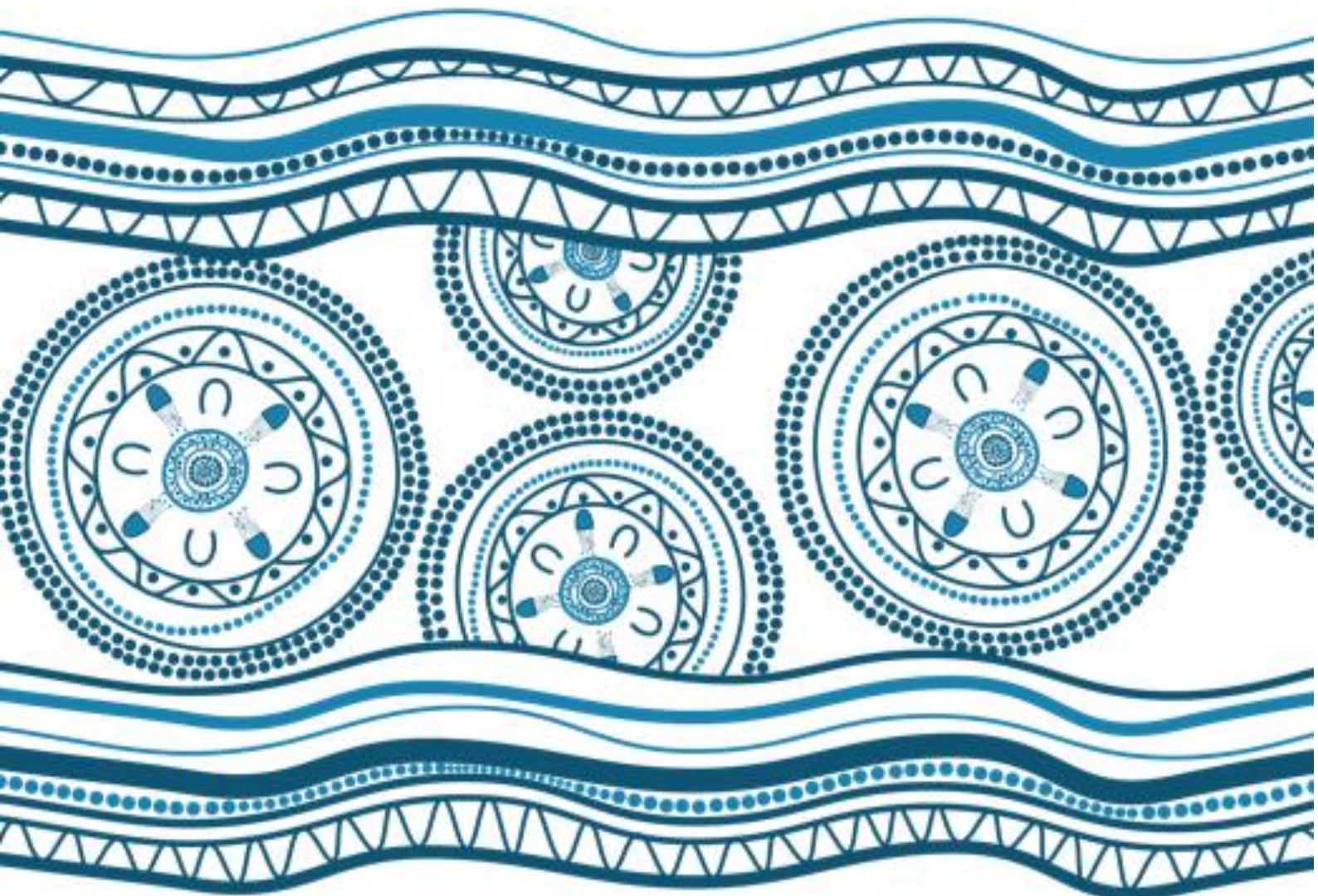


Appendix W

# Greenhouse Gas Calculations



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# Construction Greenhouse Gas Calculations

SCOPE 1								
Emission Source	Inclusion	Assumptions/Calculations	EF	Unit	EF Source	tCO2e/month	Operation Period (months)	TOTAL Emissions (tCO2e)
Stationary fuel	Marine vessels (tugs and barges)	Tugs and barges - diesel Estimated number of vessel moves (TLM Constructability Info to support EIS Preparation - Table D) is provided over the total construction period; Assume 4 hour operation per move Barges; 266 moves - average fuel use 10L/hour Tug: 34 moves - average fuel use of 150L/hr	2.72	t CO2-e / KL	NGA Factors 2019	NA	NA	84.47
Stationary fuel	Marine vessels (work punts)	Work punts – unleaded petrol Estimated number of vessel moves (TLM Constructability Info to support EIS Preparation - Table D) is provided over the total construction period; Assume 2 hour operation per move Work punt: 1230 moves - average fuel use of 26.5L/hour	2.38	t CO2-e / KL	NGA Factors 2019	NA	NA	155.1522
<b>TOTAL</b>								<b>239.62</b>

SCOPE 2								
Emission Source	Inclusion	Assumptions/ Calculations	EF	Unit	EF Source	tCO2e/month	Operation Period (months)	TOTAL Emissions (tCO2e)
Grid Electricity	Site offices	Typical air conditioned open planned office = 37kWh/m2 annually, 3.08kWh/m2/month (2) 2 site offices per site - approx. 20x20m Construction timeline = 13months	0.81	kgCO2-e/kWh	NGA Factors 2019	2	13	25.94592
<b>TOTAL</b>								<b>25.95</b>

**SCOPE 3**

Emission Source	Inclusion	Assumptions/ Calculations	Volume	Unit	EF	Unit	EF Source	TOTAL Emissions (tCO2e)
Materials	Concrete (Pre-cast and Insitu)	Pre-cast concrete + ready mix, 40MPa, 400kgs/m3 cement, simplified concrete mix, carbon footprint: 2400kg/m3, water cement ratio 0.35	830.00	m3	398	kg CO2-e/m3	TfNSW Carbon Estimate & Reporting Tool v2.1	330.34
	Fibre Reinforced Plastic (RFP) Decking	Plastic fibres (PP) for concrete reinforcement, Fibrecon2016 - 1kg Emesh 100% recycled Macro Poly and Virgin Macro Poly 1 cubic meter of plastic = 946kg	46.00	m3	4,800	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	208.88
	Steel Piles	Galvanised steel (Australian), structural steel, hot rolled coil, zinc coating Density = 7850kg/m3	150.45	m3	3,100	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	3,661.20
	Crushed rock	Coarse aggregates Density (loose packed) = 1.7t/m3	1,800.00	m3	5.7	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	17.44
	Gravel layer and core filled rock	Coarse aggregates Density (loose packed) = 1.7t/m3	2,200.00	m3	5.7	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	21.32
	Sand bags	1 cubic meter of sand = 1.53 tonnes	1,350.00	m3	4.3	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	8.88
	Roofing	Translucent Fiberglass Sheet Roof with Perforated Metal Soffit and Fascia Panels Assumed glass enforced plastic - GRP - Fibreglass Thickness =5cm Density = 1522 kg/m3 (5)	355.00	m2	1.47	kg CO2-e/kg	Inventory of Carbon and Energy (ICE) v2.0	39.71
	Concrete footpath	Ready mixed concrete, 40MPA Thickness = 12cm	125.00	m2	398	kg CO2-e/m3	TfNSW Carbon Estimate & Reporting Tool v2.1	5.97
	Handrails	Stainless steel (hollow) Diameter = 6.5cm Assume hollow and thickness of 0.5cm Volume = 1.77m3 Density = 8050kg/m3 (7) Weight = 14.2t	900.00	m	2.91	tCO2-e/t	World Stainless Steel Forum (8)	41.32
Asphalt (Car park)	Hot mix, 0% Reclaimed Asphalt Pavement Thickness =12cm Density = 2.35t/m3	765.00	m2	65	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	14.02	
Workforce vehicles (to and from site)	Workforce travel to and from site	Workforce estimated to be 45 Unleaded petrol, Average fuel consumption of passenger vehicles 10.8L/100km (1) Average trip of 5km (10km roundtrip) per person per day Work 20 days/month, for 13 months	2.38	t CO2-e / KL	NGA Factors 2019	2.31	13	30.07
Transport of materials to site (Diesel)	Deliveries by road by floats for both sites for both delivery and general servicing & equipment = 14 trips  B-Double truck =1.61km/L (4)	Floats use diesel, distance travelled per trip = 10km	140.00	km	2.72	t CO2-e / KL	NGA Factors 2019	0.24

Transport emissions	Transport of materials to site (Unleaded)	<p>When vehicle is not a float, unleaded petrol is used, average distance travelled per trip = 10km</p> <p>Deliveries by road by unleaded vehicles for both sites for both delivery and general servicing &amp; equipment = 1681 trips</p> <p>Average fuel consumption of passenger vehicles 10.8L/100km (1)</p>	16,810.00	km	2.38	t CO2-e / KL	NGA Factors 2019	4.33
	Transport emissions for construction and demolition waste, and general waste	<p>Transport to landfill (EF assumes a distance of 50km)</p> <p>Average distance from both sites to Port Botany Transfer station - Veolia (accepts building and demolition waste) = 16.85km</p> <p>1 skip per week for construction and demolition waste - 6tonnes weight limit (6)</p> <p>General Waste 1x120L (120kg) per week for general waste for each site</p> <p>Site operates 5 days a week for 52 weeks (13 months)</p>	636.48	tonnes	6.45	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	1.38
	Transport emissions for recycling waste disposal	<p>Transport to recycling facility (EF assumes a distance of 22km)</p> <p>Average distance from both sites to Port Botany Transfer station - Veolia (accepts recycling) = 16.85km</p> <p>1x120L (120kg) per week for recycling waste for each site</p> <p>Site operates 5 days a week for 52 weeks (13 months)</p>	12.48	tonnes	2.838	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool	0.03
Waste Disposal	Emissions from waste degradation in landfill (lifetime emissions)	<p>Municipal solid waste 1x120L (120kg) per week for general waste for each site</p> <p>Site operates 5 days a week for 52 weeks (13 months)</p>	12.48	tonnes	1.4	tCO2-e/t	NGA Factors 2019	17.47
	Emissions from waste degradation in landfill (lifetime emissions)	<p>Construction and demolition waste 1 skip per week for construction and demolition waste - 6tonnes weight limit (6)</p> <p>Site operates 5 days a week for 52 weeks (13 months)</p>	624.00	tonnes	0.2	tCO2-e/t	NGA Factors 2019	124.80
<b>TOTAL</b>								<b>4,527.41</b>

**TOTAL CONSTRUCTION GHG EMISSIONS 4,793**

# Operational Greenhouse Gas Calculations

SCOPE 1								
Emission Source	Inclusion	Assumptions/Calculations	EF	Units	EF Source	tCO2e/month	Operation Period (months)	TOTAL Emissions (tCO2e)
Ferry Services	Diesel fuel use for vessels	Diesel consumed at 1.149L/km 36 vessel movements per day (one crossing every 20min over 12 hours) Trip distance = 2.5km Distance travelled per month = 2738km	2.72	t CO2-e / KL	NGA Factors 2019	8.56	600	5,136.66
	Berthing & refuelling	To and from Port Botany. Travel distance 2.7km (5.4km return) Diesel consumed at 1.149L/km	2.72	t CO2-e / KL	NGA Factors 2019	0.52	600	313.85
							<b>TOTAL</b>	<b>5,450.51</b>

SCOPE 2								
Emission Source	Inclusion	Assumptions/Calculations	EF	Units	EF Source	tCO2e/month	Operation Period (months)	TOTAL Emissions (tCO2e)
Grid Electricity	Berth-side charging facilities and wharf services such as ticket machines, timetables, CCTV and lighting.	Assume 15kWh/day for each wharf 30kWh/day total per day Worst case - no decarbonation of the grid	0.81	kgCO2-e/kWh	NGA Factors 2019	0.739125	600	443.475
							<b>TOTAL</b>	<b>443.48</b>

SCOPE 3								
Emission Source	Inclusion	Assumptions/ Calculations	EF	Unit	EF Source	tCO2e/month	Operation Period (months)	TOTAL Emissions (tCO2e)
Staff vehicles (to and from site)	Unleaded fuel use for passenger cars	Unleaded petrol 4 staff total travelling an average distance of 5km (10km roundtrip/day) =40km/day Average fuel consumption of passenger vehicles 10.8L/100km (1)	2.38	t CO2-e / KL	NGA Factors 2019	0.31	600	187.93
Transport - Waste Disposal (Landfill)	General waste from wharves and ferries	Transport of waste to landfill - EF based on 50km (TfNSW) - does not go directly between wharf and waste facility 2x120L (120kg) waste bins per wharf, disposed of daily	6.45	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	0.09417	600	56.502
Transport - Waste Disposal (Recycling)	General waste from wharves and ferries	Transport of waste to recycling centre - EF based on 22km (TfNSW) - does not go directly between wharf and waste facility 2x120L (120kg) recycling bins per wharf, disposed of daily	2.838	kg CO2-e/t	TfNSW Carbon Estimate & Reporting Tool v2.1	0.0414348	600	24.86088
Waste emissions	Emissions from waste degradation in landfill (lifetime emissions)	Municipal solid waste	1.4	tCO2-e/t	NGA Factors 2019	0.01022	600	6.132
							<b>TOTAL</b>	<b>275.43</b>

<b>TOTAL OPERATIONAL GHG EMISSIONS</b>	<b>6,169</b>
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