Golden Plains Wind Farm

Appendix C.9: Traffic Impact Assessment

Traffic Impact Assessment – Planning Permit Amendment PA1700266

Golden Plains Wind Farm

V181595

Prepared for

Golden Plains Wind Farm Management

19 March 2021

Cardno

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Executive Summary

This report presents a Traffic Impact Assessment to support an application to amend the Golden Plains Wind Farm Project's Planning Permit (PA1700266). Due to revised site configurations, the number of Wind Turbine Generators (WTGs) proposed has been decreased from the 228 assessed under the Project's Environment Effects Statement (EES) to 215. Additionally, the maximum rotor diameter of each WTG is proposed to be increased from 150m to 165m due to the reconfiguration of the overall wind turbine specifications. A contingency plan in relation to the sourcing of quarry materials has also been assessed, with Scenario 1 considering the on-site quarry is operational and Scenario 2 considering all materials must be externally sourced.

First and foremost, the change of the rotor diameter from 150m to 165m does not change the number of components required for each WTG, and therefore, the construction of the 215 WTG layout can be completed using a reduced number of components when compared to the 228 WTG layout. For each WTG, the hub height decreases by 7.5m and the overall height remains unchanged, resulting in only minor changes to the dimensions of existing componentry assessed under the EES.

The changed traffic conditions have been assessed, and the traffic impacts of the 215 WTG layout have been found to be less than those associated with the EES layout. As detailed above, due to the number of components for each WTG remaining unchanged, there is no change in overall traffic volumes required for delivery of each WTG.

A reduction in the number of WTGs results in a decrease in the overall trips required to the site from port by 640, and a decrease in over-size and over-mass (OSOM) vehicle trips to the site by 143 in comparison to the number assessed in the EES. This is a total decrease in vehicle movements of 783.

Further to the reduced number of vehicles required to transport WTG components, overall construction traffic generated to and from the Project site is decreased by 13,943 one-way trips under Scenario 1. This equates to a reduction of 18 trips per day, which is anticipated to have a reduced impact on the surrounding road network when compared to the traffic volumes assessed in the EES.

Under Scenario 2, there is an increase of 24,902 construction traffic vehicles to site when compared to the EES. This equates to an increase of around 32 vehicles per day. Despite the increase in traffic compared to the EES, it is anticipated that this can be appropriately managed under the Traffic Management Plan (TMP) developed by Cardno and Golden Plains Wind Farm Management (GPWFM).

Overall construction traffic generated within the Project site is decreased by 7,296 one-way trips This equates to a reduction of 13 trips per day, which is anticipated to have a reduced impact on the local road network within the Project site when compared to the traffic volumes assessed in the EES.

Overall decommissioning traffic generated to and from the Project site is decreased by 650 one-way trips, which is anticipated to have a reduced impact on the surrounding road network when compared to the traffic volumes assessed in the EES.

Overall decommissioning traffic generated within the Project site is decreased by 13,604 one-way trips, which is anticipated to have a reduced impact on the surrounding road network when compared to the traffic volumes assessed in the EES.

A comparison of previous and new Project site layouts showed that the general density and placement of WTGs in the 215 WTG scenario was favourable to decreased traffic movements and thus reduced impact on the local road network. In addition, the relocation of some WTGs allows for more centralised construction areas for workers and delivery vehicles, reducing the distances travelled within the site boundary whilst also reducing construction times and costs.

Table 1-1 Summary of Change in Traffic Movements

Type of Traffic Movement	No. Vehicle Movements (EES Layout)	No. Vehicle Movements (215 WTG Layout)		Change
		Scenario 1	Scenario 2	
WTG Component Deliveries from Port (including pilots)	13,680	12,897		Reduced by 783
OSOM Vehicle Movements from Port	2,508	2,365		Reduced by 143
General Construction Traffic (outside site boundary)	244,541	230,598	269,443	Reduced by 13,943 (S.1) Increased by 24,902 (S.2)
General Construction Traffic (within site boundary)	127,966	120,670		Reduced by 7,296
Decommissioning Traffic (outside site boundary)	11,400	10,750		Reduced by 650
Decommissioning Traffic (within site boundary)	238,585	224,981		Reduced by 13,604
TOTAL	**638,680**	**602,261**	**641,106**	**Reduced by 36,419 (S.1) Increased by 2,426 (S.2)**

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1 Introduction & Background

Cardno has been retained by Golden Plains Wind Farm Management (GPWFM) to assess traffic impacts related to the construction of the Golden Plains Wind Farm (the Project), and to specifically highlight the traffic generation and impacts on the road network arising from the transport of WTG componentry, general construction traffic and decommissioning traffic. This report will accompany GPWFM's application to amend Planning Permit PA1700266 to allow changes to the WTG layout, allow for an increase in maximum WTG rotor diameter and assess the impacts of sourcing all materials externally under a contingency plan. This Traffic Impact Assessment has been undertaken to assess whether:

1. *The traffic and transport impacts associated with the 215 WTG layout are generally in accordance with the impacts assessed under the EES;*
2. *The 215 WTG layout will result in any change in the level of impact or detriment when compared with the impacts assessed under the EES;*
3. *The increase in rotor diameter from 150m to 165m will result in any change to traffic and transport impacts; and*
4. *The sourcing of all materials externally under a contingency plan is viable and what would be the impact of implementing such measures on the internal and external road network.*

Cardno understands the traffic-related matters contemplated through the Project's EES, the Minister's Assessment of the EES and the conditions in the Planning Permit and acknowledges the issue of the Permit by the Minister for Planning (The Minister) for the Project.

The impacts considered through the EES are outlined in the Chapter 21 of the EES report and in the Traffic and Transport Report prepared by Jacobs and attached as Appendix R to the EES. Cardno now provides the following advice to assist with assessment of the proposed amendment of the Planning Permit.

We note that the proposed layout provides for 215 WTGs. The following assessment has been undertaken on this layout to assist the Minister in assessing GPWFM's submission.

Prior to the commencement of construction, Cardno and GPWFM will prepare a detailed Traffic Management Plan (TMP). The TMP will provide greater level of detail on the Project's anticipated impacts and will also finalise the key routes previously nominated by the Project to be used in delivering componentry or loads to the site.

1.1 Transport Routes

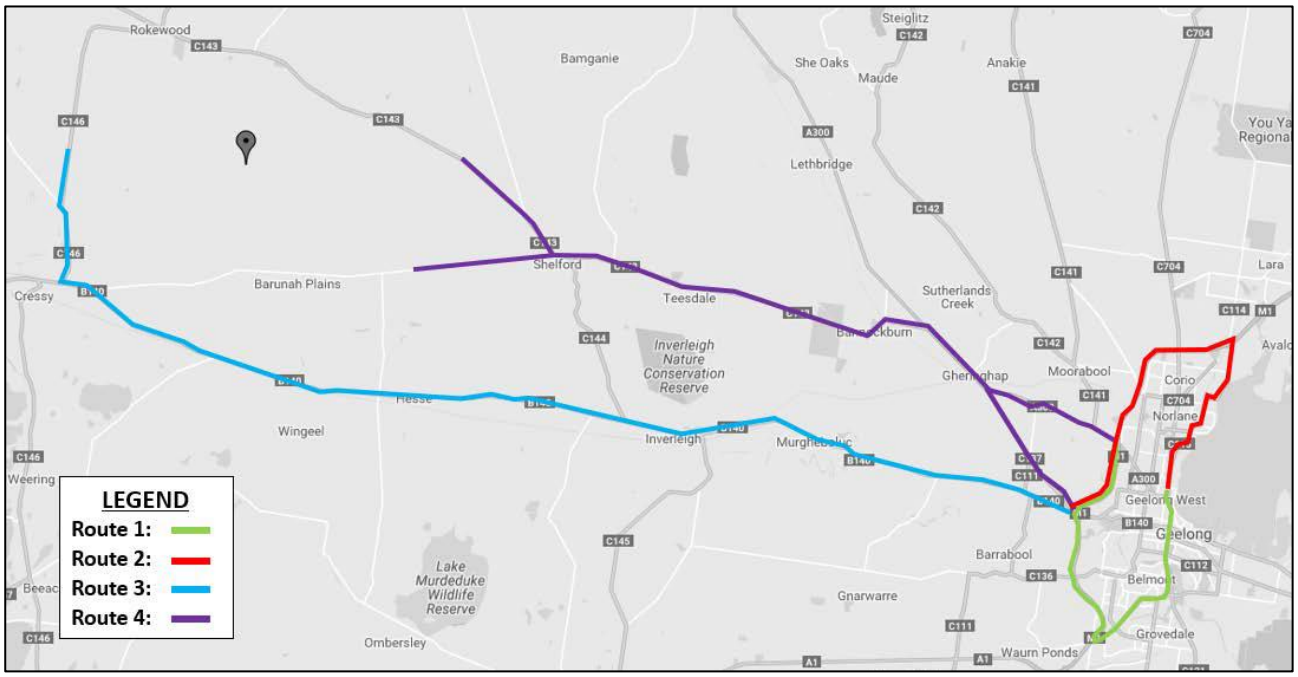
The EES and early assessments nominated potential routes to access the Project from the Port of Geelong. Routes 1 and 2 provide access from the Port to the Princes Freeway off-ramps, and Route 3 and 4 provide access from the Princes Freeway off-ramps to the Project site. The routes are illustrated in Figure 1-1 on the following page.

A summary of the proposed routes are as follows:

- **Route 1 – Port of Geelong to Princes Freeway (M1) via Waurn Ponds**
  - Proposed route: Start (The Esplanade / Langdon Street), Corio Quay Road, Princes Highway, Rossack Drive, Finish (Hamilton Highway / Midland Highway).
- **Route 2 – Port of Geelong to Princes Freeway (M1) via North Shore**
  - Proposed route: Start (The Esplanade / Langdon Street), Corio Quay Road, Arbery Road, Seabeach Parade, Shell Parade, Bell Street / Biddlecombe Avenue / Cummins Road or MacGregor Court, Finish (Princes Freeway).
- **Route 3 – Princes Freeway (M1) to the Project via Inverleigh**
  - Proposed route: Start (Princes Freeway off-ramp), Hamilton Highway, Finish (Colac-Ballarat Road).
- **Route 4 – Princes Freeway (M1) to The Project via Shelford**
  - Proposed route: Start (Princes Freeway off-ramp), Hamilton Highway, Fyansford-Gheringhap Road, or straight to Midland Highway, Kelly Road / Geelong Road, Finish (Bannockburn-Shelford Road / Cressy-Shelford Road).

Final routes to the Project site will comprise of either Route 1 into Route 3, Route 1 into Route 4, Route 2 into Route 3, or Route 2 into Route 4 as can be seen in Figure 1-1.

Figure 1-1 Proposed Access Routes from the Port of Geelong to The Project.



Although the routes identified above have been considered in this assessment, the detailed modelling referred to in Section 2.4 does not allocate movements to a particular route and instead assesses the impacts associated with the overall number of movements required for the Project. The Project's Traffic Management Plan (TMP) will include additional detail on the number of traffic movements per route and will be prepared in consultation with VicRoads and Golden Plains Shire Council.

2 Project's Traffic Impacts

2.1 WTG Specifications

A summary of the proposed WTG specifications is detailed in Table 2-1 below.

Table 2-1 Turbine Specifications

	Current	Proposed	Net Change
Rotor Diameter (max)	150m	165m	(+15) meters
Hub Height	155m	147.5m	(-7.5) meters
Overall Height	230m	230m	No change

There is a proposed increase of 15m to the rotor diameter to allow for larger turbine blades which will be offset by a shorter hub height. This results in no change in the overall height of the WTG and no change in the number of components required for each WTG. It is noted that while the number of components remains unchanged, the height of each component may be subject to minor changes based on confirmation from GPWFM. The full breakdown of componentry details for the wind turbine generators is shown in Table 2-2.

The Project's Permit allows for up to 228 WTGs on the Project site, however due to changes to the site's configuration the number of WTGs proposed has been reduced to 215. The following assessment has been undertaken based on the 215 WTG layout. The impacts associated with the 215 WTG layout have been compared to the impacts associated with the 228 WTGs assessed under the EES.

The componentry required for the WTGs is shown in Table 2-2. It is the same regardless of whether the rotor diameter is 150m or 165m. It should be noted that the comparison has been undertaken with the same componentry assessed under the EES as per Jacobs Specialist Report - Traffic and Transport dated 8 January 2018.

Table 2-2 WTG Componentry Details (with or without 165m Rotor Diameter)

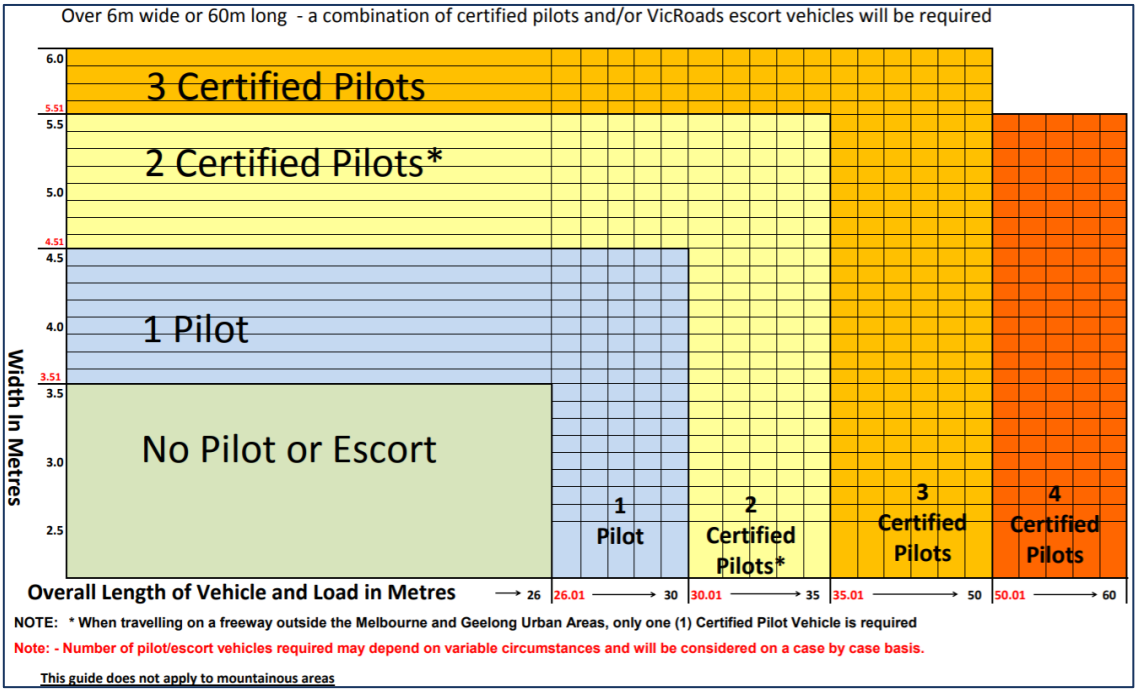
WTG Componentry	No Required per WTG	No. Required (215 WTGs)	No. Required (228 WTGs)	Summary of Proposed Change
Tower Mid-Section A	1	215	228	*Minor reduction in length of each section due to the reduced hub height.
Tower Mid-Section B	1	215	228	
Tower Mid-Section C	1	215	228	
Tower Mid-Section D	1	215	228	
Tower Mid-Section E	1	215	228	
Hub	1	215	228	No change.
Blade	3	645	684	Up to 7.5m increase in length per blade. Transport configuration to remain unchanged.
Nacelle	1	215	228	No change.
WTG Transformer	1	215	228	No change.

**Tower section to reduce by approximately 1-2 metres per section.*

2.2 Delivery Vehicle Requirements

VicRoads requires certified pilots to accompany the componentry oversized load delivery vehicles to maintain safety during transport. Figure 2-1 highlights the pilot vehicle requirements based on the length and width of the componentry being delivered.

Figure 2-1 VicRoads Certified Pilot Requirements for Oversized Loads



Each major component of the WTGs will require one prime mover and platform trailer, with the trailer type and size dependent on load.

Based on the information provided in Table 2-2 and Figure 2-1, the following pilot vehicle convoy and delivery vehicle requirements have been determined for each component delivered and is shown in Table 2-3. These figures are comparable to the pilot vehicle convoy and delivery vehicles assessed under the EES and 'Jacobs Specialist Report - Traffic and Transport' dated 8 January 2018.

Table 2-3 Delivery & Convoy Vehicles Requirements

WTG Componentry	Component Delivery Vehicles	Pilot Vehicles Required	Total Pilot Vehicles	Total Vehicles
Tower Mid-Section A	1	4 x Pilot, 1 x VMS	5	6
Tower Mid-Section B	1	4 x Pilot, 1 x VMS	5	6
Tower Mid-Section C	1	4 x Pilot, 1 x VMS	5	6
Tower Mid-Section D	1	4 x Pilot, 1 x VMS	5	6
Tower Mid-Section E	1	4 x Pilot, 1 x VMS	5	6
Hub	1	1 x Pilot	1	2
Blade	1	3x Pilot, 1 VMS, 1 VicRoads	5	6
Nacelle	1	3 x Pilot, 1 x VMS	4	5
WTG Transformer	1	1 x pilot, 1 x VMS	4	5

** VMS refers to Vehicle Mounted Signs*
***Pilot vehicle requirements to be further discussed with VicRoads*
****Worst case convoy requirements assumed if not confirmed currently*

2.3 Traffic Impact (OSOM)

As detailed in Section 2.1, the increase of the WTG rotor diameter from 150m to 165m does not impact on traffic conditions since the number of components is exactly the same. However, the reduced height of the Hub may result in less pilot vehicles being needed, which will result in a lower traffic impact, and will be assessed upon confirmation of the tower section dimensions. The following traffic impact does consider any reduction in pilot vehicle requirements and represents a conservative assessment, instead assuming that the same number of component delivery vehicles and accompanying pilot vehicles are needed for each WTG.

As previously discussed, 215 WTG's are proposed to be constructed as part of the Project. The total number of one-way trips generated during the delivery of the WTG components is shown in Table 2-4 below.

Table 2-4 Summary of Total Trips Required

WTG Componentry	Delivery vehicles	Pilot Vehicles	Total vehicles	Total Trips (228 WTGs)	Total Trips (215 WTGs)
Tower Mid-Section A	1	5	6	1,368	1,290
Tower Mid-Section B	1	5	6	1,368	1,290
Tower Mid-Section C	1	5	6	1,368	1,290
Tower Mid-Section D	1	5	6	1,368	1,290
Tower Mid-Section E	1	5	6	1,368	1,290
Hub	1	1	2	456	430
Blade	1	5	6	4,104	3,867
Nacelle	1	4	5	1,140	1,075
WTG Transformer	1	4	5	1,140	1,075
			Total	**13,680**	**12,897**

A total of 12,897 vehicle movements are required to deliver the components required for 215 WTGs. This is a reduction of 783 total (one-way) trips when compared with the 13,680 trips required to deliver components for the maximum number of 228 WTGs allowed under the Permit.

Based on a delivery schedule of 2 WTGs per week this will result in a total of around 100 one-way movements originating from the delivery port, 78 of which will support convoy vehicles and 22 of which will be WTG componentry delivery vehicles. The total number of OSOM loads required for delivery of WTG components is presented in Table 2-5.

Table 2-5 OSOM Loads

WTG Componentry	Number Per WTGs	Total Trips (228 WTGs)	Total Trips (215 WTGs)
Mid-Section A	1	228	215
Mid-Section B	1	228	215
Mid-Section C	1	228	215
Mid-Section D	1	228	215
Mid-Section E	1	228	215
Hub	1	228	215
Blade	3	684	215
Nacelle	1	228	215
WTG Transformer	1	228	215
Total		**2,508**	**2,365**

The Project's EES assessed the impact of **2,508** OSOM loads during the construction period. The total number of OSOM loads has decreased by 143 (or 5.7%) to **2,365**. A total of 12,897 vehicle movements are required to deliver the components required for 215 WTGs via Routes 1 to 4, with the final routes to be confirmed in the Project's TMP. This is a reduction of 783 total (one-way) trips when compared to the 13,680 trips required to deliver components for the maximum number of 228 WTGs assessed under the EES.

2.4 Traffic Generation (General Construction Traffic)

Construction traffic is generated by the delivery of materials, equipment, WTG components, as well as construction workforce travelling to and from the site.

Trucks that will be used for delivery purposes include concrete mixer trucks, B-Doubles, semitrailers, over-dimensioned (OD) trailers, truck and trailers and rigid trucks. The OD trailers will be the vehicles delivering the underground and overhead cables, power poles, temporary buildings, WTG tower sections, nacelles, hubs and blades.

OD vehicles fall under Class 3 of heavy vehicles, under the National Heavy Vehicle Regulator's (NHVR) Restricted Access Vehicle (RAV) category, of which covers vehicles operating under a notice or permit and vehicles operating under higher mass limits (HML) that can normally only access certain parts of the public road network. Class 3 heavy vehicles, with their loads combined generally do not comply with prescribed dimensions or mass requirements. The NHVR's prescribed dimensions for heavy vehicles can be found under the Heavy Vehicle (Mass, Dimension and Loading) National Regulation, and are as follows:

- 2.5m in width, (excluding rear vision mirrors, signalling devices and side-mounted lamps and reflectors anti-skid devices mounted on wheels, central tyre inflation systems, tyre pressure gauges permanently fixed webbing-assembly-type devices, such as curtain-side devices, provided that the maximum distance measured across the body including any part of the devices does not exceed 2.55m);
- 4.3m in height; and
- 19m in length.

OD vehicles required to transport the WTG components listed will need to obtain permits through NHVR to travel on the designed site routes using the public road network.

The following key assumptions have been adopted/developed to predict the construction traffic:

- Construction is anticipated to take four years;
- Construction is expected to commence in 2021 and end in 2024, with peak construction occurring in 2022. The maximum number of trips generated during the construction phase will occur during the peak construction year (2022);
- All construction tasks occur simultaneously, meaning there is overlap despite having different task durations;
- There are 20 working days per month;
- Unless stated in the assumptions column, there is an even split of vehicle trips across key routes to the site, as well as for all internal trips within the site; and
- A peak hour factor (PHF) of 40% (unless stated otherwise in the assumptions column) for midblock traffic impact assessment purposes is applied to the number of daily trips. This means that 40% of daily trips are expected to occur during peak hour(s).

For the overall traffic impact assessment, two scenarios have been considered for supplying quarry materials. Scenario 1 is the preferred solution and is being currently progressed by GPWFM, whilst Scenario 2 offers a conservative contingency plan should it be required. These scenarios are outlined below.

Scenario 1: Preferred strategy consisting of an on-site quarry plus local quarry

- Two quarries for the supply of rock and aggregates;
- Quarry 1 is being developed by GPWFM whilst Quarry 2 is being developed by a third-party on neighbouring land;
- Material sources under this scenario:
  - Crushed rock: Quarry 1 above
  - Concrete aggregates: Quarry 2 above
  - Sand: Maude Quarry and Hillview Sand
  - Cement: Geelong

Scenario 2: Contingency plan should neither on-site quarry be approved

- A list of all off-site quarries capable of supplying materials for the GPWF project are outlined below:
  - Crushed rock: Skipton Quarry, Dunnstown Quarry, Lethbridge Quarry, Anakie Quarry, Colac Quarry

- Concrete aggregates: Dunnstown Quarry, Colac Quarry, Anakie Quarry, Werribee Quarry
- Sand: Ararat Quarry, Grampians Quarry Stawell, Dunnstown Quarry, Moriac Quarry, Maude Quarry, Hillview Sand
- Cement: Port Melbourne, Geelong, Waurn Ponds

> For the purpose of this assessment, GPWFM have indicated their preferred quarry sources as the following;

- Crushed rock: Skipton quarry
- Aggregates: Anakie and Colac
- Sand: Maude Quarry and Hillview/You Yangs
- Cement: Geelong

Table 2-6 and Table 2-7 summarise the estimated traffic generated by the Project during the construction phase and are sourced from Jacobs Specialist Report - Traffic and Transport dated 8 January 2018. This is to provide comparable figures between the 215 WTGs and the 228 WTGs assessed during the EES.

Table 2-6 and Table 2-7 refer to Scenario 1 whilst Table 2-8 and Table 2-9 consider Scenario 2.

Table 2-6 Construction traffic estimates – one-way trips to/from the Project site only (Scenario 1)

Construction Task	Task Duration	Material	Qty. req. for 228 turbines	Qty. req. for 215 turbines	Diff.	Vehicle type(s) (L) - light, (H) - heavy	No. of daily trips by vehicle type (228 turbines)	No. of daily trips by vehicle type (215 turbines)	Diff.	Route (Origin)	Route (Destination)	Proportion of vehicles using route	Total no. of trips throughout task duration (228 turbines)	Total no. of trips throughout task duration (215 turbines)	Diff.	List of assumptions
Transport staff and management to site	4 years	People (pax)	200	189	11	Light weight service van (L), ute (L), private car (L)	200	189	11	Colac, S Approach	5 no. staff carparks (Adjacent to 4 no. concrete batching plants)	17%	192,000	181,053	10947	- Workflow is sourced from key employement centres e.g. Geelong, Ballarat, Colac and Melbourne, as well as townships within the vicinity of GPFW e.g. Meredith, Cressy, Skipton. - 1 staff per vehicle. - Even split of route proportions - Peak construction is expected to occur in 2020. - 100% of staff travel during peak hour periods. - 5 no. staff carparks and amenities are located adjacent to the 4 no. concrete batching plants
										Geelong, N Approach		17%				
										Geelong, S Approach		17%				
										Ballarat, N Approach		16%				
										Skipton, N Approach		16%				
										Lismore, S Approach		17%				
Public/private road upgrades	20 months	Transport gravel (t) from quarry to concrete batching plants	n/a	n/a	n/a	Truck & dog trailer (H)	n/a	n/a	n/a	Material is sourced on-site (quarry)	n/a	n/a	n/a	n/a	n/a	n/a
		Transport road material (t) from concrete batching plants	n/a	n/a	n/a	Truck & dog trailer (H)	n/a	n/a	n/a	From batching plants to all roads	n/a	n/a	n/a	n/a	n/a	
		Water (L)	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Rigid truck (H)	20	19	1	Geelong, N Approach	All roads within the site boundary	33%	8,000	7,544	456	- Assumed that: x4 water trucks transporting water to the site (5 times each throughout the day for this task)
										Ballarat, N Approach		67%				
Site establishment	2 months	Various	Various	Various	Various	Other HV (HV)	20	19	1	Geelong, N Approach	4 no. concrete batching plants	50%	800	754	46	- Extrapolated from the assumption that a 119 turbine wind farm (White Rock) requires approx. 1 month for site establishment and 10 daily trips
										Geelong, S Approach		50%				
Site access track, 4 no. batching plants and hardstand construction	22 months	Transport gravel (t) from quarry to batching plants	n/a	n/a	n/a	Truck & dog trailer (H)	n/a	n/a	n/a	Material is sourced on-site (quarry)	n/a	n/a	n/a	n/a	n/a	n/a
Dust Suppression	32 months	Water (L)	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Rigid truck (H)	20	19	1	Geelong, N Approach	All roads within the site boundary	33%	12,800	12,070	730	- Assumed that: x4 water trucks transporting water to the site (5 times each throughout the day for this task)
										Ballarat, N Approach		67%				
Turbine foundation excavation and construction	24 months	Sand (t)	143,640	135,450	8,190	B-Double (H)	11	10	1	Geelong, N Approach	4 no. concrete batching plants	25%	5,360	5,054	306	- Sand imported from a variety of locations east of the site. - Cement is imported from Geelong. - Concrete Ratio - 1:1.5:2 (Cement:Sand:Aggregate). - Assumed that the given amounts of cement, sand and aggregate for each turbine no. scenario is
										Geelong, S Approach		75%				
		Cement (t)	95,760	90,300	5,460	RAV 2 - B-Double (H)	6	6	0	Geelong, S Approach		100%	2,946	2,778	168	
		Water (L)	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Rigid truck (H)	20	19	1	Geelong, N Approach	All roads within the site boundary	33%	9,600	9,053	547	- Assumed that: x4 water trucks transporting water to the site (5 times each throughout the day for this task)
										Ballarat, N Approach		67%				
		Transport aggregate (t) from quarry to batching plants	n/a	n/a	n/a	Truck & dog trailer (H)	n/a	n/a	n/a	Material is sourced on-site (quarry)	n/a	n/a	n/a	n/a	n/a	n/a
		Transport mixed concrete (t)	n/a	n/a	n/a	Concrete agitator (H)	n/a	n/a	n/a	From batching plant to each turbine location	n/a	n/a	n/a	n/a	n/a	
		Foundation steel (t)	7,469	7,043	426	Semi-trailer (H)	Delivery not on a daily basis	Delivery not on a daily basis	Delivery not on a daily basis	Geelong, S Approach	All roads within the site boundary	100%	453	427	26	- Assumed that steel is imported from Geelong.
Electrical infrastructure construction	30 months	Cables underground and overhead (spindles)	300	283	17	OD Vehicle (H)	Delivery not on a daily basis	Delivery not on a daily basis	Delivery not on a daily basis	Geelong, S Approach	Gilletts Rd, Colac-Ballarat Rd, Kennersleys Rd, Geggies Rd, Bells Rd (collector stations, terminal station and 132kv pole line route)	100%	10	9	1	- Assumed that: x3 cable spindles equals one delivery, and that the main transformer for the terminal station is assumed to require only one delivery by an OD vehicle. - Electrical infrastructure material quantities have been extrapolated from the electrical requirements for a 150 turbine wind farm. - Extrapolated from the assumption that a 119 turbine wind farm requires approx. 15 months to construct electrical infrastructure.
		Main transformer (500:220kV)	1	1	0								1	1	0	
		Overhead power pole sections (t)	331	312	19	Semi-trailer (H)	1	1	0				20	19	1	
		Power pole footing steel (t)	372	351	21								23	22	1	
		Terminal/collector station foundation steel (t)	703	663	40								43	41	2	
		Terminal/collector station equipment (t)	4,419	4,167	252								268	253	15	
		Sand (t)	3,750	3,536	214	B-Double (H)	Delivery not on a daily basis	Delivery not on a daily basis	Delivery not on a daily basis	Geelong, N Approach	4 no. concrete batching plants	25%	140	132	8	- Assumed that: sand is imported from a variety of locations east of the site e.g. Bacchus Marsh, Maude and Batesford. - Assumed that: the concrete ratio is 1:1.5:2 (Cement:Sand:Aggregate). - Assumed that: the given amounts of cement, sand and aggregate for each turbine no. scenario is
										Geelong, S Approach		75%				
		Cement (t)	2,500	2,357	143	RAV 2 - B-Double (H)	Delivery not on a daily basis	Delivery not on a daily basis	Delivery not on a daily basis	Geelong, S Approach		100%	77	73	4	
		Water (L)	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Rigid truck (H)	20	19	1	Geelong, N Approach	All roads within the site boundary	33%	12,000	11,316	684	- Assumed that: x4 water trucks transporting water to the site (5 times each throughout the day for this task)
										Ballarat, N Approach		67%				
		Transport gravel (t) from quarry to batching plants	n/a	n/a	n/a	Truck & dog trailer (H)	n/a	n/a	n/a	Material is sourced on-site (quarry)	n/a	n/a	n/a	n/a	n/a	n/a
		Transport mixed concrete (t) for power pole footing and substation foundation	n/a	n/a	n/a	Concrete agitator (H)	n/a	n/a	n/a	From batching plant to each turbine location	n/a	n/a	n/a	n/a	n/a	
						TOTAL	**318**	**300**	**18**			**TOTAL**	**244541**	**230598**	**13943**	

Table 2-7 Construction traffic estimates – one-way trips within the Project site only (Scenario 1)

Construction Task	Task Duration	Material	Qty. req. for 228 turbines	Qty. req. for 215 turbines	Diff.	Vehicle type(s) (L) - light, (H) - heavy	No. of daily trips by vehicle type (228 turbines)	No. of daily trips by vehicle type (215 turbines)	Diff.	Route (Origin)	Route (Destination)	Proportion of vehicles using route	Total no. of trips throughout task durection (228 turbines)	Total no. of trips throughout task durection (215 turbines)	Diff.	List of assumptions
Public/rpviate road upgrades (regular maintenance)	4 years	Transport gravel (t) from quarry to batching plants	150,000	141,447	8,553	Truck & dog trailer (H)	5	5	0	Skipton	Zone 1	19%	4,918	4,638	280	- Assumed that for 100km of local gravel roads (5m wide) requires 50mm gravel topping for maintenance (annually over a 4-year construction period). - With an assumed density of 1.5, the amount of gravel required per year is 37,500t or 35,691t (150,000t or 142,673t over 4 years).
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
Site access track, 4 no. batching plants and hardstand construction	22 months	Transport gravel (t) from quarry to all roads	773,115	729,034	44,081	Truck & dog trailer (H)	58	55	3	Skipton	Zone 1	19%	25,348	23,903	1,445	- Assumed that: the given weights of gravel is required for access track, batching plant and hardstand construction respectively.
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
Turbine foundation excavation and construction	24 months	Transport aggregate (t) from quarry to batching plants	191,520	180,600	10,920	Truck & dog trailer (H)	13	12	1	Anakie (50%) & Colac (50%)	4 no. concrete batching plants	n/a	6,279	5,921	358	- Assumed that: the given weights for cement, sand and aggregate is required for making concrete for turbine foundations.
		Transport topsoil removal (t) from turbine locations to quarry (to fill)	273,600	258,000	15,600	Truck & dog trailer (H)	19	18	1	Zone 1	On-site Quarry	n/a	8,970	8,459	511	- Assumed that: 300m3 of soil is removed per foundation. The assumed density of soil is 2000kg/m3.
										Zone 2						
										Zone 3						
										Zone 4						
		Transport mixed concrete (t)	328,320	309,600	18,720	Concrete agitator (H)	31	29	2	4 no. concrete batching plants	Zone 1	19%	14,657	13,821	836	- Assumed that: 600m3 of reinforced concrete is required per foundation. The density of reinforced concrete is 2400 kg/m3.
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
Elecrtical infrastructure construction (including a substation)	30 months	Transport aggregate (t) from quarry to batching plants	141,752	133,670	8,082	Truck & dog trailer (H)	8	8	0	Anakie (50%) & Colac (50%)	4 no. concrete batching plants	n/a	4,648	4,383	265	- Assumed that: the given weight of aggregate is required for making concrete, in addition to 33,152t + 103,600t of aggregate required for the terminal station and construction areas/collector stations
		Transport mixed concrete (t) for power pole footing and substation foundation	10,000	9,430	570	Concrete agitator (H)	1	1	0	4 no. concrete batching plants	4 no. collector stations and 1 no. terminal station	n/a	446	421	25	- Assumed that: the given weight of concrete is required for electrical infrastructure construction
Turbine erection	24 months	Vehicles to erect turbines	11,500	10,844	656	Other HV (HV)	24	23	1	n/a	Zone 1	19%	11,500	10,844	656	- Assumed that: 50 vehicles are required to erect 1 turbine (refer to turbine OEM transport specifications).
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
Transport water (general)	32 months	Water (L)	Sourced from x3 standpipes	Sourced from x3 standpipes	Sourced from x3 standpipes	Rigid Truck (H)	80	75	5	n/a	Zone 1	19%	51,200	48,281	2,919	- x4 water trucks transporting water to the site (20 times each throughout the day for this task).
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
						TOTAL	**239**	**226**	**13**			**TOTAL**	**127,966**	**120,670**	**7,296**	

Table 2-8 Construction traffic estimates – one-way trips to/from the Project site only (Scenario 2)

Construction Task	Task Duration	Material	Qty. req. for 228 turbines	Qty. req. for 215 turbines	Diff.	Vehicle type(s) (L) - light, (H) - heavy	No. of daily trips by vehicle type (228 turbines)	No. of daily trips by vehicle type (215 turbines)	Diff.	Route (Origin)	Route (Destination)	Proportion of vehicles using route	Total no. of trips throughout task duration (228 turbines)	Total no. of trips throughout task duration (215 turbines)	Diff.	List of assumptions
Transport staff and management to site	4 years	People (pax)	200	189	11	Light weight service van (L), ute (L), private car (L)	200	189	11	Colac, S Approach	5 no. staff carparks (Adjacent to 4 no. concrete batching plants)	17%	192,000	181,053	10947	- Workflow is sourced from key employement centres e.g. Geelong, Ballarat, Colac and Melbourne, as well as townships within the vicinity of GPFW e.g. Meredith, Cressy, Skipton. - 1 staff per vehicle. - Even split of route proportions - Peak construction is expected to occur in 2020. - 100% of staff travel during peak hour periods. - 5 no. staff carparks and amenities are located adjacent to the 4 no. concrete batching plants
										Geelong, N Approach		17%				
										Geelong, S Approach		17%				
										Ballarat, N Approach		16%				
										Skipton, N Approach		16%				
										Lismore, S Approach		17%				
Public/private road upgrades	20 months	Transport gravel (t) from quarry to concrete batching plants	150,000	141447	8552.6	Truck & dog trailer (H)	5	5	0	Skipton, N Approach	n/a	n/a	4,918	4,638	280	- Assumed that for 100km of local gravel roads (5m wide) requires 50mm gravel topping for maintenance (annually over a 4-year construction period). - With an assumed density of 1.5, the amount of gravel required per year is 37,500t or 35,691t (150,000t or 142,673t over 4 years).
		Transport road material (t) from concrete batching plants	n/a	n/a	n/a	Truck & dog trailer (H)	n/a	n/a	n/a	From batching plants to all roads	n/a	n/a	n/a	n/a	n/a	
		Water (L)	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Rigid truck (H)	20	19	1	Geelong, N Approach	All roads within the site boundary	33%	8,000	7,544	456	- Assumed that: x4 water trucks transporting water to the site (5 times each throughout the day for this task)
										Ballarat, N Approach		67%				
Site establishment	2 months	Various	Various	Various	Various	Other HV (HV)	20	19	1	Geelong, N Approach	4 no. concrete batching plants	50%	800	754	46	- Extrapolated from the assumption that a 119 turbine wind farm (White Rock) requires approx. 1 month for site establishment and 10 daily trips
										Geelong, S Approach		50%				
Site access track, 4 no. batching plants and hardstand construction	22 months	Transport gravel (t) from quarry to batching plants	773,115	729034	44,081	Truck & dog trailer (H)	58	55	3	Skipton, N Approach	n/a	n/a	25,348	23,903	1,445	- Assumed that: the given weights of gravel is required for acces track, batching plant and hardstand construction respectively.
Dust Suppression	32 months	Water (L)	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Rigid truck (H)	20	19	1	Geelong, N Approach	All roads within the site boundary	33%	12,800	12,070	730	- Assumed that: x4 water trucks transporting water to the site (5 times each throughout the day for this task)
										Ballarat, N Approach		67%				
Turbine foundation excavation and construction	24 months	Sand (t)	143,640	135,450	8,190	B-Double (H)	11	10	1	Maude, S Approach	4 no. concrete batching plants	50%	5,360	5,054	306	- Sand imported from a variety of locations east of the site. - Cement is imported from Geelong. - Concrete Ratio - 1:1.5:2 (Cement:Sand:Aggregate). - Assumed that the given amounts of cement, sand and aggregate for each turbine no. scenario is required for making concrete for turbine foundations
										You Yangs, S Approach		50%				
		Cement (t)	95,760	90,300	5,460	RAV 2 - B-Double (H)	6	6	0	Geelong, S Approach		100%	2,946	2,778	168	
		Water (L)	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Rigid truck (H)	20	19	1	Geelong, N Approach	All roads within the site boundary	33%	9,600	9,053	547	- Assumed that: x4 water trucks transporting water to the site (5 times each throughout the day for this task)
										Ballarat, N Approach		67%				
		Transport aggregate (t) from quarry to batching plants	191,520	180,600	10,920	Truck & dog trailer (H)	13	12	1	Anakie, S Approach	n/a	n/a	6,279	5,921	358	- Assumed that: the given weights for cement, sand and aggregate is required for making concrete for turbine foundations.
										Colac, S Approach						
		Transport mixed concrete (t)	n/a	n/a	n/a	Concrete agitator (H)	n/a	n/a	n/a	From batching plant to each turbine location	n/a	n/a	n/a	n/a	n/a	
		Foundation steel (t)	7,469	7,043	426	Semi-trailer (H)	Delivery not on a daily basis	Delivery not on a daily basis	Delivery not on a daily basis	Geelong, S Approach	All roads within the site boundary	100%	453	427	26	- Assumed that steel is imported from Geelong.
Electrical infrastructure construction	30 months	Cables underground and overhead (spindles)	300	283	17	OD Vehicle (H)	Delivery not on a daily basis	Delivery not on a daily basis	Delivery not on a daily basis	Geelong, S Approach	Gilletts Rd, Colac-Ballarat Rd, Kennersleys Rd, Geggies Rd, Bells Rd (collector stations, terminal station and 132kv pole line route)	100%	10	9	1	- Assumed that: x3 cable spindles equals one delivery, and that the main transformer for the terminal station is assumed to require only one delivery by an OD vehicle. - Electrical infrastructure material quantities have been extrapolated from the electrical requirements for a 150 turbine wind farm. - Extrapolated from the assumption that a 119 turbine wind farm requires approx. 15 months to construct electrical infrastructure.
		Main transformer (500:220kV)	1	1	0								1	1	0	
		Overhead power pole sections (t)	331	312	19	Semi-trailer (H)	1	1	0				20	19	1	
		Power pole footing steel (t)	372	351	21								23	22	1	
		Terminal/collector station foundation steel (t)	703	663	40								43	41	2	
		Terminal/collector station equipment (t)	4,419	4,167	252								268	253	15	
		Sand (t)	3,750	3,536	214	B-Double (H)	7	7	0	Maude, S Approach	4 no. concrete batching plants	50%	140	132	8	- Assumed that: sand is imported from a variety of locations east of the site e.g.Maude & You Yangs - Assumed that: the concrete ratio is 1:1.5:2 (Cement:Sand:Aggregate). - Assumed that: the given amounts of cement, sand and aggregate for each turbine no. scenario
										You Yangs, S Approach		50%				
		Cement (t)	2,500	2,357	143	RAV 2 - B-Double (H)	5	5	0	Geelong, S Approach		100%	77	73	4	
		Water (L)	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Sourced from x3 local standpipes	Rigid truck (H)	20	19	1	Geelong, N Approach	All roads within the site boundary	33%	12,000	11,316	684	- Assumed that: x4 water trucks transporting water to the site (5 times each throughout the day for this task)
										Ballarat, N Approach		67%				
		Transport aggregate (t) from quarry to batching plants	141,752	133,670	8,082	Truck & dog trailer (H)	8	8	0	Anakie (50%) & Colac (50%)	4 no. concrete batching plants	n/a	4,648	4,383	265	- Assumed that: the given weight of aggregate is required for making concrete, in addition to 33,152t + 103,600t of aggregate required for the terminal station and construction areas/collector stations
		Transport mixed concrete (t) for power pole footing and substation foundation	n/a	n/a	n/a	Concrete agitator (H)	n/a	n/a	n/a	From batching plant to each turbine location	n/a	n/a	n/a	n/a	n/a	
						TOTAL	**414**	**391**	**23**			**TOTAL**	**285,734**	**269,443**	**16291**	

Table 2-9 Construction traffic estimates – one-way trips within the Project site only (Scenario 2)

Construction Task	Task Duration	Material	Qty. req. for 228 turbines	Qty. req. for 215 turbines	Diff.	Vehicle type(s) (L) - light, (H) - heavy	No. of daily trips by vehicle type (228 turbines)	No. of daily trips by vehicle type (215 turbines)	Diff.	Route (Origin)	Route (Destination)	Proportion of vehicles using route	Total no. of trips throughout task durection (228 turbines)	Total no. of trips throughout task durection (215 turbines)	Diff.	List of assumptions
Public/rpviate road upgrades (regular maintenance)	4 years	Transport gravel (t) from quarry to batching plants	150,000	141,447	8,553	Truck & dog trailer (H)	5	5	0	Skipton	Zone 1	19%	4,918	4,638	280	- Assumed that for 100km of local gravel roads (5m wide) requires 50mm gravel topping for maintenance (annually over a 4-year construction period). - With an assumed density of 1.5, the amount of gravel required per year is 37,500t or 35,691t (150,000t or 142,673t over 4 years).
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
Site access track, 4 no. batching plants and hardstand construction	22 months	Transport gravel (t) from quarry to all roads	773,115	729,034	44,081	Truck & dog trailer (H)	58	55	3	Skipton	Zone 1	19%	25,348	23,903	1,445	- Assumed that: the given weights of gravel is required for access track, batching plant and hardstand construction respectively.
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
Turbine foundation excavation and construction	24 months	Transport aggregate (t) from quarry to batching plants	191,520	180,600	10,920	Truck & dog trailer (H)	13	12	1	Anakie (50%) & Colac (50%)	4 no. concrete batching plants	n/a	6,279	5,921	358	- Assumed that: the given weights for cement, sand and aggregate is required for making concrete for turbine foundations.
		Transport topsoil removal (t) from turbine locations to quarry (to fill)	273,600	258,000	15,600	Truck & dog trailer (H)	19	18	1	Zone 1	On-site Quarry	n/a	8,970	8,459	511	- Assumed that: 300m3 of soil is removed per foundation. The assumed density of soil is 2000kg/m3.
										Zone 2						
										Zone 3						
										Zone 4						
		Transport mixed concrete (t)	328,320	309,600	18,720	Concrete agitator (H)	31	29	2	4 no. concrete batching plants	Zone 1	19%	14,657	13,821	836	- Assumed that: 600m3 of reinforced concrete is required per foundation. The density of reinforced concrete is 2400 kg/m3.
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
Elecrtical infrastructure construction (including a substation)	30 months	Transport aggregate (t) from quarry to batching plants	141,752	133,670	8,082	Truck & dog trailer (H)	8	8	0	Anakie (50%) & Colac (50%)	4 no. concrete batching plants	n/a	4,648	4,383	265	- Assumed that: the given weight of aggregate is required for making concrete, in addition to 33,152t + 103,600t of aggregate required for the terminal station and construction areas/collector stations
		Transport mixed concrete (t) for pow er pole footing and substation foundation	10,000	9,430	570	Concrete agitator (H)	1	1	0	4 no. concrete batching plants	4 no. collector stations and 1 no. terminal station	n/a	446	421	25	- Assumed that: the given weight of concrete is required for electrical infrastructure construction
Turbine erection	24 months	Vehicles to erect turbines	11,500	10,844	656	Other HV (HV)	24	23	1	n/a	Zone 1	19%	11,500	10,844	656	- Assumed that: 50 vehicles are required to erect 1 turbine (refer to turbine OEM transport specifications).
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
Transport w ater (general)	32 months	Water (L)	Sourced from x3 standpipes	Sourced from x3 standpipes	Sourced from x3 standpipes	Rigid Truck (H)	80	75	5	n/a	Zone 1	19%	51,200	48,281	2,919	- x4 w ater trucks transporting w ater to the site (20 times each throughout the day for this task).
											Zone 2	17%				
											Zone 3	36%				
											Zone 4	29%				
						TOTAL	**239**	**226**	**13**			**TOTAL**	**127,966**	**120,670**	**7,296**	

NOTE: The values for the internal trips from Scenario 1 to Scenario 2 will not differ, only the percentage split of vehicles using access roads will be altered. More is discussed in Section 2.4.2.3.

2.4.2 General Construction Traffic Summary

2.4.2.1 Construction Traffic Generation to and from the Project Site – Scenario 1

A total of 230,598 vehicle movements will be required to and from the Project site during construction of the 215 WTGs (excluding OSOM). This is a reduction of 13,943 total (one-way) trips when compared with the 244,541 trips required during construction for the maximum number of 228 WTGs (EES conditions) allowed under the Permit. As such it is anticipated that a reduction in total vehicle movements during construction to and from the Project will reduce impacts on the road network when compared to the traffic volumes assessed in the EES.

Daily trips will be reduced by 18 trips per day to and from the Project with the reduction in WTGs to be constructed going from 228 to 215. As such, it is anticipated that a reduction in daily trips during construction will reduce the impact on the road network to and from when compared to the traffic volumes assessed in the EES.

2.4.2.2 Construction Traffic Generation to and from the Project Site – Scenario 2

A total of 269,443 vehicle movements (391 daily trips) will be required to and from the Project site during construction of the 215 WTGs (excluding OSOM) under Scenario 2. This is an increase of 24,902 total (one-way) trips when compared with the 244,541 trips required during the construction phase under the EES conditions. The increase in traffic movements on the network surrounding the site will be adequately managed via the TMP and agreements with VicRoads / DoT and local council.

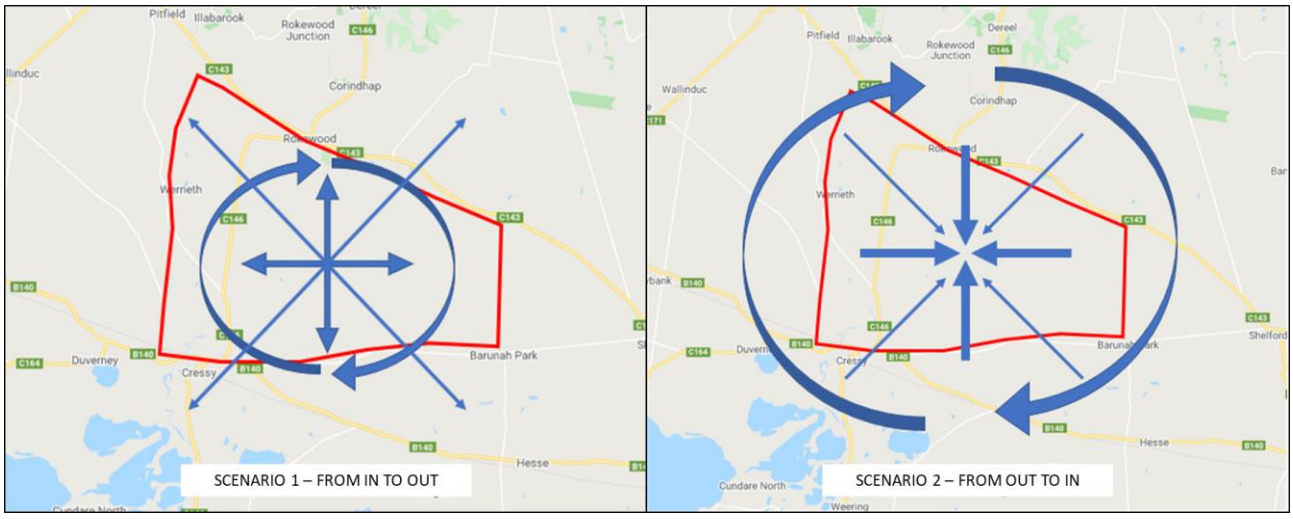
2.4.2.3 Construction Traffic Generation within the Project Site

A total of 120,670 vehicle movements will be required within the Project site during construction of the 215 WTGs (excluding OSOM). This is a reduction of 7,296 total (one-way) trips when compared with the 127,996 trips required during construction for the maximum number of 228 WTGs (EES conditions) allowed under the planning permit. As such it is anticipated that a reduction in total vehicle movements during construction will reduce the impact on the road network when compared to the traffic volumes assessed in the EES.

Daily trips will be reduced by 13 trips per day within the site during construction with the reduction in WTGs to be constructed going from 228 to 215. As such, it is anticipated that a reduction in daily trips will reduce the impact on the local road network when compared to the traffic volumes assessed in the EES.

Although the total number of trips will not differ from Scenario 1 to Scenario 2, it should be noted that their distribution on the internal network will be altered. Scenario 1 involves a centralised quarry and as such the more central access roads within the site will be utilised at a higher rate compared to the outer access roads. Scenario 2 will have an opposite trip distribution, with the outer access roads used more frequently than those located in the centre of the site. An assessment of the varied impact on the internal road network will be managed within the TMP. Figure 2-2 below gives a basic view of how the trip distribution will differ between Scenario 1 and Scenario 2.

Figure 2-2 Conceptual overview of difference in trip distribution of internal trips between Scenario 1 and Scenario 2.



2.5 Traffic generation (Decommissioning Traffic)

Table 2-10 and Table 2-11 summarise the estimated traffic generated by the Project during the decommissioning stage by: decommissioning task and task duration, material and quantity required to dismantle 228 WTGs as per the EES and 215 WTGs, vehicle type and number of daily trips (one-way), and the origins and categorised key routes to site.

The following key assumptions have been adopted as per Jacobs Specialist Report - Traffic and Transport dated 8 January 2018 to predict the decommissioning traffic and give a like for like comparison between the decommissioning of 228 and 215 WTGs:

- Decommissioning is anticipated to take up to four years, commencing 25 – 30 years after construction;
- The maximum number of trips generated during the decommissioning phase will occur during the 1st year;
- All decommissioning related tasks occur simultaneously, meaning that they overlap despite having different task durations;
- There are 20 working days per month;
- Unless stated in the assumptions column, there is an even split of vehicle trips across key routes to site, as well as for internal trips within the site;
- A peak hour factor (PHF) of 40% (unless stated otherwise in the assumptions column) for midblock traffic impact assessment purposes is applied to the number of daily trips, meaning that 40% of daily trips are expected to occur during peak hour(s);
- All WTGs are disassembled and delivered back to the Port of Geelong or the Port of Portland;
- All infrastructure is removed to allow for the remediation of land if required or requested by landholders, this includes electrical infrastructure, site establishment facilities, access tracks and hardstands;
- A portion of concrete (50%) will be removed from the surface of each WTG foundation and will be trucked to a concrete disposal facility located in Geelong;
- All electrical infrastructure and site establishment facilities are disassembled and delivered to the locations where they were sourced; and
- Public and private road upgrades will remain in situ.

Table 2-10 Decommissioning traffic estimates – one-way trips within the Project site only

Decommissioning Task	Task Duration	Material	Qty. req. for 228 turbines	Qty. req. for 215 turbines	Diff.	Vehicle type(s) (L) - light, (H) - heavy	No. of daily trips by vehicle type (228 turbines)	No. of daily trips by vehicle type (215 turbines)	Diff.	Route (Origin)	Route (Destination)	Proportion of vehicles using route	Total no. of trips throughout task duration (228 turbines)	Total no. of trips throughout task duration (215 turbines)	Diff.	List of assumptions
Turbine disassembly	24 months	Vehicles to disassemble turbines	11,400	10,750	650	Other HV (H)	24	23	1	Zone 1 Zone 2 Zone 3 Zone 4	n/a	n/a	11,400	10,750	650	- Assumed that: 50 vehicles are required to disassemble 1 turbine (Senvion transport specifications).
						TOTAL	**24**	**23**	**1**			**TOTAL**	**11,400**	**10,750**	**650**	

Table 2-11 Decommissioning traffic estimates – one-way trips to/from the Project site only

Decommissioning Task	Task Duration	Material	Qty. req. for 228 turbines	Qty. req. for 215 turbines	Diff.	Vehicle type(s) (L) - light, (H) - heavy	No. of daily trips by vehicle type (228 turbines)	No. of daily trips by vehicle type (215 turbines)	Diff.	Route (Destination)	Route (Origin)	Proportion of vehicles using route	Total no. of trips throughout task duration (228 turbines)	Total no. of trips throughout task duration (215 turbines)	Diff.	List of assumptions
Transport staff and management to site	4 years	People (pax)	200	189	10	Light weight service van (L), ute (L), private car (L)	200	189	10	5 no. staff carparks (Adjacent to 5 no. concrete batching plants)	Colac, S Approach Geelong, N Approach Geelong, S Approach Ballarat, N Approach Skipton, N Approach Lismore, S Approach	17% 17% 17% 16% 16% 17%	192,000	181,053	10947	- Workflow is sourced from key employement centres e.g. Geelong, Ballarat, Colac and Melbourne, as well as townships within the vicinity of GPFW e.g. Meredith, Cressy, Skipton. - 1 staff per vehicle. - Even split of route proportions - The first year of decommissioning is expected to occur in 2058 - 100% of staff travel during peak hour periods.
Take down site establishment	2 months	Various	Various	Various	Various	Other HV (HV)	20	19	1	5 no. concrete batching plants	Geelong, N Approach Geelong, S Approach	50% 50%	800	754	46	- Extrapolated from the assumption that a 119 turbine wind farm (White Rock) requires approx. 1 month for site establishment and 10 daily trips
Removal of access tracks, 5 no. batching plants and hardstand aggregate material	22 months	Transport aggregate (t) for disposal	773,115	729,034	44,081	Truck & dog trailer (H)	58	55	3	All roads within the site boundary	Geelong, N Approach	100%	25,348	23903	1445	- Assumed that aggregate is removed and trucked to Geelong for disposal
Turbine foundation (partial removal - 50)	24 months	Transport concrete that has been	164,160	154,800	9,360	Truck & dog trailer (H)	13	12	1	All roads within the site boundary	Geelong, N Approach Geelong, S Approach	25% 75%	6,025	5681	344	- Assumed that: 300m3 of reinforced concrete per foundation is removed and trucked to Geelong for disposal. Density of reinforced concrete is
Removal/return of all electrical infrastructure (part of concrete to remain in situ - 50)	30 months	Cables underground and overhead (spindles)	300	283	17	OD Vehicle (H)	Delivery not on a daily basis	Delivery not on a daily basis	Delivery not on a daily basis	Gilletts Rd, Colac-Ballarat Rd, Kennersleys Rd, Geggies Rd, Bells Rd (collector stations, terminal station and 132kv pole line route)	Geelong, S Approach	100%	10	9	1	- Assumed that: all electrical components are returned.
		Main transformer (500:132kV)	1	1	0								1	1	0	
		Overhead power pole sections (t)	331	312	19	Semi-trailer (H)	1	1	0				20	19	1	
		Power pole footing steel (t)	372	351	21								23	22	1	
		Terminal/collector station foundation steel (t)	703	663	40								43	41	2	
		Terminal/collector station equipment (t)	4,419	4167	252								268	253	15	
		Transport concrete that has been removed to disposal area (t)	5,000	4,715	285	Truck & dog trailer (H)	Delivery not on a daily basis	Delivery not on a daily basis	Delivery not on a daily basis		Geelong, N Approach Geelong, S Approach	25% 75%	187	174	13	- Assumed that: 5,000t of concrete is removed from electrical infrastructure and trucked to Geelong for disposal.
Return turbine components to the Port	12 months	Tower Sections	1,140	1,075	65	OD Vehicle (H)	12	11	1	Geelong, N Approach	All roads within the site boundary	50%	13,860	12,887	973	- Assumed that: all turbine components are returned to the Port
		Blades	684	645	39					Geelong, S Approach		50%				
		Hubs	228	215	13	Other HV (H)	48	45	3	Geelong, N Approach		50%				
		Nacelles	228	215	13					Geelong, S Approach		50%				
		Tranformers	228	215	13											
						Total	**352**	**332**	**20**			**Total**	**238,585**	**224,797**	**13,788**	

2.5.2 Summary – Decommissioning Traffic Generation to and from the Project Site Only

A total of 224,797 vehicle movements will be required to and from the Project during the decommission of the 215 WTGs. This is a reduction of 13,788 total (one-way) trips when compared with the 238,585 trips required during decommission for the maximum number of 228 WTGs allowed under the planning permit. As such it is anticipated that a reduction in total vehicle movements during decommission of the Project will reduce the impact on the road network when compared to the traffic volumes assessed in the EES.

Daily trips will be reduced by 20 trips per day to and from the Project with the reduction in WTGs to be constructed going from 228 to 215. As such, it is anticipated that a reduction in daily trips during decommission will reduce the impact on the road network to and from when compared to the traffic volumes assessed in the EES.

2.5.3 Summary – Decommissioning Traffic Generation within the Project Site Only

A total of 10,750 vehicle movements will be required within the Project during the decommission of the 215 WTGs. This is a reduction of 650 total (one-way) trips when compared with the 11,400 trips required during decommission for the maximum number of 228 WTGs allowed under the planning permit. As such it is anticipated that a reduction in total vehicle movements during decommission of the Project will reduce the impact on the road network when compared to the traffic volumes assessed in the EES.

Daily trips will be reduced by 1 trip per day within the Project with the reduction in WTGs to be constructed going from 228 to 215. As such, it is anticipated that a reduction in daily trips during decommission will reduce the impact on the road network to and from when compared to the traffic volumes assessed in the EES.

3 Traffic Network Impacts

To assess the impacts of the quarry transportation traffic on both the internal and external road networks, a traffic impact assessment has been undertaken. In doing so, some basic assumptions were made, including:

- Only one-way trips to/from site have been assessed;
- An even split of the material source should more than one quarry be required;
- Basic percentage splits were utilised when assessing where a route may diverge (i.e. where a route splits in two (2), the traffic split on each new road is assumed to be 50/50);
- In assessing the materials required to enable the electrical infrastructure construction phase, it was conservatively assumed that all turbines are being constructed simultaneously; and
- Where no current traffic volume data was available, it was assumed that an increase in traffic on these roads would be negligible based on the road locality and surrounding network data.

As the execution for Scenario 1 has already been assessed and accepted, this section will only assess the suitability of Scenario 2 to act as a contingency plan.

3.1 Overview of Internal Network

The internal road network within the GPWF site consists of 16 local roads which are used to facilitate movement to the WTG access roads from the VicRoads arterial roads.

3.2 Internal Network Impacts

To assess the impact quarry vehicles may have on the internal network under Scenario 2, it can be assumed that the vehicle distribution on access roads will be dependent on the numbers of WTGs required to be serviced. This is assuming that each WTG requires equal effort and materials to construct. A breakdown of the number of WTGs serviced by the internal access roads is highlighted in Table 3-1.

Table 3-1 Internal access road vehicle distribution as per WTG location

Road Name	Number of WTGs accessed	% of Total Traffic
Bells Road	54	25.1%
Geggies Road	51	23.7%
Wingeel Road	3	1.4%
Meadows Road	14	6.5%
Two Bridges Road	13	6.0%
Colac-Ballarat Road	13	6.0%
Gilletts Road	8	3.7%
Mill Road	11	5.1%
Kennersleys Road	1	0.5%
Rokewood-Skipton Road	2	0.9%
Boyles Road	45	20.9%
TOTAL	**215**	**100%**

It is important to note that the overall vehicle distribution will differ slightly from Scenario 1 to Scenario 2. This is a consequence of materials being externally sourced, resulting in less traffic for some internal roads in Scenario 2 compared to Scenario 1, in particular those used to directly access the on-site quarry, and more traffic on other internal roads in Scenario 2 compared to Scenario 1, in particular those which provide direct access to the external road network

3.3 Overview of External Network

The external road network consists of arterial roads (highways and main roads), municipal roads (link roads, collector roads and access roads) and some local access roads.

3.4 External Network Impacts

In order to assess the impact Scenario 2 will have on the external road network, the following process was undertaken:

- Identify the routes used to transport materials from each quarry (one-way only);
- As each quarry will have multiple destinations due to the size of the wind farm, this must be accounted for when assessing the route paths;
- Calculate the percentage of the total trips which use each road for each quarry;
- Combine these percentage splits where a material is sourced from multiple quarries; and
- Combine the total traffic on each road in the external network.

Scenario 2 considers that materials are sourced from six (6) quarries across Victoria's south-west within close proximity to the site. The materials required and their source location are as follows:

- Crushed rock: Skipton;
- Aggregates: Anakie and Colac;
- Sand: Maude Quarry and Hillview/You Yangs; and
- Cement: Geelong.

In following the process outlined above, along with the knowledge of the total daily trips required per material source, we are able to estimate the number of additional daily trips on each road in the external road network. Table 3-2 summarises the trip breakdown whilst Table 3-3 to 0 calculate the new daily trips.

Table 3-2 Trip breakdown per material

Material	Daily Trips
Crushed Rock	60
Aggregates	20
Sand	17
Cement	11

Table 3-3 Crushed rock new daily trips

Roads Used	% Split	Daily Trips
Rokewood-Skipton Rd	100%	60
Rokewood-Shelford Rd	50%	30
Colac-Ballarat Rd (north of Cressy)	50%	30

Table 3-4 Aggregates' new daily trips

ROADS USED	% SPLIT	DAILY TRIPS
Old Boundary Rd	100%	20
Carrs Rd	100%	20
Geelong-Ballan Rd	100%	20
Robbs Rd	100%	20
Steiglitz Rd	100%	20
Parker Rd	100%	20
Clyde Hill Rd	100%	20
Clyde Rd	100%	20
High St	100%	20
Bannockburn-Shelford Rd	100%	20
Lineens Rd	100%	20
Corangamite Lake Rd	100%	20
Coragulac-Beeac Rd	100%	20
Grassy Vale Rd	100%	20
Colac-Ballarat Rd (south of Cressy)	100%	20
Hamilton Hwy (between Colac-Ballarat Road East/West)	100%	20
Rokewood-Shelford Rd	37.5%	7.5
Cressy-Shelford Rd	50%	10
Rokewood-Skipton Rd	25%	5
Colac-Ballarat Rd (north of Cressy)	37.5%	7.5

Table 3-5 Cement new daily trips

ROADS USED	% SPLIT	DAILY TRIPS
Hamilton Hwy (east Barwon Park Rd)	100%	11
Hamilton Hwy (west Barwon Park Rd)	50%	5.5
Inverleigh-Shelford Rd	50%	5.5
Rokewood-Shelford Rd	25%	2.75
Colac-Ballarat Rd (north of Cressy)	25%	2.75
Cressy-Shelford Rd	50%	5.5
Rokewood-Skipton Rd	50%	5.5

Table 3-6 Sand new daily trips

ROADS USED	% SPLIT	DAILY TRIPS
Maude-She Oaks Rd	100%	17
Sharp Rd	100%	17
Midland Hwy	100%	17
Green Tent Rd	100%	17
Meredith-Shelford Rd	100%	17
Sandy Creek Rd	100%	17
Forest Rd N	100%	17
Windermere Rd	100%	17
Bacchus Marsh-Geelong Rd	100%	17
Staceys Rd	100%	17
Geelong-Ballan Rd	100%	17
Robbs Rd	100%	17
Steiglitz Rd	100%	17
Parker Rd	100%	17
Clyde Hill Rd	100%	17
Clyde Rd	100%	17
High St	100%	17
Bannockburn-Shelford Rd	100%	17
Rokewood-Shelford Rd	50%	8.5
Cressy-Shelford Rd	50%	8.5
Rokewood-Skipton Rd	25%	4.25
Colac-Ballarat Rd (north of Cressy)	25%	4.25

To assess the overall impact of the new daily trips on the external road network, we can compare these with the current AADTs (where applicable) and determine the percentage increase in traffic. From these increases, we can determine whether the impact is of significance or can be deemed negligible. Table 3-7 outlines these changes per road in the external network.

Table 3-7 Quarry road traffic volume data

Road Name	Road at Start	Road at End	Existing AADT	Quarry Traffic	AADT % Increase
Rokewood-Skipton Rd	***Skipton Quarry***	Lismore-Scarsdale Rd	440	75	17.0%
	Lismore-Scarsdale Rd	Pitfield-Scarsdale Rd	422		17.7%
	Pitfield-Scarsdale Rd	Reservoir Rd	404		18.5%
	Reservoir Rd	Colac-Ballarat Rd	404		18.5%
Rokewood-Shelford Rd	Colac-Ballarat Rd	Karuc-A-Ruc Rd	614	49	7.9%
	Karuc-A-Ruc Rd	Inverleigh-Shelford Rd	491		9.9%
Colac-Ballarat Rd (north of Cressy)	Rokewood-Skipton Rd	Morris Rd	1200	45	3.7%
	Morris Rd	Hamilton Hwy	323		13.8%
Hamilton Hwy	Colac-Ballarat Rd (east)	Colac-Ballarat Rd (west)	1400	20	1.4%
	Inverleigh-Shelford Rd	Colac-Ballarat Rd (east)	1700	6	0.3%
	Phillips Rd	Inverleigh-Shelford Rd	1700	11	0.6%
	Inverleigh-Winchelsea Rd	Phillips Rd	1800		0.6%
	Dunhill Court	Inverleigh-Winchelsea Rd	2000		0.6%
	Geelong Quarry	Dunhill Court	2600		0.4%
Colac-Ballarat Rd (south of Cressy)	Grassy Vale Rd	Synot St	440	20	4.5%
	Synot St	Hamilton Hwy	440		4.5%
Geelong-Ballan Rd	Robbs Rd	Staceys Rd	527	37	7.0%
	Carrs Road	Robbs Rd	527		7.0%
Inverleigh-Shelford Rd	Hamilton Hwy	Rokewood-Shelford Rd	187	17	9.1%
Bannockburn-Shelford Rd	Rokewood-Shelford Rd	Burnside Rd	1800	37	2.1%
High St	Burnside Rd	Clyde Rd	4600	37	0.8%
Clyde Rd	High St	Midland Hwy	n/a	37	n/a
Clyde Hill Rd	Midland Hwy	Parker Rd	n/a	37	n/a
Parker Rd	Clyde Hill Rd	Steiglitz Rd	n/a	37	n/a
Steiglitz Rd	Parker Rd	Robbs Rd	597	37	6.2%
Robbs Rd	Steiglitz Rd	Geelong-Ballan Rd	n/a	37	n/a
Staceys Rd	Geelong-Ballan Rd	Bacchus Marsh-Geelong Rd	n/a	17	n/a
Bacchus Marsh-Geelong Rd	Staceys Rd	Windermere Rd	6300	17	0.3%
Windermere Rd	Bacchus Marsh-Geelong Rd	Forest Rd N	n/a	17	n/a
Forest Rd N	Windermere Rd	Sandy Creek Rd	n/a	17	n/a
Sandy Creek Rd	***You Yangs Quarry***	Forest Rd N	n/a	17	n/a
Old Boundary Road	***Anakie Quarry***	Carrs Road	n/a	20	n/a
Carrs Road	Old Boundary Road	Geelong-Ballan Rd	n/a	20	n/a
Lineens Rd	***Colac Quarry***	Corangamite Lake Rd	786	20	2.5%
Corangamite Lake Rd	Lineens Rd	Coragulac-Beeac Rd	786	20	2.5%
Coragulac-Beeac Rd	Corangamite Lake Rd	Grassy Vale Rd	786	20	2.5%
Grassy Vale Rd	Coragulac-Beeac Rd	Colac-Ballarat Rd (south of Cressy)	786	20	2.5%
Cressy-Shelford Rd	Hamilton Hwy	Rokewood-Shelford Rd	n/a	24	n/a
Maude-She Oaks Rd	***Maude Quarry***	Sharp Rd	n/a	17	n/a
Sharp Rd	Maude-She Oaks Rd	Midland Hwy	n/a	17	n/a
Midland Hwy	Sharp Rd	Green Tent Rd	2900	17	0.6%
Green Tent Rd	Midland Hwy	Meredith-Shelford Rd	n/a	17	n/a
Meredith-Shelford Rd	Green Tent Rd	Bannockburn-Shelford Rd	n/a	17	n/a

As observed in Table 3-7, Scenario 2 results in an increase in the Average Annual Daily Traffic (AADT) volumes on roads in around the project site. However, a significant portion of these increase occur on VicRoads arterial routes including:

- Rokewood-Skipton Rd (17-18%);
- Rokewood-Shelford Rd (8-10%);
- Colac-Ballarat Rd (north of Cressy) (4-14%); and
- Inverleigh-Shelford Rd (~9%).

The increase experienced on these roads will not cause delays or disruptions along the route. The impacts associated with road surface and structure can be appropriately managed through the Project's TMP and agreements with VicRoads / DoT and local councils.

Where no existing traffic volumes are available, the traffic impacts along these routes can be deemed negligible.

4 The Project Site Layout Comparison

An assessment was undertaken to determine if the amended 215 WTG layout is generally in accordance with the plans referred to in the Condition 1 of the Permit. The key findings of the assessment are as follows:

- The use of Wingeel Road is significantly reduced, as a combined total of 12 WTGs will no longer be accessed via the entire length of Wingeel Road. In the 215 WTG scenario, Wingeel Road will only be used to access a total of 3 WTGs on a much smaller southern portion of the road with;
- 2 of these WTGs being relocated are accessed via existing access points on the southern portion of Bells Road;
- 2 WTGs with access via Boyles Road, north of Gilletts Road, have been removed, and as such Boyles Road will experience a small decrease in traffic when compared to the overall traffic generation in the area;
- The 215 WTG layout indicates that access routes are more centralised, resulting in less entry points along the main roads within the site boundaries, resulting in easier traffic coordination and less local routes undergoing degradation; and
- The 215 WTG layout scenario shows more centralised clusters of WTGs, whereas the 228 WTG scenario shows a much larger spread of WTGs across the site. This may result a more centralised area for construction workers and delivery vehicles to be based, resulting in reduced travel distances across the Project site.

5 Conclusions

Based upon Cardno's analysis, the following has been determined:

- Each WTG blade will increase in length by up to 7.5m, which will increase the rotor diameter from 150m to 165m, however the overall tip height of 230m remains unchanged. This is due to the reduced length of the tower sections, which will reduce the hub height from 155m to 147.5m;
  - The increase in blade length does not result in any change to transport configurations or pilot vehicle requirements, and hence has no effect on traffic and transport impacts; and
  - A decrease in the overall number of vehicle movements may be possible once dimensions of the tower sections are confirmed, as the reduced length of the tower sections may reduce pilot vehicle requirements.
- A total of 12,897 one-way or 25,794 two-way trips inclusive of convoy vehicles are anticipated to be generated for the delivery of the 215 WTGs (a reduction of 783 one-way and 1566 two-way trips from the original 228 WTG layout);
- A total of 2,365 one-way trips for overdimensional loads are anticipated to be generated for the delivery of the 215 WTGs (a reduction of 143 one-way trips from the original 228 WTG layout);
- A total of 230,598 movements will be required to and from the Project site during construction of the 215 WTGs (a reduction of 13,943 one-way trips from the original 228 WTG layout);
- A total of 120,670 movements will be required within the Project site during decommission of the 215 WTGs (a reduction of 7,296 one-way trips from the original 228 WTG layout);
- A total of 224,797 movements will be required to and from the Project site during decommission of the 215 WTGs (a reduction of 13,788 one-way trips from the original 228 WTG layout);
- The overall impacts associated with transporting components for 215 WTGs from the Port of Geelong to the Project site are less than the impacts associated with transport of components for the permitted 228 WTGs;
- The overall impacts associated with construction and decommission for 215 WTGs are less than the impacts associated with the construction and decommission of the permitted 228 WTGs;
- The reconfigured and consolidated WTG layout will result in an overall net decrease in transport related impacts compared with the impacts considered by the EES and approved by the Minister under the Planning Permit; and
- Should the sourcing of materials not be possible as per Scenario 1 (all conclusion dot points as listed above), Scenario 2 would generate an additional 108 new daily trips (one-way);
  - 60 new daily trips for crushed rock;
  - 20 new daily trips for aggregates;
  - 17 new daily trips for sand; and
  - 10 new daily trips for cement.

  The additional trip generation that is likely to be generated onto the external road network to the project site is considered to have a negligible traffic impact on the existing road network.