

6. Visual Issues

This chapter of the EA outlines the visual impact of the Capital Wind Farm and the measures to mitigate its impacts. A comprehensive visual impact assessment has been undertaken and is provided as Appendix C of the EA. The key aspects of that assessment are summarised in this chapter of the EA. Included here is a description of the local landscapes, the visual features of typical wind farm developments, a review of the visual catchment of the Capital Wind Farm and a description of the process for preparation of simulated views of the proposed wind farm from selected representative viewpoints.

6.1 Introduction

Wind turbines, by their nature, are usually located in elevated exposed positions and, as large structures, can be highly visible. The proposed development is no exception in this regard and the wind turbines will be clearly visible from a range of viewing points. Accordingly, visual issues are recognised as being a key aspect of the environmental assessment process.

The proposed wind farm site and much of the landscape surrounding it comprises rural land that has been extensively cleared. It is predominantly used for grazing and has scattered rural residences and farm buildings. In addition, there are areas of remnant woodland along the slopes forming the Great Dividing Range and localised clusters of small acre farmlets.

The topography of the wind farm locality varies by about 250 metres from the low lying area of Lake George (about 680 metres) to the elevated features of Governors Hill and Hammonds Hill at about 900 and 935 metres respectively. Steep slopes flank features such as Governors Hill but elsewhere slopes are less steep and the ridges on which the turbines will be located are generally broad and rounded.

The wind farm will introduce large wind turbine structures that contrast with the landscape and have potential to attract attention but which do not obscure views of the rural landscape features.

Compared to the wind turbines, the visual impact of ancillary works will be minor and appropriate design will further reduce their impact. The location of the substation, the section of overhead line and the location and design of access tracks as described in Chapter 3 have all been selected to minimise their visual impact.

The methodology adopted for the visual impact assessment (Appendix C) included the following steps:

- landscape analysis
- identification of the approximate visual catchment of the wind farm
- compilation of a list of assessment sites and photography at each of the sites
- computer modelling to generate simulated perspective views of the wind farm
- photomontage compilation
- development of visibility assessment criteria
- review of photomontages using visibility assessment criteria
- review of indicative visibility for a range of other viewpoints including residences
- review of visual aspects of ancillary works
- review of mitigation options.

Key aspects of the visual impact review are summarised in the following sections.

Because visual impact is somewhat subjective, it is desirable that potentially affected landowners and the Consent Authority have access to realistic representations of the proposed wind farm from a range of vantage points to enable them to make their own visual assessments. To this end, a series of photomontages presenting views as seen from ten representative viewing points has been produced and is provided in Appendix C. These are incorporated in the supporting report (Appendix C) and two examples (Plates 6.9 & 6.10) are included at the end of this Chapter.

6.2 Landscape Analysis

Appendix C provides a review of the natural and cultural features of the local landscape for the area surrounding the proposed Capital Wind Farm.

The landscape elements comprise mainly cleared pastoral land with some adjacent uncleared remnant woodlands. In places, plantings of pine trees provide windbreaks that can be prominent features in the mostly cleared rural landscape. Built features such as buildings, roads, fences and power lines are scattered through the landscape at a low density. The larger physiographic elements include Lake George, the Great Dividing Range, areas of cleared grazing land and areas of remnant woodland that are more distant from the site. In addition to the natural and cultural features that comprise the landscape, a viewer's perception of these elements and the values they assign to them will vary.

Representative views of selected landscape elements in the vicinity of the wind farm are provided in Plates 6.1 to 6.8. Some of the landscape elements reflect particular physiographic features. All of the landscape elements have been influenced by human activities, particularly clearing and settlement of the land. Despite the clearing and settlement activities having occurred relatively recently, many people viewing the landscape scenes would regard them as the natural visual state of the locality.

The installation of wind turbines on the ridges at the locality will add a new element to the landscape scenes. A viewer's perception of this addition to the landscape as either a positive or negative attribute of a scene will vary dependent on their own circumstances.

The set of representative photomontages that has been provided in Appendix C enables individuals to gain their own appreciation of the project's visual impact on the landscape. The two photomontages reproduced in this Chapter show that while the turbines are prominent they do not obscure the view of the existing landscape elements. A set of ten photomontages is provided in Appendix C.

6.3 Visual Catchment of the Wind Farm

The visual catchment of a wind farm is the area of surrounding land from which the wind turbines may be wholly or partly visible. For the proposed development the visual catchment to a distance of ten kilometres was determined using a Geographic Information System (GIS) that accessed topographic data and the wind farm model (turbine location and height) to map the areas from which the wind farm will be either partially or fully visible.

The effect of screening by trees was not included in the computation of the visual catchment as data was not available for the height of tree cover. Accordingly, the computed visual catchment will overestimate the extent of the wind farm's visual catchment.

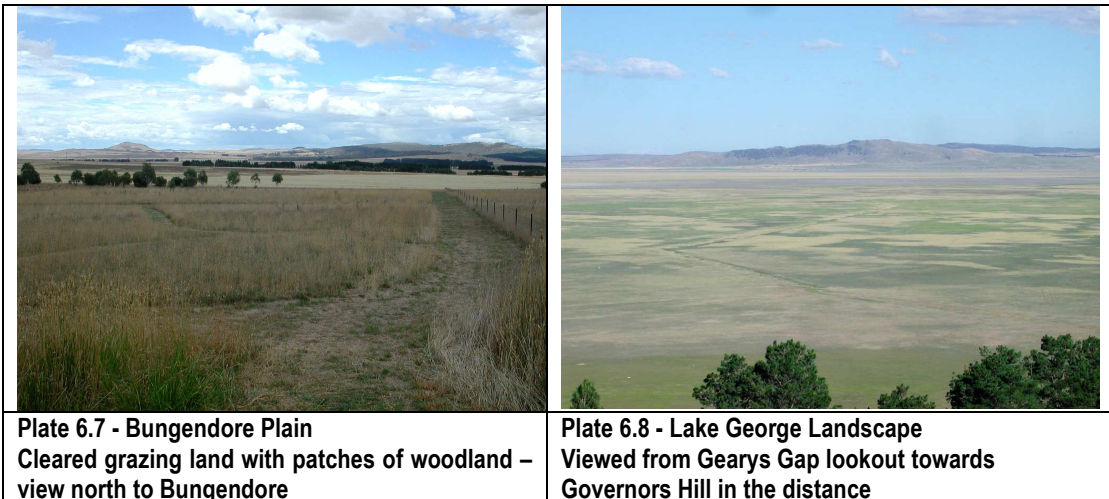
A site inspection was also used to gain further understanding of the visual catchment. Roads, which surround the project area, were travelled and the areas from which the wind farm site could potentially be seen were noted. Most neighbouring properties were also visited to verify the visual

catchment. It was found that the wind farm will be visible over a large area but that local topography and vegetation will limit visibility from many locations.

The wind farm will be visible at distances greater than 10 km in some directions, where it may be discernible on clear days. However, the visual impact of the Capital Wind Farm beyond about 10 km would be minor. Accordingly, the assessment was focused on viewpoints between one kilometre (the closest public viewpoint) and about nine kilometres from the site. The visual catchment of each of the three turbine groups is also shown in Appendix C.

Plates 6.1 – 6.8 - Capital Wind Farm Locality – Landscape Elements

<p>Plate 6.1 - Grose Hill Cleared rural land with planted pine wind breaks.</p>	<p>Plate 6.2 - Taylors Creek Catchment Rural land with Taylors Creek Road and scattered buildings including Bonnie Doon residence and Rural Fire Service building.</p>
<p>Plate 6.3 – Red Hill Cleared grazing land with small wind break</p>	<p>Plate 6.4 – Governors Hill Cleared grazing land with farm buildings</p>
<p>Plate 6.5 – Hammonds Hill Grassland Cleared grazing land and scattered trees</p>	<p>Plate 6.6 – Hammonds Hill Woodland Semi-cleared land with woodland remnant</p>



6.4 Visual Impact Assessment Sites

For the purposes of visual impact assessment, 10 representative viewpoints within the visual catchment were selected for study. Figure 6.1 at the end of this Chapter shows the locations of the viewpoints and includes reference contours showing approximate distances of 5 km and 10 km respectively from the wind farm (distance to nearest turbine). The chosen viewpoint locations are all on public roads surrounding the wind farm site often close to residence locations. Photomontages have been prepared for the representative viewpoints (Appendix C) and visibility of the wind farm classified (Table 6.1).

6.5 Production of Photomontages for Selected Viewpoints

To assist the assessment of visual impact at each of the selected assessment sites, photographic representations (photomontages) of the landscape with the wind turbines superimposed were prepared. The objective of the photomontages was to provide an accurate simulation of the appearance and scale of the wind farm in the landscape.

The process for production of photomontages involved three primary stages as follows:

- Photographs were taken at each of the visual impact assessment sites. The photographs were taken with a 35mm single lens reflex camera with its lens set to 65mm focal length. Due to the focal length used, it was necessary, for many of the viewpoints, to join several photographs to produce a panoramic view of the wind farm. As far as possible the photography was taken with fine weather and with blue sky. Where the turbines are silhouetted against the sky they are likely to be more prominent against the blue background than for a white or grey cloudy background. This enhances their visibility in the photomontages.
- Computer modelling WindFarmer software was used to produce perspective diagrams from each viewpoint and provide accurate representations of the turbines in relation to the topography.
- The photomontages were prepared using a computer based graphics system that enabled incorporation of scaled images of the turbines into the respective photographic images. The appearance of the turbines have generally been enhanced in the photomontage to aid recognition.

A complete collection of photomontages showing views from all 10 of the selected assessment sites around the area is included in the detailed Visual Impact Assessment Report (Appendix C). As mentioned in Section 6.1 the photomontages from the 10 representative viewpoints form the principal reference by which the Consent Authority and the community can gain an appreciation of the likely visual impact of the wind farm. Two examples of the photomontages are supplied in this document. The two representative views from Viewpoints 4 and 5 are provided as outlined below.

- Plate 6.9 - a view to the south at Viewpoint 4 on Taylors Creek Road
- Plate 6.10 - a view to the north-west at Viewpoint 5 on Taylors Creek Road

The orientation of the wind turbines will vary with the wind direction and, for most of the time, they are likely to be facing east or west into the predominant wind directions. The views of the wind turbines will look different, depending on the orientation of the turbine relative to the viewpoint. To maximise the impact of the turbines in the individual photomontages they have been shown generally facing the viewpoint.

6.6 Visibility Assessment

The visibility of the proposed development from the 10 assessment sites was reviewed against the following assessment criteria and described in Appendix C.

- the distance from the wind farm (for the nearest wind turbine)
- the spatial extent of the visible turbines (referred to here as the wind farm view angle)
- the number of turbines visible

The key visibility criteria and the resulting classifications for each site are shown in Table 6.1.

Table 6.1 – Visibility Assessment Results – Representative Viewpoints

Ref No.	Viewpoint Location (Figure 6.1)	Number of Visible Turbines			Visibility Criteria		
		Mid-ground	Background	Background	Distance to Nearest Turbine	Wind Farm View Angle	Visibility Class (see Appendix C)
		1 – 3 km	3 - 5 km	> 5 km	km	degrees	
1	Gearys Gap Lookout	0	0	63	9	45	Low
2	Lakoona entrance	7	10	0	2.2	75	High
3	Taylors Creek Road, north of West Leg Intersection	0	2	41	5	45	Low
4	Taylors Creek Road, north	0	11	22	3.5	75	Mod
5	Taylors Creek Road, mid	9	5	3	2.8	40	Mod
6	Taylors Creek Road, (near Nardoo)	9	6	1	1.5	20	High
7	Eastern end Taylors Creek Road	1	1	0	3	5	Mod
8	Mt Fairy Road/Tarago Road	0	18	0	3.2	55	Mod
9	Tarago Road	3	13	11	2.7	30	Mod
		Substation – Low visibility due to low height and tree screening					
10	Hope Drive, Bungendore	0	0	55	6.6	45	Low

Of the sites assessed, in two the turbines were rated as being subject to high visibility, five views were rated as moderate visibility, and three views have low visibility.

The view of the wind farm from the distant site (Viewpoint 1 at 9 km) was assessed as being subject to low visibility. It can be seen from the relevant Plate in the Appendix C that, due to the effects of distance, the visibility from Viewpoint 1 is indeed low, but nevertheless the wind turbines are discernible within the landscape.

Viewpoints 2 and 6 are the only viewpoints assessed as having high visibility of the wind farm. Both have turbines at distances less than 3 kilometres. Viewpoints 5 and 9 also has turbines within three kilometres of the viewpoints but most turbines are set back further and the view angles are smaller than for Viewpoints 2 and 6.

There are few trees on the ridges on which the wind farm is located and, therefore, little to reduce or soften its image. At other locations, such as residences, trees, topography or other features may reduce the visible portion of the wind farm. Many local residences are surrounded by trees to provide a degree of shelter. These trees may partially or completely obstruct views of the wind farm from the residence. In most of these cases, more expansive views of the wind farm will generally be available beyond these tree screens often within short distances from the residences.

A qualitative review of the indicative visibility at a range of other locations, particularly residences, was also undertaken to assist stakeholders to evaluate the wind farm's visibility at locations of interest to them. The results of that review are provided in Table 7.2 of Appendix C.

For many of the viewpoints, the wind turbines are silhouetted against sky and when cloud cover is present, it may reduce the level of visual impact when compared to that of clear sky.

Overall, the development will be a prominent addition to the local landscape with its visibility being primarily dependent on the distance of the viewpoint from the wind farm and also the proportion of the view occupied by the wind farm.

Even though the wind turbines are prominent features they will not significantly mask the elements of the various scenes although they may change the scene's character. Furthermore, there will be large areas of the adjoining landscape that will remain unchanged by the development. In short, a significant part of the existing landscape will remain unchanged.

6.7 Visual Issues associated with Ancillary Works

Ancillary works will include the construction of temporary and permanent access tracks, the upgrading of existing tracks, the construction of a facilities building, a substation and the installation of underground cables and overhead lines.

The visual impact of most of the ancillary works will be insignificant compared to that of the wind turbines and they will be designed and located so as to reduce their visual impact.

Upgrading of existing tracks and construction of new permanent and temporary tracks will be required. All temporary tracks not required for ongoing operation and maintenance will be removed and re-grassed after construction works have been completed. Permanent tracks will be located to achieve suitable grades on stable slopes and designed so that they will not exacerbate erosion at the site. As far as possible, their location will also be chosen to minimise visual impact from the surrounding countryside.

However, some access tracks may need to be located on slopes visible from surrounding vantage points. It is possible with careful design to construct these tracks such that their visual impact is minimised. Earth batters on any tracks that are benched into slopes will be revegetated to prevent erosion and to reduce visibility of the track.

The facilities building and substation will be located in a valley to the south of the wind farm at a location selected to minimise the length of high voltage transmission line required, and also to minimise visibility from as much of the surrounding countryside as possible. The minimal visual impact will be achieved by siting the substation to the north of a stand of trees and by minor benching into the slope. This will mean that it will only have limited visibility from a small number of residences or as fleeting glimpses from passing vehicles to the south in areas sparsely settled and where tree screening will also filter views toward the substation.

To reduce visual impact at the location of the turbines, the 33,000 volt cables linking the turbines within each group will be placed underground along the ridge tops. An overhead 33,000 volt transmission line will be used to link the Grose Hill, Ellenden and part of the Hammonds Hill Groups of turbines to the substation. The 33,000 volt overhead transmission line will be constructed using wood or concrete poles and may be part single circuit and part double circuit. It will be routed from the Grose Hill Group in the north-western part of the project area to the facilities building in the south of the area. The route has been chosen to minimise visual impact, minimise tree disturbance and to avoid areas of unstable ground or areas of archaeological significance. Most of the overhead line will not be visible from neighbouring residences, local roads or public areas.

6.8 Shadow Flicker

Shadow flicker is a visual effect that occurs when rotating turbine blades cause intermittent shadowing as the blades momentarily block the sun's path. The effect will occur under circumstances where the turbine location is such that at certain times of the day the sun's rays pass through the swept area of the rotating blades and affect the viewpoint. The effect is diminished by distance between the turbine and the viewpoint, by increased cloud cover and when the turbine is facing at an angle to the rays of the sun and the blades present a narrower profile and reduced shadowing.

An assessment of the potential for shadow flicker effects is provided in Appendix D and its findings are summarised here. The zones where there is potential for shadow flicker at residence locations were assessed using WindFarmer software and with consideration of factors illustrated in Figure 5 of Appendix D.

Shadow flicker effects at distances greater than 1 km were assessed as being minor (i.e. indistinct and faint). At a distance of less than approximately 400 metres between a turbine and residency, there is the potential for the sun to be completely blocked by blades of 3.5 metres width, although only intermittently. Only two residences are located at distances of less than 400 metres and these will both be leased by Renewable Power Ventures.

The next closest residence, Euroka, was found to be within the zone of potential blade flicker for three separate turbines that are each at distances of approximately eight hundred meters. As the residence is sheltered by a dense stand of pine trees any shadow flicker affects will be largely mitigated. In addition the residence is a Wind Farmer property. The closest neighbour (non-wind-farmer) residence is at a distance of 1.2 kilometres from the nearest turbine and any flicker affects at this distance are unlikely to be significant.

No public roads or public places will be significantly affected by shadow flicker. A small part of the local roads will have short term impacts on passing vehicles and due to the short period they could be affected and the distance involved between the turbines and the roads the impact is assessed as negligible.

6.9 Blade Glint

Blade glint refers to the regular reflection of sun off rotating turbine blade. This can be a temporary effect at any particular location, though the vast bulk of any glint occurs where the viewer is located above the altitude of the turbine hub. The occurrence of blade glint depends on a number of conditions including the orientation of the nacelle, angle of the blade, and the angle of the sun. The reflectivity of the surface of the blades is also important, and is influenced to some extent by colour and age of the blade.

Blade glint is an aspect that could be a potential distraction to drivers if roads are aligned towards turbines, particularly where the road is located at a higher altitude to the turbine hub and can be noticed over some distance, as much as 10 to 15 kilometres. While the effect may be noticeable at distance, its impact is regarded as transient and low.

Blade glint is not expected to represent a significant issue for the Capital Wind Farm project due to the altitude of the turbines relative to potential view points, low density of settlement in the areas that could be potentially affected and the low volumes of traffic on the local roads. Where it does occur it will be of short term duration.

6.10 Mitigation of Visual Impact

The three bladed turbine design and the chosen matt white colour is generally accepted as being the most visually acceptable turbine arrangement and colour. However, due to their size and prominent position the wind turbines will be difficult to screen at the site. Existing trees and other features at some surrounding locations may partially obstruct views of the wind farm.

Measures to further mitigate the visual impact that have or will be incorporated in the development will include:

- As part of the wind farm planning, RPV has removed a number of turbines which were close to neighbouring residences where the visual and/or noise impacts may have been unacceptable
- Use of underground cabling between wind turbines
- Substation and facilities building located to minimise visibility from most public viewpoints around the wind farm
- Access roads located to as far as possible limit their visibility
- The internal transmission line between the Grose Hill Group and the substation has been located to minimise its visibility
- Selected tree planting may be undertaken to reduce the visibility of certain elements of the wind farm
- Tree planting at some neighbouring properties.
- A matt finish will be applied to blades if practicable

While the chosen colour is representative of most wind turbine installations and indicated to be generally preferred, if requested by Council, an alternate colour choice could be used.

6.11 Overview of Visual Issues

The layout of the proposed site has been based on achieving an acceptable energy output while addressing potential visual and noise impacts and the wishes of the property owners and neighbours. While minor adjustments may be made to the locations of turbines within the site, such adjustments are unlikely to alter the overall visual impact.

The wind farm will be noticeable from many points within its visual catchment. The photomontages provide representative views from each direction and at various distances from the wind farm. In many cases actual views will be limited partially or fully by topography and or trees. As far as possible, all ancillary works will be implemented with due consideration to reducing their visual impact and in most cases they will have a minor contribution to the project's visual impact.

The perceived visual impact is likely to vary between individuals depending on a range of factors. For this reason a set of photomontages has been produced showing how the wind farm will appear when viewed from a selection of representative sites in the area. These photomontages are intended to provide stakeholders with the means to reach their own conclusion as to the visual impact of the wind farm.

Based on experience with the Crookwell and Blayney Wind Farms, it is likely that the majority of the community will regard the visual impact of the installed wind farm as being acceptable. At Blayney and Crookwell initial concerns about the developments, including visual impacts, were reduced significantly after construction of the wind farms.

Consultation to date with residents in the vicinity of the Capital Wind Farm has encountered a range of views. Some concerns have been raised on a range of issues and, where possible, these will be addressed during future stages of consultation. However there is a considerable degree of support for the project from the local community and the proposal is considered to be warranted based on the overall benefits delivered by this sustainable energy project.