2800	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	1,514	1,514	0.07%	0.02%
Gravel (Maintenance Track)	1,695,128	t					14.700	14.7000	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	24,918	24,918	1.15%	0.29%
Sleepers - Merinda to Collinsville	63,225	t					20.507	20.5065	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	1,297	1,297	0.06%	0.02%
Sleepers - Collinsville to Eaglefield	63,225	t					64.925	64.9250	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	4,105	4,105	0.19%	0.05%
Sleepers - Eaglefield to Gregory Hwy	63,225	t					106.330	106.3300	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	6,723	6,723	0.31%	0.08%
Sleepers - Gregory Hwy to Alpha Mine	63,225	t					172.235	172.2350	kg CO ₂ -e/t	Materials Delivery worksheet	Q x EF/1000	0	0	10,890	10,890	0.50%	0.13%
Total Materials Transportation												0	0	557,251	557,251	25.68%	6.58%

Fuel - Operation

Diesel used - construction	163,590	kL	6,314,574	GJ	69.90		5.30	75.20	kg CO ₂ -e/G	NGA Factors June 2009	Q x EF / 1000	441,389	0	33,467	474,856	21.89%	5.61%
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Vegetation removal

Vegetation removal	1,600	ha						0.00	t CO ₂ -e/ha	Full Carbon Accounting Model	Q x EF	217,451	0	0	217,451	10.02%	
Total Vegetation Removal												217,451	0	0	217,451	10.02%	2.57%

Total emissions for construction period

												217,451	0	1,477,386	2,169,694	100.00%	25.63%
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OPERATION

Fuel - Transport

Diesel used - transport operation (over 30 year period)	2,168,901	kL	83,719,571	GJ	69.90		5.30	75.20	kg CO ₂ -e/G	NGA Factors June 2009	Q x EF / 1000	5,851,998	0	443,714	6,295,712	100.00%	74.37%
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Total emissions for operation period												5,851,998	0	443,714	6,295,712	100.00%	74.37%
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TOTAL PROJECT EMISSIONS

												6,069,449	0	1,921,100	8,465,405	100.00%	
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Transportation of Materials

Transportation Emission Factors	EF	Units	Source
Rigid Truck		0.245 kg CO2-e/t.km	Simapro
International freight shipping		0.00537 kg CO2-e/t.km	SimaPro
Rail		0.0123 kg CO2-e/t.km	Simapro

Material	Origin	Rigid Truck Distance (km)	Ship Distance (km)	Rail Distance (km)	EF (kg CO2-e/t)
Materials - Construction					
Sand (Common)			60		14.7
Gravel (Common)			60		14.7
Crushed Aggregate (Common)			60		14.7
Crushed rock (Rock)			60		14.7
Sand (Borrow material for general fill)			10		2.5
Gravel (Borrow material for general fill)			10		2.5
Crushed Aggregate (Borrow material for general fill)			10		2.5
Sand (General fill)			10		2.5
Gravel (General fill)			10		2.5
Crushed Aggregate (General fill)			10		2.5
Crushed Aggregate (Top capping layer)			60		14.7
Ballast - Merinda	Proserpine		66.1		16.2
Ballast - Collinsville	Proserpine		144		35.3
Ballast - Eaglefield	Proserpine		325		79.6
Ballast - Gregory Hwy	Proserpine		494		121.0
Steel - reinforced concrete (Sleepers)	Brisbane		1144		280.3
Cement (Concrete - Sleepers)	Mackay		195		47.8
Gravel (Maintenance Track)			60		14.7
Sleepers - Merinda to Collinsville	Merinda camp		83.7		20.5
Sleepers - Collinsville to Eaglefield	Merinda camp		265		64.9
Sleepers - Eaglefield to Gregory Hwy	Merinda camp		434		106.3
Sleepers - Gregory Hwy to Alpha Mine	Merinda camp		703		172.2

Total Materials - Construction

References

Reference 1		DEFRA, 2005 "Guidelines for Company Reporting on Greenhouse Gas Emissions"
Reference 2		http://www.portworld.com/map/
Reference 3	Distances calculated on	http://maps.google.com.au/
Reference 4	Ballast quarries in QLD	http://www.dme.qld.gov.au/mines/quarry_materials.cfm
Reference 5	Cement plant	http://www.cemaust.com.au/driver.asp?page=%2Foperations%2Flocations



Alpha Rail

Vegetation community	Area (ha)	Onsite (tC/ha)	Onsite (tC)	Onsite (t CO2-e)
Local Vegetation (FullCAM)				
Total area to be cleared	1600		136	217,451

Calculations by Matthew Searson:

Rainfall band	1		2		3		4		5	
	mm	450-500	500-600	600-700	700-800	800-900				
	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
Endangered		131.21	30.01	1.88		0		0		
Of Concern		91.65	88.53	22.53		66.03		12.16		
Least Concern		460.1	452.31	131.8		26.04		23.79		
Regrowth		51.81	5.76	1.76		2.26		0.09		
Total area		734.77	577	158		94		36		
		tC/ha	tC/ha	tC/ha	tC/ha	tC/ha	tC/ha	tC/ha	tC/ha	tC/ha
Endangered		3,030	1,458	102		-		-		
Of Concern		2,116	4,300	1,222		2,454		744		
Least Concern		10,624	21,969	7,149		968		1,456		
Regrowth		1,196	280	95		84		6		
Total tC		16,965.84	28,006	8,568		3,505		2,206		
		tCO2-e/ha	tCO2-e/ha	tCO2-e/ha	tCO2-e/ha	tCO2-e/ha	tCO2-e/ha	tCO2-e/ha	tCO2-e/ha	tCO2-e/ha
Endangered		11,119	5,349	374		-		-		
Of Concern		7,766	15,781	4,485		9,005		2,731		
Least Concern		38,989	80,625	26,236		3,551		5,343		
Regrowth		4,390	1,027	350		308		20		
Total tCO2		62,265	102,782	31,446		12,864		8,095		



Fuel Use Operation

Lifespan **30 years**
 Fuel Consumption per trip (L/tonne) **1.36 L / tonne** Notes: 1.36l/t (using 3 locos.) for the return trip.

Tonnes per annum

Year (calendar)	Tonnes	Fuel Usage		Tonnes per annum			
2014	6000	8,160.00		2014	6000	8,160.00	8,160,000.00
2015	18156	24,692.16		2015	18156000	24,692,160.00	24,692,160.00
2016	29168	39,668.48		2016	29168000	39,668,480.00	39,668,480.00
2017	42959	58,424.24		2017	42959000	58,424,240.00	58,424,240.00
2018	46066	62,649.76		2018	46066000	62,649,760.00	62,649,760.00
2019	52025	70,754.00		2019	52025000	70,754,000.00	70,754,000.00
2020-2043	58600	1,912,704.00	7,969,600	2020-2043	58600000	1,912,704,000.00	1,912,704,000.00
		2,177,052.64 L				2,168,900,800.00 L	2,177,052,640.00
		2,177.05 kL				2,168,900.80 kL	2,177,053
		2,177,052,640.00 L					
		2,177,052.64 kL					

Fuel Use Construction

Estimated Fuel Usage:

Bulk Earthworks (bench marked from past projects): 6 l/m ³ - 18,700,000 m ³ moved & treated: Approx 112,200,000 L	112,200,000 L
Road Maintenance: 6 plant; 50% of time spent per day for each 6 Separable portions; 700 days: Approx 2,000,000 L	2,000,000 L
Track Construction: Approx 500,000 liters	500,000 L
Camps:	
Camp 1 (800 man) Assume power is available before construction; Fuel needed for LV's /buses: 39,000 l/wk; 2 years: Approx 3,900,000 L	3,900,000 L
Camp 2 (600 man) inc LV's /buses: 98,000 l/wk; 2 years: Approx 10,200,000 L	10,200,000 L
Camp3 (600 man) inc LV's /buses: 98,000 l/wk; 2 years: Approx 10,200,000 L	10,200,000 L
Camp4 (600 man) inc LV's /buses: 98,000 l/wk; 2 years: Approx 10,200,000 L	10,200,000 L
Camp5 (600 man Assume power is available before construction; Fuel needed for LV's /buses: 30,000 l/wk; 2 years: Approx 3,000,000 L	3,000,000 L
Track Construction Depot: Assume power is available before construction: 0 L	- L
Ballast Transport: Average haul dist 20km (round trip: 40km); 30m ³ of ballast for a double; 900,000m ³ of ballast; fuel consumption 3 l/km; 3,600,000 L	3,600,000 L
Rail Transport: Fuel provided off site: 0 L	- L
Miscellaneous & Other: 5 % of all above items: Approx 8,000,000 L	155,800,000
	7,790,000 L
	163,590,000 L
	163,590 KL

