Kyoto energypark

Appendix J

Traffic and Transportation Impact Assessment
Pamada Pty Ltd
(May 2008)

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Kyoto Energy Park Scone

Traffic and Transportation Impact Assessment

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1.0 Introduction

1.1 Project Location

The Kyoto Energy Park (KEP) project consists of two separate sites referred to as **Mountain and Middlebrook Station, Scone.** Mountain Station is situated approximately 9-12km west, and Middlebrook Station approximately 8km north-west of Scone township. The project is located on two sites in the Upper Hunter LGA. The location plan below (Figure 1.0) illustrates the approximate location of the two sites west of the New England Highway at Scone.

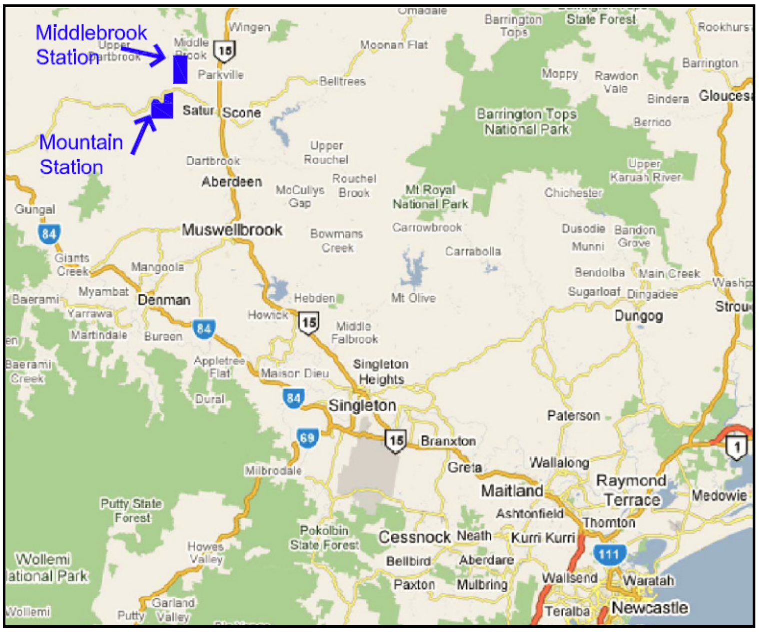

Figure 1.0 Kyoto Energy Middlebrook and Scone.

Location of Park – Mountain Station

1.2 Scope and Objectives

This traffic and transportation study is concerned with the impact of the transport and traffic related activities associated with the project for periods of construction and operation of the KEP. This Plan reviews the existing road infrastructure to the proposed site, type and number of vehicles generated during the construction period and operational phase including any statutory and permit requirements for access on local road networks.

The report shall also looks at port of entry options for safe and efficient handling of over-dimensional components arriving by ship. At different stages throughout the construction of the wind farm there will be oversize and over-mass loads transported on public roads, mainly involving transportation of wind turbine components and a large over weight electrical transformer. There will be an increase in traffic on public roads in the locality mainly during the construction phase of the project which will have the potential to hinder local traffic. A large proportion of the impacts relate to transportation of heavy components involved with the wind farm, which have the potential to hinder local traffic regimes. An assessment of traffic flows during construction is contained in the report with mitigation strategies identified for the locality.

The KEP proposal involves the construction of the following components:

- 42 x Wind Turbine Generators(31 Mountain 11 Middlebrook);
- 1 x Solar PV Plant and associated low voltage network;
- 1 x 1MW Closed Loop hydro plant and cabling;
- 1 x 132/66/33kV site substation/switchyard and associated cabling;
- Electrical Connection to the local electricity grid;

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- 1 x 10m x 30m Maintenance building;
- 1 x Manager's residence
- 1 x Visitor's and Education centre on Mt Moobi Plateau
- 5m wide access tracks

During the construction period the following facilities will be installed:

- Site Depot including site offices and amenities and laydown area
- On-site concrete batching plant

This report Plan has identified any route obstacles that may impact on the efficient and safe transportation of project components, site access requirements, and internal access road upgrading works required. Environmental impacts during construction and operational phases of the project such as noise and air quality will be discussed in relevant reports.

Electrical transmission lines, external to the site will be constructed by a third party contractor. An estimate of the traffic flows during construction of the external lines has been included in this report.

Works for both sites will be undertaken in a single stage of anticipated timeframe of 20 months.

During construction there will be upgrading to existing access tracks constructed on both sites allowing all weather access for road vehicles to each of the turbine locations and the proposed substation. This study also considers traffic issues internal to the sites.

2.0 Transport of Over size and Over mass components.

2.1 Wind Turbine specifications

The wind turbine generators are supported by a tower of up to 105m and the turbines are driven by three blades which are up to 50m long. The maximum height above ground level of the erected turbine is 150m. The larger sections of the wind turbine components will need to be transported from port to the site using over-dimensional vehicles.

Some of the wind turbine components will be manufactured oversees and shipped to Port. This will include nacelles, blades, hubs and nose cones, panels and accessories. Four wind turbine models are being investigated for the study. This equipment is currently manufactured in countries such as India (Suzlon), Denmark (Vestas) and various other countries dependent on the type of machine. Each model has slightly different dimensions and transportation packages. For example the Vestas turbine blades are transported individually while the Suzlon blades are packed in twos and transported in what is referred to as a 'blade cage'.

This report shall consider transport requirements for the Suzlon s88 2.1 MW Wind Turbine Generator. The Vestas V90 is also similar in size and weight to the Suzlon machine.

Tower tubes are fabricated from heavy duty mild steel plate and rolled into sections to form a circular structure which when erected and bolted together supports the nacelle and rotor assembly.

Table 2.0 outlines turbine equipment specifications for transportation purposes. A full description of turbine components is illustrated in Appendix A–Wind Turbine Specifications.

Table 2.0 Suzlon s88 2.1 MW Wind Turbine Generator – Equipment Specification

Tower Section	**Total length (m)**	**Packaged Weight (kg)**	**Minimum tube Ø (mm)**	**Maximum tube Ø (mm)**
Base section T1	17.79	62330	4300	4300
T2	18.89	54450	4105	4105
T3	19.02	48890	4030	4030
T4	21.61	40390	4024	4024
Top section T5	25.89	29690	4016	4016
Component	**Height (mm)**	**Width (mm)**	**Total length (mm)**	**Packaged Weight (kg)**
Nacelle	4093	3995	9376	75000
Hub	3129	2941	2941	17164
Blades (each)	3200	2190	43.25	7700 (±200)
Blade Cages (2 blades per cage)	2950	4050	43870	29900 (±400)
Nose Cones	2300	4500	3900	1808
Containers				
- 20'	2591	2438	6058	3100
- 40'	2896	2438	12192	4500
Substation Transformer	1800	1900	6100	65000

2.1.1 Wind Turbine transportation

An individual Wind Turbine Generator (WTG) is transported to site in components or packages of components and assembled or erected on site. An individual turbine consists of 3 blades, 1 hub, 1 nacelle and up to 5 tower sections (total hub-height = 105m) depending on the overall height. Most turbine components use specialist haulage vehicles , for safe and efficient transportation by road.

Tower sections are transported individually using low bed or multi-axle truck trailers. The truck/ trailer combination will depend on size, weight and dimensions of the sections. Nacelles are transported on drop truck trailers under police escort. Hubs are transported individually using a flat bed truck or semi-trailer and nose cones are transported in pairs on a flat bed truck.

Tower sections are currently manufactured within Australia either in Victoria or South Australia. And recently within South Queensland. Should tubes be manufactured in these states they would either be shipped to the Port of entry or transported directly by road to site. Pamada are also looking at possible fabrication of tubes locally in the Newcastle area.

Turbine components arriving by ship are unloaded at the dock and generally stored at the port storage areas prior to scheduling transportation to site. Oversize and over weight components can only be transported at certain times and will require police escorts. Components are generally escorted to site and must meet RTA regulations and controls regarding transportation on local and regional roads. Prior to road transport of an over weight or over size component the haulage contractor will need to apply for a special use permit from the RTA.

Turbine components arriving to site are either taken directly to hardstand areas for erection by heavy lifting cranes or unpacked in the laydown area and prepared prior to installation at turbine locations. For ease of lifting and transportation turbine components are arranged into packages.

Photo 2.0 Trailer with rear end steering system for blade cage transportation

2.2 Substation Transformer

The substation will require a single transformer estimated to be around 55-70 tonne (depending on final design parameters for the substation) and therefore will require an over mass permit. The transformer will be transported on a large multi-axle low load trailer and guided transport. The overall impact compared to the remaining construction activities is deemed to be low.

2.3 Concrete Batching Plant

The batching plant is likely to be fully mobile however an allowance for transportation in segments via semi-trailer has been allowed for. The plant shall batch concrete from storage reserves on site to produce up to 100m3 of concrete per hour at maximum capacity. The plant is likely to be in excess of 19m long for the main conveyor section, and will therefore require a permit from the RTA.

2.4 Earthmoving equipment and Heavy Cranes

During site establishment heavy earthmoving equipment shall be transported to the site on multi-axle low load trailers. In addition, large cranes will also be required on site during erection stages of the wind turbines. It is anticipated that large 300, 500 and 600 tonne mobile cranes will be used to erect turbines at turbine foundations pads. Smaller assist cranes shall be used to unload components in the laydown areas and assist in general lifting duties at the turbine site.

Other smaller cranes will also be required as assist cranes in loading and unloading at the depot and laydown area. Heavy earth moving equipment will be moved to the site in the usual manner. Although some of this plant may require permits the disturbance is expected to be minor with only several truck movements compared with the transport of the wind turbine components

A full list of the earthmoving equipment required for site establishment, earthworks and lifting is described in *Section 6.1.2 Heavy Earthmoving Equipment.*

3.0 Roads and Traffic Authority requirements.

Over size and over mass permits are required from the NSW RTA for load-carrying and Special Purpose Vehicles (SPVs) exceeding standard dimensions and mass limits. Oversize permits are required for loaded vehicle dimensions exceeding maximum standard dimension limits of 19.0 m long, 2.5 m wide and 4.3 m high. Therefore oversize permits will be required for all tower tubes and blade transportation. Applications for combined oversize and overmass permits can be made, including multiple applications in some instances for multiple trips. Applications are also required for interstate travel from respective states.

An overmass permit will also be required for each nacelle and tower components. The requirement for overmass permits for blade components will depend on the type of vehicle used to transport them. Transport of blade components will most likely require a rear end steering system on an extended trailer or low loader. All tower and blade components will require oversize vehicle permits for travel.

An experienced haulage contractor would be used for the scheduling and logistics of transport movements. The contractor would be required to organise single and multiple permit applications as required. General travel times are sunrise to sunset as published in the newspaper and subject to visibility and daylight. Travelling during public holiday periods and at nighttimes is subject to approval from the NSW Northern Region Police Department on (02) 49 290060. Pilot vehicles and police escorts are required for trips as per police requirements. Also if a vehicle is wider than 5.5 metres or longer than 35 metres, 2 pilot vehicles are required and the vehicle operator must notify police prior to travel.

Transport routes may be subjected to specific time restrictions and should be fully checked with the RTA (or relevant State Road Authority at the time of permit application. Some of the major restrictions include the following:

- Sydney Metropolitan zone restricted transport of SPV in daytime after 6am
- Sydney to Newcastle Freeway restricted for vehicles exceeding dimension limit between 9.00am and 4.00pm in the daytime
- New England Highway between Hexham and Weakleys Drive restricted after 8.30am

The NSW Roads & Traffic Authority (RTA) special permit unit at Glenn Innes were contacted during the project investigation stages for specific comments. The RTA advised that all requirements for oversize and overmass would be required by permit application prior to approval. All vehicles would need to be inspected and registered for use on NSW roads. As part of the transport permit application the RTA will make an assessment of all bridges along road routes, road capacity and specify strengthening requirements if any.

The (RTA) Special permit unit raised no objection regarding the proposed transport tasks, however it will require the submission of a transport plan by the Transport Contractor that details route, time of travel, load type, proposed vehicles, etc. before a transport permit can be issued. While this study gives consideration to feasible road transport routes, the final choice of route is dependent upon the Transport Contractor selected, the availability and type of vehicles at the Contractor's disposal and the route that is acceptable to the RTA.

4.0 Port Options

The suitability of ports for handling and transportation of large turbine components is critical in the efficient coordination and movement of parts to site. Ships would normally dock for up to 4 days at a time, weather permitting (i.e. wind speeds above 10m/s can delay crane lifting operations on dock), while components are unloaded and transferred onto special purpose vehicles and low loaders. It is estimated for a total of 42 turbines that 3-4 ships would be required to transport turbine parts (excluding tower tubes), which would be scheduled to occur at 1-2 monthly intervals. Ports must be able to handle ship dimensions and (normally 150 metres length and 25-30 width), and berths must have capacity for lifting of heavy components (up to 100 tonne capacity). Turbine components are normally unloaded using ship cranes directly onto truck trailers dockside and taken to port storage area as shown in Figure 1.4

Photo 4.0 Ship crane unloading blade cage onto extendable trailer dockside.

Suitability of port facilities for handling, storage and safe transportation of wind turbine components to road network is important in determining the most suitable port of entry. Areas of investigation for this report include:

- Suitability for ship docking for a period of 1 week at a time
- Berth handling capacity of at least 100 tonnes
- Truck ease of access, manoeuvrability and turning circle radius at port entrance and berth landside area.
- Ample storage area of minimum size of 8000m2 which is flat, and accessible for oversize trailers
- Cost of storage for minimum 2 weeks storage or provision for long term lease
- Ease of access from port to main road network including road capacity, traffic management requirements, dimensional limitations of vehicles and road infrastructure.
- Experienced Haulage Contractors and Stevedores operating at the port and in the region with registered vehicles to the required specifications.
- Road transport from port to main road network subject to minimal traffic restrictions.

Based on the above criteria Port options were investigated and outcomes summarised below. Transportation routes from ports is addressed in Section 5.0.

Port options include:

- Fisherman's Island Brisbane, Queensland.
- Port Kembla, Wollongong NSW
- Darling Harbour, Sydney NSW
- Eastern Basin Carrington, Newcastle NSW

4.1 Port Brisbane Queensland.

AAT operate three heavy lifting berths at Berths 1 to 3 Fisherman's Island, Port of Brisbane. All berths can accommodate ships in excess of 300 metres in length. Truck and trailer manoeuvrability and access to the berths is good, with sufficient turning circle distance and space for multiple trailers. Storage space is in the order of 8000m2 which is adequate, however the average width of the space is approx 35m which is considered minimal and could cause turning problems for over length vehicles. The storage area is located approximately 1km form the berth and requires heavy vehicles to cross Port Drive which is the main access route to all berths located north of the Drive. Therefore from initial discussion with the Port Authority storage facilities would be considered feasible however may increase costs and complications related to distance from storage area to the berth. Other options would be to consider alternative private storage areas on unused lots but this is likely to significantly increase port handling operations and delays during unloading of ships and storage.

Access onto main road networks south of the Port is good. No load restrictions are apparent from discussion with the Port Authority.

4.2 Port Kembla

Port Kembla has berthing facilities suitable for the management of a wide variety of bulk and non-bulk cargoes and is serviced by both road and rail. Of the berths available, the 'Multi Purpose Berths' (MPB) is the most suitable terminal for handling the imported WTG equipment. The berths can accommodate vessels up to 315 metres long. Dockside infrastructure includes a 300 m long wharf plus an adjacent 3 hectares (30,000m2) of hardstand and two 2,200 m2 sheds.

4.3 Darling Harbour

Sydney Port at Darling Harbour has the necessary facilities for unloading wind turbine cargo (up to 120 tonne capacity) and for direct transfer to vehicles for road transportation. Other ports at Sydney Harbour were not considered suitable due to lack of storage space and limited wharf handling facilities. However the period of dockside storage at Darling harbour is constrained with periods longer than 10-days duration and only available by arrangement in the non-seasonal times from February through to August. Storage limitations therefore reduce the feasibility of using this port and further investigation was ceased.

4.4 Port Newcastle

Berth No 2 Eastern Basin at Carrington Newcastle Inner Harbour has a lifting capacity of up to 150 tonnes. The berth is located adjacent to rail network and has direct access to Industrial Drive which has capacity and ease of access for overweight and over-dimensional transport. The adjacent flat storage area of 11500m2 which is managed by the Newcastle Port Authority is available within 200 metres of the docking area. This storage area can be licensed at a rate of 15m2 p.a for minimum periods of a month. Ships would be docked for a period of up 1 week depending on size of ship and no of components.

Suitable access, manoeuvrability and turning circle movements for oversize trailers is provided close to the wharf. Stevedores and haulage contractors in the region have experience with handling over-size over length components used in the Hunter coal mines such as heavy earthmoving machinery and large conveyor systems. Figure 4.1 shows the general layout of the Berth at Carrington and access to the storage area.

Photo 4.1 Eastern Basin No 2 Bulk Capacity - Inner Harbour Port Newcastle (Source: Google Earth 2008)

5.0 Transportation Routes

For transportation of turbine components options for rail, road and shipping have been considered. All turbine components (with the exception of tower sections which are currently manufactured within Australia and overseas) are currently manufactured overseas and would therefore be shipped to the port entry facility by ship. Consideration has been given to both rail and road transport to site based on logistics, port facilities rail capacity and dimensional restrictions.

5.1 Rail Transportation

Rail transport in all cases was not considered an option for nacelles due to the possibility of damaging internal components from vibration and also due to rail width clearance restrictions on most of the commercial lines that were initially investigated. Discussion with Suzlon Energy Australia (SEA) revealed that blade cages for rail were used as a means of rail transportation in overseas cases but were not yet considered as a viable option in Australia. Blades cages were a problem with rail transport being too long for single carriages and special carriages would be required to allow safe rail. Also consideration of rail corridors, height clearances and swing of blade overhangs at curved sections of railway and clearances with adjacent rail traffic. Tower tubes are currently fabricated in Adelaide, South Australia and Melbourne in Victoria. Other tube fabricators are located in Tasmania. An option for unloading components at a disused mine site (that utilised a rail platform) near Scone was considered however due to the inability to coordinate all transportation of components by rail in this case further investigation was not considered.

5.2 Road Transportation

All major road networks from Port Kembla, Port Brisbane and Port Newcastle are either National highways or State roads and are subject to statutory permit conditions, for over-mass and over limit vehicles. Therefore subject to Transport Contractor compliance with road authority permit conditions, routes for the transport of over mass and over size vehicles to the KEP site are available in each State (NSW, Queensland, Vic, SA).

Based on the initial investigation into port options (Section 4.0) three (3) feasible port options were identified:

- Port Kembla to Scone;
- Port Brisbane to Scone;
- Port Newcastle to Scone.

Further discussion with individual Port Authorities and Haulage Contractors were made to determine suitability of transport routes from each of these ports as described below.

5.2.1 Port Kembla to Scone

Figure 5.0 illustrated the general route from Port Kembla (A) Inner Harbour to the KEP site (B).

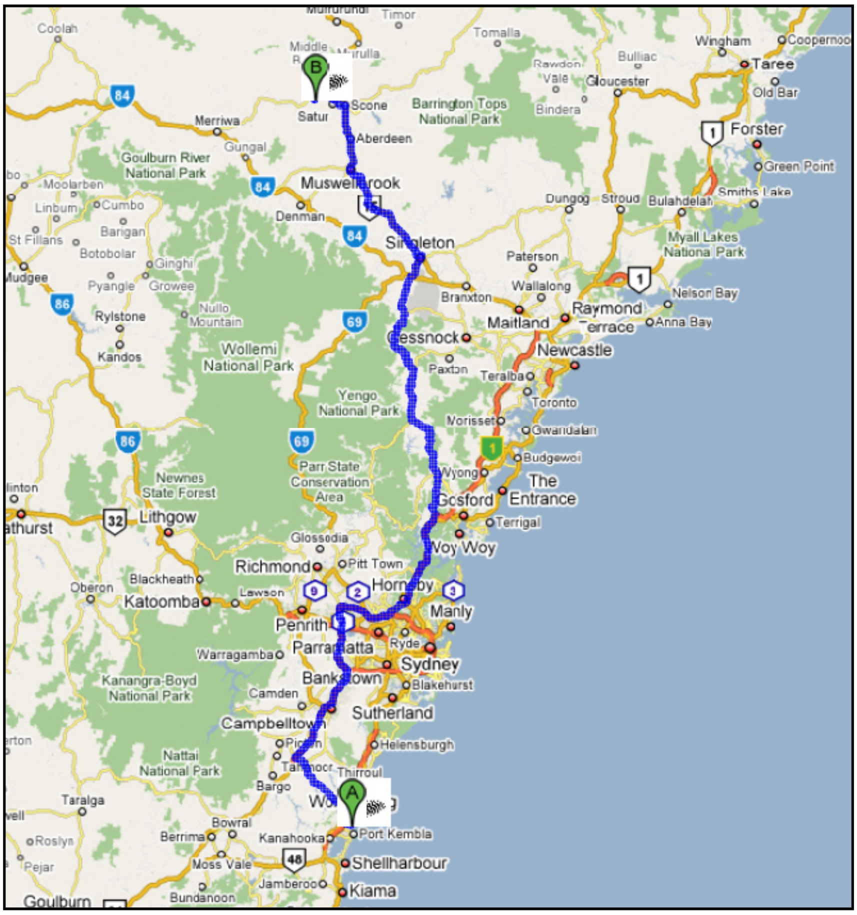

Figure 5.0 Transportation route Port Kembla to Scone

The total road distance is estimated at 384 km from Port Kembla Inner Harbour to KEP site at Scone. Transport route follows road network as follows:

- Exit Berth 105/106 along Farrer Rd onto Tom Thumb Drive;
- Link onto Southern Fwy via Springhill Rd and Masters Rd;
- Exit Southern Fwy onto Mt Keira Rd Nth Wollongong;
- Access the Sth Western Freeway (M5) at Mt Keira Rd intersection;
- Travel North along the M5, take the Westlink(M7) and link onto the M2 Motorway;
- Exit onto Pennant Hills Rd at Carlingford travelling north
- Route follows Sydney Newcastle Fwy to Thornton Nth of Newcastle

There are some steep ascents out of Port Kembla/Wollongong area along Mt Keira Rd and special restrictions apply to bypassing Sydney on M7 and M2. Also time restrictions are applicable on the F3 Sydney to Newcastle Freeway south of Kariong. Further investigation into this option would be required prior to implementation.

5.2.2 Port Brisbane to Scone

The route south to the New England Hwy follows Port Drive out of the Fisherman's Island Berth 1-3, along the Gateway Motorway, Logan Motorway, Ipswich Motorway, Cunningham Hwy, to Warwick where a diversion route can accesses the New England Highway. This route is a dual freeway to Warwick, with no height restrictions to road eight for turbine components i.e. no overhead bridge and line restrictions. The route from Warwick would then continue south on the New England Hwy, through Tenterfield, Glen Innes, Armidale, Tamworth and to Scone. Road freight would bypass Scone township To access the site from the North on the New England Hwy trucks would turn off at the Dartbrook Mine access road at Dartbrook on the New England hwy which connects to Back Muswellbrook Road. There is a major roundabout in Scone which may which would restrict movement of blades through Scone township. An alternate route would need to be considered north of Scone for access to the site.

Road access south to Scone would be predominantly via the Gold Coast and New England Highway as shown in Figure 5.1 below.

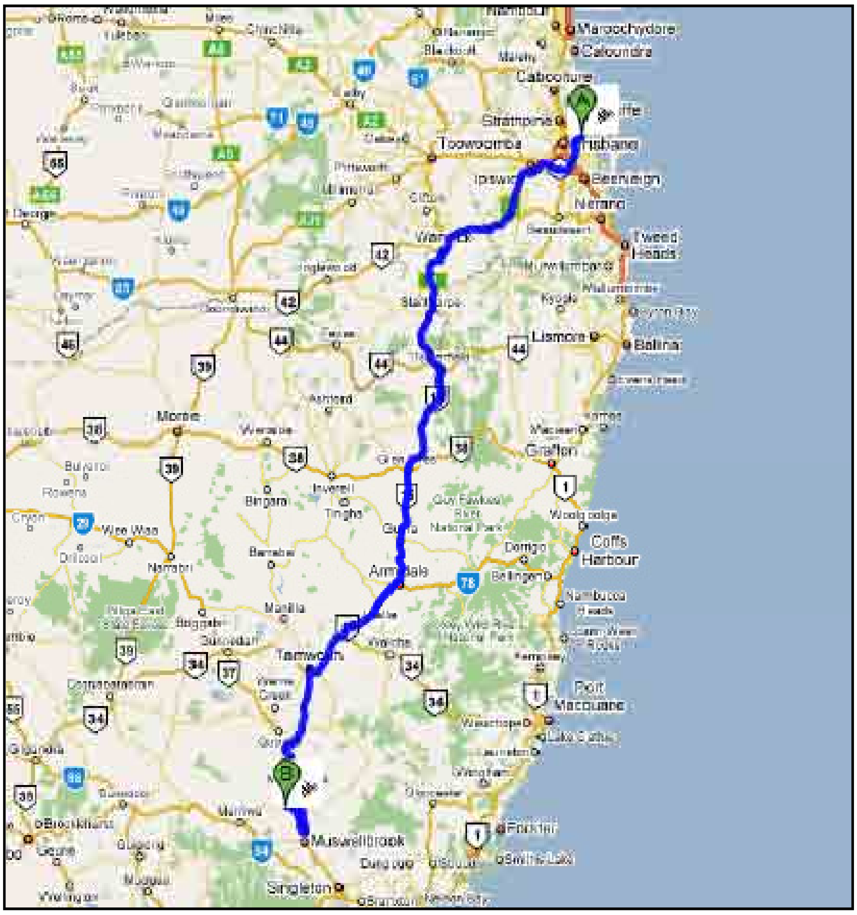

Figure 5.1 Transportation route Port Brisbane to Scone

Total distance for road haulage is 792 km from Port Brisbane interstate to the KEP site at Scone NSW. The route from Port Drive at Fisherman's Island to Warwick on the New England Highway is via mainly a dual and four land freeway with no height restrictions. This route has not been inspected however is deemed feasible following discussions with the Port Brisbane office and interstate haulage contractor. The route from Warwick to north of Scone has not been inspected and would require further investigation of this route prior being deemed acceptable.

5.2.3 Port Newcastle to Scone (Direct Route)

Total distance of approximately 166 km from Port Kembla Eastern Berth No 2 to Mountain Station at Kyoto Energy Park, Scone. Transport route follows road network as follows:

- Exit Eastern Basin No 2 at Bourke St;
- Link onto Industrial Drive via Elizabeth St;
- Follow Industrial Dr to Pacific Hwy entrance and then access New England Hwy;

- Follow New England Hwy through Hexham, Maitland and Branxton to Singleton
- Travel on New England Hwy through Muswellbrook, Aberdeen and Scone;
- Take left turn into Liverpool St at New England Hwy Junction, Scone;
- Take right turn into Satur road and follow Bunnan Road to site access points.

The following route shall be generally used for all components not requiring over-mass or over-length permits and is the most direct route to site.

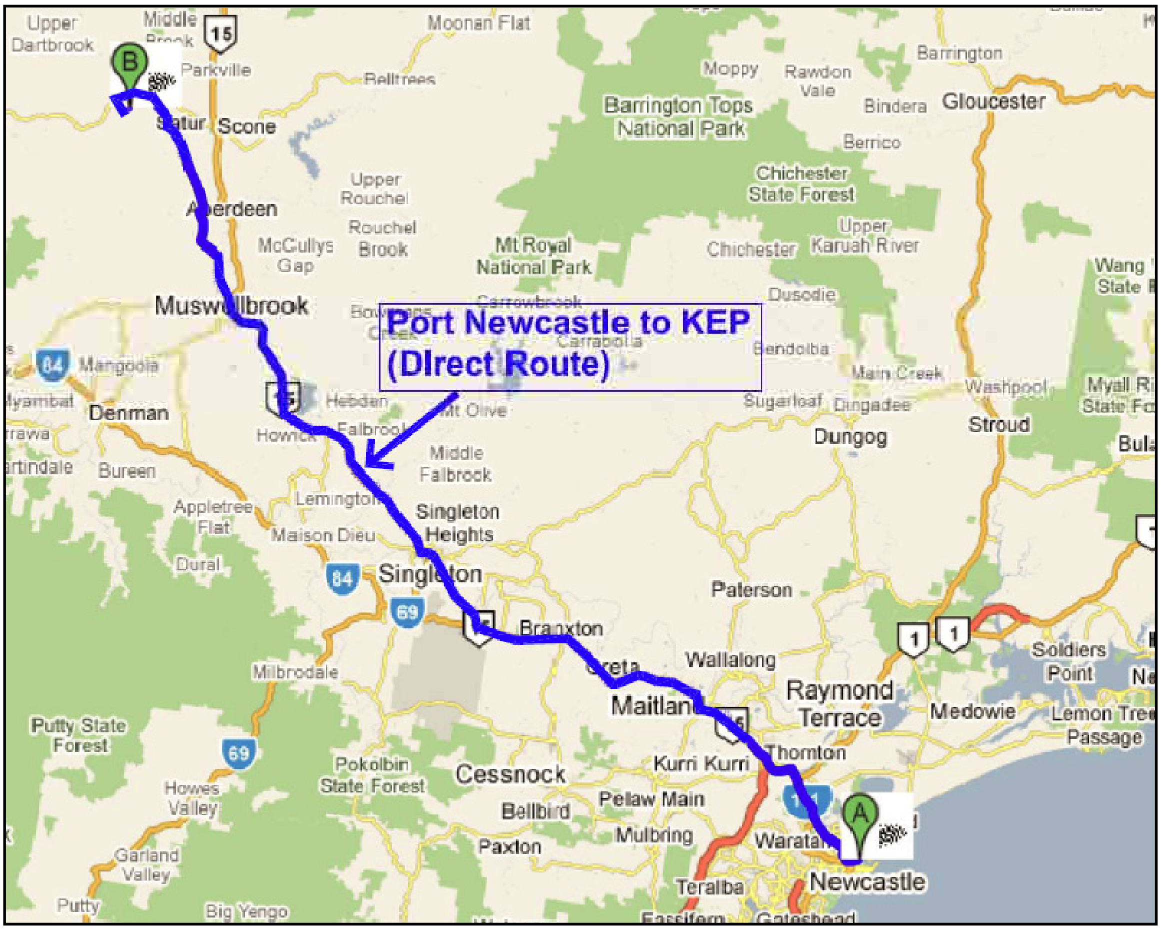

Figure 5.3 Port Newcastle to KEP (Direct Route)

A full description of the proposed diversion routes for over-size and over-mass vehicles is discussed below:

5.3 Port Newcastle to KEP diversion routes

For trips with restrictive mass and length limitations diversion routes were investigated to bypass identified pinch points and rural centres with potential traffic affectation. Pinch points can be described as locations on a road that has been identified as restricting the passage of the laden SPV and may include low overhead wires, pavement faults, road side culverts, narrow roads, sharp turns and under capacity bridges. The potential diversion routes were identified after consulting with the RTA Special Permits Unit at Glen Innes, Newcastle Stevedores and a Newcastle Haulage Contractor specialising in transport of oversize components in the area, such as 45m conveyors and 90 tonne capacity earthmoving equipment. Following this Pamada undertook a visual inspection of diversion routes to checking for adequacy of routes for transport of over-size and over-mass wind turbine components. A more detailed evaluation will be made by the RTA upon receipt of a permit application.

5.3.1 Eastern Basin to Port Newcastle to Branxton

The route out of Port Newcastle Carrington Basin via Industrial drive is suitable for oversize/overmass vehicles. No special restrictions were observed along this route. Multiple lane widths and wide intersections allow for safe transport onto Pacific Hwy, and while the road has heavy traffic flows no restrictions to road capacity, low overhead wires, bridges or pedestrian overpasses were evident.

Photo 5.0 Pacific Hwy Warabrook looking west showing multiple lane high road capacity.

5.3.2 Singleton diversion through Jerry's Plains and Denman

Two pinch points were identified just north of Singleton on the New England Hwy potentially restricting access for oversize components past these points. Details of the two pinch points are described as follows:

- ***Pinch Point 1:*** Low bridge (5.0 metre high bridge) at the intersection of Maison Dieu Rd and New England Hwy. This bridge may be a potential height restriction problem for transportation of the tower tube sections using a multi-axle low loader. (see Photo 5.1)
- ***Pinch Point 2:*** Steep ascent just after the bridge at McDougalls Hill. This ascent may be to steep for nacelles (80 tonne capacity) and some of the heavier tower tubes (max 68 tonne). An option may be to use assistance from second prime mover (push/pull), however this would require additional traffic management conditions and approval from the RTA to close a traffic lane. (see Photo 5.2)

Photo 5.1 Pinch Point 1 Low bridge Int Maison Dieu Rd/New England Hwy, Singleton.

Photo 5.2 Pinch Point 2 Steep ascent Int Maison Dieu Rd/New England Hwy, Singleton.

Other components such as blades, nose cones and hubs and general truck deliveries would not be affected by these two pinch points. The diversion route options bypassing Singleton (and Muswelbrook) are illustrated below in Figure 5.4. The first option (in blue) diverts through Denham and the second option (in red) utilises a longer route though Sandy Hollow.

Two possible diversion routes were identified to bypass the two pinch point locations north of Singleton as shown in Figure 5.4 below. These diversion routes are described as

1. Diversion route via Jerry's Plains and (Blue line in Figure 5.4). The diversion route follows the Golden Hwy, through Jerry's Plains then Denman road equating to a total distance of 193km, adding an additional 28 km in haulage distance to the direct route along the New England Hwy via Singleton and Muswellbrook.
2. Diversion route through Denman or Sandy Hollow (Red line in Figure 5.4). This route diverts through Sandy Hollow and Wybong Rd equating to a total distance of 216km, which is 50km more than the direct route.

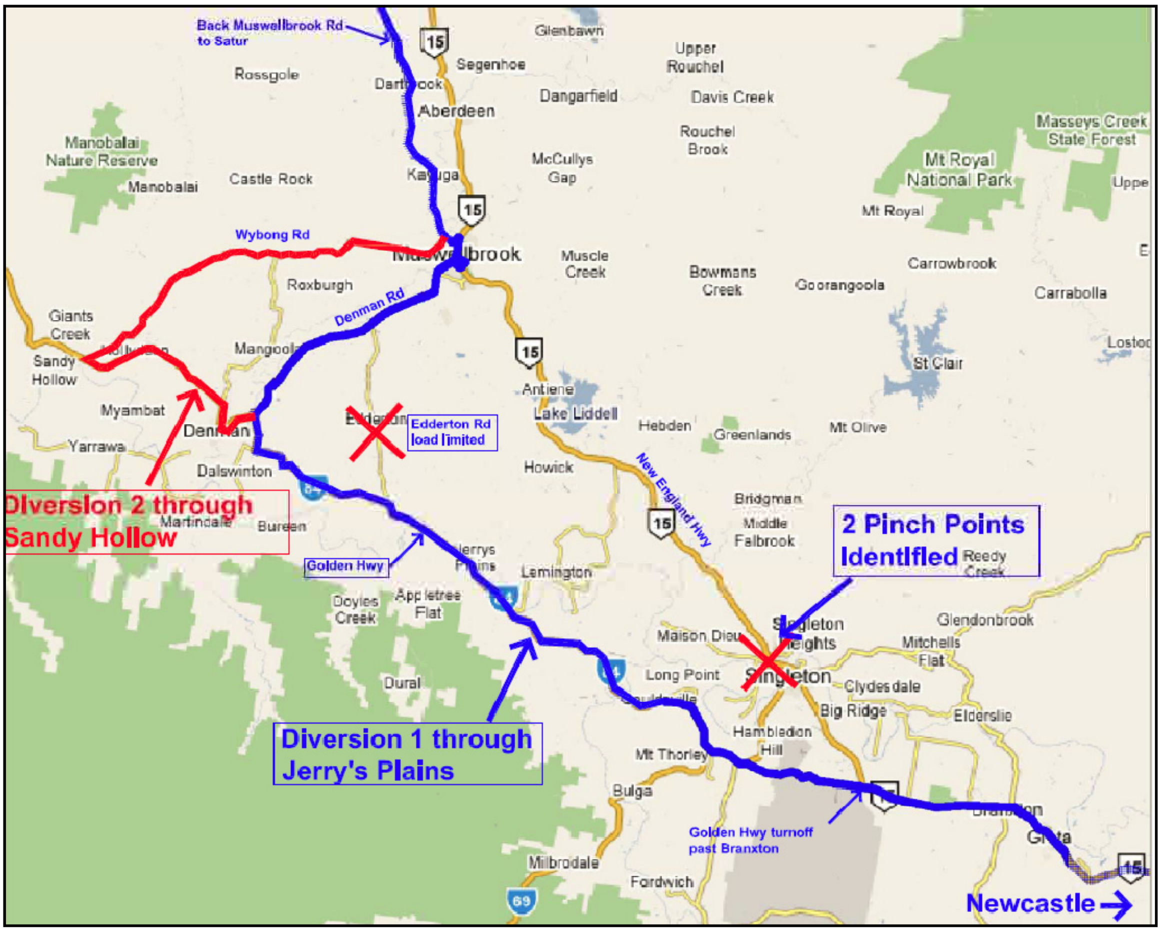

Figure 5.4 Singleton diversion via the Denman or Sandy Hollow

5.3.3 Muswellbrook diversion through Kayuga Mine

Three major pinch points were identified on the direct route in the Muswellbrook township, which are illustrated in Figure 5.5. These pinch points are described as follows:

- ***Pinch Point 1:*** Bell St Bridge (cnr Bell St and Victoria St) on the High Vehicle Detour diversion route Muswellbrook. The road leading up to the bridge has sharp turns which would not allow access for overlength vehicles. Based on visual inspection it is likely that the bridge would not satisfy load capacity for nacelles or transformers for the site substation. (see Photo 5.3)

- ***Pinch Point 2:*** Low bridge (5.2m) Muswellbrook. It is likely that tower tubes and possibly nacelles would be restricted due to height. The road dips under the bridge which would exaggerate the height of the component. Based on visual inspection it is likely that blades and hubs as well as all general deliveries would not be hindered. (see Photo 5.4)
- ***Pinch Point 3:*** Kayuga Rd bridge. This bridge would be restricted for overmass components including nacelles, transformers and tower sections. It is likely that blades would be restricted in turning capacity as well (see Photo 5.5)

Photo 5.3 Pinch Point 1. Under capacity Bridge Bell St, Muswellbrook .

Photo 5.4 Pinch Point 2. 5.2 m Bridge, New England Hwy just before Muswellbrook town centre.

Photo 5.5 Pinch Point 3. Kayuga Rd bridge- Wooden bridge with restrictive access.

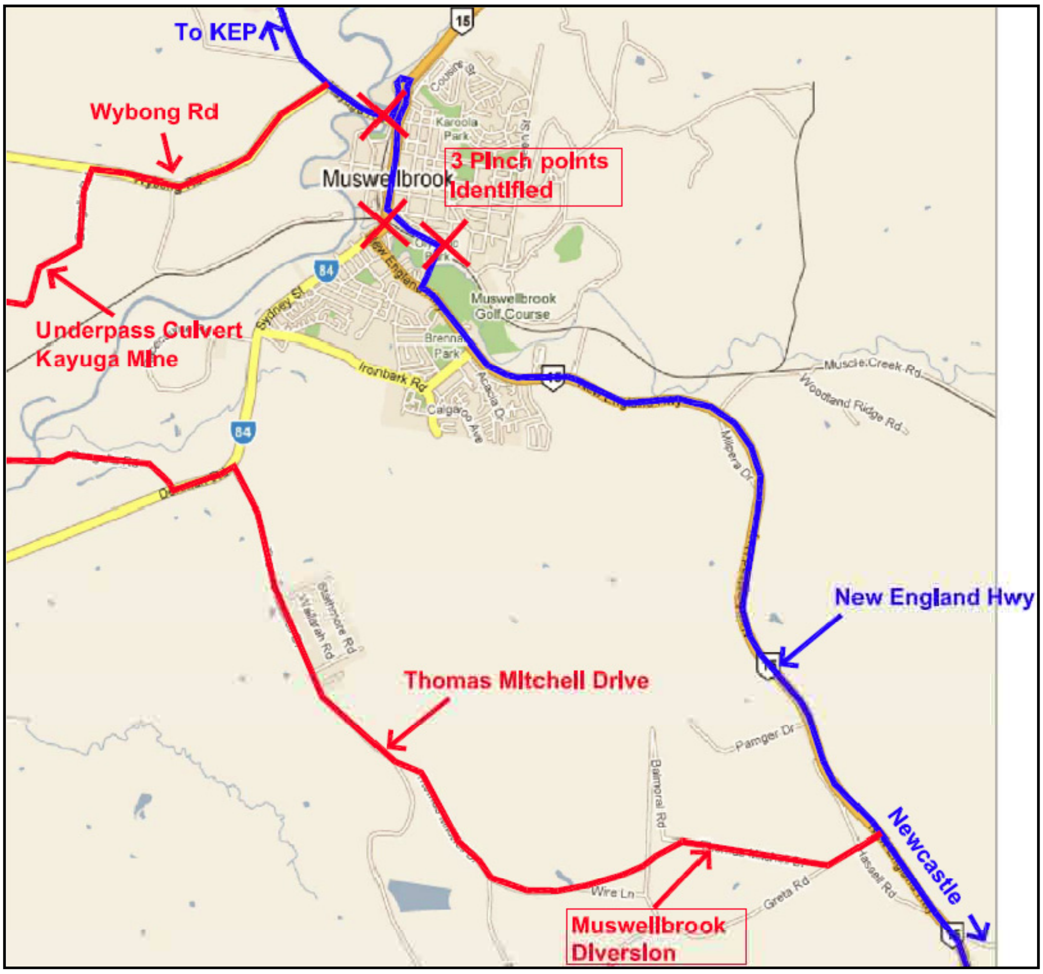

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Figure 5.5 Muswellbrook diversion via Industrial Area and Kayuga mine

A diversion route option (Red line in Figure 5.5 above) was identified along Thomas Mitchell Drive through the Muswellbrook Industrial Area, bypassing the township of Muswellbrook, transecting through Kayuga mine and connecting onto Wybong Rd. From Wybong Rd access is made onto Back Muswellbrook Rd to Mountain Station at KEP. This route has low traffic flows and is suitable for overmass and overlength components. An underpass culvert used by Bengala mine (see Photo 5.6) was identified along Bengala Rd as being potentially load limited based on initial visual inspection. During the permit application options for temporarily reinforcing the underpass culvert could be looked at if it was found to be unsuitable for the heavier components.

Photo 5.6 Bengala Mine Culvert Bengala Rd. Potential culvert strengthening required.

5.3.4 Scone diversion via Back Muswellbrook Road

A large roundabout in the centre of Scone township was identified as a turning circle constraint for over length vehicles particularly blades. An option to bypass the township of Aberdeen and Scone via Back Muswellbrook Rd was considered as preferable (see Figure 5.6). This road is mainly sealed up to Moobi until it becomes unsealed just prior to the intersection of Bunnan Road. Any sealing works damaged during the movement of components would be rectified. A small section of privately sealed road was inspected on Back Muswellbrook Rd near the intersection of Bunnan Road. Any damage to this section of the pavement would be replaced upon completion of all works on site.

For oversize components travelling through Muswellbrook a secondary diversion at Dartbrook along Dartbrook Rd can be taken. This is a sealed straight road 5m in width linking the New England Highway to Back Muswellbrook Rd.

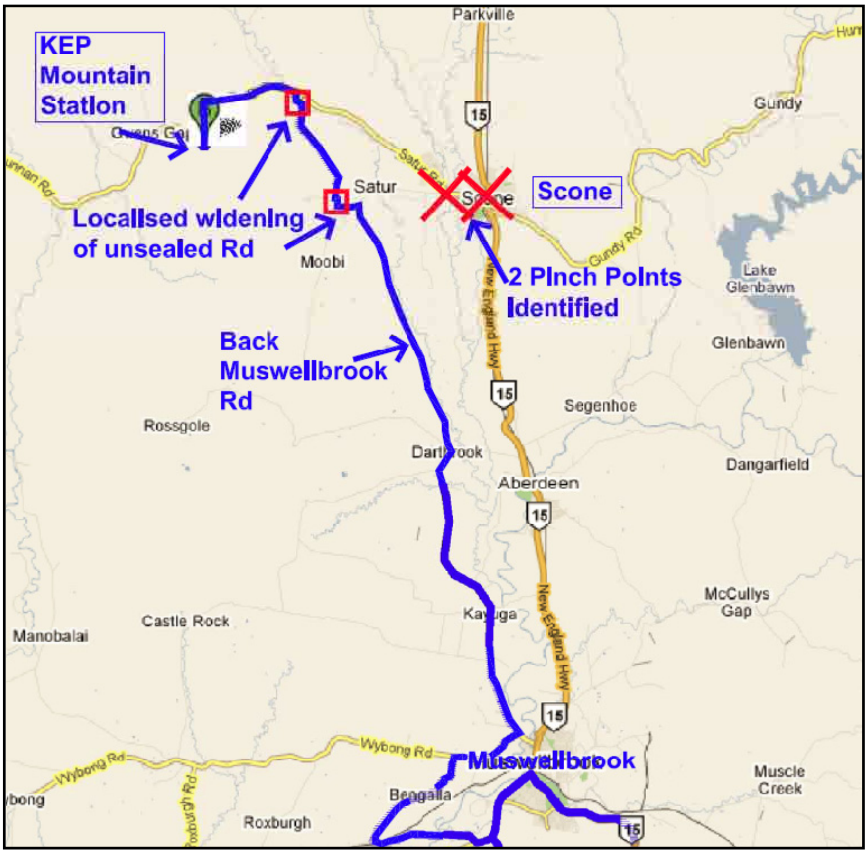

Figure 5.6 Scone diversion via Back Muswellbrook Rd

Photo 5.7 Localised widening of road required along Back Muswellbrook Rd, Satur

5.4 Transportation scheduling and coordination

WTG components would be shipped and then trucked to site as detailed in previous sections. Coordination of components arriving to site need to be coordinated by the Project Construction stakeholders to allow for adequate contingencies in the construction schedule. Turbine components arriving by ship, once they have cleared customs at Port will be unladen and stored for up to 2 weeks in an area located near the port berth. From here the haulage contractor will schedule road transport to site as permitted and under police and pilot escort where required.

Turbine sections and components arriving to site will be delivered directly to turbine hardstand areas for erection by heavy lifting cranes or assembly or to the site laydown area for temporary storage and pre-assembly as required. The laydown area will be flat, levelled and compacted with road base material to provide safe and secure storage at site for the purpose of delivery management and co-ordination.

The haulage contractor will have one or two prime movers and trailers readily available to the site for delivery of items to the various turbine locations to meet construction requirements. This strategy will enable a supply of a sufficient number of components on site ahead of scheduled construction requirements in order to minimise the construction timeframe and optimise usage of heavy machinery and cranes working at the site.

It is anticipated the haulage contractor will provide a tracked machine and a multi-tyred tractor (see Photo 5.8) on site to assist the prime movers in delivering components to turbine positions around the site, particularly where ridges are steep and it is not viable to provide roads suitable for heavy haulage road vehicles.

Photo 5.8 Multi-tyred tractor assisting Prime Mover and multi-axle loader up ascent .

5.4.1 Road access and safety

Based on the initial assessment of port options Port Newcastle was the preferred option and the most feasible option. A full inspection of proposed routes was undertaken based on initial discussion with stakeholders in the region. The following impacts of transport and traffic associated with the development require consideration:

- Route suitability in terms of road capacity, load layout, structures and road surface
- Impact on other road users along the proposed routes and associated safety issues
- Impact on local communities and traffic flow regimes
- Site Access, onsite traffic and new road construction impact

5.4.2 Suitability of Existing Road Layout and Structural Capacity

The critical vehicles will be those transporting blade and heavy parts such as tower parts and nacelles. The length of the blade trucks means that consideration of bend radii and roads width at bends as well as the approach to bridges were investigated during this study. The height of the tower sections when loaded will require that overpass clearances are checked along the route in detail. Preliminary visual inspections were made for this feasibility study.

The road surface capacity and condition were visually inspected for suitability. Further consideration would be given at the time of permit application by the RTA. Smaller roads may not be designed for the passage of over-mass vehicles, consequently any deterioration or road wear such as potholes or edge spalling may be accelerated by the passage of such loads. Any damage to existing roads shall be repaired immediately by the Contractor to local standards. A consent under Section 138 of the Roads Act (1993) from the Upper Hunter Council will be required for any works required over roads.

The structural capacity of features such as bridges, road networks and drainage culverts would be addressed at permit application stage. During the SPV permitting process route assessments are undertaken by the Road Traffic Authority in NSW. In NSW the permit assessment will include a review of the structural capacity of bridges along the main roads.

5.4.3 Impacts to Rural Community and traffic flows

Traffic associated with the development has the potential to disrupt and restrict normal traffic flow, increase noise levels experienced by residents and pose a safety threat. Other road users and the communities nearby to the transport routes may be subject to such issues.

SPVs required for the movement of tower components have the potential to restrict traffic flow due their size and slow speed. This may result in significant disruption to traffic when passing through metropolitan areas or lead to delays on single lane roads where there are not opportunities for other traffic to pass.

In the immediate vicinity of the site the movement of vehicles associated with the civil works trucks bringing material to site (concrete, road base, steel, water etc) will create additional noise and pose a hazard for local road users. Noise related traffic issues have been addressed as a worst case scenario in the noise assessment for construction activities. Construction related impacts of traffic movements and traffic management strategies will be addressed in detail in a Construction Management Plan.

5.4.4 Traffic Safety

The capacity of oversized vehicles to delay traffic may lead to other road users becoming frustrated and attempting unsafe overtaking manoeuvres as an example. The significant increase in the number of this type of vehicles along a single route compounds the risk. Wide loads on single lane (each way) roads introduce a hazard for oncoming vehicles. On the highway speed and driver fatigue are a concern while on narrow country roads the unexpected nature of such vehicles and the often windy nature of the route increase the risk to driver safety.
In the rural towns pedestrian traffic is also a consideration, where the highway passes directly through the commercial centre. The transport of turbine components through these centres will attract attention and may pose an additional risk to the safety of pedestrians as well as other road users. Proposed traffic routes have utilised routes which bypass rural centres to increase safety on major rural feeders and reduce community disturbance.

Where oversized vehicles are required to negotiate significant turns, sufficient warnings to other road users are required and it is likely that localised traffic control measures will also be needed.

5.4.5 Site Access

Site access to both Mountain Station and Middlebrook Station would be via Bunnan Road. In determining the suitability of access points the following criteria was considered:

- Suitability of the existing internal access roads including Clifford Quarry access point off Bunnan Rd for Middlebrook Station Access;
- Suitability of access points including, adequate sight distance either side of intersection point, road grades, roadside vegetation, current traffic volumes along Bunnan Road to ensure that operational safety is not compromised;
- Existing traffic conditions at access points and suitability for traffic management, while entering or exiting the sites during both the construction and operation phases;

The existing access point to Mountain Station was found to be unacceptable due to insufficient sight distance east of the current access point. The current access is situated at the end of a road crest with insufficient turning radius and unsuitable grade for ease of access. It is proposed to move the access point further west along Bunnan Road to increase sight distance, increase turning circle radius past roadside vegetation, and allowance for passing traffic without the need for undertaking any upgrade works.

The existing access point at Middlebrook Station is used by Clifford Quarries trucks off Bunnan Road. The access is located on a straight flat grade with adequate sight distance either side of the intersection. No structural modifications or upgrade works are proposed for the intersection.

Photo 5.7 Existing and proposed Mountain Station Access Point

Photo 5.8 Existing Middlebrook Station Access Point for Quarry vehicles

5.6 On-Site Traffic Management

The weight and length of the vehicles will mean that grades and changes in grade will require due consideration. Ideally grades en-route should be less than 10% however once on site grades of up to 14% and over can be negotiated with the support of a multi-tyred tractor and tracked earthmoving equipment.

Construction of the wind farm requires that access tracks be constructed to each turbine position. Most of these roads are already formed as farm 4WD tracks along the ridgelines and would be

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upgraded where required. These roads and the crane hardstands need to be of sufficient pavement design to facilitate the traffic of heavy and civil works vehicles. Post construction they may be grassed over for the occasional use by maintenance staff.

The nature of the impact on site due to upgrading of existing access tracks may include disturbance to habitat, potential erosion and the introduction and movement of weeds onto farmland. Erosion and Sedimentation design and controls will be considered separately to this study.

The Wind turbines are located away from dense vegetation so that the disturbance of vegetation is minimal. During the hours of construction wildlife are likely to move away from the immediate vicinity, however assuming habitats are not removed this is only a temporary impact. The impact of the construction and use of internal roads on flora and fauna is addressed separately in an independent study.

Disturbance to areas of indigenous and cultural heritage importance has been avoided. Construction support facilities have been located on existing cleared areas away from stream and drainage channels. A separate archaeological site study has been carried out for both sites and is contained as an Appendix to the main Kyoto Energy Park Environmental Assessment.

Appropriate drainage design and avoidance of steep slopes and water courses serves to minimise erosion. Further to this, detailed management plans will be required to ensure the appropriate sediment control measures are put in place on site and maintained. Vehicles will be entering the site with loads which may carry unwanted plants or seeds or spores. The propagation of weed species may be a negative impact of transport on site and, depending upon the concerns of the landowner, may require control or mitigation through the use of wash down areas for vehicles.

Post construction and commissioning tracks would be allowed to re-grass. During the operational lifetime of the wind farm traffic levels on internal access tracks will be very light. Scheduled maintenance activities occur every 6-12 months using light commercial vehicles or four wheel drives which will have a negligible impact. Rarely there may be the requirement for medium to large cranes to access the site in the unlikely case of the failure of a large component which cannot be repaired on-site. Unless original access roads or hardstand have suffered significant deterioration there is unlikely to be a requirement for further civil works. Maintenance of Sedimentation and Erosion Control facilities and regrading shall be undertaken as required.

6.0 Traffic Generation

The proposed wind farm development will result in an increase in the level of traffic however this level will vary greatly between the construction and operational periods.

The major transportation requirements for various stages of the project including construction operational and decommissioning are listed below:

- Oversized and/or overweight components associated with wind turbines, e.g. tower, nacelles, blades, substation transformers etc requiring special permits;
- Site establishment and delivery of construction facilities including concrete batching plant, site offices and containers;
- Transportation of prefabricated components and panels for Solar PV Plant;
- Transportation of components for Closed-loop hydro plant;
- Electrical equipment required for the site substation and the electrical reticulation system within the Energy Park. The substation transformer is the most significant of these items to transport.
- Road base and gravel for upgrading of internal access tracks and hard stands around each tower base.
- Sand, water, cement and concrete aggregates required for the tower footings, anchors and other buildings;
- Heavy earthmoving and erection equipment moving to and from the site, e.g. cranes, excavators, graders, dozers, rollers, watercarts, etc;
- Light vehicles (cars, utes, station wagons etc.) for transport of workers and other project personnel to and from the site and for maintenance and operational staff during park operation;
- Improvements to the road network to allow large vehicles to negotiate the local roads, including local widening at 'pinch points' and at the site access points.
- Daily operation and control of the KEP facilities, including maintenance of facilities internally and externally
- Intermittent traffic generated during operation for the Visitors and Education Centre at Mt Moobi Plateau.
- Decommissioning or wind turbine structures, Solar PV structures, site substation, buildings. These facilities shall be decommissioned, and transported from site fro reuse or recycling at external facilities. This is expected to occur following a 30 years lifecycle for all components.

There will be provision for appropriate construction and transport vehicle routes to the KEP through one or more designated access points from main roads and local access roads.

The main sources of development traffic occurring during construction and operational stages of the project and will be discussed in more detail below. The construction of the KEP shall occur in a single continuous stage with an anticipated duration of approximately 20 months for both sites. The operational period for the wind and solar plant is anticipated for a maximum of 30 years duration combined.

6.1 Construction Period

Construction of the project will be undertaken on two separate sites Mountain Station and Middlebrook Station. The construction period is estimated to be for a period of 20 months duration for all works on Mountain and Middlebrook Station sites. Works on Mountain Station will comprise site establishment works, earthworks, heavy lifting, access track construction, concreting and building constructions etc. Works on Middlebrook Station will include construction of access tracks installation and commissioning of wind turbines and overhead connection to Mountain Station site substation. The operations period is expected for a 30 year duration for all components of the park. Following this components would be decommissioned and transported from site.

The main sources of construction traffic are described below. A full summary of all traffic movements are outlined in Appendix B - Traffic Movements during Construction

6.1.1 Tower & Turbine Traffic and Electrical Component Delivery

Tower sections, blades and nacelles will be delivered by extended articulated trucks. The prime mover and trailers will be in excess of 30m long with the blade carrier approximately 44m long load. Electrical components generally will be delivered on semi trailers, with the exception of the substation transformer which will be transported on a multi-axle low loader. All tower and turbine components will require an Special Permits as well as vehicle escorts as described in Section 3.0 Roads and Traffic Authority requirements. Larger components will require pilots and some will require police escorts.

6.1.2 Heavy Earthmoving Equipment

The earthmoving equipment and heavy lifting cranes required to complete activities will typically include:

- 30-40 tonne Excavator with rock breaker attachment;
- Mini Excavator for trenches;
- Grader for road and drainage formation;
- Bulldozer;
- 2 x 40 tonne articulated dump trucks;
- 2 x rollers;
- 1 x mobile concrete batch plant (approx 100m3/hr capacity);
- Front end loader;
- Drill rig for geotechnical work;
- Trucks (flat beds, semi-trailers, extendable trailer, concrete)
- Heavy lifting cranes (50,100,500,850 tonne capacity)
- Assist cranes (50 tonne, Crawler Crane, Franner)
- fork lift
- various 4WD and service vehicles.
- Multi-tyred tractor
- Mobile Rock Crusher
- Scraper for bulk earthworks
- 1 x Backhoe

6.1.3 Foundation Construction and Rock Anchors

The use of a concrete batching plant will help to reduce the amount of wind farm generated traffic on the local road network. It is estimated that approximately 6,300m3 of concrete will be required for the turbine foundations. In addition and estimate of 2800m3 of concrete will be required for the solar frame foundations and 160m3 for Closed loop hydro plant. Additional cement requirements shall be used to premix grout slurry for rock anchors. The above quantities are estimates with final quantities subject to detailed geotechnical investigation and foundation design. Semi-trailers will deliver steel reinforcement for the footings most likely from the Newcastle area. Grout and anchor strand will be delivered from Sydney.

6.1.4 Concrete aggregate, Sand and Cement

Delivery of raw materials (concrete aggregate, sand cement), for the on-site concrete batching plant shall be stored in bins on site for use as required. Steel reinforcing for the foundations will be delivered by 22 tonne semi-trailers ex-Newcastle with a total of 101 one way trips estimated. Grout for rock anchors will be delivered by semi trailers, with approximately approx 15 tonnes of cement per turbine, equating to a total weight of 630 tonne representing 31 loads. Strand for anchors which would comprise an estimated total weight of 250 tonne would be delivered in cable drums each weighing 9 tonne, representing approximately 14 deliveries to site.

6.1.5 Water Supply for Concrete, Dust Suppression and Emergency Services

The water required for concrete production will be sourced from a Council registered bore and will be trucked and stored on site. A separate water tank shall be used on site for concrete batching. 2 additional tanks will be located in the site compound for amenities and for fire fighting storage.

The water requirement for concrete foundations will be in the order of 1759 m3 equating to 147 truck movements. Water requirements for grout equate to approximately 283m3 of water (0.45:1 w/c ratio), equating to 24 water tanker loads. Water for dust suppression shall be sourced from on-site dams or registered bores, and trucked to the site. An allowance for 3 trucks per day has been made based on a tanker capacity of 12m3 (12 tonne capacity). The water used for dust suppression shall vary on a daily basis based on temperature and wind conditions.

6.1.6 Supply and Installation of the Solar Electric Plant

Installation of the Solar Photovoltaic (PV) Plant is proposed on Mt Moobi Plateau, Mountain Station. Traffic requirements have been made based on the supply and installation of a dual axes tracker system comprising up to 1000 individual dual axes solar trackers and associated electrical systems, cabling and control equipment.

The solar tracker units are currently manufactured overseas and would be transported to site from the port of entry. Solar cells, inverters, low voltage electrical components and control equipment would be either imported or sourced within Australia. No special permits for oversize or overlength will be required. The design has estimated transportation requirements for installation of up to 1000 dual axes tracker solar systems. All components will be delivered on a flat bed truck directly to site for assembly on Mt Moobi or for temporary storage in the laydown area. Solar tracker mounts (4 per truck), solar frames (10 per truck) and galvanised iron sections (20 trucks) would utilise the Mt Moobi area for installation and erection.

A full description of traffic movements during construction is outlined in Appendix B - Traffic Movements during Construction.

6.1.7 Supply and Installation of the Closed loop Hydro Plant

The Closed loop hydro unit will utilise 5 mini hydro synchronous generator units each weighing approximately 1.5 tonne. These will transported by flat bed truck and will not require over size or over mass permits for road travel. Up to 1.5 km of pipe will be delivered on flat bed truck in 6 or 12 metre sections. Concrete header and footer tanks will be designed as in-situ reinforced concrete tanks batched and poured on site. For construction of concrete tanks, slabs and retaining walls an estimate of 160m3 of concrete has been allowed for as internal movements from the site batching plant to the hydro plant.

Construction traffic includes traffic generated by specialised contractors for concreting works and installation or pipe and hydro units. These movements have been included in Site personnel estimates and general deliveries.

6.1.8 66/132/33kV Transmission Line

Overhead line work external to the site shall consist of pole replacement and line upgrades. Final negotiation of line route and easements will be undertaken subject to approval and in consultation with Energy Australia. Final line design and construction would be undertaken by an

Energy Australia certified contractor. Traffic movements associated with 22km of line upgrade work has been estimated in this report. This would require a maximum of 220 poles (estimated @ 100m spacing for traffic requirements only), equating to a total of 74 truck movements. Line work has been estimated at a total truck requirement of 60 trucks. These movements would be distributed along the line route external to the site.

Traffic Management requirements would be included in a detailed Traffic Management Plan submitted by a third party contractor submitted prior to the works being undertaken. Cable reels for underground power cables will be delivered to site using a semi-trailer, estimated at 66 semi-trailers movements.

6.1.9 Employee Traffic

There will be between 50-60 employees on-site during the civil works mainly the construction of the wind turbine foundations and electrical reticulation works. Maximum labour on site is expected to peak at between 80 and 90 when tower erection commences however the peak will decline as civil trades will quickly demobilise leaving approx 40 employees for the final 13 months of the contract.

The majority of employees are expected to be based in the Upper Hunter area with other skills base travelling from the Newcastle region, on the New England Highway.

6.2 Operational Period

In contrast to the shorter construction period, the traffic associated with the long-term operation of the KEP will be minimal. There are two phases of operations being:

- Commissioning and Testing;
- Operations and Maintenance;
- Additional tourism traffic associated with Visitor’s and Education Centre

6.2.1 Commissioning and Testing

Following erection and installation, commissioning of the wind turbines would commence. During the commissioning stage, teams of technicians (10-20 staff) will be travelling to and from the site daily in commercial vehicles such as 4WD and Vans for a period of 2 to 4 months.

In the long term operations the KEP will be staffed by 2-5 permanent staff, depending on final requirements. Site operational traffic would involve movement of employees to and from the site each day from within the Hunter region. The majority of employees will reside in Scone and the majority will use light vehicles or 4WDs.

6.2.2 Maintenance requirements

Maintenance requirements will vary for the Wind, Solar and Hydro components of the project. Remote monitoring of the solar and hydro component will generally reduce the need for ‘hands on’, on-site testing and maintenance. Maintenance would generally consist of replacements of damaged equipment specialised technical works such as inverter replacements (solar) or turbine maintenance (hydro). Much of this work can be carried out on site by specialised technicians that will travel to the site. A Maintenance shed has been allowed for on site for maintenance of small to medium sized components.

Maintenance of the wind turbines will occur in specified periods from monthly to 4 yearly for the life of the Energy Park. Maintenance vehicles will access the site at access points and traffic requirements will be minimal. Hence operational traffic level will be low and consist of light commercial vehicles such as vans and 4WD’s. Larger equipment may be required for major unscheduled maintenance events such as the replacement of a gearbox or in case of the failure of a drive train component which cannot be repaired on-site. A maintenance shed will be located on site for storage of smaller components, to reduce the need for transportation of large components for servicing. Modern wind turbines have a winch installed within the generator as a safety requirement and also to allow for smaller components to be lowered to ground for ease of maintenance.

6.2.3 Visitor's and Education Centre

Provision has been made in this study to construct a Visitor's and Education Centre on Mt Moobi Plateau, Mountain Station. Consideration has been made in this study for traffic requirements estimated during construction of this facility. Intermittent traffic generated from visits to the site from educational groups such as local schools, TAFE students, University or tourist groups would be expected. These activities are expected to be in buses (individually or in groups) with an allowance of 3-4 bus trips per week included in the traffic estimate.

Existing tourist accommodation is located at Middlebrook Station, off Middlebrook Rd and is currently accessed by large buses visiting the site. An average of 2 large bus trips per week currently visit the Middlebrook Station Accommodation site. Existing tourist activities on both sites include round trips to Mountain Station and Mt Moobi lookout using a modified 4WD bus.

The proposal will include merging of the existing tourism activities with expected participation from educational institutions, tourist groups, and other interest groups. Access to the Visitors and Education Centre would be via main access for the site from Bunnan Road. A 10-15 space carpark would be located behind the Centre to accommodate vehicles visiting the site. The Centre would not be open to the public initially and is proposed to operate on an intermittent basis (i.e. by appointment only) for external groups (educational institutions, visitor groups and conferences) to utilise the facility.

7.0 Mitigation measures

The following further measures would be implemented to reduce the potential transportation effects and traffic problems on roads:

- A Special Permit for all over dimension and/or over weight loads will be required prior to transportation of these components. An application to the Special Permit Unit of the RTA will be required for individual or multiple permits prior to delivery.
- Special permit transportation will require pilot and police escort vehicles.
- Special considerations for travel outside of scheduled travel periods as specified by the RTA will need to be approved by the NSW Northern Region Police Department.
- Offsite transport activities to minimise inconvenience of the public. This would cover issues such as speed limits, signage, avoidance of convoys, allowing vehicles to pass slow traffic at regular intervals and public notification mechanisms.
- For unsealed roads, regular maintenance as required together with dust suppression where necessary
- Erection of suitable warning signs on the site to warn of construction traffic
- Minor improvements as required to facilitate long loads, e.g. minor earthworks, pavement widening etc. as identified by final route/vehicle details.
- Extension of culverts where necessary to allow convenient passing of wider vehicles. Improvements to culverts
- Liaison with adjacent landowners and notification of information and warning signs to minimise potential effects during construction work. Information/warning signs will be erected alongside public roads on the property to warn of construction traffic.

These issues shall be addressed in the Traffic Management Plan for the site as described below.

7.1 Traffic Management Plan

A Traffic Management Plan (TMP) will be developed for the project and integrated with the requirements for the Construction Environmental Management Plan. The TMP will ensure all issues are addressed and incorporated to maintain safety standards and minimise impacts on existing traffic users.

Components of the TMP will include:

- Community consultation program for local residents, through measures such as newsletters and letter drops, with regular updates, to ensure that the community is aware of the activities and timings, and has an opportunity to comment;
- Designated delivery periods, delivery routes and access points to the site for all materials and plant supplied for different locations around the site including provisions for local bus travel considerations;
- Designated speed limits and load limits specified for heavy vehicle routes;
- Design and construction of site access tracks to ensure safe vehicle movements around the site, with appropriate erosion and sediment management plans and controls to avoid erosion from site tracks and laydown areas;
- Directional and warning signage on designed access routes to the site;
- Designated reserves on the construction site for parking, turning, loading and unloading;
- Appropriate traffic controls and management on site, to ensure that vehicles use constructed site tracks and do not travel across ‘cross-country’;
- Implementation of an inspection and maintenance program for access routes and site tracks, to ensure these are kept in adequate and safe condition;
- Implementation of controls and management measures to ensure farm stock (sheep) are not able to escape from the site through access points, during construction operations (both during day time activities and at night when no work is carried out).

During normal wind farm operation the traffic generated by site staff would be negligible in comparison with existing traffic flows, limited to vehicle movements to and from the site, and occasional movements on access roads during site inspections. However, there will be occasional requirement for additional vehicles to access the site during maintenance activities, and this aspect will be managed through the overall Traffic Management Plan developed for the project.

7.2 Haulage Contractor for Over Size and Over mass Components

Following development of the TMP a licensed and experienced haulage contractor(s) will be contracted, with special equipment and experience in transport of over-weight and over size cargoes, and have established knowledge and contacts with road authorities. The contractor(s) will be responsible for:

- Compliance with all specific requirements of the TMP and CEMP for the project;
- Obtaining all required permits (overmass / oversize permits) for undertaking the haulage tasks, from the responsible authorities;
- Compliance with permits obtained from authorities, including measures such as pilot cars and police escort, and staging of deliveries to meet restrictions on travel times on different routes;
- Mode of operation and timetable, and modifications to any infrastructure (including physical improvements to access roads, temporary removal of street furniture, temporary modifications to existing infrastructure such as roundabouts), as part of obtaining the required permits;
- Phasing of delivery schedules to meet construction requirements, and to ensure deliveries will not overwhelm local transport infrastructure, based on the permits obtained from authorities;
- conduct any surveys and arrange for any pavement and infrastructure inspections prior to carrying out the transport tasks to ensure all access roads are suitable and liaison with private landowners (where required by main contractor);
- installation of suitable warning signs and signage at appropriate locations along the route, to alert other transport users of the transportation activities.

8.0 Summary and Conclusions

Port Newcastle is the most commercially feasible option when considering overall transportation costs, travel distance, port handling and road access to the site. This port is considered the most preferred port of entry for the project. There are haulage contractors and Stevedores within the Newcastle area that have the necessary experience for carrying large components including transformers and heavy earthmoving equipment for the Hunter Mines situated around Muswellbrook and to the North. Initial traffic routers have been identified based on discussion with these stakeholders in the region. Storage space is restrictive at the Eastern Basin however is sufficient and manageable. Other options for storage could be investigated including additional storage space on nearby land, however for efficient port handling the storage area is recommended to be within approx close proximity to the dock. Various onsite options could be to reduce space needed for turbine components for example blade cages can be stacked in pairs to minimize space.

Port Kembla, Wollongong has adequate faculties for access and storage. Certain time restrictions on metropolitan roads could considerably delay and effect coordination of transport. Road vehicles would need to bypass Sydney using metropolitan link roads (mainly M7 and M2) accessing the Sydney to Newcastle Freeway.

Darling Harbour has a quick turnaround but is time limited which could cause scheduling problems from storage areas.

Both Port Kembla and Darling Harbour are heavily trafficked ports which is likely to place difficulties on docking and egress movement. Access out of these sites would need to be investigated further. Storage costs were high for both ports which would seriously increase overall costs, and potential for costs blowouts corresponding with site delays to scheduling traffic.

Fisherman's Wharf, Brisbane has good berth capacity, truck access and manoeuvrability, however storage space is some distance from the berth and very narrow, which would reduce manoeuvrability of large components. Other options could be considered for nearby storage however this would severely increase costs and may over complicate unloading at the port. The port is serviced by a dual carriageway freeway to he south which is ideal, however overall distance to site would potentially cause logistics problems and increase transportation costs significantly.

Road Transport is considered the most preferred method of transport. The major transport impacts of the KEP will occur during the construction stage. During the operational stage, the wind turbines are designed to operate with minimal maintenance and therefore the associated transport impacts, apart from the replacement of blades and nacelles over the twenty five year life would be minimal. Facilities and personnel for basic maintenance activities on site would be provided. The solar and mini hydro facilities are monitored from a remote location and will not require heavy lifting of components for the duration of the project.

The proposed transport route from Port Newcastle utilises major road networks such as multilane roads and highways for long distance travel which generally have adequate road capacity, sight distance and minimal height restrictions such as low overhead wires, overhanging trees and lines. Diversion routes were investigated during the study which bypass the rural town locations of Maitland, Singleton, Muswellbrook and Scone which were found to contain localised restrictions or 'pinch points' on turning radii for blades, and low and old bridges.

During the construction stage, the transport activities external to the site will include the delivery of machinery, raw materials for the manufacture of concrete for the foundations, electrical components, the delivery of turbine components, solar trackers and cells, hydro units, construction of buildings and employee traffic. The longest item to be transported is the blade cage at nearly 44m. The nacelle is the heaviest item weighing in excess of 80 tonne.

The main access point to both Mountain Station and Middlebrook Station sites is from Bunnan Road respectively. The Mountain Station access would be relocated 100m west of the current point to increase site distance and allowance for traffic management at this point. The current

Middlebrook access point is adequate for all vehicle types proposed and is currently used by the Road Base Quarry operation on that site. These two access points are safe access points for all construction traffic (both light and heavy vehicles) and allow the use of the existing internal access track network on both sites.

The access to all facilities will be via an internal road network. The internal network which is mostly existing and would be upgraded as required to a total pavement width of 5 metres. Pavement will be all weather design and will be constructed from locally sourced materials from the Middlebrook Station Quarry. Internal access tracks will be constructed to follow the natural contours in order to minimise grades, earthworks, visual impacts and be constructed on ridge lines where possible to negate erosion difficulties. The roads will be used initially by construction traffic and then retained for the use site personnel and by maintenance and monitoring vehicles.

A mobile concrete batching plant would be utilised for most concrete works including turbine foundations, building slab foundations, mini-hydro tanks, and solar tracker foundations. Additional traffic should not adversely effect the traffic operation of the external road network, however it does represent an increase in heavy vehicle traffic and therefore existing regular road users may need to be informed of increased usage of local roads. Traffic routes have been selected to minimise disturbance to normal traffic flows in local centres.

Subject to approval a Traffic Management Plan (TMP) shall address all aspects of road transportation and quantify impacts and amelioration procedures for improvements to local roads, community consultation and awareness, traffic and safety management. Heavy vehicle movements should not be undertaken on the local road network during school bus times.

9.0 References

RTA 2007 Operating Conditions: Specific permits for oversize and overmass vehicles and loads. NSW Roads and Traffic Authority RTA Special Permits Unit

Suzlon Energy Australia (SEA 2006)- Transportation Manual S88-2.1 MW, V3 Suzlon Wind turbine

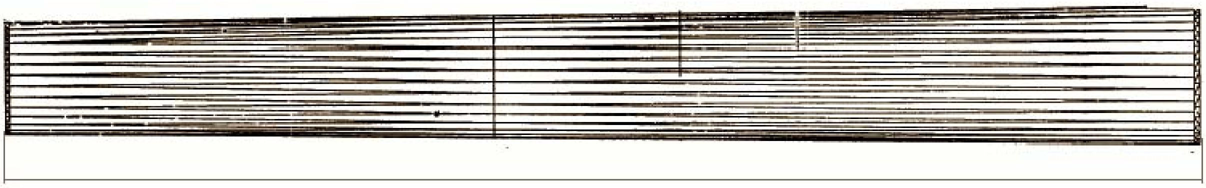
RTA 2006 - Guide to Traffic Generating Developments
http://www.rta.nsw.gov.au/publicationsstatisticsforms/rtapublications.html

Appendix A

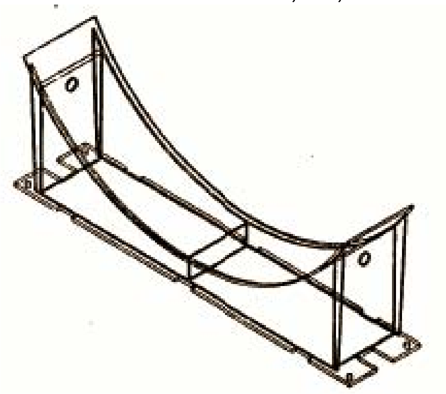
Wind Turbine Equipment Specifications

(This Specification has been extracted from the Suzlon Transportation Manual for the WTG S88-2.1 MW V3 turbine).

Tower Tubes



Tubular tower section T1, T2, T3 & T4



Saddle

Tower section on the low bed truck

Nacelle

Nacelle Weight and dimension details

The S88-2.1 MW nacelle overall dimensions and weights with assembly/transportation frame.

Length (mm)	Width (mm)	Height with carrier (mm)	Weight (kg)	Weight with carrier (kg)
9376	3995	4093	72000	75000

Tolerance (±2%)

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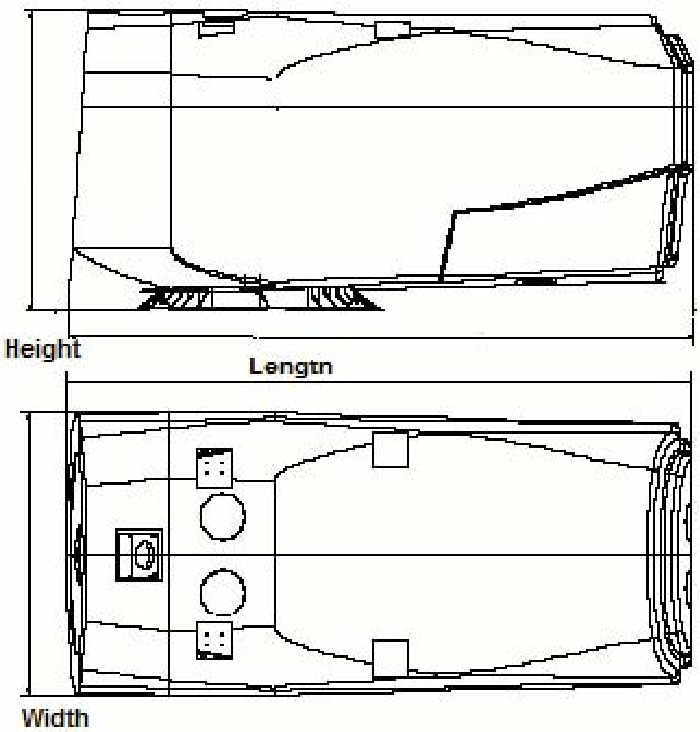


Nacelle internal components weight and maximum overall dimension

Components	Length (mm)	Width (mm)	Height (mm)	Weight (kg)
Main frame	4267	3500	1160	13000
Main frame bearing bottom				3721
Yaw unit top	490	490	1143	298
Yaw drive unit				2220
Rotor lock	1262	300	300	291
Girder system	2975	3500	860	3554
Rotor shaft	2760	1500	1500	7879
Gear box	3200	2500	2566	20200
Main bearing housing	1730	666	1294	2777
Gear mount	490	330	395	1272
Generator	3430	1850	2230	9300
Nacelle cover	9376	3995	3815	2628
Control panel	1600	600	1900	430
Nacelle carrier	3100	3000	500	2960
Miscellaneous				4300

Tolerance (±2%)

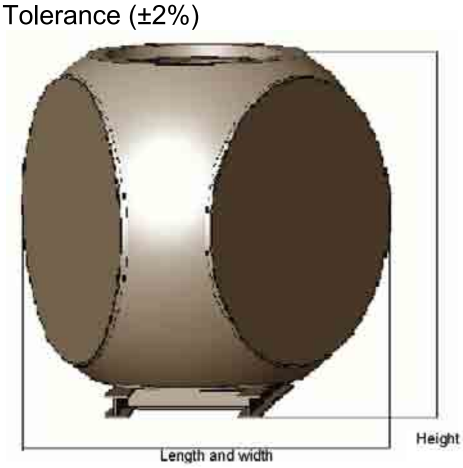
Nacelle on multi-axle low bed trailer

Hub

Hub dimension and weight details

Hub model	Length (mm)	Width (mm)	Height with carrier (mm)	Weight (kg)	Weight with carrier (kg)
S88-V3	2941	2941	3129	16799	17164

Tolerance (±2%)



Hub with transportation carrier

Note: During transport, the hub should be protected with the tarpaulin cover (cover made by cotton laminated fabrication sheet or flex) to avoid ingress of dust, damage and rainwater.

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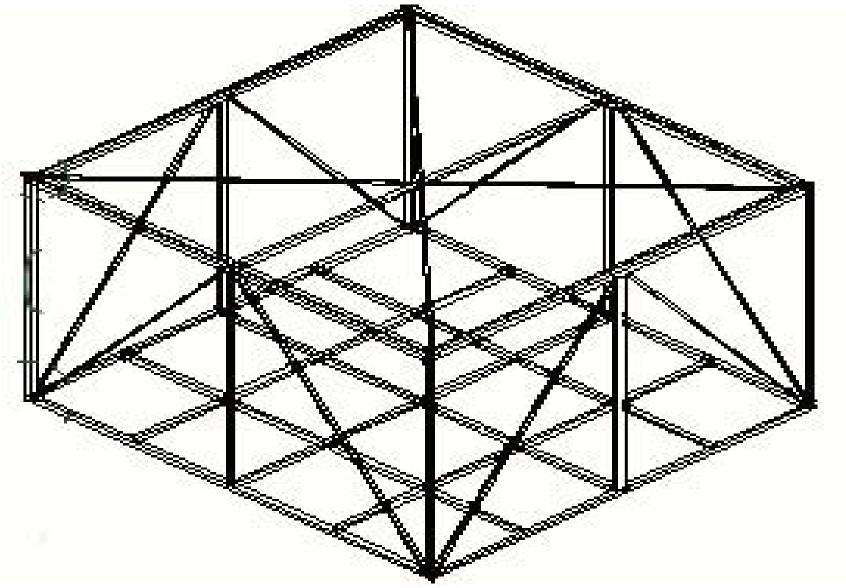
Nose cone

Nose cone cage dimension and weight details

Component	Length (mm)	Width (mm)	Height (mm)	Cage weight (kg)	Weight with nose cone (kg)
Cage	3900	4500	2300	1120	1808



Nose cone transportation cage

Before storing, the nose cone must be dismantled into three (3) segments. Then the top of the nose cone cage is removable. After removing the cage top, the nose cone segments are kept over a ply wood (ply wood must be approved and minimum 10mm thickness) support inside. Then the top cover of the cage is attached by M12 bolt/4nos.

Nose cone dismantled into three (3) segments

One (1) cage is loaded in a flat bed truck.

Transportation cage with nose cone

one cage loaded on a truck

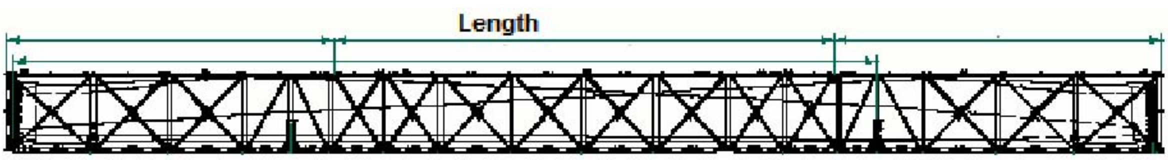
Blade

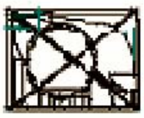
Blade dimension and weight details

Model	Blade size	C of G mm from blade mounding	Length (mm)	Width (mm)	Height (mm)	Weight per blade (kg)
S88-V3	43.25	14600 (±500)	43250	2190	3200	7700 (±200)

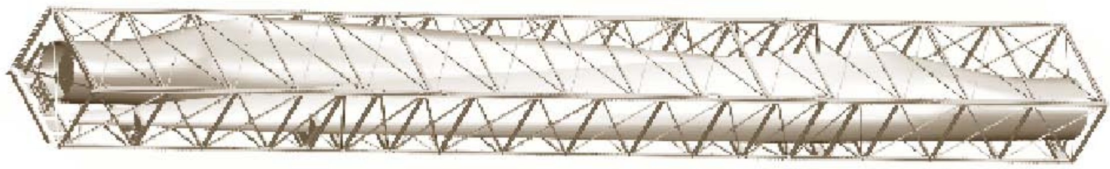
Blade transportation frame dimension and weight details

Frame model	Blade size	Length (mm)	Width (mm)	Height (mm)	Cage weight (kg)	Weight with 2 blades (kg)
S88–V3	43.25	43870	4050	2950	14500	29900 (±400)





- Two (2) blades are loaded in a frame for transportation purpose.
- While loading the blades in the cage, one (1) blade tip portion should be projected towards back side of the truck and second blade tip potion should be projected towards the truck.
- The blades are supported at an angle of inclination.



Two (2) blades stored in a frame.

Blade lifting Instruction

Blade transportation cage loaded to the truck

Panels and accessories

Panels
Before dispatch all bottom panels (power, capacitor, LTVR panels & panel frame) are to be packed with corrugated box. After packing, the panels are loaded in the container using fork lift or crane. While using the crane for lifting the panel, the box top cap must be removed before attaching the slings. The slings are attached at four (4) lifting points on the top of the panel with shackles. While lifting the panel, the webbing slings must be uniformly distributed. While using the fork lift, fork must enter as per instruction mentioned in the box location.

Accessories
The nacelle, hub and nose cone accessories (anemometer holder, duct, nacelle hand rails, nose cone bracket, resistor box, etc.) are packed to the corrugated box in kit wise and machine wise. Kits are loaded in the 20 feet or 40 feet container using fork lift.
Accessories weight = 1018 kg per machine

Accessories container

Appendix B

Traffic Movement estimates during Construction

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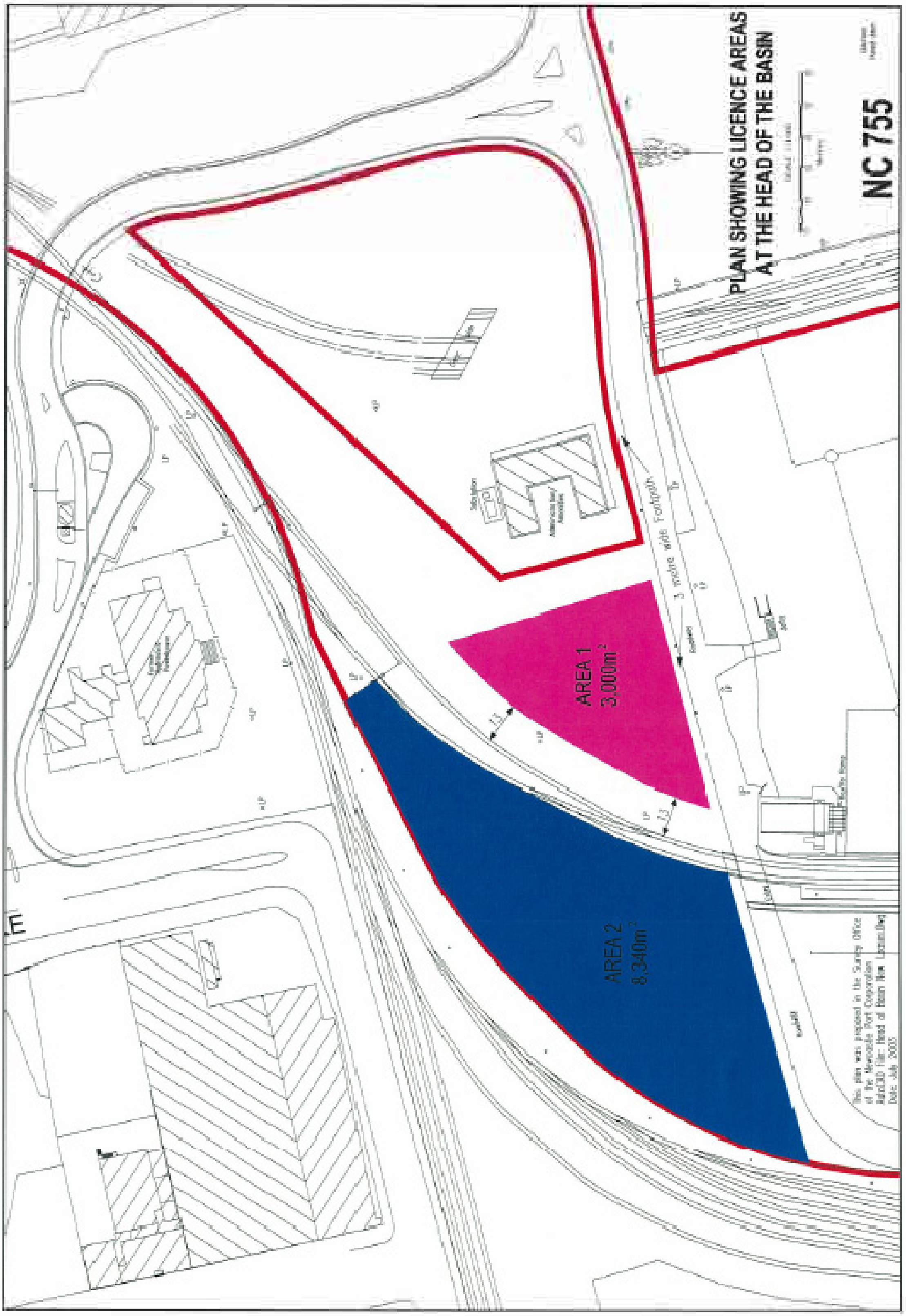
Kyoto Energy Park Scone Traffic Movements generated during Construction

Item	Quantity	One-Way vehicle movements	Sourced Internally/ Externally	Vehicle type
Site Establishment				
Concrete Batching Plant	8	8	External	Semi-trailer
Site offices/depot	13	13	External	Truck
Delivery of civil plant/Cranes/machinery	35	35	External	Semi-trailer, Platform Truck, Truck
Access Roads				
Aggregate from quarry	11240m3	1613	Internal/ External	Truck
Dust suppression (3 trucks per day)	17ML	1440	External	12t Water Tanker
Turbine Foundations				
Concrete	6300m3	1260	Internal	Concrete Truck
Sand and aggregate	4221m3	603	External	Truck
Cement	1584m3	287	External	Cement tanker
Water	1391m3	116	External	12t Water Tanker
Reinforcement steel	950m3	101	External	Semi-trailer
Steel Anchors	880t	45	External	Semi-trailer
Wind Turbine components				
Tower sections (x5)	210	210	External	Extendable trailer
Nacelles	42	42	External	Platform Truck
Blades (2 per truck)	126	63	External	Extendable trailer
Hubs	42	42	External	Semi-trailer
Nose Cones	42	42	External	Semi-trailer
Containers (20'/40')	105	105	External	Truck
Transformers	42	42	External	Truck
Site Substation				
Slab	10m3	2	External	Concrete Truck
Transformers	2	2	External	Platform Truck
Other components/fence	8	8	External	Truck
Control room/Other	10	10	External	Truck
Crushed rock	150t	10	External	Truck
Closed-loop hydro Plant				
Pipe delivery	1500m	15	External	Truck
Concreting Works	160m3	32	Internal	Concrete Truck
200kW hydro units	5 units	2	External	Truck
Maintenance Shed	13	13	External	Semi-trailer
Managers residence	16	16	External	Truck
Visitor's/Education Center	25	25	External	Truck
Underground 33kV cables/control	18.136km	66	External	Semi-trailer
66/33kV transmission				
Pole installation	220 poles	74	External	Semi-trailer
Line work	22km	60	External	Truck
Solar PV Plant				
Solar Trackers/frames	1000 trackers	350	External	Platform Truck
Solar Panels/Cables	20	20	External	Platform Truck
Concrete foundations	2800m3	560	Internal	Concrete Truck
Solar switchyard	1	1	External	Truck
Water	616m3	51	External	12t Water Tanker
General				
Site personnel	Av 10/day	4803	External	Car/4WD
General deliveries	12/week	880	External	Truck
Waste disposal	2/week	147	External	Truck
Site Disestablishment	41	41	External	Semi-trailer
Total		**8452 Trucks 4803 Cars**		

Appendix C

Storage facilities and Access Eastern Berth No 2 Port Newcastle


PLAN SHOWING LICENCE AREAS
AT THE HEAD OF THE BASIN
NC 755
AREA 1
3,000m²
AREA 2
8,340m²
3 metre wide Footpath