5. Existing Environment

This chapter of the EA provides a review of selected aspects of the existing environment of the Capital Wind Farm site and its surrounds, together with a review of potential impacts and measures for their mitigation.

It is complemented by subsequent Chapters 6 to 10, which address the more significant aspects of the environment relating to the impacts arising from the development of the Capital Wind Farm. Those chapters and the associated Appendices C to J provide comprehensive assessments of specific environmental aspects that have been undertaken and include a review of the existing environment for those issues.

A guide to the location of the respective information is provided in Table 5.1.

Table 5. 1 - Key to Location of Sections Describing the Existing Environment

Chapter 5		Subsequent Chapters		
Environmental Aspect	**Section**	**Environmental Aspect**	**Section**	**Appendix**
Setting	5.1	Visual & Shadow Flicker	6	C & D
Climate	5.2	Flora and Fauna (incl. Bats)	7	F & G
Air Quality	5.3	Heritage	8	E
Geology	5.4	Traffic and Transport	9	I
Soils	5.5	Noise	10	H
Site Drainage	5.6	Telecommunications	11	J
Land Use	5.7	Safety Aspects	12	--
Socio-Economic	5.8 & 5.9	Greenhouse Issues	13	--

5.1 Regional Setting and Topography

The proposed Capital Wind Farm is located within the Southern Tablelands Region of New South Wales and on the Great Dividing Range about 40 kilometres to the north east of Canberra.

The wind farm comprises three groups of turbines located on ridges at elevations of between 750 and 935 metres above sea level as shown in Figure 1.4. These ridges are between about 70 to 250 metres above the level of Lake George to the west of the site. The highest topographic point within the wind farm site is Hammonds Hill at an elevation of 935 metres above sea level. Lake George is at an elevation below 680 metres.

The general topographic variations are shown in Figure 5.1. The north south feature of the Great Dividing Range is clearly seen and provides the potential sites for the Hammonds Hill Group of turbines. The Groses Hill and Ellenden Groups are located on hills at lower elevations to the west of the main range and adjacent to Lake George. While Governors Hill offers good potential in terms of wind energy it has been excluded due to access difficulties.

The project area is entirely within the Lake George catchment. The ridges are dissected by intermittent creeks that drain generally to the west. Ridges to the east of the project area separate it from the Wollondilly and Shoalhaven catchments.

The wind farm site is mostly cleared grazing land (Plates 5.1 to 5.4). However, some areas of remnant woodland occur in close proximity to the wind farm, primarily on Hammonds Hill. The mixture of cleared grazing land and scattered woodland provides an element of visual diversity in the landscape.

The density of rural settlement is variable, from very low for the large properties where the turbines will be located, to low to moderate where small acre holdings have been formed.

Plate 5.1 - View of Ridge within Groses Hill Group showing Cleared Nature of the Site

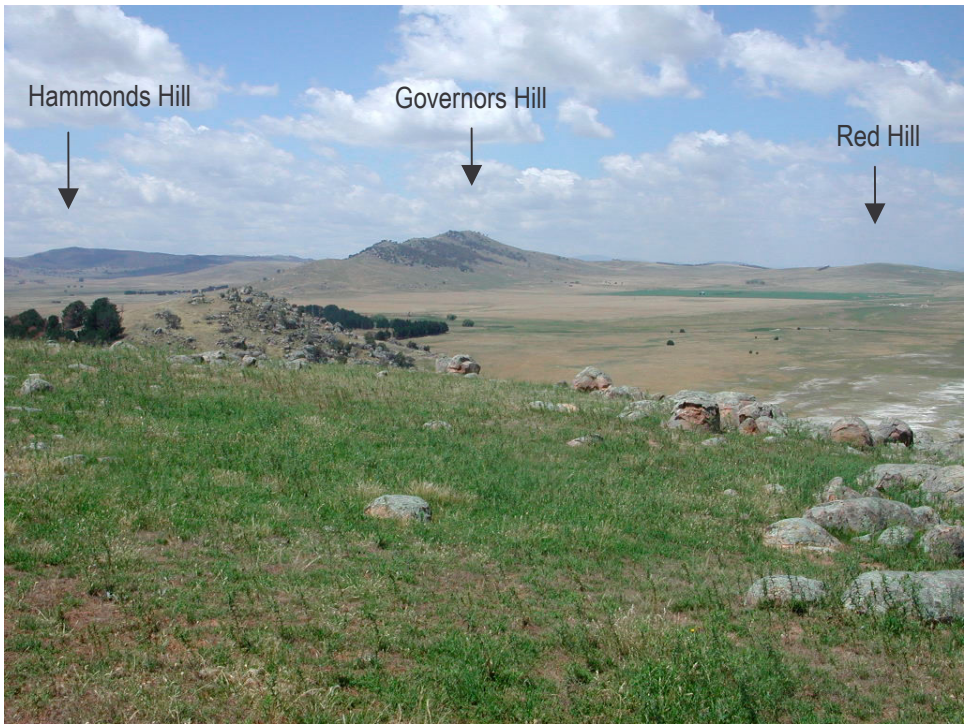

Plate 5.2 - Distant View of the Ellenden Group from the Groses Hill Group

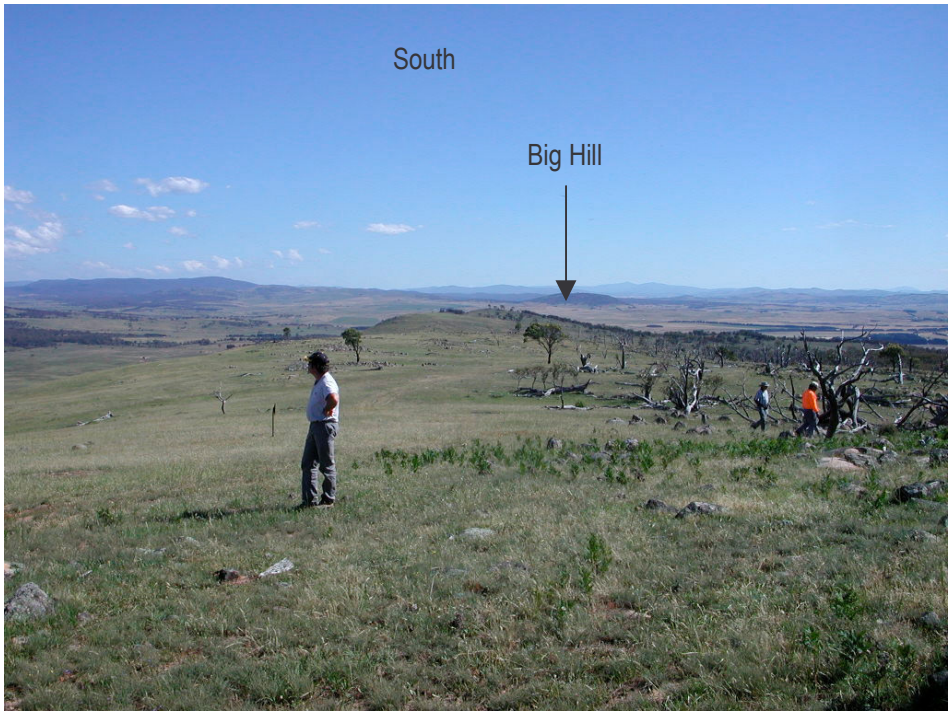

Plate 5.3 – View to the South along Hammonds Hill Ridgeline towards Big Hill

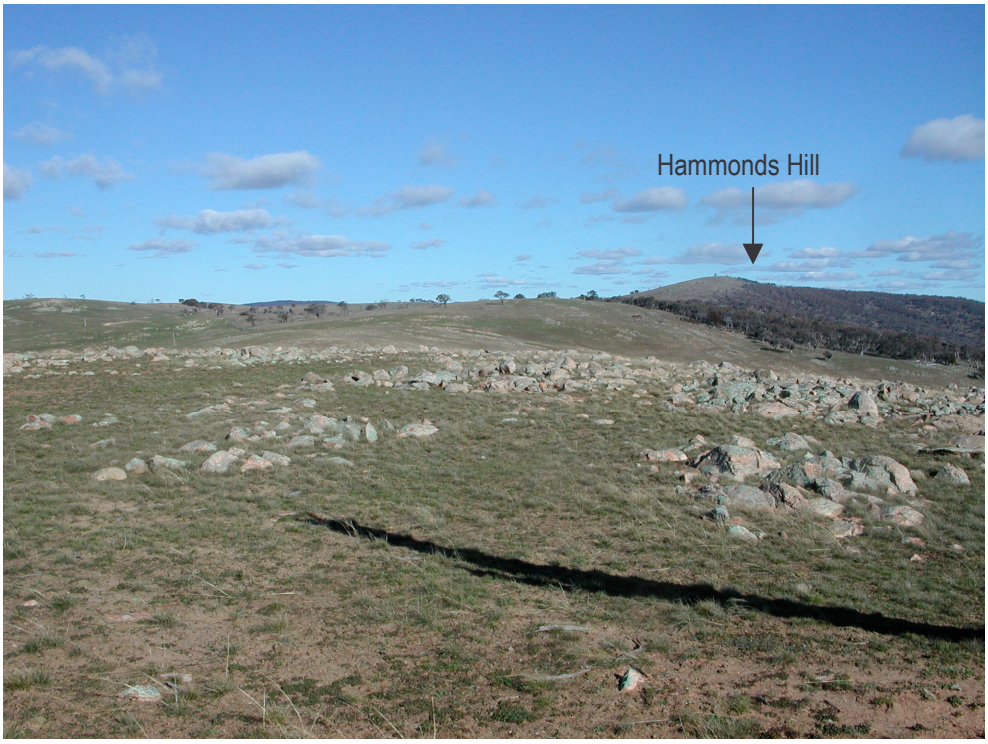

Plate 5.4 – View to the South toward Hammonds Hill from Northern End of Hammonds Hill Group

5.2 Climate

5.2.1 Climate Data

This section provides an overview of climate characteristics for the Capital Wind Farm locality based on climate data obtained from the Bureau of Meteorology (BOM) data for the nearest monitoring stations and wind monitoring data for the wind farm site. Stations that have been referred to are shown in Table 5.2.

Table 5. 2 - Locations of Climate Data Stations

Station	Ref no.	Period of data	Distance from site
Canberra Airport	BOM - 70014	1939 to 2004	36 km to south-west of the site.
Goulburn - Progress Street	BOM - 70263	1971 to 2003	35 km to the north-east of the site.
Tarago Woodlawn Mines	BOM - 70313	1984 to 1988	6 km to north east of Groses Hill
Sunnybrook wind monitoring tower	Renewable Power Ventures	1995 to 2002	on Groses Hill ridgeline.

The climate characteristics summarised in this chapter should be regarded as indicative only, due to distance of the more comprehensive monitoring stations from the wind farm site and the limitations of the available data.
The climate of the Capital Wind Farm site is influenced by its elevated location within the Southern Tablelands Region. There are minor differences between the nearby Goulburn and Canberra locations which are only about 80 kilometres apart. Both the Goulburn and Canberra stations have a greater amount of data than is referenced in this document.

Due to the small set of climate data that is available from the Woodlawn Mine near Tarago, the data has limited use despite its close proximity to the Capital Wind Farm site. For each climatic factor, the Tarago Woodlawn Mine data has been compared to the Canberra data of the same time period as a check to ensure the applicability of the BOM data.

This assessment has been based on historical data over the period that the stations have operated. Future climate data may differ due to the effects of enhanced climate change or other causes. Considerable information is appearing in the media and scientific reports that indicate a trend towards global warming and an associated increase in erratic weather characteristics. While it is difficult to quantify the extent of such changes, allowance should be made for variation beyond the climate ranges presented in the following sections.

5.2.2 Precipitation as Rainfall or Snow

Canberra Airport and Goulburn have average annual rainfall of 622 mm and 636 mm respectively as shown in Tables 5.3 and 5.4 for the respective sites. An average annual rainfall of about 630 mm may be a reasonable estimate for the Capital Wind Farm site.

The annual rainfall for the Canberra station shows variation from a low of about 262 mm to a maximum recorded value of 1063 mm.

Table 5. 3 - Rainfall Statistics for Canberra Airport

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Years of data	65	65	66	66	66	66	66	66	66	66	66	66	-
Mean	60	56	52	48	46	39	41	48	53	64	64	53	**622**
Lowest	1	0	1	1	0	4	4	2	3	2	0	0	**262**
Highest	218	211	312	187	150	126	121	156	151	161	138	215	**1063**

Table 5. 4 - Rainfall Statistics for Goulburn

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Years of data	27	28	28	27	28	29	28	28	28	29	29	29	-
Mean	61	59	57	53	49	47	45	58	51	56	66	55	**636**
Lowest	3	3	2	0	4	9	4	5	4	5	5	1	**362**
Highest	181	167	181	208	125	185	97	215	98	148	117	131	**911**

Mean monthly rainfall values are fairly consistent over the year but with slightly lower winter rainfall.

For the Goulburn station, snow has been recorded on an average of one day per year with a maximum number of four snow days recorded in a single year. The frequency may be higher at the more elevated parts of the site. Based on these data, snowfall would be most likely to occur in the months of May to November.

The wind farm locality had been subject to drought conditions over several years but some relief occurred during the 2003/2004 period prior to environmental studies being undertaken for the EA.

5.2.3 Temperature

A temperature range of –10 (July) to 42.2 degrees Centigrade (February) has been recorded for Canberra Airport. Mean daily maximum temperatures for Canberra Airport vary from 32 (January) to 9 degrees centigrade (July). Mean daily minimum temperatures for Canberra Airport vary from 17 (January) to –3 degrees Centigrade (July). Temperatures at the Capital Wind Farm site are likely to have a similar range.

Temperature inversions are considered a possible feature of this location in the vicinity of Lake George and valleys around the wind farm site.

5.2.4 Solar incidence and evaporation

Although evaporation data is limited, there is sufficient data to confirm that evaporation is as expected, greatest in summer and least in winter. Even though rainfall is fairly evenly distributed through the year, the lower evaporation during winter would give rise to higher soil moisture contents. The higher soil moisture conditions during winter are a characteristic of many locations on the Great Dividing Range of the Central and Southern Tablelands of NSW.

5.2.5 Wind data

Detailed wind energy data has been collected at and adjacent to the Capital Wind Farm site since 1995. The on-site data was obtained using 65 metre wind monitoring towers located on the Groses Hill ridgeline.

Two additional 80 metre wind monitoring towers have been installed at the locality during March 2005, one near Hammonds Hill and the second to the south-east of the project area near Mt Fairy. Data gained from the new towers will provide more detail of the wind resource to assist the final design of the wind farm layout and equipment specifications. The 80m monitoring level provides greater confidence in predicting wind energy for the type of wind turbine equipment being considered for the site.

As discussed in Chapter 3, temporary and permanent towers will replace the current monitoring towers.

A graphic representation of 12 months of wind data for 2004/2005 obtained from the Sunnybrook tower on the Groses Hill ridgeline is shown in Figure 5.2 together with views of the monitoring tower.

Wind direction

As can be seen in Figure 5.2 the predominant wind direction (more than 30% of the time) at the Capital Wind Farm site is from the north-west. The next most prominent wind directions are from the east and west which account for about a further 28% of the time. The contributions from the north and south are only about 5% of the wind at the site.

The final layout and detail of siting of the wind farm will rely on the results of detailed analysis of the wind speed data and an energy model derived from data gained from all the monitoring towers.

Wind energy model

Modelling of wind energy data has confirmed the site's capability to sustain a viable wind farm. A wind energy map showing relative wind power distribution for the site is included as Figure 5.3. The proposed turbine locations can be seen relative to the energy zones. Some high energy locations have not been selected due to environmental and/or access constraints.

5.3 Air Quality Aspects

5.3.1 Existing Air Quality

The existing air quality in the Palerang Shire primarily varies with seasons in response to airborne particulate matter associated with windy and dusty conditions and events such as bushfires. Visibility can be affected under severe conditions and it is possible that some people could experience some discomfort associated with the conditions. Visibility can also be affected by climatic factors such as low cloud cover on the ranges and fog and mist in the lower areas.

Apart from the Woodlawn Bioreactor the locality is distant from major industry. The placement of wastes at the Bioreactor is subject to stringent controls and accordingly air quality at the location is not likely to be significantly affected by visible industrial air emissions. Also, due to the distance of the wind farm from the Federal Highway, some 10 kilometres to the west, it is likely that any impact from freeway vehicle emissions on air quality at the wind farm site would be negligible. Traffic volumes in the immediate locality of the wind farm are much lower and are not likely to significantly affect air quality at the site.

A sand quarry exists on the south-eastern shores of Lake George, several kilometres to the south of the wind farm and a second sand quarry is located to the south of Big Hill. At times, their operation may be associated with some local dust.

5.3.2 Impacts of the operating wind farm on air quality

The wind farm represents a low emission form of electricity generation that will have very little impact on the air quality of the locality once operational. The turbines will not produce emissions at the site. The very low emissions associated with the project are mainly associated with the equipment manufacture at other locations and transport of equipment and materials to the site. Vehicle emissions associated with operators and maintenance staff visiting the site will be negligible. Overall, there will be net savings in emissions for electricity generation associated with this renewable energy project to the extent that fossil fuel generation at other sites is displaced (Chapter 13).

5.3.3 Impacts on air quality during the construction stage

The construction stage involves a significant amount of earthworks and the transport of large amounts of equipment and materials to the site as described below.

5.3.3.1 Earthworks

Exposure of soils for foundations and access track construction and the formation of topsoil and rock stockpiles means that there is potential for the wind to create airborne dust that could degrade local air quality, albeit temporarily. Control measures will be incorporated in the works to ensure that such impacts are minimised. The controls will include:

- Wetting of access tracks with water and, if necessary, wetting agent during dry and windy periods
- Stabilisation of exposed soils and stockpiles
- Where necessary, placement of stockpiles in sheltered locations
- Restoration of disturbed areas as soon as possible

These measures will be integrated in the project Soil and Water Management Plan (see also Section 5.5.3).

5.3.1.2 Vehicle movements

All vehicles delivering equipment, materials and personnel to the site will be registered vehicles that are required to maintain the necessary emission controls. These vehicle movements will be confined to a period of about 8 months and their impact on air quality is likely to be negligible.

5.4 Geology

This section of the EA describes the geology of the project area, the associated mineral resources, geotechnical considerations and earthquake potential for the site. Measures incorporated in the project to address these aspects are outlined in the following sections.

5.4.1 Regional and Site Geology

The Tarago/Bungendore area is within the geological domain of the Lachlan fold belt that comprises folded sediments, volcanics and various intrusive igneous bodies. The rocks have been subject to varying degrees of metamorphism and weathering.

The geology of the Capital Wind Farm area is illustrated on the 1:100,000 geological sheets for Canberra and Braidwood that are published by the Bureau of Mineral Resources and NSW Department of Mineral Resources, respectively. The parts of the maps relating to the project site are shown in Figure 5.4.

The published geology indicates that site is comprised of:

- Silurian and Devonian age igneous intrusive rocks

- a series of metamorphosed Ordovician and Silurian age sediments and volcanics
- alluvial deposits in the lower areas, including Lake George and creek-lines

The main rock unit at the wind farm site is the Ellenden granite which is present for much of the areas of the Groses Hill, Ellenden and Hammonds Hill Groups. The mapping indicates that the Ellenden Granite extends as far east as the level crossing on the Mt Fairy Road. It also indicates that the Ellenden Granite is an Adamellite (Plates 5.5 and 5.6). Such rocks typically are associated with acidic, poor quality and erodible soils (see section 5.5).

In the western part of the Ellenden Group, in the vicinity of Red Hill, is an area identified as the Lockhart Basic Intrusive Complex that is indicated to comprise amphibolites and gabbro. These more basic rocks are darker in colour and distinguishable in the field from the pink Ellenden Granite. Weathering of these rocks has resulted in red soils due to the greater iron content.

Areas of Silurian age Woodlawn Volcanics are found within the area of the Ellenden Granite, notably between the Ellenden and Hammonds Hill Groups. The Woodlawn Volcanics are indicated to comprise rhyodacite, ignimbrite, tuffaceous shale and minor ashstone. The areas where these rocks are present exhibit severe erosion.

To the south in the valley where the substation will be located, the mapping indicates the presence of Ordovician metasediments, referred to as the Birkenburn Beds. Lithologies present include a flysch sequence, quartz rich greywacke, shale, slate and minor chert (Plate 5.7). The unit exhibits considerable variation and appears to have a layered structure that would result in variation of lithological characteristics across the areas where it is exposed. The valley where the substation would be located exhibits severe erosion.

Areas of alluvium are present along Taylors Creek. Lake George itself contains a considerable thickness of sediment that has accumulated in the former valley topographic regime since the uplift of the Cullarin Block on the western side of Lake George.

5.4.2 Geological Structure

The geological sequence has been extensively faulted and folded, with several major north–south trending thrust faults recognised in the area. The most prominent fault in the locality is the Lake George fault on the western side of Lake George that forms the distinctive escarpment and has resulted in restriction of the drainage from Lake George.

A number of large faults occur several kilometres to the east of the wind farm site in the vicinity of the Tarago to Braidwood Road. No major faults are shown through the middle of the site but the presence of a large granitic body in this area may mean that such features would be less easily distinguished.

The folded rocks in the Dry Creek valley where the substation would be located show very steep dips.

The weathering process has resulted in the formation of broad flat alluvial soil deposits in the valleys of the creeks that cross the project area and in the low land areas such as Lake George and Lake Bathurst that contain considerable depths of alluvial material.

5.4.3 Mineral Potential

The Woodlawn Mine Site is located about 5 km to the north-east of the Groses Hill Group of turbines. The mine is now closed and is undergoing rehabilitation including the use of wastes to fill the mine void.

There is no indication of any other metalliferous mineral deposit within the project area that could conflict with the development of the wind farm project. A review of the NSW Department

of Mineral Resources' records showed that the nearest exploration licence title is held by Boral. At an early stage of planning, Boral was provided with details of the proposed wind turbine locations within its exploration licence area and its comments sought. Boral indicated that their interest is in an area of dolomitic limestone, about 5 kilometres east of the Hammonds Hill Group. The current layout no longer comprises any activities within the area of Boral's exploration licence and Boral has also indicated that it intends to relinquish the licence. As such, no conflict exists.

Sand is extracted at the southern end of Lake George several kilometres south of the Ellenden Group of turbines and to the south of the Hammonds Hill Group of turbines. These extractive operations will not be impacted by the development.

5.4.4 Geotechnical Assessment

A preliminary field inspection of the site has assessed the nature of the ground in the vicinity of the turbine sites and the possible underground cable routes. This has been supplemented by a series of test holes to assess the subsurface characteristics. These assessments have revealed a variability in rock characteristics but no obvious geotechnical constraints that would preclude the proposed development. The preliminary survey found that:

- Most of the potential turbine sites are located on stable ground on the ridge tops and appear to have acceptable foundation conditions. Most of the turbines will be located on areas of granitic rocks. Although there are few rock outcrops along the generally grass covered ridge tops, resistant rock appears to be at shallow depth and a proportion of the turbine footings will most probably intersect resistant rock requiring hydraulic rock breakers. It is not expected that any low level blasting will be required to remove it. Plate 5.6 shows material excavated for a monitoring tower footing on Hammonds Hill.

- As far as possible, the location of the access tracks are selected to avoid steep slopes and provide reasonable grades. Based on the initial observations, the existing ground surface is stable and in most cases appears to provide a reasonable sub-base material for access track construction. Some areas of high erodibility may require special treatment to avoid erosion of the track. Suitable roadbase material may be obtainable from within the project area (subject to appropriate testing and any approvals required). Where access tracks cross any alluvium filled creek valleys, it may be necessary to increase the thickness of road base material and provide suitable drainage measures.

- Installation of underground cables may require some excavation in rock and will encounter a range of conditions.

Further geotechnical assessment may be undertaken prior to finalising the project design.

5.4.5 Geological Hazards

The Dalton-Gunning area to the north of the locality, has been assessed as one of the highest hazard earthquake areas in eastern Australia. Three earthquakes with Richter Magnitude Level (RML) of 5.5 or greater are known to have occurred during the last 120 years (November 1886, November 1934 and March 1949). All three were felt strongly in the Canberra area. A recent smaller event (RML 4.0) causing minor damage at Oolong (6 km south of Dalton) was the Oolong earthquake of 9 August 1984. It was felt over a radius of about 70 km and occurred at a depth of 5 km.

In the Dalton-Gunning area, the average time interval between large, potentially damaging magnitude RML 6.0 earthquakes is of the order of 120 years. Nevertheless, smaller earthquakes are far more common. On average one earthquake per month has been reported heard or felt in the Dalton area since June 1993. These events have had magnitudes as low as RML 0.6 and up to RML 2.7.

The geological structures in this region have a prominent north-south alignment and it is possible that the geological conditions to the north may extend to the south.

The towers that support the wind turbines will be designed in accordance with the relevant engineering standards.

There are no geological hazards in the region that would preclude the construction of a wind farm. In particular:

- There is no evidence of any large scale landslides which could influence tower stability and access track construction
- There are no known major active volcanic or surface tectonic structures in the project area.

Plate 5.5 – Adamellite Boulders – Hammonds Hill

Plate 5.6 – Excavated Granitic Material from Monitoring Tower Footing

Plate 5.7 – Steeply Dipping Strata in Creek near Substation

Plates 5.5 to 5.7

Representative images of geology of the site

5.5 Soils Assessment

This section of the EA provides a description of soils within the project area, the potential impacts of the project on the soils and measures to mitigate the impacts.

5.5.1 Soil Landscapes

Soil landscapes in the project locality have been mapped by the NSW Soil Conservation Service at 100,000 scale and are reported in their publications, *"Soil Landscapes of the Braidwood Sheet"* of 1996 and *"Soil Landscapes of the Canberra Sheet"* of 2000. There are also corresponding soil landscape maps for Braidwood (1995) and Canberra (2000). Soil landscapes relevant to the Capital Wind Farm site are shown in Figure 5.5 as extracted from the abovementioned maps.

The Groses Hill, Ellenden and Hammonds Hill turbine groups are located predominantly on the Hammonds Hill Soil Landscapes and adjacent to the Taylors Creek Soil Landscapes. The Coopers Soil Landscape which is generally below the level of the wind farm occurs in areas of alluvial flats east of Lake George. The proposed substation site is within the Taylors Creek Soil Landscape. The Morass and Moura Creek Soil Landscapes occur to the north of the area at locations where access will be gained to Groses Hill Group. The main features of the relevant soil landscapes are summarised in Table 5.5.

Within each soil landscape there is scope for variation in the characteristics of any particular location based mainly on:

- the lithological variation within the underlying rock unit
- the degree of deformation and metamorphism that the rocks have undergone
- the aspect of the location involving slope and drainage characteristics

Plates 5.8 to 5.10 show the soils exposed in two footings for the monitoring tower on Hammonds Hill ridgeline and an area of gully erosion west of Big Hill. Instances of erosion are more prominent on lower slopes particularly in the Wrights Creek, Sandy Creek, Dry Creek and Taylors Creek catchments.

5.5.2 Potential impact on the soils

The erodibility of the various soil landscapes as assessed by the Soil Conservation Service is summarised in Table 5.4. In the case of concentrated and non-concentrated flows, the erodibility typically ranges between moderate and very high. In particular, the Hammonds Hill and Taylors Creek soil landscapes, which cover a high proportion of the wind farm site, have a high to very high water induced erodibility. Observations of slopes in these areas show large erosion gullies. In general, the project will involve minor disturbance of the slopes. Given the identified erodibility, the construction stage will include comprehensive controls to minimise erosion.

It is noted that the area has a low rainfall and that soil moisture will be dependent on time of year with summer periods generally being associated with very dry soils and winter periods, moist soils. Given the elevated nature of the sites and occurrence of strong winds, the potential for dust generation is an important consideration for earthworks. This is particularly applicable for construction undertaken during dry summer periods.

In undertaking earthworks, it will be necessary to relate each of the component works to the soils impacted and their erodibility and to assign appropriate control measures for the potential impacts. A Soil and Water Management Plan will be prepared for the project and the contract works will be undertaken in accordance with the Plan. The plan will be prepared in conjunction with the contractor that will undertake the works based on the work methods to be used.

Restoration of areas disturbed by the construction works will also need to consider fertility of the soils in selecting vegetation species for restoration of disturbed areas.

Table 5. 5 – Summary of Soil Landscape Characteristics at the Wind Farm Locality

Soil Landscape	Main rock types	Soil Landscape – main characteristics	Erodibility			K factors	USCS Code
			Concentrated Flows	Non-concentrated Flows	Wind		
Hammonds Hill (Erosional) (hh)	Granite (Adamellite)	Rolling to steep to low hills with tors common. Lithosols at crests and near rock outcrops and various Podzolic Soils at lower to upper slopes. Strongly acidic with risk of sheet erosion. Shallow soils of low wet bearing strength.	high to very high	moderate to high	low	0.060	ML-CL
Hammonds Hill (hha)	Granite (Adamellite)	Lower local relief and gentler slopes than (hh). highly erodible, strongly acid, infertile and shallow soils; engineering hazard; rock outcrop (localised.	high to very high	moderate to high	low		
Taylors Creek (Erosional) (tc)	Granite (Adamellite)	Undulating low hills. Shallow Lithosols and earthy sands near crests. Red earths and podzolics on upper/mid slopes. Gully and sheet erosion risk and low wet bearing strength	high to very high	high to very high	very low to moderate	0.035 0.058	CL SM
Coopers (Beach) (cp)	Quaternary alluvium	Old lake beaches, dunes and sandsheet. Poorly drained alluvial soils, yellow podzolics and siliceous soils with no rock outcrop. Groundwater pollution hazard, localised waterlogging and excessive drainage.	very high	low to moderate	very high	0.02	CL
Morass (Residual) (ms)	Tertiary sediments	Undulating rises with occasional rock outcrops. Well-drained Lithosols on crests, yellow earths on midslopes and Solodic soils on lower slopes. Seasonal waterlogging and low wet bearing strength.	high to very high	moderate to high	very low to moderate	0.0391 0.018	CL CH
Moura Creek (Vestigial) (mk)	Meta-sediments	Rolling low hills with short steeper slopes above drainage lines. Alluvial soils on drainage lines. Lithosols and Yellow Podzolics on crests and upper slopes, Red Podzolics, Solodics. Localised flood hazard, low wet bearing strength.	high to very high	high to very high	moderate to high	0.028 0.050	CL ML-CL

USCS – Unified Soils Classification Scheme: CL/CH represent Clays ML Silt dominant, SM - Sand dominant K Factor, is a measure of Soil Erodibility

5.5.3 *Land Capability*

A slope analysis for the wind farm site is shown in Figure 5.6. The steepest slopes at the wind farm site are for Governors Hill and apart from its southern end, these areas will not be accessed. Most of the development, including the access tracks will avoid the steeper slopes with the exception of access on to the northern end of Hammonds Hill where the track will need to be designed to minimise the grade and to avoid causing erosion of the slope.

Land Capability mapping by DIPNR classifies most of the wind farm site as Class 5 or 6 land that is suitable for grazing. Areas of steeper slopes are classed as Class 7 capability as shown for Governors Hill but as mentioned above these areas are not part of the project.

The development of the wind farm is not anticipated to affect the land capability classification and landowners will continue to use the wind farm site for its prior grazing purpose with little reduction in the grazing area available.

5.5.4 Measures to mitigate erosion and sediment discharges

A Soil and Water Management Plan (SWMP) including erosion and sediment controls will set out the measures to mitigate the potential impacts on the soils at the wind farm site. The measures are outlined below and will be incorporated into the management of construction works as described in Section 15. Details of the SWMP and specific measures will be provided at the Construction Certificate Stage. Erosion and sediment control measures will be designed to:

- divert runoff away from areas of earthworks or soil stockpiles
- reduce the energy of surface flows in areas of potential erosion
- prevent sediment laden or contaminated water leaving the construction site
- provide containment for sediment entrained in surface flows
- reduce susceptibility of disturbed areas to erosion and include prompt revegetation of disturbed areas

Such measures may include:

- construction of drains and check dams
- construction of diversion banks, perimeter banks and level spreader sills
- use of sediment traps
- sediment fences around stockpiles and areas of earthworks
- stabilisation of temporary batters
- straw bale and geotextile filter fabric sediment traps and filters

All erosion and sediment control devices will be maintained in satisfactory working order until such time as the disturbed areas have been stabilised to the satisfaction of Renewable Power Ventures and the respective landowners. Erosion and sediment devices will be inspected regularly after each rain period and during periods of prolonged heavy rain and any defects rectified promptly.

Disturbed areas will be required to be stabilised in accordance with the following principles:

- temporary vegetation or mulch will be applied to all disturbed areas, including soil stockpiles that remain exposed for a period of 30 days or more
- all temporary earth diversion banks and sediment basin embankments will be seeded and fertilised as soon as possible after construction
- stabilisation of all batters will be commenced within ten days of completion of formation

All temporary control measures will be removed when revegetation has established on formerly disturbed areas and will be disposed of in a satisfactory manner.

Topsoil suitable for stripping and re-use in revegetation will be stockpiled. Stockpile sites will be clearly identified and selected to be free from traffic and away from drainage lines and watercourses. They will be managed to minimise erosion and loss of topsoil.

The small size of the areas to be disturbed for the installation of the wind turbines, access tracks and associated facilities, combined with the development of detailed site management and rehabilitation procedures should ensure that no significant problems arise due to the disturbance of soils on the site.

At the conclusion of construction, all temporary tracks and areas disturbed by construction work including cable routes and the areas surrounding the wind turbines will be reinstated and revegetated. Follow up maintenance will be undertaken until the areas are satisfactorily stabilised and restored.

Plate 5.8 – Footing for Hammonds Hill Monitoring Tower

Plate 5.9 – Centre Footing, Hammonds Hill Monitoring Tower

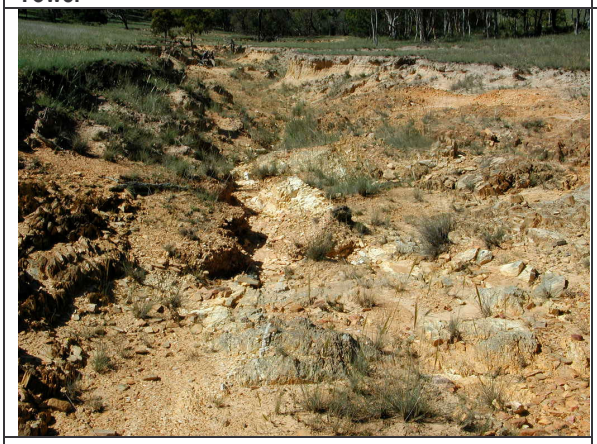

Plate 5.10 - Erosion on Slope to the West of Big Hill

Plates 5.8 to 5.10

Representative Soils Photos

5.6 Site Drainage, Water Resources & Water Quality

This section of the EA describes:

- the existing surface drainage of the project area
- the potential impacts of the project on the drainage systems and measures to mitigate any impacts
- the water resources required by the project, the means by which the water will be supplied and an assessment of the ability of the local resources to supply water for the project

5.6.1 Regional and site drainage

The project area is located on the Great Dividing Range within the Lake George catchment as shown in Figure 5.7. On the eastern slopes of the Great Divide are:

- the Mulwaree River catchment (part of Wollondilly) that drains to the north-east
- the Shoalhaven catchment that drains to the south-east

The latter two catchments are not impacted by the project.

Lake George Catchment

Lake George is a significant inland wetland that is listed on the National Directory of Important Wetlands. It receives drainage off the Great Dividing Range that prior to the uplift of the Cullerin fault scarp would have flowed to the west into the Murrumbidgee catchment. The water level in Lake George fluctuates depending on rainfall and evaporation. For much of the time evaporation exceeds inflow and recently the lake has been dry for an extended period due to drought conditions. The project area is within the headwaters of the drainage to the lake and adjacent to the lake's eastern shore.

The main tributaries that drain surface waters from the project site to Lake George are shown in Table 5.6 below.

Table 5.6 – Lake George Sub-catchments Draining Wind Farm Site

Sub-catchment	Description of Location
Unnamed creek north of Groses Hill	located to the north of the Groses Hill Group, it is crossed by Taylors Creek Road but is not expected to be impacted by the project.
Taylors Creek	located between the Ellenden and Groses Hill turbine groups (drains the central part of the area between the northern and southern groups of turbines). Erosion and sediment controls will prevent impact on this watercourse.
Butmaroo Creek	located to the south west of the site and flows into Lake George (drains the southern side of the Hammonds Hill via Dry Creek and Ellenden Groups via Wrights Creek). Erosion and sediment controls will prevent impacts on this water course.

Water Quality and River Flow Interim Environmental Objectives have been developed for the Murrumbidgee River and Lake George. The category relating to uncontrolled streams and Lake George catchment is applicable to the project area.

Sydney Outer Catchment Area

The area on the eastern side of the Great Divide drains either to the Wollondilly or the Shoalhaven River Catchments. The Wollondilly and Shoalhaven Catchments are part of the Sydney Outer Catchment Area. None of the project area drains to either the Wollondilly or Shoalhaven Catchment and accordingly the project does not require referral to the Sydney Catchment Authority.

Drainage Considerations

The locality has relatively low annual rainfall, typical of the Southern Tablelands areas away from the coast. Extended dry periods are not uncommon and for much of the time there is little or no surface flow in the upper reaches of the drainage. Winter is generally associated with slightly lower rainfall but due to lower evaporation, soil moisture can be higher during that time. Storms are possible at any time during the year but are more common in summer periods.

The ridges on which the turbines will be located have no permanent watercourses. There are a few dams on the upper slopes adjacent the ridges. In some places contour drains provide temporary holding areas for run-off and/or redirect it to dams. The thick accumulation of sediments in Lake George is understood to contain a significant water resource.

The surface waters do not supply drinking water for humans in the immediate vicinity of the project area but can be used by stock.

All construction works will include erosion and sediment control measures to mitigate potential impacts. All creek crossings will be constructed to avoid obstruction of natural flows or erosion of stream banks.

Flooding will not affect the ridges where the turbines will be located, but at times of heavy rain, parts of the access tracks may be temporarily affected by swollen creeks or ponded water. The Taylors Creek Road at the northern end of the Groses Hill Group has several formed 'Dips' to provide local drainage in the lowland adjacent to Lake George. Areas of Flooding Hazard are not likely to significantly affect the Capital Wind Farm construction or operation. The design and construction of creek crossings for site access will address the potential for occasional flooding along some of these water courses.

As most of the site constitutes elevated areas with low to moderate slopes flanking the sites, the proportion of run-off to infiltration would therefore normally be high. However, much of the area has sandy granite soils where infiltration can be high and this will mitigate the runoff potential. It is reasonable to infer that the groundwater recharge on the ridges is likely to be less than for more low-lying areas.

It is understood that in places, water is pumped up from the Lake George sub-strata, including that used by the Woodlawn Mine and more recently by the Woodlawn Bioreactor as well as for pastoral uses.

Subject to gaining access and approval an option for sourcing water for the 8 month construction stage of the project is the use of groundwater from local landowners. Due to the short duration of the construction period it is not expected that the extraction for supply to the project will have any significant impact on ground waters at the locality.

5.6.2 Potential impacts of the project on the water courses

The potential for the project to impact local water courses varies with the stage of the project. The following discusses the potential impacts during the construction and operational stages of the project.

5.6.3 Potential impacts of the construction stage

The construction works will involve earthworks, storage and handling of equipment, pouring of concrete for footings and use of facilities for the construction workforce over about 8 months.

Activities that will need to be managed to avoid impacts on the local drainage system include:

- soil disturbance associated with earthworks, including roads, trenches and foundations
- creation of temporary stockpiles of soil and rock
- works associated with crossings of watercourses
- removal of sewage effluent from construction workforce facilities
- storage and handling of fuels, oils and chemicals

Some of the activities will take place at multiple locations over a large area and will require that each location has appropriate measures to address potential impacts of the project.

A Soil and Water Management Plan will be prepared for the project (section 3.10.3 & 5.5.4) and the project Environmental Management Plan (EMP) will include the relevant soil and water management measures to address the potential impacts. Such measures will include:

- design of earthworks to minimise erosion and sedimentation
- diversion of water flows around disturbed areas or stockpile areas

- sedimentation controls (eg. sediment fences, hay bales, contour drains) below work areas and below stockpiles
- stabilisation of stockpiles until required
- excavations kept open for a minimal period
- disturbed areas to be stabilised and revegetated promptly after works are undertaken
- where possible, timing of earth works to target favourable weather conditions
- bunding of any fuel or oil storage
- sediment detention ponds will be installed at the Site Office and Batch Plant location and any other batch plant sites. Ponds will be sized in accordance with the CALM Method for sediment basin design that includes consideration of soil characteristics, rainfall intensity, ground cover and slope. In practice the site office area will be compacted by vehicle movements and have a lesser potential for erosion and sediment transfer than would otherwise be the case.

5.6.4 Potential Impacts of the operational stage

The operational stage of the wind farm will have minor potential for impact on the local drainage system. Potential impacts could relate to:

- a low potential for loss of oil from electrical or mechanical equipment which is discussed below
- the installation of a septic system at the facilities building.

5.6.5 Oil in transformers

The transformers to be installed as part of the development contain oil. Loss of oil from equipment may occur from failure of the equipment. In order to minimise the risk of water or soil contamination by oil, the following measures are proposed:

- The 33,000 volt to 330,000 volt transformer, located within the substation will contain about 50,000 litres of oil. Accordingly it will be located within a bunded area designed to contain the transformer oil in the event of leakage or spillage. Secondary containment, most likely utilising an earth dam with underflow discharge, will also be provided. The dam will be of sufficient size to retain the 50,000 litres of oil in the unlikely event that it was released from the transformer and not contained in the bund. Spill response equipment will be maintained on site and the site will maintain a site-specific emergency response plan. In addition, the proposed site has been moved to a location more distant from Dry Creek and that will further reduce the potential for impact on that watercourse.

- The 690 volt to 33,000 volt generator transformers that will be located near the base of the turbine towers will be either oil filled or dry type. If oil filled transformers are used they would include internal oil containment to retain any oil leakage. Any leakage that escaped the containment would only affect a relatively small area around the transformer that could be effectively remediated. Regular inspection of the transformers and associated turbine equipment will be carried out to ensure that they remain in good working condition and are leak free.

- The nacelles and supporting tower structures will be designed to contain any lubricating or hydraulic oil in the event of spillage or leakage.

- A small store of oil may be maintained on-site for maintenance purposes. Any facility for storage of oil will purpose designed with sufficient containment for potential spillage and include spill recovery equipment and materials. Procedures for maintenance will be documented and followed by maintenance staff.

5.6.6 Battery Systems

A small bank of batteries is required at the substation to supply back up power for control systems in the event of failure of the grid supply. These batteries will be located in the facilities building and will

be maintained by routine checking and adjustment of electrolyte levels and as necessary replacement of batteries. Any spillage would be unlikely to escape the building.

5.6.7 Water Supply for the project

Once operational, the project will require a relatively small water supply and this will be supplied primarily from roof drainage at the facilities building and if necessary by importing water.

The construction stage will have a greater requirement for water (including batch plant supply, dust control, domestic use and fire fighting reserves) and it is expected that water may be imported during that time. The water is likely to be obtained from local water supply sources as required. Potential sources of supply would include:

- Goulburn – restrictions on water supply and long cartage distance, over 30 kilometres
- Mulwaree River/Chain of Ponds – significant cartage and environmental considerations
- Bungendore- in excess of 10 kilometres cartage distance
- Groundwater supplies – can be obtained close to, or on site, and short term nature of the extraction is unlikely to significantly affect the large water resource contained in sediments below Lake George

The use of the local groundwater resources for the construction is favoured as it will not significantly affect the local resource, it involves less off site impacts and does not compete with other users of surface water supplies.

The quantity required may vary depending on the timing of the works, weather conditions and site practices. Over the eight month construction period a total amount of about 19.5 megalitres may be required. About 7.2 ML of the total is required for the concrete batching plant. The total amount represents a small proportion of the local groundwater resource.

5.7 Land Use

This section of the EA describes the land use applicable to the wind farm site, the neighbouring properties and the immediate locality. The locality comprises mainly cleared pastoral land with low to moderate density rural residential development. The development is able to co-exist with the existing use of the land for grazing and the turbine layout has been designed with setbacks from residences.

5.7.1 Existing land use on the Wind Farm Properties

The wind farm site is located on nine rural properties that are predominantly used for grazing sheep. Other pastoral activities include small pine plantations and sand extraction. Properties are of moderate to large size covering over 2000 hectares. Nine landowners have entered into lease agreements with Renewable Power Ventures for the co-use of the property for a wind farm. The locations and extent of the properties on which the wind farm would be located are shown in Figure 1.5. As shown in Table 1.2, there are 63 turbines proposed to be located on seven of the nine properties.

Each of the properties has been mostly cleared and now comprise mainly grassland with varying degrees of scattered trees. Some remnant woodland areas have been retained on small areas of some of the properties but these areas are generally unsuitable for wind farm development and have not been included as part of the development. Some properties in this region have rural cottages additional to the main homestead, which may be leased to rural tenants. The sheep grazing and residential activities will continue and be little affected by the operation of the wind farm. Some disruption to the normal land use is expected during the construction stage.

Several Trig Stations exist at the wind farm locality, one of which is located on a Trig Reserve. One of the Trig Reserves is between the placement of two wind turbines but no turbines will be located on the Trig Reserve.

Existing land uses that are applicable to the wind farm site include:

- Grazing of sheep, and to a lesser extent cattle and other livestock
- Residences on various properties
- Survey reference points at four Trig Stations

5.7.2 Land use of properties adjacent to the wind farm site

Neighbouring properties to the wind farm site vary considerably in size (see Figure 1. 5). Some are large properties used for grazing of various types of stock. In particular, Lake George to the west is devoid of settlement. The Collex property to the north-east also has an extensive coverage of the land. Other land titles are small parcels that are primarily rural residential properties with or without small-scale pastoral uses such as grazing of sheep, cattle or horses and limited cropping. The locations of residences in the area within about three kilometres of the wind farm site are shown on Figure 1.4.

Not all of the landowners in the locality are permanently resident on their properties with several living and working at other locations and visiting their rural property periodically.

The layout of the wind farm includes set backs to residences to minimise noise impacts to acceptable levels and mitigate impact on visual amenity at residences.

There does not appear to be any public recreational use of lands surrounding the wind farm. In wetter periods, Lake George and Lake Bathurst may have potential to be used for recreational boating.

5.7.3 Review of land use types for the wind farm locality

Grazing: The use of grazing land for development of the wind farm will not significantly affect its potential for grazing. Once developed, the area of land required by the wind farm structures will be a minor fraction of each property. During construction, there may be a greater impact due to the increased numbers of people on-site, movement of large equipment and materials, earthworks and temporary storage of equipment. The areas affected during construction will depend on arrangements with the landowner and whether the contractor chooses to progress all sites at the same time or sequentially. The environmental management for the construction works is described in Section 3.9.

Rural residential: On some of the larger properties there are one or more rural cottages in addition to the homesteads, some of which are tenanted. It is likely that the tenants work on properties nearby or in Goulburn or Bungendore. Shearers' quarters that provide short-term accommodation are located on the Ellenden property between Ellenden and Hammond Hill Groups of turbines.

Approximately 13 residences are located on properties where landowners have leased their land for development of the wind farm. The distribution of neighboring residents close to the wind farm is shown in Table 5.7 below.

Table 5.7 – Proximity of Neighbouring Residences to the Wind Farm

Distance from nearest turbine	Number of residences	
	Wind-Farmer	Non-Wind-Farmer
0 to 1 kilometres	5	0
1 to 2 kilometres	9	12
2 to 3 kilometres	1	19

The owners of residences within three kilometres of the site have been consulted in regard to the development and have expressed views on the development as discussed in Section 4.

Trigonometrical Stations: There are six trigonometrical (Trig) stations within a relatively close distance of the wind farm (Ellenden, Red Hill, Lake George North Base, Groses Hill, Osborne and Butler).

Turbines have been for located close to two Trig Stations (Red Hill and Osborne). Both have heritage significance and one is a constructed rock cairn structure. Only Osborne is located on a Crown Land Reserve and the nearest turbine sites will be outside the Trig Reserve. A licence will be sought from Department of Lands for proposed cable and access routes that cross the Reserve. Such a licence would of course avoid the actual Trig Station itself. Table 5.8 summarises the relevant details of each of the Trig Stations.

Table 5.8 – Trigonometrical Stations in the Project Area

Trig Station Name	Group of Turbines	Date Installed	Description	Land Title	Status for Survey Work
Trig Stations located close to proposed turbine sites					
Red Hill	Ellenden	Circa 1888	Concrete pillar with mast and vanes. Two reference marks	Non-reserve	Major station – Used for GDA "Spine" Adjustment
Osborne *(On Trig Reserve)*	Hammonds Hill	Circa 1879	Cairn and mast	Reserve	Minor station Close to turbine sites and access
Trig Stations located within the project locality but distant from turbine sites					
Ellenden (Governors Hill)	Ellenden	1888	Bronze plug in large rock	Non-reserve	Major station – Used for GDA "Spine" Adjustment
Lake George North Base	Ellenden	Circa 1966	Cairn, mast and disc with copper plug in rock	Non-reserve	Major station – Used for GDA "Spine" Adjustment
Butler *(On Trig Reserve)*	Hammonds Hill	Circa 1879	Cairn, mast and disc	Reserve	Minor station
Groses Hill	Groses Hill	Circa 1888	Cairn, mast, vanes and plug in rock	Non-reserve	Minor station

Other nearby Trig Stations include "Sally", "Woolowolar", "Round Hill", "Fairy" and "Rocky Point". These Trig Stations are not affected by the development, but there are sight lines between these and the trig stations on the wind farm site that could be impacted by the placement of the wind turbines. The final locations of the turbines will be assessed in relation to the existing survey sight lines and where possible the turbine locations will ensure that sight lines are unaffected or that alternative sight markings are provided either on selected turbine towers or by other means.

The potential impacts of the development on the use of the Trig Stations by surveyors relates to:

- Interruption to the "line of sight" to overhead GPS satellites
- Interruption to line of sight for making direct observations between adjoining trig stations using conventional angle and distance observations

The potential impacts of the project on the surveying operations that use the Trig Stations in the wind farm location has been reviewed by the Survey Group of the NSW Department of Lands. The surveyor reviewed the details of the turbines that were being considered as part of the planning and reviewed survey usage records in the LPI office.

The current Development Application does not include turbines on any Trig Reserves and the siting of all relevant turbines located near Trig Station sites will be agreed with the Department of Lands.

Plates 5.11 to 5.14 Trig Stations at Capital Wind Farm Site

Plate 5.11 – Groses Hill Trig Station

Plate 5.12 – Osborne Trig Station

Plate 5.13 – Red Hill Trig Station

Plate 5.14 – Butler Trig Station

Landing Strips: The nearest airports registered for instrument landings are in Canberra and Goulburn which are both approximately 35 km away from the wind farm site. According to the Civil Aviation Safety Authority (CASA) Manual of Standards Part 139 – Aerodromes, the maximum total length of the obstacles limitations surface for both approach and take-off are 15 km (CASA, 2003). Therefore, neither of these airports will be affected by the development.

The only local strip within 5 km of the wind farm is approximately 2 km to the west of the Hammonds Hill group of turbines and 2 km to the south of the Ellenden group of turbines.

As the small planes that could use the strip use visual rather than instrument based landings and the turbines are readily identified at close distance, there is not expected to be any safety risk for planes that may use local air strips.

Utility infrastructure within the locality: The local area has a network of local roads, power lines and communications. The Federal Freeway is about 10 kilometres west of the site on the western side of Lake George. The Tarago to Bungendore Road is a main road that serves local traffic and through traffic between Goulburn and Queanbeyan. Other local roads including the Tarago to Collector Road, Taylors Creek Road and Mt Fairy Road have low usage by local residents, school bus, stock transport, delivery and service vehicles and occasional tourists (see Chapter 9 and Appendix I).

A 330,000 volt line passes to the south of the wind farm site but does not directly connect to the local electricity grid that supplies local properties. It is proposed that the wind farm be connected to this line via a 33,000volt/330,000 volt substation. A separate 66,000 volt line passes through the wind farm site from north to south. Other lower voltage lines serve local properties.

Communications services in the wind farm locality include, telephone landlines, mobile phone coverage, various radio licences and satellite services. Residents also have access to broadcast services including radio and television. Potential impacts on telecommunications services are described in Chapter 11.

Future changes to land use: The potential changes to land use at the locality could include different types of pastoral activities, possible subdivision of land and increasing rural residential and industrial development. Such changes may arise from changed economic circumstances, shifting population from cities to rural areas, variations to local climate characteristics or from landowner circumstances.

In relative terms the land is sparsely settled and significant change would need to occur before there was a need for development of a service centre at the locality. Tarago and Bungendore are likely to continue as the closest towns to the site.

The installation of the wind farm will not limit the future use of the land for grazing. It does not compete for resources in the local area and its benefits are community wide.

5.8 Social Aspects

The following section reviews the existing social context of the development and its potential social impacts. It refers to the former Shire areas for which data was available and for which the assessment was undertaken. All statistics in Section 5.8.1 were sourced from the 1996 and 2001 Census' conducted by the Australian Bureau of Statistics.

5.8.1 Existing Social Characteristics of the Mulwaree Statistical Local Area

The region of the Southern Tablelands between Goulburn and Queanbeyan has a predominant rural character with the majority of the rural activity being sheep grazing. Statistics of the Mulwaree local area have been used to describe the social characteristics of this region.

The former Mulwaree area has a population of 6,834 spread over some 5,208 square kilometres, representing a density of approximately 1.3 people per square kilometre. Over a five year period between 1996 and 2001 the population had increased by 1,209 which is equivalent to 21.5% in total and an annual population increase of 4%. The nearest cities and town centres have populations as shown in Table 5.9 below.

Table 5.9 – Population for Main Population Centres closest to Capital Wind Farm

City or Town	Population	Reference
Queanbeyan	31,140	(Census 2001)
Goulburn	22,186	(Census 1996)
Bungendore	2,000	Bungendore Post Office, 2005
Tarago	1,000	Bungendore Post Office, 2005

The 2001 Census data identified some 1,755 family households with a mean household size of 2.7. The bulk of the population lives in stand alone houses, with minor townhouse or flat type accommodation. There are indicated to be 817 unoccupied private dwellings within the Mulwaree area, some of which are likely to be temporary residences for their off site owners.

The region has approximately equal numbers of male and female constituents. Median age for the region is 39. In terms of education 25% of respondents indicated that the highest level of schooling completed was Year 12 or equivalent. About 1,725 persons (33% of people over the age of 15) indicated attainment of a non-school certificate, diploma or degree. The 706 qualifications gained in the areas of engineering, architecture, building, agriculture and environmental and related sciences were more often held by males. The 576 qualifications in the areas of information technology, health, education, management, commerce and hospitality were more often held by females.

In terms of employment, 2,787 persons indicated that they are employed, of which 1,749 are on a full-time basis. The unemployment rate was 4.6% in 2001 which was approximately two percent lower than the national average at the same time and half a percent lower than the current national average. There is a high reliance on motor vehicles for transport, which will include work related vehicle use.

Table 5.10– Mulwaree (2001) Employment in Top 10 Industries

Industry Sector	Number employed	Percentage (of top 10)
AFF	556	24.0
Manufacturing	205	8.9
Construction	174	7.5
Retail	354	15.3
Accommodation, Cafes & Restaurants	121	5.2
Transport and Storage	131	5.7
Property and Business Services	175	7.6
Education	198	8.6
Health and Community Services	266	11.5
Personal and other services	134	5.8
Total (Top 10 industries)	**2314**	**100**
Total Employed Mulwaree	2786	

Reference: Australian Capital Region Development Council (August 2004)

5.8.2 Social Impacts of the Wind Farm Development

The potential social impacts of wind farm development include:

- influx of skilled people into the region during construction
- small on-site workforce once operational
- small increase in employment opportunities in the region
- minor improvement in local transport infrastructure
- various effects on the immediate wind farm locality
- any changes to the social structure of the region

During the consultation arranged by Renewable Power Ventures some concerns were expressed about visual amenity associated with wind farms. Renewable Power Ventures has adjusted the project scale by reducing the number of turbines and increasing setbacks to many of the neighbouring residences thereby reducing visual impact. Visual issues for the Capital Wind Farm are addressed in Chapter 6.

The wind farm site is located on large rural properties. Those properties are productive and appear to be successful rural businesses. Owners have indicated that the wind farm income from leases will support maintenance of their properties. The development of the wind farm is unlikely to affect the ongoing rural use of the neighbouring lands. Neighbouring properties include both small acre properties and larger holdings.

Employment opportunities may flow to residents of the local Shires through direct employment on the construction stage of the project or as a result of increased commercial activity flowing to the local towns. This impact is expected to be minor and is not expected to place undue pressure on local resources. Services such as accommodation, vehicle maintenance, refuelling and food are likely to benefit from the influx of construction staff. Provision of these services may be spread between nearby Tarago and Bungendore and the more distant regional centre of Goulburn to the north.

Persons who are able to benefit from the employment opportunities may be immediate neighbours to the wind farm or persons living in local towns or on more distant rural properties within the area.

Any influx of tourists that may visit the area to view the wind farm is likely to be relatively small, but even small numbers can have a significant impact on the local small businesses. The nearby Woodlawn Wind Farm includes a viewing area located off the Tarago-Bungendore Road. This facility will adequately provide for the needs of tourists and passersby. Bungendore and to a lesser extent Tarago will be well placed to take advantage of any increased tourist visitation.

5.8.3 Consultation with the local community

As part of the wind farm planning process community consultation has been undertaken to seek the local community views on the development, identify any issues which may require further investigation and to incorporate relevant matters in the wind farm design parameters. Initial consultation (via community open days, individual meetings and written communications) has experienced a balance of views on the project, with some demonstrating positive acceptance of wind energy development and others indicating concerns in regard to issues such as visual amenity and noise. In response to community concerns and with the benefit of the tender process and contractor selection, Renewable Power Ventures has greatly modified the project to address community concerns as far as practicable, while ensuring a viable project. The availability of the EA will provide a further basis for the local community members to make their own assessment of the impacts.

The local community newspapers include the Bungendore Mirror and the Tarago Times. Renewable Power Ventures has placed advertisements in these papers advising the local community of the project and inviting them to two Open Days held at Tarago Community Hall in March 2005.

Overall, the development is likely to have a minor impact on the towns of Tarago and Bungendore. It is likely to provide a small boost to local businesses and may provide a range of employment opportunities for locals. However, it is unlikely to have a significant impact on the social structure of the local towns. During the construction stage, it is anticipated that much of the construction workforce could be accommodated in Goulburn due to the greater range of facilities there, while a smaller proportion of the workforce may stay in Bungendore and Tarago.

5.8.3 *Summary of Social Impacts*

The proposed project will introduce a visible renewable energy project into the rural setting. It will provide a small stimulus to permanent local employment and is likely to improve the financial situation of some members of the local community. It is unlikely to affect the social structure of the locality and will not place an excessive demand on local resources.

However, some neighbours to the wind farm have expressed concerns regarding the development. Renewable Power Ventures has responded to those concerns and has significantly decreased the potential impact of the project by reducing the geographic extent of the development, by reducing the number of turbines and by increasing the setbacks from residences than was originally proposed.

For the above reasons it is expected that the impact of the project on the local community will be minor, though generally positive.

5.9 Economic Aspects

This section reviews the existing economic context of the development and the project's impacts on the local and Australian economy.

5.9.1 Key economic considerations

The key economic considerations for assessing the merits of the Capital Wind Farm development relate to:

- the economic viability of the development (for the developer and for the broader community)
- the place of renewable energy projects in Australia's future economy

- its contribution to the local economy
- whether it has any adverse economic impacts

5.9.2 Economic viability

The Capital Wind Farm is being developed by Renewable Power Ventures as a commercially viable project. The international wind industry has been recently growing at approximately 25 to 30 % per year and with the growth of the industry and improvements to equipment there have been substantial reductions in the cost of electricity generated from wind energy.

Renewable Power Ventures will operate in the competitive National Electricity Market and therefore must ensure that its operations are commercially viable. It has undertaken a rigorous review of the income and cost considerations for the project and is satisfied that development of the Capital Wind Farm is a financially viable development. The output from the wind farm will be sold to customers under the terms of long term power purchase agreements and other market mechanisms.

5.9.3 Wind energy's role in Australia's future economy

Predicting Australia's future economic health over the life of the wind farm is indeed difficult in the context of the volatile and changing global circumstances. Australia has traditionally been sustained by strong rural and mineral production and this is likely to continue for some time. Due to the country's vast expanse, a large use of fuels has been required to sustain the rural and mining sectors. Also the associated wealth of the country and its high standard of living, have resulted in one of the world's highest per capita consumption of energy. In the past few decades, Australia has consumed a large part of its own oil resources to the extent that these are in decline and Australia is expected to import increasing quantities of oil to maintain our existing lifestyles and sustain our economy.

The outcome of increased reliance on imports of oil mean:

- a greater exposure to global increases in oil price fluctuations, currently at high levels and predicted to increase further
- a negative impact on our trade deficit which in recent times is indicated to be at unfavourably high levels

In addition, the global decline in oil availability and the likely progressive rise in the price of oil will mean that increased attention will be given to alternative fuel sources, coal, gas, nuclear and renewables. As renewables have no associated fuel costs, they provide a degree of insulation from global energy price increases.

While increased wind energy supplies are unlikely to change our pattern of oil use, they can result in net savings of other fossil fuels such as coal and gas and thereby increase our energy supply options for the future.

Given the above, the development of wind energy facilities appears to be a sensible and forward looking investment in alternative energy sources.

The development of the Capital Wind Farm also offers increased employment opportunities for the local and broader Australian communities. The above factors when taken together provide positive economic support for wind energy developments and the Capital Wind Farm development.

5.9.4 Contribution to the local economy

The Capital Wind Farm development will contribute to the local community through stimulation of the local economy and by providing employment opportunities within the Shire.

It is likely that increased income will flow to the local community as a result of the development by way of:

- payments to landowners on which the wind farm is located
- payments to Palerang Council associated with contribution to local infrastructure
- income to local service suppliers such as accommodation (motel, hotel and guest houses), food and general supplies (cafes, general stores and newsagents), service stations (fuel and vehicle servicing), engagement of local contractors for specific components of the works and purchase of supplies and services from local outlets (maintenance of equipment or supply of various items required by the construction workforce)
- increased employment and associated incomes either directly by involvement in the project or indirectly by employment in service industries

The construction stage, with its import of a temporary workforce into the locality, is likely to provide the greatest stimulus to the local economy with the ongoing operations and maintenance stages having a lesser impact. A small on-site staff will be required for the operations stage.

An increase in income to the local community is likely to flow into other areas and have a multiplier effect. The local community includes rural residents and nearby towns of Tarago and Bungendore. The impacts on economic activity are likely to be spread between Queanbeyan and Goulburn and as such it is expected that the economic impact on local community will be well within its capacity to assimilate.

5.9.5 Costs that could be incurred by the local community

Overall the project is expected to provide financial benefits to local businesses and the community.

In recent times, rural areas have become increasingly targeted for rural residential development. This has meant that large properties have been carved up to provide small acre properties that are often used for residential purposes rather than their previous pastoral purposes. With this development has come the change in character of the landscape, with many residences dotted through rural landscapes and associated sheds and fencing.

Some neighbours to the wind farm have expressed concern that their land values may be negatively impacted by the wind farm development. As large Australian wind energy developments are relatively recent phenomena, there is limited quantifiable information on the impact of wind farm developments on neighbouring property values. In the case of the Crookwell and Blayney Wind Farms in NSW, no adverse impact on property values has been identified.

One consequence of the wind farm developments is that much of the rural land will be spared the proliferation of residences and urbanisation of the rural landscapes. Different people with have varying views on which outcome is preferable, the placement of turbines or residences in the rural landscape.

The construction stage of the project will involve a temporary increase in traffic on the access roads to the site and may increase the wear and tear on those roads. The Palerang Council and Renewable Power Ventures have discussed this aspect and are in negotiations for Renewable Power Ventures to fund Council's sealing of Taylors Creek Road. This improvement will enable Council to spend money that it would otherwise have spent on maintenance of Taylors Creek Road, at other locations. As such it could positively affect land values in that locality and frees up part of the Council budget for other purposes.

5.9.6 Summary of economic issues

Overall, the development has been assessed by Renewable Power Ventures to be financially viable. It is also considered to have potential to contribute to the income of landowners at the site and for parts of the local economy. The timing of the contributions to the rural economy is considered to be favourable when farming costs are rising and drought related stresses are impacting farm incomes.

Given the evident directions of the global economy particularly, the likely decline in oil resources and increased pricing of fossil fuel energy sources, the strengthening of our renewable energy generation capability can deliver greater supply diversity leading to positive returns to Australia generally and at the same time assisting local communities.