

# Stockyard Hill Wind Farm Traffic Management Plan

## Final Report

November, 2008

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Stockyard Hill Wind Farm Pty Ltd


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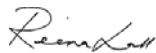
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## Executive summary

Parsons Brinckerhoff (PB) was commissioned by Stockyard Hill Wind Farm (SHWF) Pty Ltd to investigate the traffic implications arising out of the construction of the SHWF. This document provides a traffic impact assessment of the wind farm development and includes a route access plan which highlights the preferred routes for accessing the site.

A desktop study of the SHWF site was carried out prior to inspecting the site. A site inspection was undertaken on the 28 August 2008. The desktop study identified the most likely routes to be used for various types of vehicles for the construction of the wind farm. The routes comprise both VicRoads and Pyrenees Shire Council roads.

In order to be able to make a reasonable assessment of the sufficiency of various roads to carry extra traffic arising out of the SHWF construction, traffic volume data was sourced from VicRoads and Pyrenees Shire Council. The data suggests that:

- The primary connector roads are likely to have sufficient spare capacity to carry the extra traffic loading arising out of the wind farm construction.
- In general the local access roads have low traffic volumes and are considered able to carry the bulk of wind farm related traffic.

Possible geometric constraints to the transport of the raw materials and wind turbine components were identified during the site inspection, and have been noted. It was also observed that some roads have statutory truck restrictions in place.

The wind farm construction will comprise three stages of development. These are briefly described below:

- **Construction phase**, which would comprise activities such as:
  - Transport of people, materials and equipment to site
  - Civil works for access track construction, excavation for footings and trenching for cables.
- **Operation phase**
  - This phase is expected to generate less traffic than the other two phases. Only a minimal amount of traffic is likely to be generated and will pose no capacity concerns. However, the replacement of wind turbine generators or gearboxes would require a crane and low loader trucks to access the site. This could cause Over Dimensional (OD) vehicles to use the public road network.
- **Decommissioning phase**
  - Decommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the turbines.

During the construction phase, which is likely to occur over a four-year period, the development is likely to generate the following vehicle trips:

- Some 45,200 extra LMV's (Light Motor Vehicles)
- Some 39,200 regular trucks, and
- Some 4,100 OD trucks.

On a weekly basis, it is expected that there will be an extra 140 two-way trips generated per week. This traffic mix is expected to comprise approximately 10% OD vehicles, 50% employee traffic, and 40% 3-axle rigid tipper trucks.

Based on the above trip generation, all roads are expected to have sufficient capacity to carry the extra traffic volumes identified arising out of the construction of the wind farm facility.

Two potential routes were assessed, based on the constraints identified. The two route options differed only in relation to transport of the Wind Turbine Generator (WTG) components from Portland. The preferred route is described below:

- From Portland
  - The WTG components would be shipped via the Henty Highway up to Hamilton.
  - From Hamilton, trucks would use the Glenelg Highway to either:
    - Skipton township, onto Skipton Road to the site for turbines located east of Skipton Road and south of Lake Goldsmith, or
    - Via Eurambeen - Streatham Road to Geelong Road and Toppers Road to access turbines located west of Lake Goldsmith Road.
- From Ballarat, Buninyong and Dunnstown, the raw materials could be transported to the wind turbine locations via the following options:
  - Via the Glenelg Highway to Skipton. From Skipton northbound via Skipton Road to the wind farm site.
  - Via the Western Highway to Beaufort. From Beaufort southbound to the wind farm site.

One-way traffic management has been recommended as a transport solution to maximise the use of existing Pyrenees Shire roads within the SHWF site.

## **Key Conclusions**

Based on the desktop review and the subsequent site inspection, the following is concluded regarding the traffic impact of the proposed SHWF development and the subsequent route access plan:

- Traffic impact:
  - No capacity constraints are expected on the existing road network.
  - To cater for larger vehicles some upgrading of the existing intersections may be required prior to construction.
  - VicRoads managed arterials are considered geometrically adequate to carry the OD and other truck loading.

- Some Pyrenees Shire roads may require upgrades.
- Route Access Plan:
  - OD permits will be required from responsible authorities such as VicRoads and potentially, Pyrenees Shire Council.
  - Sections of Beaufort – Carranballac Road and Stockyard Hill Road that are currently subject to statutory truck restrictions should be utilised by SHWF related truck traffic. Preliminary discussions with Pyrenees Shire Council have indicated that Council would be amenable to issuing a permit to use these roads. This needs to be based on a maintenance arrangement to be agreed upon.
  - A detailed assessment of the nominated route(s) will be required prior to construction commencing. That would likely involve assessing horizontal and vertical geometry along the nominated route, as well as the load rating of the structures and mitigation measures, if any.

# 1. Introduction

## 1.1 Scope of report

Parsons Brinckerhoff (PB) was commissioned by Stockyard Hill Wind Farm Pty Ltd to investigate the traffic implications arising out of the construction of the SHWF. This document provides a traffic impact assessment of the wind farm development and includes:

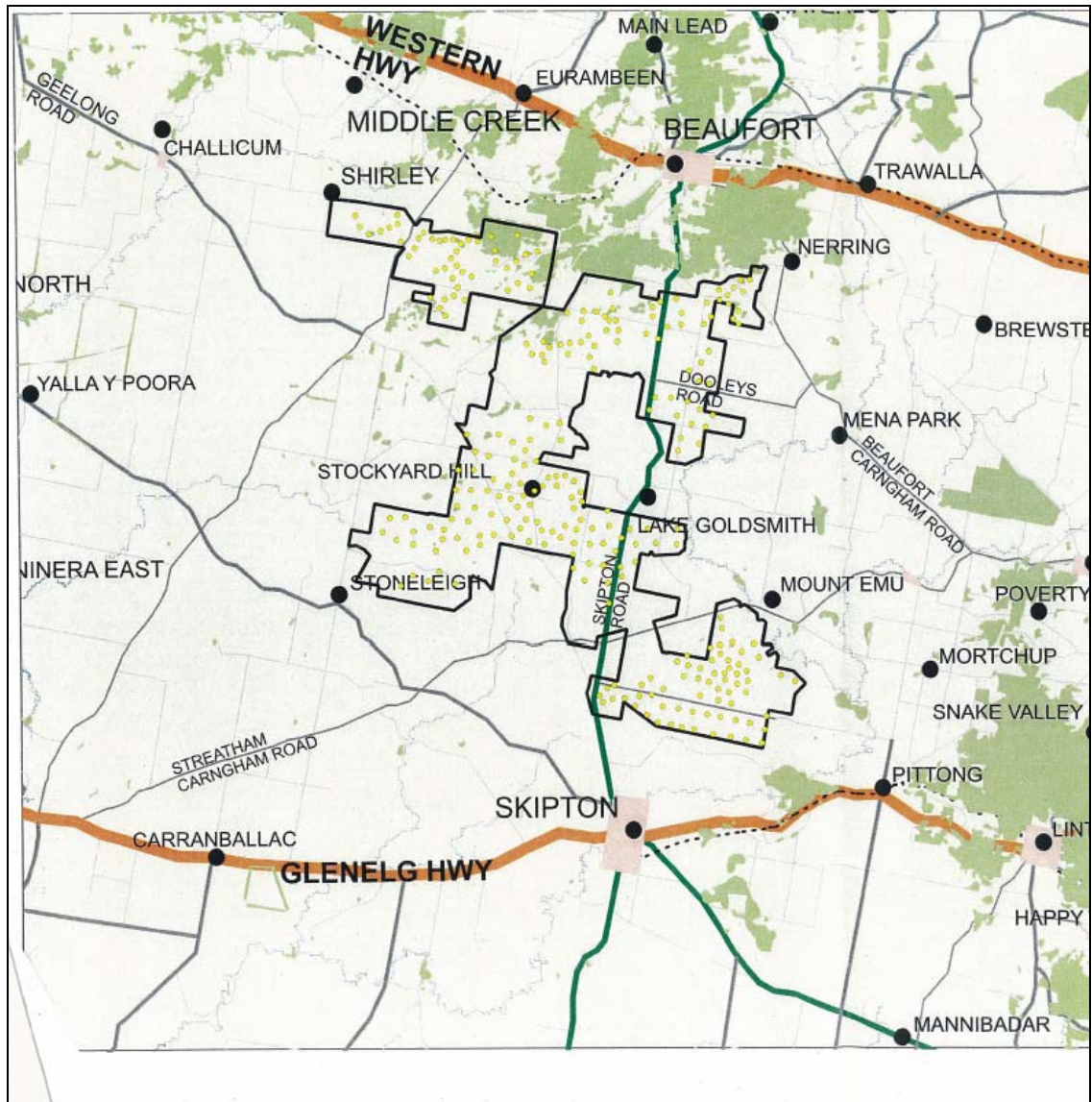
- Analysis of traffic generation associated with the wind farm development.
- Estimate of the impacts of the proposed development on the road network.

## 1.2 Background

The proposed SHWF site is expected to cover an area of approximately 250 square kilometres and will be located between the towns of Beaufort and Skipton, two and a half hours north-west of Melbourne. A general locality plan of the site is shown in Figure 1-1.

Overall, it is anticipated that the proposed wind farm will involve the construction, operation and decommissioning of:

- 242 wind turbine generators mounted on a steel tower with a hub height of 80m and rotor diameter of up to 104 m. The overall height is therefore 132 m, with a maximum blade length of 52m.
- Associated electrical infrastructure such as transformers and substation components.
- Electrical connections between wind turbines using a combination of underground cables and overhead concrete pole power lines.
- Two or more temporary concrete batching plants located on Streatham – Carngham Road near Skipton Road and on Stockyard-Wangatta Road.
- Access roads within the site and minor upgrades to local roads, as required for the installation and removal of the wind turbines.



(Source: ERM - Drawing no. 0081729\_01)

**Figure 1-1: Stockyard Hill Wind Farm Locality Plan (site boundaries are indicative only)**

## 2. Proposed development

The proposed wind farm site is located approximately 40 kilometres west of Ballarat. The Site straddles Skipton Road and is located between the towns of Beaufort and Skipton.

There are 242 turbines proposed for the Stockyard Hill Wind Farm.

The full development of the SHFW can be summarised into three phases:

- Phase 1: construction of the wind farm
- Phase 2: operation of the wind farm
- Phase 3: decommissioning of the wind farm.

A brief outline of activities involved in each stage is provided below. Information relating to each phase feeds into the calculations for traffic generation associated with the wind farm development.

### 2.1 Phase 1: Wind turbine construction and installation

It is expected that where possible, sands and aggregate will be sourced from excavation of footings, or from existing sand and gravel pits within the local area. Every effort should be made to source sands and aggregates locally from within the construction site to minimise transportation load on the public road network and potential upgrade of these roads at considerable capital cost.

The construction phase of the wind farm will include such activities as:

- Transport of people, materials and equipment to site
- Civil works for access track construction, excavation for footings and trenching for cables
- Establishment and operation of concrete batching plant and/or rock crushing equipment on site, if required
- Installation of wind turbines using large mobile cranes
- Construction of substation and onsite power reticulation lines and cables and
- Temporary site offices.

It is likely that construction will commence with the upgrading of roads and all other site civil works, including preparation of hardstand areas, and laying of cables. This will be followed by preparation of concrete footings, which must be cured for many weeks prior to construction of the wind turbines.

Wind turbine construction can be relatively fast once the footings are prepared, with wind turbines installed at a rate of 2 – 3 per week. The towers are erected in sections, the nacelles lifted to the top of the towers, and finally blades lifted and bolted to the hub.

Installation of the wind turbine blades would require establishment of a level (<1% gradient) and stable hardstand area at the base of each wind turbine. This hardstand area would support cranes used for the major component lifts, and could have an area of up to 30 metres by 30 metres. It is also necessary to have a delivery area for the various components

adjacent to the hardstand area, in most cases it is expected that the access road could be used as this delivery area.

### **2.1.1 Rock crusher**

Materials excavated during the construction of wind turbine footings may be able to be reused as road base for the road surface upgrades. For this purpose, it is possible that a mobile rock crusher would be used onsite.

### **2.1.2 Concrete batch plant**

It is likely that pre-mix concrete will be brought to the turbine locations from the on-site batch plants. However, a portable concrete batch may be required to supply concrete to each of the four quadrants of the wind farm site. This would require a level area of up to 100 metres by 100 metres on each site to locate the loading bays, hoppers, cement and admixture silos, concrete truck loading hardstand, water tank, and stockpiles for aggregate and sands.

Given the large footprint of the wind farm site, it is preferable to construct two or more batching plants on site to service the varied quadrants of the wind farm development.

## **2.2 Phase 2: Operation**

Following commissioning, the wind farm is expected to operate for an economic life of 25 years. It is not expected that phase 2 will generate any substantial employee traffic as only approximately 30 – 40 employees are expected to be on site. This extra traffic is expected to be carried by the existing road network.

### **2.2.1 Routine maintenance**

The wind farm will operate with minimal supervision but will require an operation and maintenance team for monitoring purposes.

In addition, regular maintenance is required for each turbine, generally at yearly intervals. Traffic mix will include eight to ten tonne trucks.

### **2.2.2 Major repairs**

Most repairs can be carried out in a similar manner to routine maintenance, with some exceptions:

- Replacement of wind turbine blades, if necessary, would require bringing new blades to site and installation of these blades using large cranes. The requirements are similar to the construction phase, and the access tracks established for construction may need to be brought into operation again, although helicopters may sometimes be used for one-off replacements.
- Replacement of wind turbine generators or gearboxes would require a crane and low loader truck to access the site.
- Replacement of the substation transformer would require a low loader truck to access the site.

## 2.3 Phase 3: De-commissioning

Decommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the turbines. No concrete batching plant or materials delivery would be required, therefore the decommissioning period would be significantly shortened and with significantly less truck movements than the construction phase.

## 3. Existing conditions

### 3.1 Feeder roads and key access

A desktop study of the SHWF site was carried out prior to inspecting the site. This desktop study identified the most likely routes to be used for various types of vehicles for the construction of the wind farm.

A site inspection was carried out on the 28 August 2008 to further assess the suitability of the key routes identified previously during the desktop study mentioned above. The results of this inspection are outlined in Table 3-1, Table 3-2, Table 3-6 and Table 3-7.

#### 3.1.1 Feeder roads to site

A number of State and Council roads will be utilised to carry the wind farm construction traffic. A schematic showing the likely transport routes is shown in Figure 3-1.

#### VicRoads arterials

Stockyard Hill's primary connector roads are listed in Table 3-1. All of these roads are Declared State Highways for which the Roads Corporation (VicRoads) is the Responsible Authority. In general, these roads are constructed to a higher standard than Council operated roads and are expected to carry a substantial portion of the wind farm's construction traffic. The WTG components are likely to be transported to site on these roads from Portland or the Port of Melbourne. However, the specifics of the route will be determined closer to project construction.

**Table 3-1: Primary connectors**

Road	Responsible authority	Condition	Number of lanes
Glenelg Highway	VicRoads	Sealed	1 each way
Skipton Road	VicRoads	Sealed	1 each way
Western Freeway/Highway	VicRoads	Sealed	1 each way

Neither Glenelg nor Western Highways will provide direct access to the site, however, it is expected that direct access will be required to Skipton Road at up to 12 locations. Discussion with VicRoads Western Region indicates that Skipton Road is covered by the Access Management Category - AMP 4, where:

*"Vehicular access to properties is permitted subject to safety considerations expressed as controls on type, spacing, location and design of turning movements in a higher speed and/or higher through traffic volume environment.<sup>1</sup>"*

Consequently, any direct access to Skipton Road would require assessment in terms of management of potential conflict, such as sight lines for turning / slowing vehicles. It is

<sup>1</sup> VicRoads Access Management Policies Version 1, Dec 2005, Table 1

expected that this will be addressed in the detailed Traffic Management Plan, once access locations are finalised. It should be noted that given the low traffic volumes along Skipton Road, ample opportunity for property access is expected.



**Figure 3-1: Transport routes**

### Pyrenees Shire Council roads

Council's access roads likely to be utilised in the transport to the Stockyard Hill Wind Farm site are listed in Table 3-2. All of these roads are under the care and management of the Pyrenees Shire Council. In general, these roads are constructed to a lower standard than State roads and have greater restrictions in relation to sight distances, turning radii, pavement bearing capacity and width of seal, and shoulder.

It is notable that Geelong Road is categorised as RDZ1 under the Pyrenees Planning Scheme between Middle Creek Road and Stockyard Hill Road, as is Skipton Road. As noted previously, Skipton Road is also a declared road; however Geelong Road is not, and is consequently the responsibility of the Pyrenees Shire.

Under Clause 36.04-1, section 2 of the Planning Scheme, a permit is required for the any works within the road zone. Consequently, a permit will be required for any access point to Geelong Road and Skipton Road. At this stage, it is estimated that there will be around ten access points required to Geelong Road. From the site inspection, there appears to be

ample locations for accesses along the road. It is expected that all access points will be designed to the satisfaction of the responsible authority.

**Table 3-2: Local access roads**

Road	Responsible authority	Condition	Number of lanes
Beaufort - Carranballac Road	Pyrenees Shire	Sealed & unsealed	1 each way
Carngham - Lake Goldsmith Road	Pyrenees Shire	Sealed	1 in total
Eurambien - Streatham Road	Pyrenees Shire	Sealed	1 each way
Geelong Road	Pyrenees Shire	Unsealed	1 in total
Mt William Road	Pyrenees Shire	Sealed & unsealed	1 each way
Stockyard Hill Road	Pyrenees Shire	Sealed & unsealed	1 each way
Stockyard Hill - Wangatta Road	Pyrenees Shire	Unsealed	1 in total
Streatham - Carngham Road	Pyrenees Shire	Unsealed	1 each way
Streatham – Mortchup - Mt Emu Road	Pyrenees Shire	Unsealed	1 in total

### 3.2 Key access route for wind turbine generators components

Trucks transporting WTG components such as the nacelles, hub, rotor, blades and tower sections are most likely to use the Henty Highway/Glenelg Highway and turn north at the Glenelg Highway/Skipton Road intersection.

This route has been used previously for the transport of the Waubra wind farm WTG components. The geometry has been assessed as being sufficient in terms of sight distance and road formation widths. However, the seal is poor at many places along various routes.

### 3.3 Key access route for raw materials

Raw materials to be used in the construction of the spread footings and the internal access tracks include cement, aggregate, sand, crushed rock and water. Likely access routes for transporting some of these raw materials to the Wind Farm site have been previously listed in Table 3-1 and Table 3-2.

#### 3.3.1 Cement

It is anticipated that cement will be delivered to the SHWF site from Ballarat via the Western Highway/Skipton Road and/or Glenelg Highway/Skipton Road. Cement trucks are then likely to utilise some or all of the local access roads listed in Table 3-2 to arrive at particular locations of construction.

### 3.3.2 Aggregate

Aggregate is expected to be sourced from quarries located in Dunnstown. In this case, aggregate may be delivered to Stockyard Hill via the Glenelg Highway or the Western Highway in conjunction with Skipton Road. Aggregate trucks are then likely to utilise some or all of the local access roads listed in Table 3-2 to arrive at particular locations of construction.

### 3.3.3 Sand

It is most probable that sand will be sourced from Buninyong, located approximately 10km south of Ballarat. If so, sand trucks may reach Stockyard Hill via Colac - Ballarat Road and then either the Glenelg Highway or the Western Highway together with Skipton Road.

### 3.3.4 Water

Given the large area of the SHWF site, negotiations will have to be carried out with farmers in proximity to the wind farm to determine the feasibility of obtaining water from them. It may become necessary to cart water in on water tankers from off site sources.

## 3.4 Access tracks

Onsite access tracks for construction and operation will be unsealed formations up to 5m in width, and are required to the base of each wind turbine location and the location of the substation and control building.

From this main access track, side tracks will be taken to each wind turbine location. At each wind turbine base, a firm hardstand area will be required to provide a level and stable base for cranes necessary for construction.

## 3.5 Traffic volumes

Existing two-way average annual daily traffic (AADT) volumes for all primary connector roads and local access roads identified in Sections 3.1.1 are detailed below.

### 3.5.1 VicRoads arterials

Historical traffic data for each primary connector road were sourced from VicRoads. Using this data the compound annual growth rate for each primary connector road has been calculated and is presented in Table 3-3. Based on the growth rates, traffic volumes for the year 2011 have then been estimated and are listed in Table 3-4.

The table shows the current **daily** volume, against the **hourly** capacity of the roads. The hourly volume is estimated to be around 10% of the daily volume.

All roads listed in Table 3-4 have substantial spare daily and hourly capacity.

**Table 3-3: Compound annual growth rates of traffic volumes without SHWF effects**

Primary connector roads	Compound annual growth rate
Western Freeway/Highway	2.6 %
Glenelg Highway	1.1 %
Skipton Road	1.4 %

**Table 3-4: Two-way average annual daily traffic volumes extrapolated to year 2011**

Primary connector roads	Estimated 2011 AADT (veh/day)	Roadway capacity both directions per hour (veh/hour)	Location of counting station
Western Highway/Freeway (two lanes two-way in vicinity of the SHWF site) 'A' road	4,400	2,800 <sup>2</sup>	Western Hwy west of Eurambeen
Glenelg Highway 'B' road	1,100	2,800 <sup>3</sup>	400m East of Pittong-Snake Valley Rd
Skipton Road 'C' road	1,000	1,960 (assume 30% reduction in capacity on account of terrain and classification of road)	North of Millars Road

### 3.5.2 Pyrenees Shire roads

2008 traffic volumes for each local access road were sourced from Pyrenees Shire Council. These volumes are presented in Table 3-5 below. Because the Council only has limited traffic data, the typical traffic growth rates on these local roads cannot be determined. In general traffic volumes on the local access roads are fairly low.

The table shows the current **daily** volume, against the **hourly** capacity of the roads. The hourly volume is estimated to be around 10% of the daily volume.

Clearly, all roads for which data is available have substantial spare daily and hourly capacity.

Those roads which vehicle data is not available are believed to exhibit traffic volumes in the range of the other roads for which traffic volume data is provided.

<sup>2</sup> Guide to traffic engineering practice part 2 – Roadway capacity

<sup>3</sup> Guide to traffic engineering practice part 2 – Roadway capacity

**Table 3-5: Two-way average annual daily traffic volumes on Pyrenees Council managed roads**

Local access road	2008 AADT <sup>4</sup> (veh/day)	Roadway capacity both directions per hour <sup>5</sup> (veh/hour)
Beaufort - Carranballac	No count available	< 1,000
Carngham-Lake Goldsmith Road	43	< 500
Eurambreen-Streatham Road	172	< 1,000
Geelong Road	No count available	< 500
Mt William Road	105	< 1,000
Stockyard Hill Road	34	< 1,000
Stockyard Hill -Wangatta Road	No count available	< 500
Streatham-Carngham Road	355	< 1,000
Streatham - Mortchup-Mt Emu Road	356	< 500

## 3.6 Restrictions

### 3.6.1 Truck restrictions

Statutory truck restrictions exist on some of the primary connector roads and local access roads identified in Table 3-2. These restrictions are described in Table 3-6, and were discovered during the site inspection.

**Table 3-6: Statutory truck restrictions**

Road name	Description of restriction
Beaufort – Carranballac Road	Trucks are banned between Thompsons Road intersection and Glenelg Road intersection
Skipton Road	Trucks are denied entry onto Skipton Road from the northern end
Streatham – Carngham Road	Trucks are banned between Glenelg Highway intersection and Mt Williams Road intersection

Discussions with the Asset Department at Pyrenees Shire Council have revealed that routes with the statutory truck restriction signs would still be able to carry over dimensional (OD) loads provided the contractor enters into an agreement with the Shire to assess maintenance requirements for the duration of the construction program.

### 3.6.2 Intersections

The sufficiency of key intersections has been assessed for the movement of the rigid tipper plus 3-axle dog tipper trailer combinations for the movement of raw materials. None of the intersections listed in Table 3-7 are expected to constrain the movement of raw materials. .

<sup>4</sup> Provided by Pyrenees Shire Council

<sup>5</sup> Table 3.6 of Guide to traffic engineering practice part 2 – Roadway capacity

However from the point of view of transporting the WTG components, these intersections may be deficient and would require further investigation prior to construction. These intersections have been listed in Table 3-7 below.

**Table 3-7: Deficient intersections**

Intersection
Glenelg Hwy/Skipton Rd
Mt William Rd/Streatham – Carngham Rd
Eurambeen – Streatham Rd/Meadows La
Eurambeen – Streatham Rd/Geelong Rd
Skipton Rd/Carngham – Lake Goldsmith Rd
Skipton Rd/Mt Emu/Settlement Rd
Skipton Rd/Stockyard Hill Rd
Mt William Rd/Skipton Rd

### 3.6.3 Narrow width roads

Of the Council roads identified in Table 3-2, a number have narrow width roads (i.e. under 4.5 metres wide) and may require one-way traffic management during construction of the Wind Farm. The narrow width roads were identified during the site inspection.

**Narrow width roads:**

- Beaufort – Carranballac Road
- Carngham – Lake Goldsmith Road
- Geelong Road
- Stockyard Hill Road
- Stockyard Hill – Wangatta Road
- Streatham – Carngham Road
- Streatham – Mortchup – Mt Emu Road.

## 4. Traffic impact

In order to determine the impact of traffic generated by the wind farm development on the road network, a two-step process has been considered.

Firstly, the traffic likely to be generated due to the SHWF is calculated. Then, this information is utilised to determine the impact on the road network.

### 4.1 Traffic generation

The traffic generation has been calculated using information provided in Section 3 and assumptions listed in Table 4-1. Table 4-2 gives the total expected traffic generation associated with the wind farm development.

Overall, it is expected that there will be an extra 140 two-way trips generated per week. This traffic mix is expected to comprise approximately 10% OD vehicles, 50% employee traffic, and 40% 3-axle rigid tipper trucks. It has also been assumed that of the total traffic demand (excluding OD trucks):

- 50% of traffic will use Streatham - Carngham Road to access the site
- 25% of traffic will use Eurambeen – Streatham Road to access the site
- 25% of traffic will use Skipton Road to access the site.

**Table 4-1: Assumptions used for traffic generation calculations**

Activity	Assumption
Raw materials	<ul style="list-style-type: none"> <li>▪ 23T three axle trucks will be used</li> <li>▪ 16,000 litre premium water tank on chassis will be used</li> <li>▪ two turbine foundations will be poured per week</li> <li>▪ two turbine foundations worth of material will be transported per week</li> </ul>
Access tracks	<ul style="list-style-type: none"> <li>▪ 20 km of pavement to be upgraded with crushed rock, say, black clay about 700 mm thick</li> <li>▪ the class 2 crushed rock will come from outside the SHWF site</li> <li>▪ 5km of crushed rock will be laid every week</li> <li>▪ the construction program will be 4 weeks prior to the first turbine footing being poured</li> </ul>
WTG components	<ul style="list-style-type: none"> <li>▪ 3 tower sections per turbine</li> <li>▪ 1 nacelle per turbine</li> <li>▪ 1 hub per turbine</li> <li>▪ 3 blades per turbine</li> <li>▪ 2 blades per truck</li> <li>▪ 1 generator transformer per truck</li> <li>▪ two complete turbines will be transported each week</li> </ul>
Employees	<ul style="list-style-type: none"> <li>▪ twenty light or 4WD vehicles will travel to and from each WTG 4 times/day</li> </ul>

Activity	Assumption
Substation, cables, overhead cables and transmission poles	<ul style="list-style-type: none"><li>▪ 300 transmission poles</li><li>▪ 300 trucks for carting electrical equipment and employees</li></ul>
Water	<ul style="list-style-type: none"><li>▪ In the event that an on-site batch plant is developed, water may need to be trucked in from off site. It is possible that, depending on water levels, water from existing dams on the property could be used to supplement water cartage (also see Section 3.3.4)</li></ul>

on stage traffic volumes due to the wind farm

	Quantity	Total two-way vehicle movements	Daily two-way vehicle movements assuming two turbines erected per week	Vehicle type
	36,900 t	3,600	30	3 axle rigid tipper truck
	107,400 t	10,400		3 axle rigid tipper truck
	57,800 t	5,600		3 axle rigid tipper truck
	30,700 KL	2,100		
	9,800 t	560	Nominal	3 axle rigid tipper truck
	66,600 cu m	13,200	20	3 axle rigid tipper truck
rol	4 trucks/day	1,200	15	
	Assumed to be sourced locally from footing excavation	Assumed to be sourced locally		
er	726	1452	6	OD truck
	242	484	2	OD truck
	242	484	2	OD truck
2/truck	726	726	2	OD truck
mers	242	484	2	
s	300	1,050	4	Semi trailer truck
ment	70	85	2	3 axle rigid tipper truck
	20 cars 4 times/day	45,200	70	4 WD
les		<b>45,200</b>	<b>70</b>	
		<b>37,000</b>	<b>60</b>	
		<b>4,700</b>	<b>10</b>	

## 4.2 Traffic impact on the surrounding network

Based on roadway capacities identified in Table 3-4 and Table 3-5, all roads will have sufficient capacity to carry the extra traffic volumes identified in Table 4-2.

The following assumptions that impact on the capacity of Council roads have been made:

- One-way traffic management could potentially be implemented to mitigate the requirement for expensive capital road improvements.
- Routes with statutory truck restrictions be made available for the transport of large trucks.

Further information regarding these issues is presented below:

### Impact on Council operated arterials

As per the VicRoads design guidelines, the requirements for shoulder lane and carriageway widths for roads are listed in Table 4-3. This table provides threshold levels for upgrading road formation widths. The anticipated traffic volumes on Council roads have been assessed against these threshold levels to determine need for upgrading the relevant roads.

**Table 4-3: VicRoads guidelines for road improvement intervention<sup>6</sup>**

AADT	Shoulder width (m)	Lane widths (m)
1 – 50	2.0	1 x 3.1
51 – 150	1.5	2 x 3.1
151 – 1500	1.5	2 x 3.1
1501 – 3000	2.0	2 x 3.5
3001 – 10000	2.5	2 x 3.5

Using routes with current truck restrictions is expected to keep the traffic volumes to within the threshold levels identified in Table 4-3 and avoid the need for possibly expensive capital investment.

Statutory truck restrictions have been observed on the following Council roads:

- Portions of Beaufort – Carranballac Road
- Stockyard Hill Road.

Preliminary discussions with Pyrenees Shire Council have indicated that Council would still be amenable to the use of these roads for the transport of the WTG and raw material trucks. This would be predicated on the contractor entering into agreement with Council for the ongoing maintenance of these roads for any damage caused on account of the SHWF related traffic.

Utilising the above roads is expected to keep traffic volumes generated by the wind farm facility to within capacity levels without the need for capital investment in road infrastructure.

<sup>6</sup> VicRoads road design guidelines part 3 – Cross section elements

If the above assumptions are utilised and the Council roads assessed against the information provided in Table 4-3, no capital investment into these roads is likely to be required.

### Impact on intersections

Based on on-site observations, the intersections listed in Table 4-4 are likely to be heavily loaded and may require upgrades and resurfacing. Determination of the intersections upgrade requirements would require further detailed work after the development permit for the proposed wind farm is granted.

**Table 4-4: Impact of heavy axle traffic on intersections**

Intersection
Glenelg Hwy/Skipton Rd
Mt William Rd/Streatham – Carngham Rd
Eurambeen – Streatham Rd/Meadows La
Eurambeen – Streatham Rd/Geelong Rd
Skipton Rd/Carngham – Lake Goldsmith Rd
Skipton Rd/Mt Emu/Settlement Rd
Skipton Rd/Stockyard Hill Rd
Mt William Rd/Skipton Rd

## 4.3 Operational phase traffic

During the operational phase of the wind farm, it is expected that a maintenance office will be located on Stockyard Hill Road, just south of Stockyard Hill – Wangatta Road. The office is expected to staff around 32 people, with provision of 40 parking spaces to be made available. Operation of the facility is primarily during business hours.

Given the current low traffic volumes, the road network would easily be able to cater for a traffic generation of the amount described above.

## 5. Route access plan

The route access plan has been developed to provide guidance on the most suitable route to transport the raw material and WTG components during the construction phase of the proposed SHWF wind farm.

### 5.1 Route selection criteria

An assessment was made of key potential transport route against a set of criteria. The criteria that were utilised in the assessment, and applied to heavy vehicles including over dimensional (OD) vehicles, are listed below:

- Designated bus routes
- Designated truck routes
- Road formation widths
- Condition of the riding surface
- Sight distances at intersections
- Availability of turning space at intersections
- Existing freight traffic on the relevant road network.

## 6. Constraints to route selection

A variety of constraints on the movement of vehicles was assessed during the site inspection of the 28 August 2008. These constraints are listed in the following sections. An assessment of the constraints has guided the development of the potential routes and the preferred route.

### 6.1 Designated bus routes

Pyrenees Shire Council has provided a map of designated bus routes. A schematic is shown in Appendix B. Within the SHWF site and west of Skipton Road, the bus routes run primarily along:

- Mount William Road from Skipton Road to Beaufort - Carranballac Road
- Beaufort Carranballac Road from Streatham - Carngham Road to Skipton Road.

East of Skipton Road, the potential transportation routes of SHWF related traffic is not expected to be impacted by buses.

### 6.2 Truck constraints

Two types of restrictions relating primarily to truck traffic were observed. These are described below.

#### 6.2.1 Existing grain traffic

Several granaries were observed on site at different locations near the proposed wind farm site. Specifically, a granary was observed near the Eurambeen - Streatham Road and Mount William Road intersection.

Pyrenees Shire Council has provided advice that grain traffic uses the Eurambeen-Streatham Road and Mount William Road. In some cases, the Carngham-Streatham Road is also a preferred route to access the grain facility on the corner of Mount William and Eurambeen-Streatham Road.

The haulage season is December through to late January, and this can see as many as 150<sup>7</sup> semi trailers per day on Eurambeen-Streatham Road daily during this time.

#### 6.2.2 Statutory truck restrictions

Appendix A shows designated truck routes provided by Pyrenees Shire Council.

As can be seen, the primary Council roads that are likely to be used by trucks are:

- Eurambeen-Streatham Road
- Carngham-Streatham Road from Mt William Road to Beaufort-Carngham Road
- Mount William Road from Glenelg Highway to Eurambeen-Streatham Road
- Beaufort-Carngham Road from Western Hwy to Carngham-Streatham Road.

<sup>7</sup> This number is separate to the wind farm traffic and relates to existing grain traffic.

These roads have been assessed in the determination of possible transport options identified in Section 7.

### **6.3 Pavement sufficiency**

A kerbside assessment of straights and curves along several routes was carried out. The Glenelg Highway and Western Highway are of a high standard and will be able to carry the extra traffic, including OD vehicles. A major stretch of Skipton Road has also been assessed as being of reasonably good standard to carry the extra traffic.

Sections of roads controlled by Pyrenees Shire may require upgrading to a sufficient standard for the development traffic. It is suggested that an audit of road conditions be carried out upon granting of the development permit.

### **6.4 Traffic volumes and capacities constraints**

As mentioned in Section 6.2.1, up to 150 semi trailers per day are expected to use Eurambeen - Streatham Road from December to January. This route is also likely to be the major transport route of the WTG components from the west. The route is currently being reconstructed under the AusLink program and is expected to carry the extra traffic loading arising out of the SHWF construction.

### **6.5 Intersection sight distance constraints**

During the site inspection, some sections of road having insufficient sight distance were observed. In general, the sight distance can be improved by utilising simple measures such as tree lopping and pruning.

### **6.6 Low overhead wires**

Nearly all routes under the care and management of Pyrenees Shire will require low overhead wires to be raised prior to construction.

### **6.7 Permitting**

Due to the OD nature of some of the loads expected to be transported, obtaining the necessary permits becomes an important component of the final approval process by government. A brief mention of the permitting requirements is detailed below:

#### **6.7.1 Over Dimensional Vehicle Permits**

The transport of the turbine components and the movement of the large cranes used for the erection of the turbines will require OD load permits. Pilot and escort vehicles will need to escort the OD loaded trucks. Details of these requirements are included in the Pilot and Escort Vehicle Graph contained in VicRoads Publication Number 0083 "Additional Permit Conditions".

### **6.7.2 Load Limits**

The transport of the raw materials as well as the WTG components will be subject to the Victorian Statutory Load Limits set out in Part 4 of the Road Safety (Vehicles) Regulations 1999. These regulations will have to be investigated and met prior to any movement of the WTG components and raw materials.

## 7. Transport route assessment

The constraints listed in Section 6 have guided the selection of the possible transport routes.

Furthermore, certain assumptions have been made about the transport of the wind turbine components and raw materials. These are listed in Table 7-1 below.

**Table 7-1: Transportation assumptions**

Transported items	Source of materials
<b>Raw materials</b>	
Aggregate	Ballarat
Sand	Ballarat
Cement	Ballarat
Water	On site from farmers or near Ballarat
<b>WTG components</b>	
Hubs	Portland
Nacelles	Portland
Turbine generators	Portland
Turbine blades	Portland
Site transformer	Port of Melbourne <sup>8</sup>
<b>Employees</b>	
Employees	Beaufort, Skipton, Ararat, Ballarat and surrounding towns.

Also, the transportation solutions adopted for the construction of the nearby Waubra wind farm were investigated.

### 7.1 Access routes from the East

In general, raw materials are expected to be sourced from Ballarat and surrounding area, including Dunnstown and Buninyong. Routes to the site via Ballarat will follow either of the following routes:

- Via the Glenelg Highway to Skipton. From Skipton northbound to the wind farm site.

<sup>8</sup> This is an assumption only. As the transformer route was unknown at the time of writing, and it has not been assessed.

- Via the Western Highway to Beaufort. From Beaufort southbound to the wind farm site.

## 7.2 Access routes from the West

Two options were assessed in relation to transport of the WTG components from Portland.

Based on the discussions with REpower Pty Ltd as well as Pyrenees Shire Council, the constraints listed in Section 6, the assumptions of Table 7-1 and historical data for nearby wind farms, it has been determined that the following transportation options are possible.

### 7.2.1 Option 1 from Portland

The WTG components are shipped from Portland and use the Henty Highway up to Hamilton. From Hamilton, trucks would use the Glenelg Highway to Skipton Township:

- From Skipton Road to the site for turbines located east of Skipton Road and south of Lake Goldsmith.
- From Eurambeen - Streatham Road to Geelong Road and Toppers Road to access turbines located west of Lake Goldsmith Road, and on to Millars Road.

### 7.2.2 Option 2 from Portland

The WTG components are shipped from Portland and use the Henty Highway up to Hamilton. From Hamilton, trucks to use the Glenelg Highway to Glenthompson and then:

- Onto B180 (Maroona - Glenthompson Road which becomes Mortlake-Ararat Road) to the Western Highway, onto Beaufort and then on to the site for turbines located east and west of Skipton Road.

### 7.2.3 Selected route from the west

The intersection between the Western Highway and Skipton Road, in Beaufort, was assessed as part of a site inspection. It was determined that traffic signal mast arms as well as tight turning radii would likely restrict the movement of OD trucks. Coupled with potential issues arising out of travelling through Ararat, Option 2 is not considered suitable for the transport of the WTG/OD vehicles.

The options have been shown in Figure 7-1.

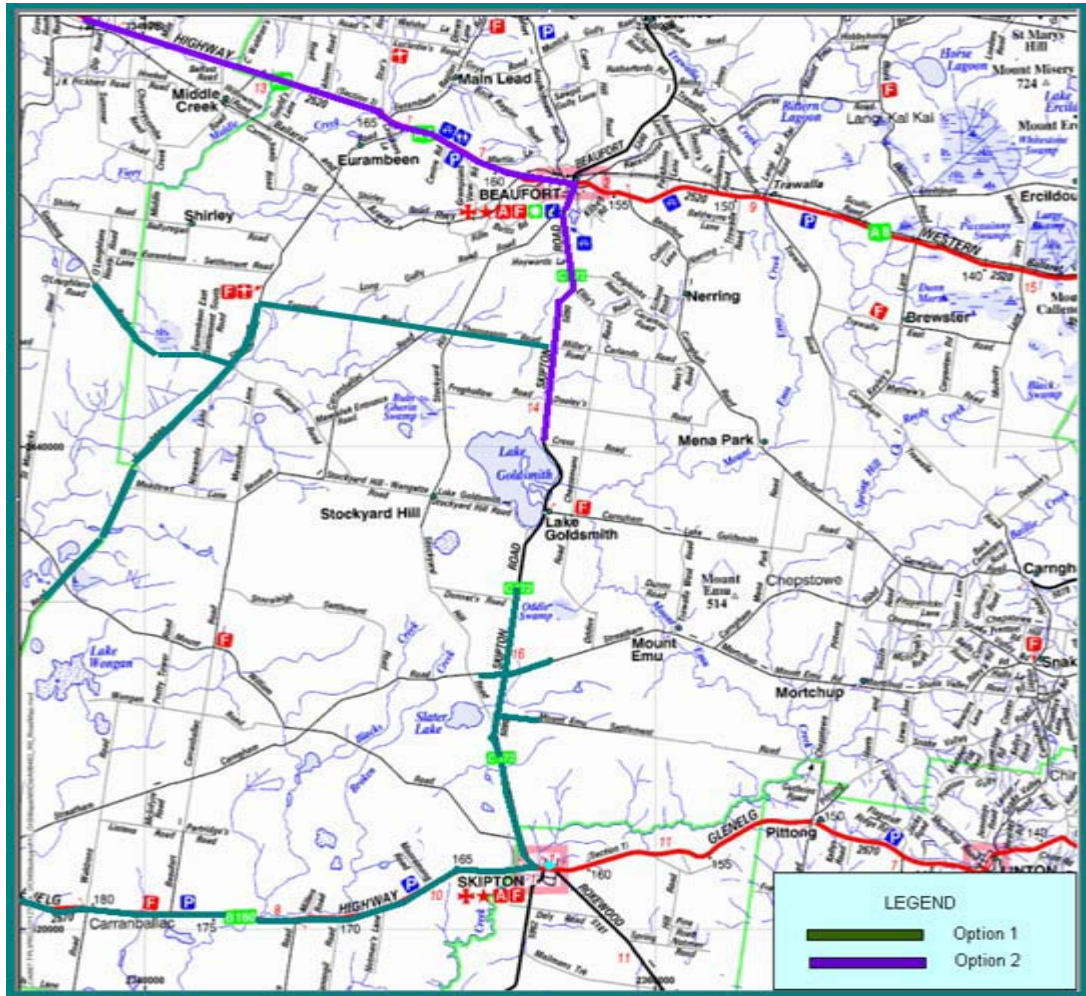


Figure 7-1: Transport route options from Portland

## 8. Selected route

As mentioned in the previous sections, roads under the care and management of VicRoads are likely to be able to carry OD traffic. Due to the lower standard that the Shire roads have been constructed, additional traffic management measures are likely to be required. These have been listed in Figure 8-1 below.

### 8.1 Recommended access roads

Table 8-1 below lists recommended access roads for accessing different quadrants of the SHWF site. These roads all are under the care and management of Pyrenees Shire Council. Detailed assessment of these roads will be required prior to construction commencing to determine upgrade requirements.

**Table 8-1: Recommended access points**

Quadrant of Site	Access roads
North west	<ul style="list-style-type: none"> <li>▪ Eurambeen - Streatham Road</li> <li>▪ Eurambeen - Settlement Road</li> <li>▪ Long Gully Road</li> <li>▪ Stockyard Hill Road</li> <li>▪ Toppers Road</li> </ul>
North east	<ul style="list-style-type: none"> <li>▪ Millars Road</li> <li>▪ Thompsons Road</li> <li>▪ Dooleys Road</li> <li>▪ Frog Hollow Road</li> <li>▪ Cheesemans Road</li> </ul>
South west	<ul style="list-style-type: none"> <li>▪ Stoneleigh - Settlement Road</li> <li>▪ Stockyard Hill Road</li> <li>▪ Stockyard Hill - Wangatta Road</li> <li>▪ Dunned Road</li> <li>▪ Old Skipton Road</li> </ul>
South east	<ul style="list-style-type: none"> <li>▪ Mt Emu - Settlement Road</li> <li>▪ Streatham - Mortchup - Mt Emu Road</li> <li>▪ Stockyard Hill - Wangatta Road</li> </ul>

## 8.2 Existing deficiencies on the recommended route

Some roads were observed as being unable to carry simultaneous two-way traffic. At many locations along the nominated route, property fences abut the edge of carriageway. Further, tight horizontal and vertical curves were observed during the site inspection along the nominated routes.

## 8.3 Solutions

Based on the constraints identified in Section 6 and deficiencies identified in Section 3, the road geometry in a number of locations is expected to be tight for two-way heavy vehicle flow. The topography and historical development of the lots would likely require significant capital expenditure into road infrastructure which may render the wind farm development unfeasible.

One-way traffic management would reduce the requirement for two-way truck traffic and eliminate the need to widen most roads. Figure 8-1 shows the concept one-way traffic management plan based on site observations and historical data.

Key routes have been highlighted at Figure 8-1. Trucks would be expected to enter the greater site from Eurambeen - Streatham Road and Skipton Road onto Geelong Road and Toppers Road. They would egress from Thompsons Road, Mt Emu - Settlement Road and Meadows Lane onto Eurambeen - Streatham Road, Streatham - Carngham Road (with statutory truck exemption), Glenelg Highway and Skipton Road.

Smaller, more local access roads, such as Dalgleishs, Caramuir, Long Gully and Dooleys Roads, that provide access to specific sections of the site, are unlikely to require a one-way access arrangement put in place given the very low potential volumes. Two-way operation is likely to be viable, with additional co-ordination through radio/telephone. The impact on traffic on these roads is likely to be negligible, however, infrequent one-way arrangements can be organised should the need arise. This arrangement may also apply to specific instances on the larger roads.

Statutory truck restrictions have been observed on the following Council roads:

- Portions of Beaufort – Carranballac Road
- Stockyard Hill Road (it may require two-way access for a short section; this should be achievable under the co-ordination mentioned above).

As discussed earlier, preliminary discussions with Pyrenees Shire Council have indicated that Council would still be amenable to the use of these roads for the transport of the WTG and raw material trucks.

Obtaining permits from the Shire to be able to utilise these routes for SHWF related truck traffic would reduce the need for upgrades to the existing road network.

Appendix B shows designated bus routes. PB suggests the contractor endeavour to operate outside of peak bus service times of operation.

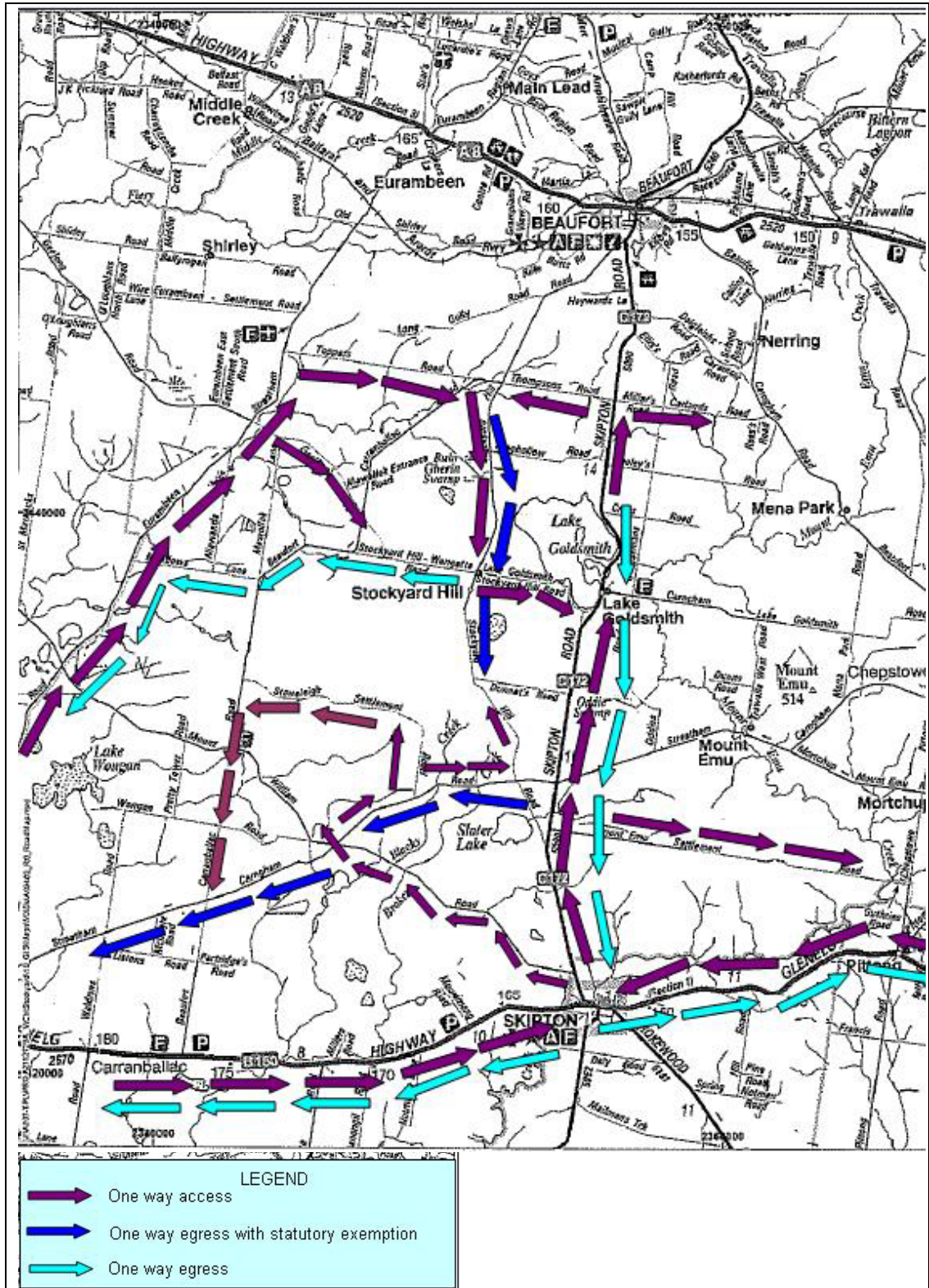


Figure 8-1: Concept one-way traffic management

## 9. Conclusions

Based on the desktop review and the subsequent site inspection, the following is concluded regarding the traffic impact of the proposed SHWF development:

### **Traffic impact:**

- The existing road network is expected to be able to easily accommodate the additional traffic volumes generated during all stages of the wind farm development life cycle.
- Sections of Beaufort – Carranballac Road and Stockyard Hill Road that are currently subject to statutory truck restrictions should be utilised by SHWF related truck traffic. Council appears to be amenable to entering into an agreement with the contractor to modify restrictions.
- Reconstruction of some intersections may be required prior to construction. Detailed investigation of upgrade requirements is likely to be required closer to commencement of construction.
- VicRoads managed arterials are considered geometrically adequate to carry the OD and other truck loading.
- OD vehicles carrying the WTG components will most likely use the Glenelg Highway/Skipton Road intersection based on prior use for the transport of the WTG components of the Waubra wind farm.
- A more detailed Operational Traffic Management Plan should be prepared closer to the start of construction. This would provide opportunity for costing.

### **Route Access Plan:**

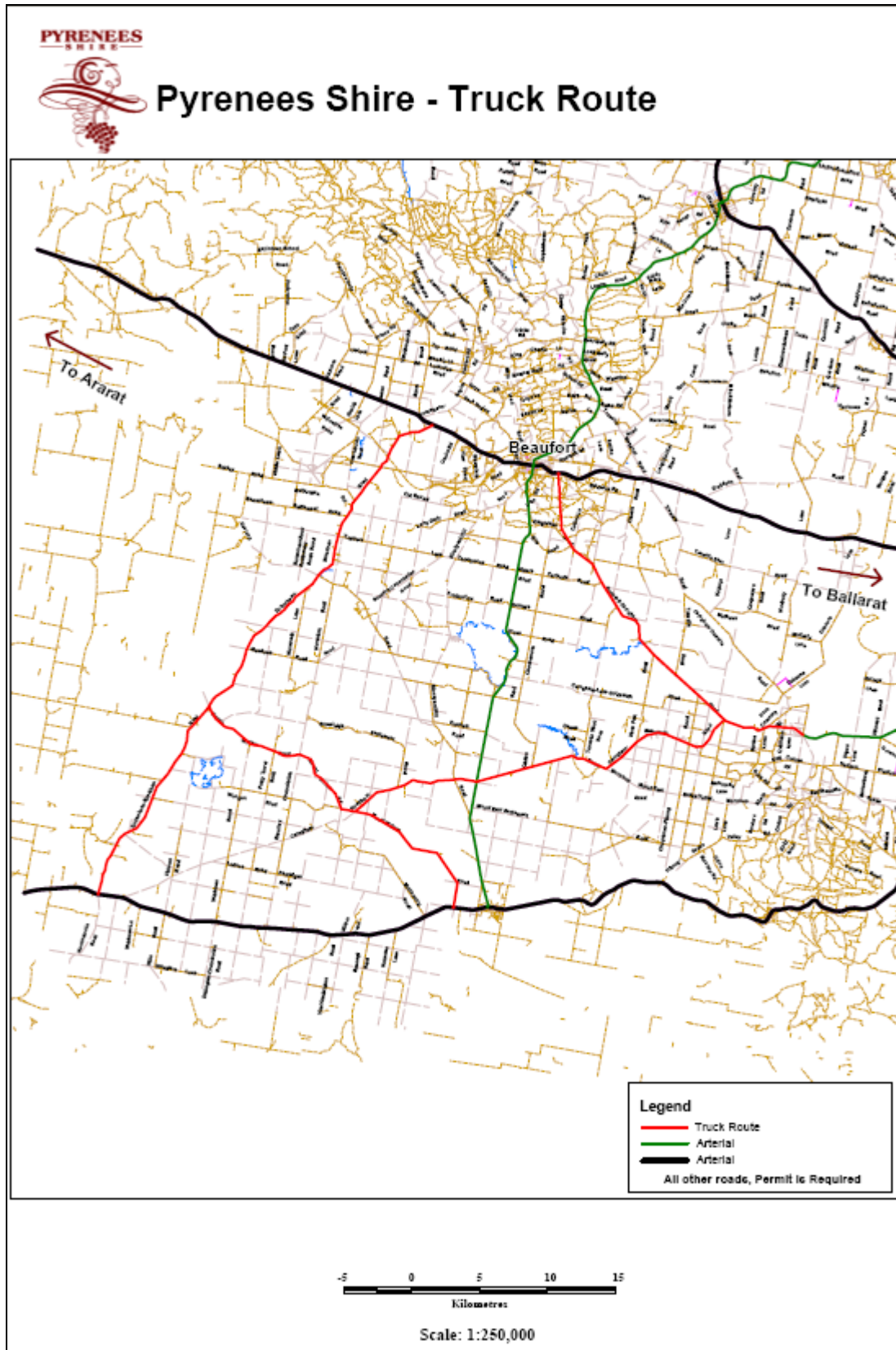
- From the east, two routes from Ballarat to the wind farm for raw material transport are viable, via Glenelg Highway to Skipton, and via Western Highway to Beaufort.
- From the west, the nominated route from Portland follows the Henty Highway to Hamilton, onto the Glenelg Highway, where it diverges from the Glenelg Highway utilising either the Eurambeen - Streatham Road or Skipton Road (via Skipton) to access the SHWF site.
- The northern connections of the Eurambeen - Streatham Road and Skipton Road with the Western Highway are not suitable for the transport of the WTG OD trucks.
- The Glenelg Highway/Skipton Road/Western Highway route has been used for the transport of the Waubra wind farm OD vehicles.
- OD permits will be required from responsible authorities from VicRoads and potentially, Pyrenees Shire Council.
- A detailed assessment of the nominated route will be required prior to construction commencing. That assessment would likely involve the assessment of horizontal and vertical geometry along the nominated route, an assessment of the load rating of the structures and mitigation measures, if any.

- It is recommended that sections of Beaufort – Carranballac Road and Stockyard Hill Road that are currently subject to statutory truck restrictions should be utilised by SHWF related truck traffic. Preliminary discussions with Pyrenees Shire Council have indicated that Council would be amenable to issuing a permit to use these roads based on a maintenance arrangement be agreed upon.

## Appendix A

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Map of designated truck routes

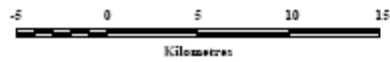
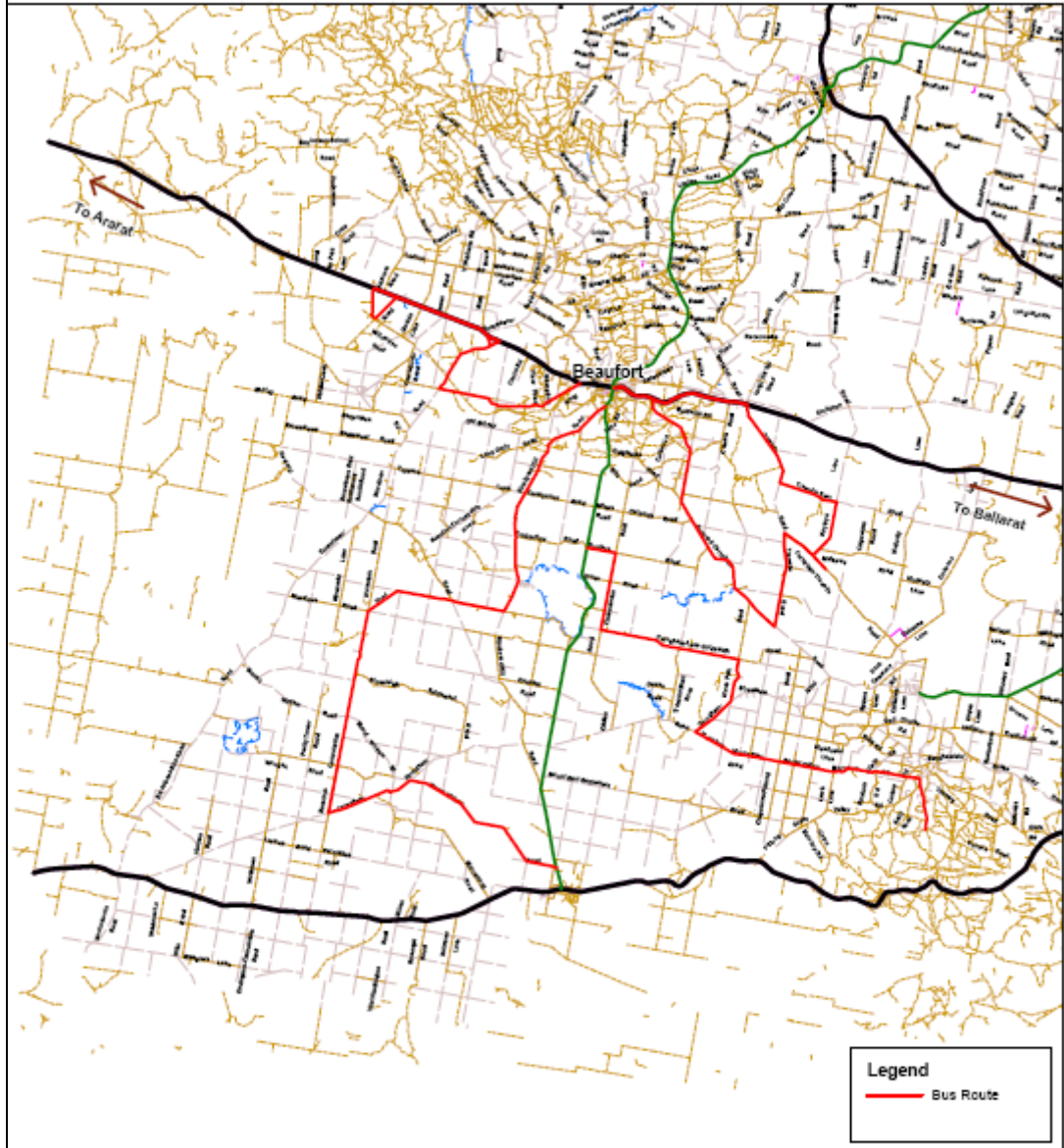


## Appendix B

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Map of designated bus routes

## Pyrenees Shire - Bus Route



Scale: 1:230,000