Annex H

H. Assumptions for GHG Assessment

1 METHODOLOGY

All methodology used in this assessment for the estimation of GHG emissions has been in accord with the *National Greenhouse Accounts (NGA) Factors (2008)* document in the first instance and/or in accord with sound scientific and engineering principles where NGA Factors have proved inadequate for the required calculations. The specific methodologies used in each calculation are given in the following sections. To ensure emissions are not underestimated, all calculations are conservative in nature.

1.1 SOURCE DATA

All source data used in this assessment was obtained from stable and reliable sources where possible or estimated based on engineering experience and reasonable assumptions where sound reference data was not available.

The source data and quantities used in the assessment for each calculation are noted or described in the GHG Emission Calculation spreadsheet, which is provided in **Section 2** of this Appendix.

1.2 FUEL, DIESEL, AND NATURAL GAS CONSUMPTION CALCULATIONS

The methodology used for calculating GHG emissions from combustion of fuels onsite and during transportation was obtained from the NGA Factors (2008). The following formula was used:

GHG emissions (t CO_2-e) = (Q x EF x EC) / 1000 (Equation 2)

Where,

Q is the quantity of fuel consumed expressed by volume (kL or GJ);

EF is the relevant emission factor expressed in kg CO_2-e/GJ, obtained from the *NGA Factors (2008)* document; and

EC is the energy content factor of the fuel type, expressed in GJ/kL (if Q is measured in GJ, EC=1), obtained from NGA Factors (2008).

Both Scope 1 and Scope 3 emissions are associated with combustion of fuels. Scope 1 emissions account for the point source onsite combustion of the fuel (within the organisation) and Scope 3 emissions account for extraction and transportation of the fuel (outside the organisation). The emission factors for each fuel are different.

1.3 WASTE TRANSPORTATION AND DISPOSAL CALCULATIONS

Municipal and Construction Waste

Solid waste that is ultimately disposed of in a well-managed landfill is estimated to produce methane in accordance with the formula:

GHG Emission (t CO_2-e) = Q x EF (Equation 3)

Where,

Q is the quantity of solid waste in tones; and

EF is the waste emission factor for the type of waste.

As the composition of the waste is not yet known, the emission factor for commercial and industrial waste (1.70 t CO_2-e / t waste) was conservatively used for general municipal waste and the construction and demolition waste emission factor (0.30 t CO_2-e / t waste) was used for construction waste.

Green Waste

Green waste transportation and disposal emissions were calculated using the following formula, which is provided in NGA Factors (2008), page 62:

GHG Emissions (t CO_2-e) = [((Q x DOC x DOC_F x F_1 x 16/12)-R) x (1 – OX)] x 21

(Equation 4)

Where,

Q is the quantity of green waste expressed in tonnes;

DOC is the Degradable Organic Carbon expressed as a proportion of the particular waste, value provided by NGA for green waste = 0.2;

DOC_F is the fraction of DOC dissimilated for the waste type product, default value is 0.5;

F_1 is the methane fraction of landfill gas, default value is 0.5;

16/12 is the conversion rate of carbon to methane;

R is the recovered methane from wastewater in a year, expressed in tones;

OX is the oxidation factor. Equal to 0.1 for covered landfills, 0 for uncovered landfills; and

21 is the methane global warming potential.

A DOC value of 0.2 (garden and green waste, Table 40), and the default values (Table 41) were used for all other parameters.

1.4 ELECTRICITY CONSUMPTION CALCULATIONS

Emissions from the consumption of purchased electricity were calculated using the following equation (NGA Factors, 2008):

GHG Emission (t CO_2-e) = (Q x EF) / 1000 **(Equation 5)**

Where,

Q is the amount of electricity consumed in kWh; and

EF is the relevant emission factor in kg CO_2-e/kWh, obtained from NGA Factors (2008) document.

Both Scope 2 and Scope 3 emissions are associated with electricity consumption. Scope 2 emissions account for combustion of fuel in the energy generation process (eg, coal fired power station), and Scope 3 emissions account for the extraction and transportation of that fuel. Emission factors for both Scope 2 and Scope 3 emissions are provided in NGA Factors (2008).

1.5 EMISSIONS FROM WASTEWATER TREATMENT

Waste water emissions were calculated using the following formula, which is provided in NGA Factors (2008), page 64:

GHG Emission (t CO_2-e) = $[(P \times DC \times (1 - F_{sl}) \times F_{an} \times EF_w) + (P \times DC \times F \times EF_{sl}) - R] \times CH_4$ GWP

(Equation 6)

Where,

P is the population producing the waste water;

DC is the BOD per capita per year measured in kg per person per year;

F_{sl} is the fraction of BOD removed as sludge. Assumed NGA 2008 default value of 0.29;

F_{an} is the Fraction of BOD anaerobically treated. Assumed NGA 2008 default value of 0.8 for an anaerobic digester/reactor;

EF_w is the methane emission factor for wastewater. Assumed NGA 2008 default value of 0.65 kg CH_4/kg BOD;

EF_{sl} is the methane emission factor for sludge. Assumed NGA 2008 default value of 0.65 kg CH_4/kg BOD;

R is the recovered methane from wastewater, assumed to be 0; and

CH_4 GWP is the global warming potential of methane. Used to convert units into CO_2-e.

All calculations provide reasonable descriptions of source data, references, assumptions, and methodology, and are included in this Appendix as **Section 2** on “Calculations” (starting next page).

2 CALCULATIONS

2.1 FUEL CONSUMPTION

Fuel Consumption During Construction Works (Stage 1)		
1. Earthworks (incl. onsite excavators, haul trucks, and miscellaneous machinery)		
Earthworks volume TBC with LJD/MM		
Total duration of Stage 1 construction works	13.9	months
(estimated construction durations are based on an overall construction period of 12 years for the entire project, proratered by floor space)		
Duration of Stage 1 earthworks (assumed 20% of total Stage 1 construction duration)	2.8	months
Total No. of working days (assumes 5 d/wk for duration of earthworks)	55.8	days
Total No. of excavator working days (assumes 2 x 30 tonne excavators used for duration of earthworks)	111.5	excavator days
Total No. of excavator working hours (assumes 8 hrs/d for duration of earthworks)	892.2	hours
Total No. of onsite haul truck working days (assumes 2 x haul trucks for duration of earthworks)	111.5	haul truck days
Total No. of onsite haul truck working hours (assumes 8 hrs/d for duration of earthworks)	892.2	hours
Total Machine hours	1784.4	hours
Diesel consumption for excavators and haul trucks (assumes 30L/hr for each machine)	53.5	kL
Additional allowance for miscellaneous machinery (25% of excavator and haul truck fuel)	13.4	kL
Diesel consumption for earthworks	**67**	kL
2. Transportation of Construction Materials for Roads and Pathways		
Area of roads + driveways + outdoor car parking (indicative only, allowance for access road and pathways)	10000	m2
Mass of road construction materials (assumes 0.9 t/m2)	9000	t
Effective mass to transport due to packing inefficiency (assumes packing inefficiency factor of 3)	27000	t
No. of trips for 10 tonne truck	2700	trips
Total haulage travel distance (assumes haul distance of 60km [avg distance from Wollongong / Sydney])	162000	km
Diesel consumption for delivery of materials using 10-tonne truck (assumes 30L/100km, ie, 0.3L/km)	**49**	kL
3. Transportation of Construction Materials for Buildings		
Total floor space of stage 1 buildings	16200	m2
Mass of construction materials (assumes 2.0 t/m2)	32400	t
Effective mass to transport due to packing inefficiency (assumes packing inefficiency factor of 3)	97200	t
No. of trips for 10 tonne truck	9720	trips
Total haulage travel distance (assumes haul distance of 60km [avg distance from Wollongong / Sydney])	583200	km
Diesel consumption for delivery of materials using 10-tonne truck (assumes 30L/100km, ie, 0.3L/km)	**175**	kL
4. Fuel Consumption for Worker Travel		
Total duration of Stage 1 construction works	13.9	months
Duration of Stage 1 earthworks (assumed 20% of total Stage 1 construction duration)	2.8	months
No. of travel days (assumes return trip to work each day, 4 wks/month, 5 days/wk)	56	travel days
Total No. of return trips (assumes 15 worker return trips per day)	840	return trips
Duration of Stage 1 building construction	11.2	months
Total No. of workers for all stages	1500	workers
Average No. of workers per stage (11 stages in total - 1, 2, 3, 4, 5a, 5b, 5c, 6, 7, 8a, & 8b)	137	workers
Number of return trips	30558	return trips
Total No. of return trips	31398	return trips
Total worker travel distance (assumes avg return trip distance from Wollongong of 30kms [15km each way])	941940	km
Total fuel consumed (assumes 7 L/100km, ie, 0.07L/km)	**66**	**kL**

5. Fuel Consumption for Work Site Diesel Generator		
Diesel Generator for Earthworks Phase (site office)		
Earthworks duration (assumed duration)	2.8	months
No. of generator hours for civil works (assumes 5d/wk for duration of works)	446.1	hours
Diesel generator fuel consumption (assumes 8 kVA diesel generator with fuel consumption 2L/hr)	**0.89**	kL
Diesel Generator for Building Construction Phase (site office and construction power supply, incl. power tools etc.)		
Construction works duration (assumed duration)	11.2	months
No. of generator hours for construction works (assumes 5d/wk for duration of works)	1784.4	hours
Diesel generator fuel consumption (assumes 70 kVA diesel generator with fuel consumption 7L/hr)	**12**	kL
Totals for Stage 1		
Total Diesel Fuel Consumption (Stationary and Transport)	**304**	kL
Total Petrol Fuel Consumption (Transport)	**66**	kL
Fuel Consumption During Construction Works (All remainding Stages, ie, 2 - 8b)		
1. Earthworks (incl. onsite excavators, haul trucks, and miscellaneous machinery)		
Earthworks volume TBC with LJD/MM		
Total duration of Stages 2-8b construction works	130.1	months
(estimated construction durations are based on an overall construction period of 12 years for the entire project, proratered by floor space)		
Duration of Stages 2-8b earthworks (assumed 20% of total Stages 2-8b construction time)	26.0	months
Total No. of working days (assumes 5 d/wk for duration of earthworks)	520.2	days
Total No. of excavator working days (assumes 2 x 30 tonne excavators used for duration of earthworks)	1040.5	excavator days
Total No. of excavator working hours (assumes 8 hrs/d for duration of earthworks)	8323.8	hours
Total No. of onsite haul truck working days (assumes 2 x haul trucks for duration of earthworks)	1040.5	haul truck days
Total No. of onsite haul truck working hours (assumes 8 hrs/d for duration of earthworks)	8323.8	hours
Total Machine hours	16647.6	hours
Diesel consumption for excavators and haul trucks (assumes 30L/hr for each machine)	499.4	kL
Additional allowance for miscellaneous machinery (25% of excavator and haul truck fuel)	124.9	kL
Diesel consumption for earthworks	**624**	kL
2. Transportation of Construction Materials for Roads and Pathways		
Area of roads + driveways + car parking (indicative only, conservative estimate from concept plan)	30000	m2
Mass of road construction materials (assumes 0.9 t/m2)	27000	t
Effective mass to transport due to packing inefficiency (assumes packing inefficiency factor of 3)	81000	t
No. of trips for 10 tonne truck	8100	trips
Total haulage travel distance (assumes haul distance of 60km [avg distance from Wollongong / Sydney])	486000	km
Diesel consumption for delivery of materials using 10-tonne truck (assumes 30L/100km, ie, 0.3L/km)	**146**	kL
3. Transportation of Construction Materials for Buildings		
Total floor space of buildings (indicative only, conservative estimate based on concept plan)	138770	m2
Mass of construction materials (assumes 2.0 t/m2)	277540	t
Effective mass to transport due to packing inefficiency (assumes packing inefficiency factor of 3)	832620	t
No. of trips for 10 tonne truck	83262	trips
Total haulage travel distance (assumes haul distance of 60km [avg distance from Wollongong / Sydney])	4995720	km
Diesel consumption for delivery of materials using 10-tonne truck (assumes 30L/100km, ie, 0.3L/km)	**1499**	kL
4. Fuel Consumption for Worker Travel		
Total duration of Stages 2-8b construction works	130.1	months
Duration of Stages 2-8b earthworks (assumed 20% of total Stages 2-8b construction time)	26.0	months
No. of travel days (assumes return trip to work each day, 4 wks/month, 5 days/wk)	521	travel days
Total No. of return trips (assumes 15 worker return trips per day)	7815	return trips

Duration of Stages 2-8b building construction	104.0	months
Total No. of workers for all stages	1500	workers
Average No. of workers per stage (11 stages in total - 1, 2, 3, 4, 5a, 5b, 5c, 6, 7, 8a, & 8b)	137	
Number of return trips	399127	return trips
Total No. of return trips	406942	return trips
Total worker travel distance (assumes avg return trip distance from Wollongong of 30kms [15km each way])	12208260	km
Total fuel consumed (assumes 7 L/100km, ie, 0.07L/km)	**855**	**kL**
5. Fuel Consumption for Work Site Diesel Generator		
Diesel Generator for Earthworks Phase (site office)		
Earthworks duration (assumed 20% of total Stages 2-8b construction time)	26.0	months
No. of generator hours for civil works (assumes 5d/wk for duration of works)	4161.9	hours
Diesel generator fuel consumption (assumes 8 kVA diesel generator with fuel consumption 2L/hr)	**8.32**	kL
Diesel Generator for Building Construction Phase (site office and construction power supply, incl. power tools etc.)		
Construction works duration (assumed duration)	104.0	months
No. of generator hours for construction works (assumes 5d/wk for duration of works)	16647.6	hours
Diesel generator fuel consumption (assumes 70 kVA diesel generator with fuel consumption 7L/hr)	**117**	kL
Totals for Stages 2-8b		
Total Diesel Fuel Consumption (Stationary and Transport)	**2394**	kL
Total Petrol Fuel Consumption (Transport)	**855**	kL

Fuel Consumption During Ongoing Operation of Facility		
1. Fuel Consumption for Worker Travel (annual total)		
(NOTE: this calculation is conservative as some staff will be accomodated onsite and a large portion will use public transport)		
Number of teachers and staff from offsite (indicative estimate based on preliminary concept plan)	1479	workers
Number of worker days (assumes 5 day week, 52 weeks a year)	384540	worker days
Total worker travel distance (assumes avg return trip distance from Wollongong of 30kms [15km each way])	11536200	km
Total fuel consumed (assumes 7 L/100km, ie, 0.07L/km)	**808**	kL

2.2 GHG EMISSIONS

1	**DEVELOPMENT PHASE OF PROJECT (Stage 1)**		
1.1	**Diesel Fuel Consumption from Construction Activities (Scope 1 & Scope 3)**		
	Fuel type = "Diesel Oil"		
	(refer NGA Factors (2008), p16, Table 4)		
	Total Volume of Fuel Consumed (Q_i)	304	kL
	Energy Content Factor (EC_i)	38.6	GJ/kL
	Energy Content	11729	GJ
	Scope 1		
	CO_2 Emission Factor (EF_{ijoxec})	69.2	kg CO_2-e / GJ
	CH_4 Emission Factor (EF_{ijoxec})	0.1	kg CO_2-e / GJ
	N_2O Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	Total Emission Factor (EF_{ijoxec})	69.5	kg CO_2-e / GJ
	Total Scope 1 $CO_{2\text{-}e}$ emissions (E_{ij})	815.2	t CO_2-e
	Scope 3		
	Scope 3 CO_2-e Emission Factor (EF_{ijoxec})	5.3	kg CO_2-e / GJ
	(NGA Factors [2008], page 58,Table 38)		
	Total Scope 3 $CO_{2\text{-}e}$ emissions (E_{ij})	62.2	t CO_2-e
	Overall Onsite Diesel Fuel Combustion GHG Emission (Scope 1 + Scope 3)	**877**	**t $CO_{2\text{-}e}$**
1.2	**Petrol Fuel Consumption from Employee Travel (Scope 1 & Scope 3)**		
	Fuel type = "Gasoline (other than for use as fuel in an aircraft)"		
	(refer NGA Factors (2008), p16, Table 4)		
	Total Volume of Fuel Consumed (Q_i)	66	kL
	Energy Content Factor (EC_i)	34.2	GJ/kL
	Energy Content	2255	GJ
	Scope 1		
	CO_2 Emission Factor (EF_{ijoxec})	66.7	kg CO_2-e / GJ
	CH_4 Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	N_2O Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	Total Emission Factor (EF_{ijoxec})	67.1	kg CO_2-e / GJ
	Total Scope 1 $CO_{2\text{-}e}$ emissions (E_{ij})	151.3	t CO_2-e
	Scope 3		
	Scope 3 CO_2-e Emission Factor (EF_{ijoxec})	5.3	kg CO_2-e / GJ
	(NGA Factors [2008], page 58,Table 38)		
	Total Scope 3 $CO_{2\text{-}e}$ emissions (E_{ij})	12.0	t CO_2-e
	Overall Onsite Petrol Fuel Combustion GHG Emission (Scope 1 + Scope 3)	**163**	**t $CO_{2\text{-}e}$**
1.3	**Construction Waste Transport & Disposal (Scope 3)**		
	Mass of construction materials for roads and pathways (refer "Fuel Consumption" calculations)	9000	t
	Mass of construction materials for buildings (refer "Fuel Consumption" calculations)	32400	t
	Total mass of construction material	41400	t
	Amount of waste generated (Q_i), assumes waste mass of 2% of construction material	828	t
	Emission factor for waste generated (refer NGA Factors [2008], page 63, table 42, column C)	0.3	t $CO_{2\text{-}e}$ / t waste
	Emissions from transportation and disposal of waste generated onsite	248	t $CO_{2\text{-}e}$
	Total GHG Emissions from Waste Generated onsite (Scope 3)	**248**	**t $CO_{2\text{-}e}$**
1.4	**EMISSION TOTALS for Construction Phase (Scope 1 & Scope 3)**		
	Scope 1	966	t $CO_{2\text{-}e}$
	Scope 2	NA	t $CO_{2\text{-}e}$
	Scope 3	323	t $CO_{2\text{-}e}$
	TOTAL (Scope 1 + Scope 2)	**966**	**t $CO_{2\text{-}e}$**
	TOTAL (Scope 1 + Scope 2 + Scope 3)	**1289**	**t $CO_{2\text{-}e}$**

2	**DEVELOPMENT PHASE OF PROJECT (all other stages)**		
2.1	**Diesel Fuel Consumption from Construction Activities (Scope 1 & Scope 3)**		
	Fuel type = "Diesel Oil"		
	(refer NGA Factors (2008), p16, Table 4)		
	Total Volume of Fuel Consumed (Q_i)	2394	kL
	Energy Content Factor (EC_i)	38.6	GJ/kL
	Energy Content	92395	GJ
	Scope 1		
	CO_2 Emission Factor (EF_{ijoxec})	69.2	kg CO_2-e / GJ
	CH_4 Emission Factor (EF_{ijoxec})	0.1	kg CO_2-e / GJ
	N_2O Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	Total Emission Factor (EF_{ijoxec})	69.5	kg CO_2-e / GJ
	Total Scope 1 $CO_{2\text{-}e}$ emissions (E_{ij})	6421.5	t CO_2-e
	Scope 3		
	Scope 3 CO_2-e Emission Factor (EF_{ijoxec})	5.3	kg CO_2-e / GJ
	(NGA Factors [2008], page 58,Table 38)		
	Total Scope 3 $CO_{2\text{-}e}$ emissions (E_{ij})	489.7	t CO_2-e
	Overall Onsite Diesel Fuel Combustion GHG Emission (Scope 1 + Scope 3)	**6911**	**t $CO_{2\text{-}e}$**
2.2	**Petrol Fuel Consumption from Employee Travel (Scope 1 & Scope 3)**		
	Fuel type = "Gasoline (other than for use as fuel in an aircraft)"		
	(refer NGA Factors (2008), p16, Table 4)		
	Total Volume of Fuel Consumed (Q_i)	855	kL
	Energy Content Factor (EC_i)	34.2	GJ/kL
	Energy Content	29227	GJ
	Scope 1		
	CO_2 Emission Factor (EF_{ijoxec})	66.7	kg CO_2-e / GJ
	CH_4 Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	N_2O Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	Total Emission Factor (EF_{ijoxec})	67.1	kg CO_2-e / GJ
	Total Scope 1 $CO_{2\text{-}e}$ emissions (E_{ij})	1961.1	t CO_2-e
	Scope 3		
	Scope 3 CO_2-e Emission Factor (EF_{ijoxec})	5.3	kg CO_2-e / GJ
	(NGA Factors [2008], page 58,Table 38)		
	Total Scope 3 $CO_{2\text{-}e}$ emissions (E_{ij})	154.9	t CO_2-e
	Overall Onsite Petrol Fuel Combustion GHG Emission (Scope 1 + Scope 3)	**2116**	**t $CO_{2\text{-}e}$**
2.3	**Construction Waste Transport & Disposal (Scope 3)**		
	Mass of construction materials for roads and pathways (refer "Fuel Consumption" calculations)	27000	t
	Mass of construction materials for buildings (refer "Fuel Consumption" calculations)	277540	t
	Amount of waste generated (Q_i), assumes waste mass of 2% of construction material	304540	t
	Emission factor for waste generated (refer NGA Factors [2008], page 63, table 42, column C)	0.3	t $CO_{2\text{-}e}$ / t waste
	Emissions from transportation and disposal of waste generated onsite	91362	t $CO_{2\text{-}e}$
	Total GHG Emissions from Waste Generated onsite (Scope 3)	**91362**	**t $CO_{2\text{-}e}$**
2.4	**EMISSION TOTALS for Construction Phase (Scope 1 & Scope 3)**		
	Scope 1	8383	t $CO_{2\text{-}e}$
	Scope 2	NA	t $CO_{2\text{-}e}$
	Scope 3	92007	t $CO_{2\text{-}e}$
	TOTAL (Scope 1 + Scope 2)	**8383**	**t $CO_{2\text{-}e}$**
	TOTAL (Scope 1 + Scope 2 + Scope 3)	**100389**	**t $CO_{2\text{-}e}$**

3	**ONGOING OPERATION OF TRAINING FACILITY**		
3.1	**Transport Fuel Consumption from Employee Travel (Scope 1 & Scope 3)**		
	Fuel type = "Gasoline (other than for use as fuel in an aircraft)"		
	(refer NGA Factors November 2008, p16, Table 4)		
	Total Volume of Fuel Consumed (Q_i)	808	kL
	Energy Content Factor (EC_i)	34.2	GJ/kL
	Energy Content	27618	GJ
	Scope 1		
	CO_2 Emission Factor (EF_{ijoxec})	66.7	kg CO_2-e / GJ
	CH_4 Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	N_2O Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	Total Emission Factor (EF_{ijoxec})	67.1	kg CO_2-e / GJ
	Total Scope 1 $CO_{2\text{-}e}$ emissions (E_{ij})	1853.1	t CO_2-e/yr
	Scope 3		
	Scope 3 CO_2-e Emission Factor (EF_{ijoxec})	5.3	kg CO_2-e / GJ
	(NGA Factors [2008], page 58,Table 38)		
	Total Scope 3 $CO_{2\text{-}e}$ emissions (E_{ij})	146.4	t CO_2-e
	Overall Transport Fuel Combustion GHG Emission (Scope 1 + Scope 3)	**2000**	**t CO_2-e / yr**
3.2	**Diesel Fuel Consumption from Onsite Maintenance Activities (eg, landscaping) (Scope 1 & Scope 3)**		
	Fuel type = "Diesel Oil"		
	(refer NGA Factors November 2008, p16, Table 4)		
	Total Volume of Fuel Consumed (Q_i) (Indicative allowance, assumed100L diesel fuel per week)	5.2	kL
	Energy Content Factor (EC_i)	38.6	GJ/kL
	Energy Content	200.7	GJ
	Scope 1		
	CO_2 Emission Factor (EF_{ijoxec})	69.2	kg CO_2-e / GJ
	CH_4 Emission Factor (EF_{ijoxec})	0.1	kg CO_2-e / GJ
	N_2O Emission Factor (EF_{ijoxec})	0.2	kg CO_2-e / GJ
	Total Emission Factor (EF_{ijoxec})	69.5	kg CO_2-e / GJ
	Total Scope 1 $CO_{2\text{-}e}$ emissions (E_{ij})	14.0	t CO_2-e
	Scope 3		
	Scope 3 CO_2-e Emission Factor (EF_{ijoxec})	5.3	kg CO_2-e / GJ
	(NGA Factors [2008], page 58,Table 38)		
	Total Scope 3 $CO_{2\text{-}e}$ emissions (E_{ij})	1.1	t CO_2-e
	Overall Onsite Diesel Fuel Combustion GHG Emission (Scope 1 + Scope 3)	**15.0**	**t CO_2-e/yr**
3.3	**Natural Gas Consumption (Scope 1 & Scope 3)**		
	Fuel type = "Natural Gas"		
	(refer NGA Factors (2008), p16, Table 4)		
	Rate of gas consumption per ft2 (energy consumption for Hospital/Inpatient Health)	119.7	ft3 / ft2
	(Data Source: US Energy Information Administration (EIA), available online at: http://www.eia.doe.gov/emeu/cbecs/pba99/healthcare/healthconstable.html (accessed 7/04/09)		
	Equivilent in m3 gas per m2 (based on 1ft = 0.3048m)	36.5	m3 / m2
	Total gross floor space	154970	m2
	Total Volume of Fuel Consumed (Q_i) (for all Stages of development)	5654012	m3 gas
	Energy Content (EC) (refer Table 2, page 13 of NGA Factors 2008)	0.0393	GJ / m3
	Scope 1		
	CO_2 Emission Factor (EF_{ijoxec})	51.2	kg CO_2-e / GJ
	CH_4 Emission Factor (EF_{ijoxec})	0.1	kg CO_2-e / GJ
	N_2O Emission Factor (EF_{ijoxec})	0.03	kg CO_2-e / GJ
	Total Emission Factor (EF_{ijoxec})	51.3	kg CO_2-e / GJ

	Annual Scope 1 $CO_{2\text{-}e}$ emissions (E_{ij})	11405.7	t CO_2-e/yr.
	Scope 3		
	Scope 3 CO_2-e Emission Factor (EF_{ijoxec})	14.2	kg CO_2-e / GJ
	(NGA Factors [2008], page 58,Table 38)		
	Total amount of energy consumed (Volume x EC)	222203	GJ
	Annual Scope 3 $CO_{2\text{-}e}$ emissions (E_{ij})	3155.3	t CO_2-e/yr
	Annual Onsite Natural gas Combustion GHG Emission (Scope 1 + Scope 3)	**14561**	**t CO_2-e/yr**
3.4	**Electricity Consumption (Scope 2 & Scope 3)**		
	Rate of electricity consumption per ft2 (energy consumption for Hospital/Inpatient Health)	28.6	kwh / ft2
	(Data Source: US Energy Information Administration (EIA), available online at: http://www.eia.doe.gov/emeu/cbecs/pba99/healthcare/healthconstable.html (accessed 7/04/09)		
	Equivilent in kwh per m2 (based on 1ft = 0.3048m)	307.8	kwh / m2
	Total gross floor space	154970	m2
	Annual Electricity Consumption	47707179	kWh / yr
	Emission Calculation:		
	(refer NGA Factors November 2008, p59, Table 39)		
	EF ($CO_{2\text{-}e}$) Scope 2 (Electricity consumed in NSW & ACT)	0.9	kg CO_2-e / kWh
	EF ($CO_{2\text{-}e}$) Scope 3 (Electricity consumed in NSW & ACT)	0.2	kg CO_2-e / kWh
	EF ($CO_{2\text{-}e}$) Scope 2 & 3 (Electricity consumed in NSW & ACT)	1.1	kg CO_2-e / kWh
	Onsite Electricity Consumption GHG Emission (Scope 2)	42459	t $CO_{2\text{-}e}$ / yr
	Onsite Electricity Consumption GHG Emission (Scope 3)	8110	t $CO_{2\text{-}e}$ / yr
	Overall Onsite Electricity Consumption GHG Emission (Scope 2 + 3)	**50570**	**t $CO_{2\text{-}e}$ / yr**
3.5	**Municipal Waste Transport & Disposal (Scope 3)**		
	Waste Total		
	Number of hopper bin collections per week	30	per week
	Hopper capacity	3	t
	Total waste generated per year	4680	t / yr
	Amount of waste generated per year (Q_i)	4680	t waste / yr
	Emission factor for waste generated (refer NGA Factors November 2008, page 63, table 42, column B)	1.7	t $CO_{2\text{-}e}$ / t waste
	Total GHG Emissions from Municipal and Recyclable Waste Generated onsite (Scope 3)	**7956.0**	**t $CO_{2\text{-}e}$ / yr**
3.6	**Green Waste Transport & Disposal (Scope 3)**		
	Landscaped area (indicative allowance for landscaped areas, estimate based on concept plan)	25000	m2
	Green waste generation rate (assumed to be 10kg/m2/yr)	0.01	t / m2 / yr
	(rate estimated based on 80L green waste bin filled fortnightly from lawn of size 220m2 and assumed green waste density of 1kg/L)		
	(Following methodology from NGA Factors (2008), Appendix 4, page 62)		
	Quantity of green waste generated (Q)	250	t / yr
	Degradable Organic Content proportion (DOC) for green waste (NGA Factors [2008], table 40, page 62)	0.2	
	Fraction of degradable organic carbon (DOC_F), default value from NGA Factors [2008], page 62	0.5	
	Methane fraction of landfill gas (F_l), NGA Factors [2008], page 62	0.5	
	Conversion rate of carbon to methane (16/12)	1.3	
	Recovered methane (R)	0	
	Oxidation factor (OX), default value from NGA Factors [2008], page 62	0.1	
	Total GHG Emissions from Green Waste Generated onsite (Scope 3)	**315**	**t $CO_{2\text{-}e}$ / yr**
3.7	**Offsite Wastewater Treatment (Scope 3)**		
	NOTE: Calculations here undertaken in accord with methodology in NGA Factors (2008), page 64 (wastewater handling [domestic and commercial])		
	Population served (P) (conservative estimate incl. staff, students, and residents)	1899	People
	Quantity of BOD per capita (DC_w), default value from NGA Factors (2008), page 65, table 43	22.5	kg / person / yr
	Biochemical Oxygen Demand (BOD_w)	42728	kg / yr
	Fraction of BOD removed as sludge (F_{sl}), default value from NGA Factors (2008), page 65, table 43	0.29	
	Methane emission factor for wastewater (EF_w), default value from NGA Factors (2008), page 65, table 43	0.65	kg CH_4 / kg BOD
	Methane emission factor for sludge (EF_{sl}), default value from NGA Factors (2008), page 65, table 43	0.65	kg CH_4 / kg BOD
	Fraction of BOD anaerobically treated (Fan), assumed anaerobic digester/reactor treatment type	0.8	

	Global Warming Potential for CH_4 (CH_4 - GWP)	21	
	Recovered Methane in wastewater per year	0.0	kg
	GHG emission from waste water	500412	kg $CO_{2\text{-}e}$ / yr
	Total GHG Emissions from Wastewater Treatment (Scope 3)	**500**	**t $CO_{2\text{-}e}$ / yr**
3.8	**EMISSION TOTALS for Construction Phase (Scope 1, 2, & Scope 3)**		
	Scope 1	13273	t $CO_{2\text{-}e}$ / yr
	Scope 2	42459	t $CO_{2\text{-}e}$ / yr
	Scope 3	20184	t $CO_{2\text{-}e}$ / yr
	TOTAL (Scope 1 + Scope 2)	**55732**	**t $CO_{2\text{-}e}$ / yr**
	TOTAL (Scope 1 + Scope 2 + Scope 3)	**75916**	**t $CO_{2\text{-}e}$ / yr**

2.3 SUMMARY

DEVELOPMENT PHASE OF PROJECT (Stage 1)	Scope 1 Emission (t CO_2-e)	Scope 2 Emission (t CO_2-e)	Scope 3 Emission (t CO_2-e)	Total Scope 1, 2, & 3 (t CO_2-e)
Diesel Fuel Consumption from Construction Activities (Scope 1 & Scope 3)	815		62	**877**
Petrol Fuel Consumption from Employee Travel (Scope 1 & Scope 3)	151		12	**163**
Construction Waste Transport & Disposal (Scope 3)			248	**248**
DEVELOPMENT PHASE TOTAL (Over 14 month period)	**966**		**323**	**1289**

DEVELOPMENT PHASE OF PROJECT (all other stages)	Scope 1 Emission (t CO_2-e)	Scope 2 Emission (t CO_2-e)	Scope 3 Emission (t CO_2-e)	Total Scope 1, 2, & 3 (t CO_2-e)
Diesel Fuel Consumption from Construction Activities (Scope 1 & Scope 3)	6421		490	**6911**
Petrol Fuel Consumption from Employee Travel (Scope 1 & Scope 3)	1961		155	**2116**
Construction Waste Transport & Disposal (Scope 3)			91362	**91362**
DEVELOPMENT PHASE TOTAL (Over 144 month period)	**8383**		**92007**	**100389**

ONGOING OPERATION OF TRAINING FACILITY	Scope 1 Emission (t CO_2-e/yr)	Scope 2 Emission (t CO2-e/yr)	Scope 3 Emission (t CO2-e/yr)	Total Scope 1, 2, & 3 (t CO_2-e)
Transport Fuel Consumption from Employee Travel (Scope 1 & Scope 3)	1853		146	**2000**
Diesel Fuel Consumption from Onsite Maintenance Activities (eg, landscaping) (Scope 1 & Scope 3)	14		1	**15**
Natural Gas Consumption (Scope 1 & Scope 3)	11406		3155	**14561**
Electricity Consumption (Scope 2 & Scope 3)		42459	8110	**50570**
Municipal Waste Transport & Disposal (Scope 3)			7956	**7956**
Green Waste Transport & Disposal (Scope 3)			315	**315**
Offsite Wastewater Treatment (Scope 3)			500	**500**
OPERATIONAL PHASE TOTAL (t CO2-e/yr)	**13273**	**42459**	**20184**	**75916**