Appendix 1 LANDSCAPE AND VISUAL ASSESSMENT

FINAL REPORT

Yass Valley Wind Farm

Planning Application Report Landscape & Visual Assessment

For:
Epuron Pty. Ltd.

AUGUST 2009 Rev3

Environmental Resources Management Australia
World Trade Centre
Level 3, Yarra Tower
18-38 Siddeley Street, DOCKLANDS VIC 3005
AUSTRALIA
Telephone +61 3 9696 8011
Facsimile +61 3 9696 8022
www.erm.com

FINAL REPORT

Yass Valley Wind Farm

Planning Application Report Landscape & Visual Assessment

For:
Epuron Pty. Ltd.

AUGUST 2009

Ref No: 0092376 RPT1 REV2

For and on behalf of
Environmental Resources Management Australia

Approved by: _____ Allan Wyatt

Signed: _____

Position: _____ Partner

Date _____ 5th August 2009

CONTENTS

CONTENTS

VIEWPOINTS

CONTENTS

1 INTRODUCTION

This report provides a landscape and visual assessment for a proposal by Epuron Pty Ltd Pty to install up to 182 wind turbines, near the township of Yass in central New South Wales.

The Yass Valley Wind Farm project comprises wind turbines in three separate precincts, which are the Coppabella Hills Precinct, the Marilba Hills Precinct and the Carrols Ridge Precinct.

This Project Application is seeking approval of the Marilba Hills and Coppabella Hills precincts only and a further application will be submitted for the Carrolls Ridge precinct.

However as the Carrolls Ridge precinct may ultimately form part of the Yass Valley Wind Farm, this Landscape and Visual Assessment includes the assessment of all three precincts for the sake of continuity, transparency and thoroughness. Therefore this landscape and visual assessment was prepared on a conservative basis and contemplates the cumulative visual impacts of the entire wind farm.

This landscape and visual assessment has been prepared in accordance with the Director-General's Requirements (DGR's) and forms one component of the Environmental Assessment (EA) seeking project approval under Part 3A (Major Projects) of the Environmental Planning and Assessment Act 1979.

1.1 METHODOLOGY

The methodology used within this visual assessment is based on the *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria (May 2003)* as well as past projects undertaken by ERM in the visual assessment of wind farms in NSW, Victoria, South Australia and New Zealand. This methodology is supported by the *Wind Farms and Landscape Values, National Assessment Framework*.

The methodology used within this visual assessment of the Yass Valley Wind Farm includes the following steps.

The Visual Components of the Yass Valley Wind Farm

Describing the visual components of the Yass Valley Wind Farm. These include, but are not limited to, wind turbines, substations and access roads.

Statutory Context

Describing the planning policies and plan provisions that apply to the site and the surrounding areas.

Perception Studies

Understanding peoples' perception of wind farms in the landscape based upon past research in Australia and overseas, is an important step in assessing the visual impact. Wind farms are unusual in that they are perceived as positive elements in many landscapes by a great majority of viewers. This is dissimilar to the acceptance of any other infrastructure within the landscape, which is generally perceived as negative. Therefore it is important that this perception data is understood and that it is recognised as a factor that needs to be considered when assessing the extent of visual impact. The results of several overseas studies, which share similar findings to the Australian studies, are appended to this report (Refer Annexure A).

The Viewshed and Zones of Visual Influence

Defining the viewshed of the Yass Valley Wind Farm based upon the parameters of human vision. The rationale behind the definition of the viewshed is appended to this report (Refer Annexure B) which also describes the parameters of human vision, which assists in defining the viewshed.

Landscape Units and Sensitivity

Landscape Units are based on the physical characteristics of the area within the viewshed. The characteristics that assist in defining the Landscape Units include geology, vegetation, topography and drainage patterns as well as the extent of man-modifications and urban development.

The sensitivity of the landscape units is primarily an assessment of the extent to which the landscape units can accept further change. Generally, the greater the extent of existing man-modifications, the lesser the sensitivity.

However when assessing residential properties the landscape sensitivity is always rated as high.

Seen Area Analysis

The Geographical Information Systems software (GIS) can map those areas from which wind turbines, whole or in part, are visible. This is referred to as a Seen Area Analysis.

Assessment of Publicly Accessible Viewpoints

The visual impact of a development is affected by:

- the distance of the viewer from the development;
- the nature of the surrounding landscape (including the landscape units represented and their sensitivity); and
- the number of viewers able to see the development.

Accordingly, the overall effect of the development of the proposed wind farm on each viewpoint has been assessed by evaluating the value of each of those criteria, ranking those as being either low, medium, or high, and subsequently making an assessment as to the overall effect by balancing each of those criteria and deriving an overall visual impact along a scale of effects.

The scale of effects that has been used to describe the overall visual impact (low moderate, high) is discussed in Chapter 7 '*Assessment of the visual impact from publicly accessible viewpoints*'.

As assessment of the visual impact from indicative viewpoints within the public domain is partly based on photomontages which show the view of the existing landscape and the alteration to this view to include the proposed wind farm. These have also been used to show a range of sequential impacts on viewers travelling along the Hume Highway, along Burley Griffin Way and near the Hume & Hovell Walking Track to the south of the Hume Highway.

Mitigation Measures for Publicly Accessible Viewpoints

Mitigation measures are also considered if such measures may be appropriate in reducing the visual impact from a publicly assessable viewpoint. For example, roadside planting along a section of highway may significantly reduce the visual impact.

Residential Viewpoints

Locating and assessing the visual impact from residential properties. Residences are usually selected that are representational of properties within precincts around the wind farm (with priority given to those that are closest to the wind farm) or who have expressed particular concerns.

The assessment of visual impact from residences is different to one undertaken from publicly accessible viewpoints. An assessment of visitor numbers is not applicable. The landscape sensitivity is always rated as "high", as it must be recognised that people feel most strongly about the view from their house and from their outdoor living spaces.

Mitigation Measures for Residential Viewpoints

Mitigation measures have also been considered and these will be evaluated to see how they may reduce the visual impact from residences.

Cumulative Visual Impact

Examining the cumulative visual impact of the Yass Valley Wind Farm against other approved or existing wind farms. A cumulative visual impact will occur when either sequential and /or simultaneous views to wind turbines from publicly accessible viewpoints or from private viewing locations lead to a change in a community's, resident's or visitor's perception of the Yass locality.

1.2 PHOTOMONTAGE PREPARATION

Photomontages are used to illustrate the potential visual impact from selected locations and assist in the assessment of the visual impact. These have been prepared by Garad Hassan.

The methodology used in the creation of the photomontages includes a computer model of the existing topography and the wind turbines and this model is then overlaid on the photographs of the existing view. Wind turbines from this model are then be rendered for the "after" view.

Generally the field of view for photomontages is approximately 60^{O} horizontal and 15^{O} vertical. The rationale behind this field of view is set out in Annexure B.

It is stressed that the small images used within the report are only for referencing comments made within the text. While technically correct, they do not accurately portray a perceptually accurate image to assess the visual impact. For this reason larger (A3) images are appended to this report (Annexure D) however while these are better, a proper assessment of the visual impact can be made when the images are produced at A0 sizes and held at arm's length.

2 PROJECT DESCRIPTION

This section locates the project and provides a description of the visible components to be assessed in this Landscape and Visual Impact Assessment (LVIA).

The Yass Valley Wind Farm is located to the west of Yass, north and south of the Hume Highway.

This Project Application seeks the approval for wind turbines (and associated infrastructure) within two precincts. These are:

- Coppabella Hills Precinct (up to 86 wind turbines), and the
- Marilba Hills Precinct (up to 66 wind turbines).

Approval for wind turbines in the Carrolls Ridge precinct (up to 30 turbines) will be sought in a future application to the NSW Department of Planning.

This Development Application is only for the wind turbines within the Coppabella Hills and Marilba Hills Precincts, a total of 152 wind turbines. The wind turbines within the Carrols Ridge Precinct (up to 30 wind turbines) will form part of a future Development Application, however to ensure that this landscape and visual assessment is conservative the assessment will also take into account the wind turbines within the Carrols ridge precinct.

There are a total of 152 wind turbines proposed within these two precincts and with a further thirty wind turbines within the Carrols Ridge Precinct, the total number of wind turbines within the Yass Valley Wind Farm could be up to 182.

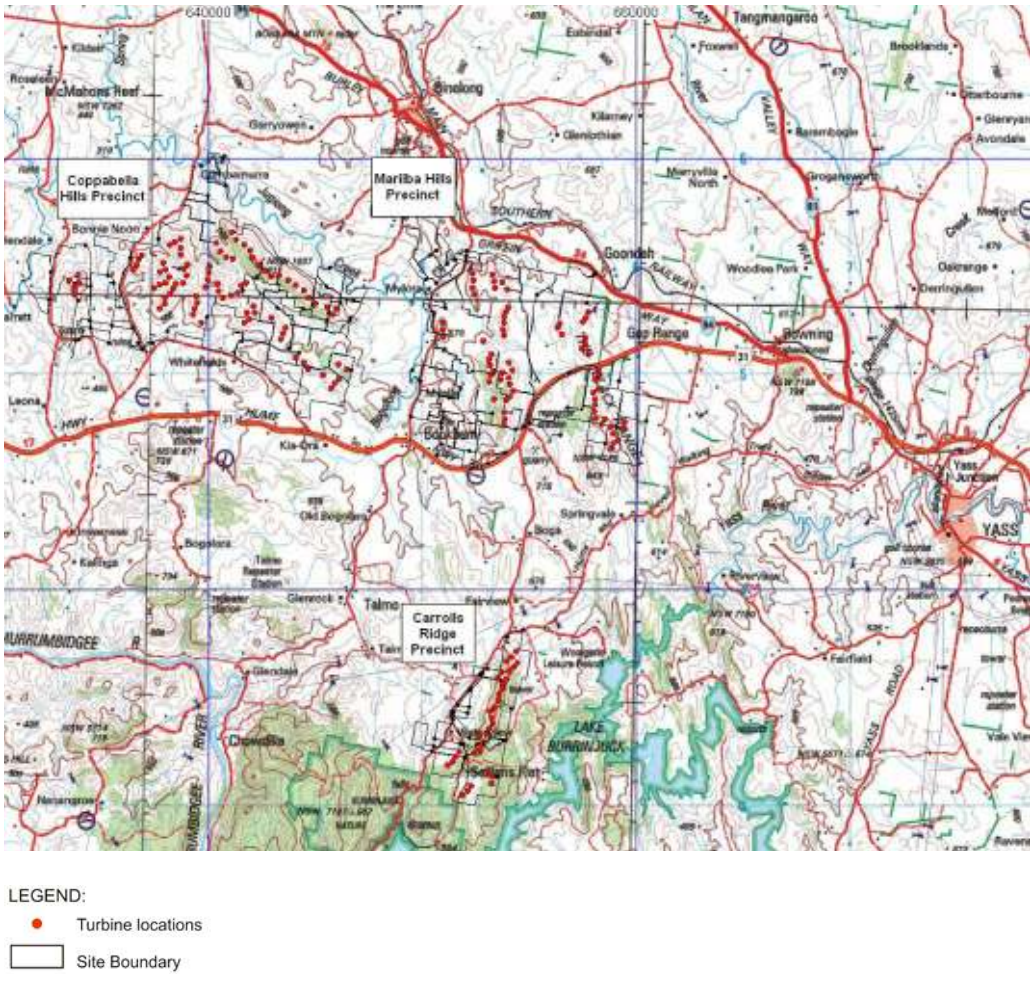


Figure 2.1 Location Map (three precincts)

The Coppabella Hills Precinct is the western-most group of wind turbines. The Marilba Hills Precinct is located further to the east. Both of these precincts are located south of the township of Binalong, south of Burley Griffin Way and north of the Hume Highway. There are a small number of wind turbines in the Marilba Hills Precinct that lie to the south of the Hume Highway.

The Carrolls Ridge Precinct, which is not part of this Development Application, is located further south of the Hume Highway and to the north of Lake Burrinjuck.

2.1 SITE LAYOUT

The location of the 152 wind turbines within the two precincts which form part of this Project Application are illustrated in the following Figures and for the sake of completeness the layout of the wind turbines within the Carrols Ridge Precinct are also shown. The location of the proposed wind turbines are designated by a red dot, whilst the property boundaries of the contracted landowners are designated in black. Where distances are quoted they are to the nearest wind turbine, not to the property boundary.

Coppabella Hills Precinct (Part of this Project Application)

There are up to 86 wind turbines proposed for the Coppabella Hills Precinct.

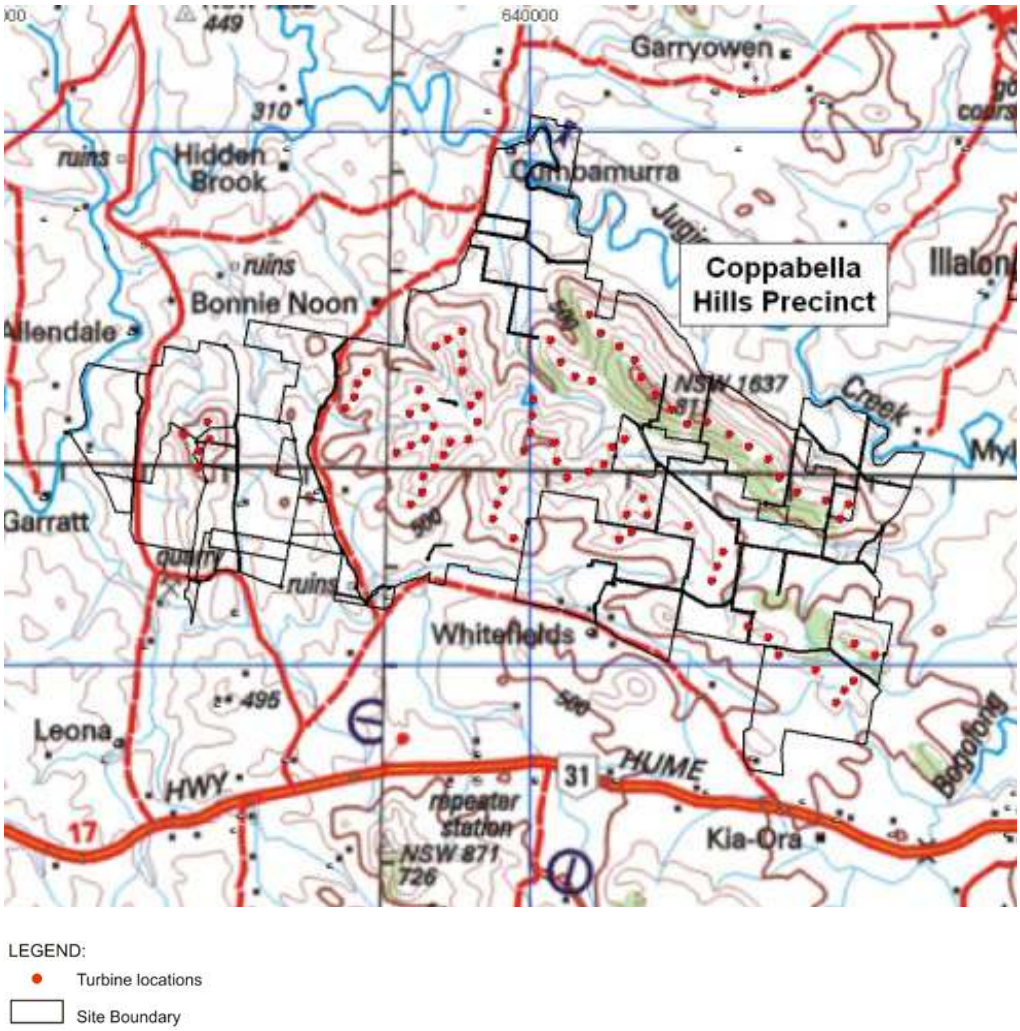


Figure 2.2 Site Layout - Coppabella Hills Precinct

The Coppabella Hills Precinct lies to the north of the Hume Highway, with most of the wind turbines to be located more than 3 km to the north of the highway. A small number of wind turbines on the eastern edge of this precinct are within 2 km of the Hume Highway.

Burley Griffin Way is more than 8.5 km to the north.

Binalong, which is located approximately 10 km to the north-east on Burley Griffin Way, is the nearest township.

Marilba Hills Precinct (Part of this Project Application)

There are up to 66 wind turbines proposed for the Marilba Hills Precinct.

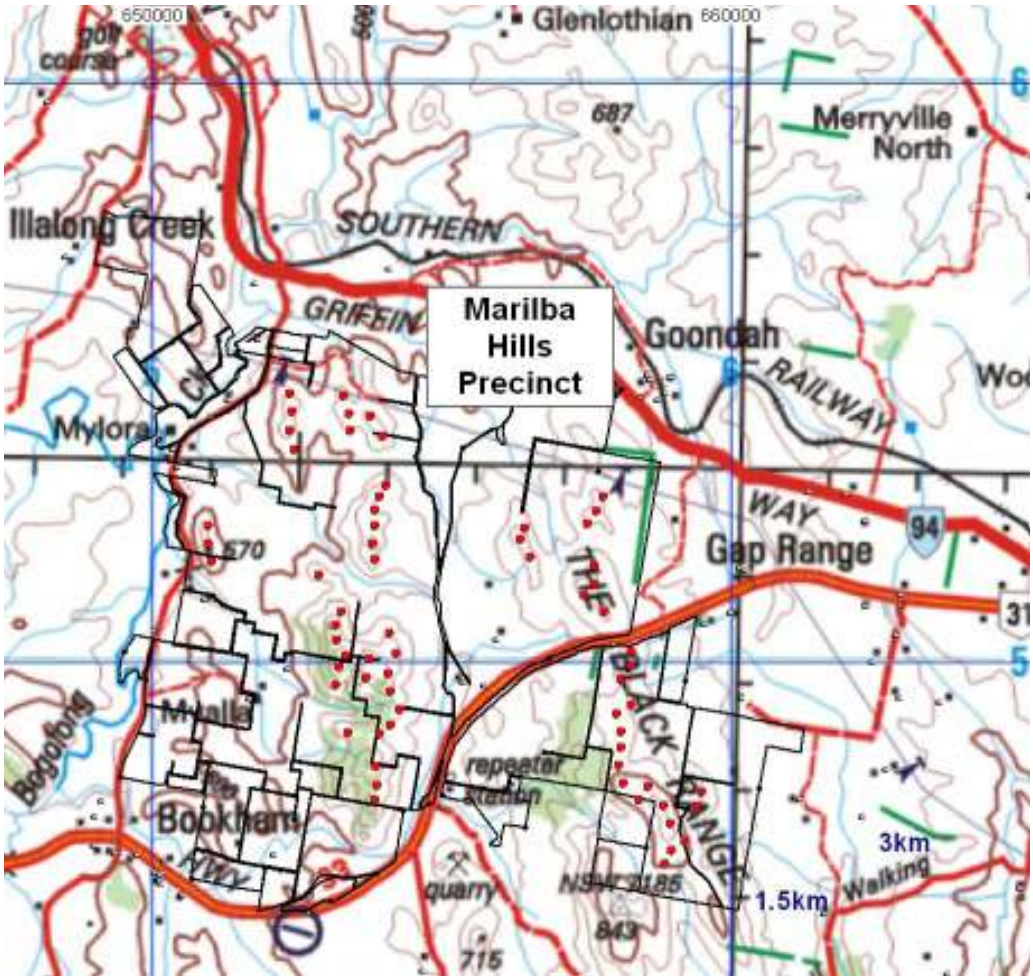


Figure 2.3 *Site Layout - Marilba Hills Precinct*

The Marilba Hills Precinct is located between the Hume Highway and Walter Burley Griffin Way with a cluster of wind turbines stretching south of the Hume Highway along the Black Range.

Binalong is the nearest township which is located on the Burley Griffin Way approximately 8 km to the north of the nearest wind turbine.

Carrols Ridge Precinct (Not part of this Project Application)

The wind turbines within the Carrols Ridge Precinct are not part of this Development Application, however there are up to 30 wind turbines proposed for the Carrols Ridge Precinct which will form part of a future Development Application and will be assessed as part of this Application to ensure that the Landscape and Visual Assessment is conservative and gives an assessment of the entire project.

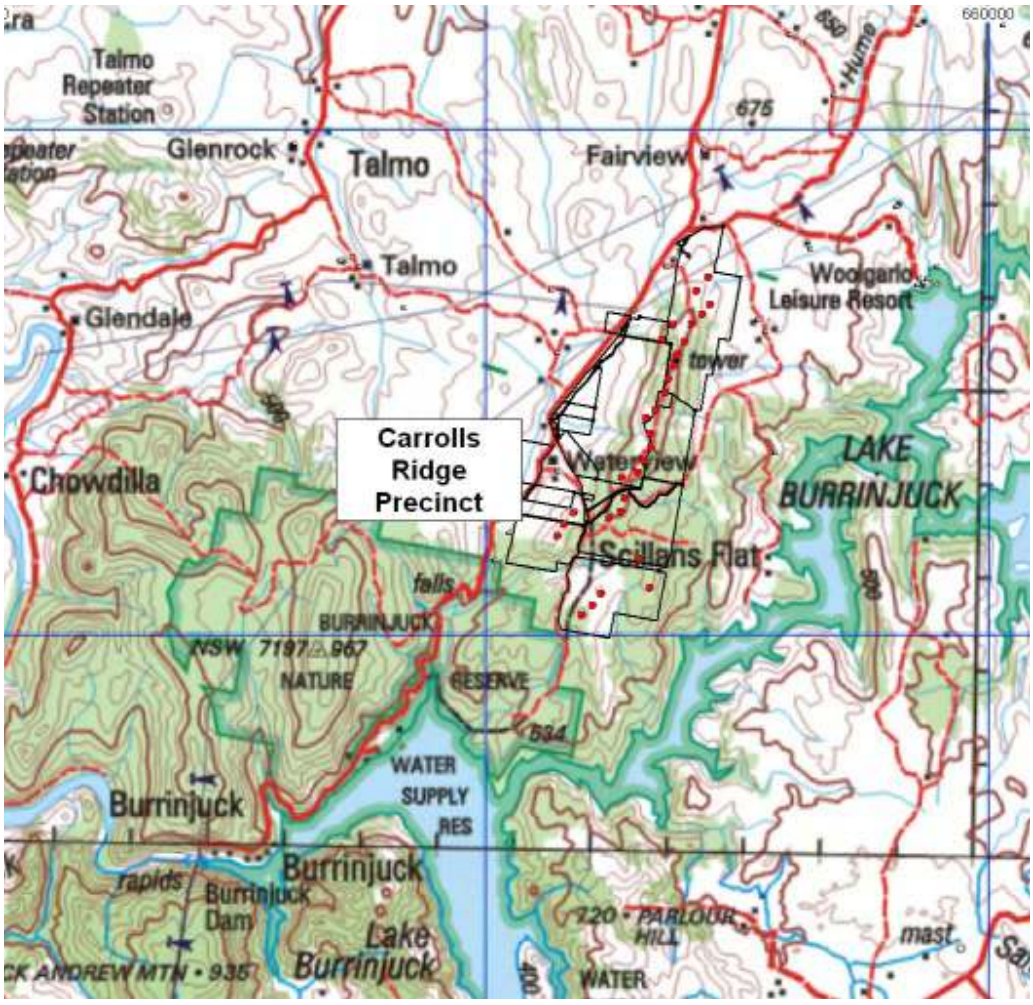


Figure 2.4 Site Layout - Carrols Ridge Precinct

The Carrols Ridge Precinct is a cluster of wind turbines more than 8.5 km to the south of the Hume Highway

As well as the wind turbines, other wind farm infrastructure will include access tracks to link each turbine, crane hardstand areas, site substations, control rooms and wind monitoring masts. There will also be some overhead electrical lines mounted on concrete or steel monopoles.

2.2 WIND TURBINES

The wind turbines are the most visually apparent element of a wind farm proposal. The proposed wind turbines are 150 m tall to the blade tip. The nacelle is 100 m from ground level and the blades have a total diameter of 100 m.

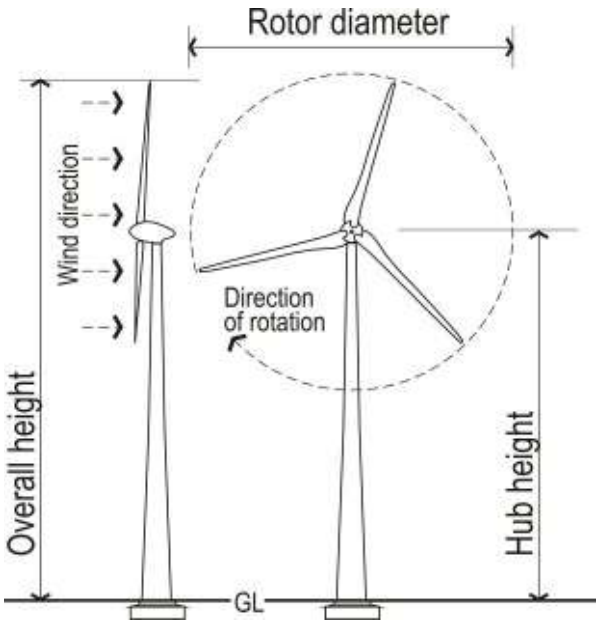


Figure 2.5 Indicative wind turbine

A summary of the physical characteristics of the proposed wind farm is given in the following table. All values are maximums and may differ slightly between turbine models.

Table 2.1 Wind turbine specifications

ITEM	Maximum Values
Hub Height (Approx)	100 metres (Approx)
Rotor Diameter (Approx)	100 metres (Approx)
Overall Height (Approx)	150 metres (Approx)
Proposed number of turbines	182 turbines (Approx)

2.3 ACCESS TRACKS, ANCILLARY OPERATIONS AREAS & SUBSTATION(S)

The site is to include a number of 33kV/132kV transformers. Each wind turbine will have its own transformer to step up the voltage to the on-site distribution voltage of 33kV. Each turbine would then be connected by cabling to the substation. In general, the interconnecting cables will be underground.

The substation compound would be approximately 100 m x 100 m with a 2.4 m high security fence.

Most structures within the compound are less than 6 m high although the highest structure would be less than 12 m high. The substation will most likely be located in an area central to the site and would avoid high visual impact. Vegetation would be used to further mitigate any visual impact.

A Control building will be situated on site to house metering equipment, switchgear and electrical control panels. The building would be approximately 8 m x 20 m x 5.5 m high.

There are to be a number of access tracks to allow for the construction of the turbines and also for ongoing maintenance. Where practicable, the access tracks will utilise existing farm tracks. Tracks will be approximately 6 to 10 m wide.

Topsoil will be removed to a suitable founding layer and the track running surface will be constructed by tipping and compacting road base. Construction of tracks from the valley floor to the ridge line may require cut and fill on the hill side. Where tracks cross water bodies, crossings will need to be installed.

Overhead 33 kV lines within the wind farm will be supported on mono pole structures built of timber, steel or concrete.

2.4 AVIATION OBSTACLE LIGHTING

Aviation obstacle lighting may be required as the height of the wind turbines exceed 110 m above ground level.

Options that may satisfy the CASA requirements are being explored and include:

- Lights mounted on the nacelle of wind turbines located at the corners of the site.
- Lights mounted on the nacelle of wind turbines located around the perimeter of the site at a distance of approximately 1 km.
- Lights located on nacelles set at high points within the wind farm and at the corners of the site.

The lights are configured with two red lights approximately 2 m apart mounted on the nacelle of wind turbines or on the wind monitoring masts. These lights could be of the unblinking or the blinking types.

The unblinking lights will consist of static light source mounted on top of the nacelle or the wind monitoring masts. The blinking lights consist of flashing lights that blink on and off at 3 second intervals. These lights will be partly baffled to decrease their visibility at the ground level.

2.5 *CONSTRUCTION*

The period from pre-construction through to completed tests following commissioning of the wind turbine generators is likely to be between 24-36 months. This period is dependant on weather and ground conditions as well as detailed design and delivery of equipment. Among the various activities during the construction process, those which are likely to have a landscape and/or visual impact are likely to be the following:

- Construction of the temporary construction compound(s) 100 x 50 m;
- Construction of internal site access tracks;
- Excavation and construction of turbine foundations;
- Construction of substation and grid connection networks;
- Excavation of trenches and the laying of power and instrumentation cables;
- Erecting the turbines, which would involve the construction of crane hardstand areas;
- On site concrete batching plant;
- On site quarries; and
- Vehicular traffic.

Although the major visual components will be the wind turbines, the access tracks and, to a lesser extent, a small car park serving a building which may contain a substation, control room, storage and office building may also be visible from the surrounding road network. If a separate substation or substations are required, these may also be visible from the surrounding road network.

However, before defining the viewshed of the wind farm and examining potential visual impacts, it is worthwhile examining community perceptions of wind farms based on previous studies undertaken in the near to the Yass Valley Wind Farm and for other Australian and international studies.

3 COMMUNITY PERCEPTION STUDIES

Viewer perception is an important issue to consider for wind farm proposals, especially in areas near tourist destinations or heritage areas. The visual impact of a wind farm ultimately depends on the opinion of the viewer. Community perception is discussed in the *Wind Farms and Landscape Values, National Assessment Framework* and has therefore been included in the assessment of the Yass Valley Wind Farm.

The degree of visual impact partly depends on how the viewer perceives renewable energy, the wind turbines and the landscape.

The presence of wind turbines will change the existing landscape character of this locality, however to postulate that these will create irreplaceable damage to the landscape values and negatively impact the amenity of the area is not substantiated on the basis of perception studies.

Perception studies show many people find wind turbines attractive and have shown that the majority of those surveyed enjoy the view to wind turbines. Therefore for many people the visual impact may be positive, not negative as suggested. And even if the wind turbines are visible at both sunset and sunrise, there is no evidence to suggest that this will be detrimental.

Perception studies continually show that in many Australian and overseas examples that between 60-70% of people find wind turbines an attractive element in the landscape, with up to 15% of respondents undecided and 20% disliked wind farms. Viewer perception is an important issue to consider, especially in areas near tourist destinations or other attractions.

Public opinion research on wind farms in New South Wales has been limited. Although community consultation is undertaken as part of the planning process for wind farms, this consultation is mostly qualitative in nature, in that it seeks the views on a number of aspects of the wind farm development from specific stakeholders, including the local community, and those further away, as well as the views of special interest groups, government and local government agencies involved or impacted by the development. This information is primarily anecdotal and is not rigorously documented.

However some social research has been undertaken by government agencies as well as wind farm proponents, to ascertain people's perception and response to wind farms in the New South Wales and Victorian landscapes and this research is remarkably consistent.

3.1 YASS VALLEY WIND FARM AREA – COMMUNITY PERCEPTION TOWARDS WIND FARMS

A study to ascertain the regions view towards wind farms was conducted from the 27th of July and concluded on the 2nd of August 2007. This study was previously quoted in the Planning Application Report for the Gullen Range Wind Farm. However, the study area included the Goulburn – Crookwell – Yass regions, which are located within the Southern Tablelands area. This area is known for high wind speeds and therefore has potential for wind energy projects.

The respondents in this study were located in small urban and rural locations within the immediate vicinity of the proposed Gullen Range Wind Farm; however the study also selected residents further:

- to the west around Gunning and Yass;
- to the north-west at Binalong;
- to the east towards Crookwell; and
- to the south east towards Goulburn.

These are areas in which the Yass Valley Wind Farm is also to be located.

Within the study area, an existing wind farm known as Crookwell I is located to the immediate east of the Crookwell township. Another approved wind farm (Crookwell II) is located to the immediate south of Crookwell I. Further approved wind farms are located to the south-east known as Walwa-Gunning and Cullerin Range. Located further to the west of Yass is the approved wind farm at Conroys Gap.

At the beginning of the study, it wasn't known just how much respondents knew of these wind farm projects, what they knew of wind farms, what the wind turbines that populated and powered them looked like, or know what they actually did.

This study examines community perceptions towards renewable wind energy, derived from wind farms, for the region of south-east NSW and establishes baseline data on community perceptions in the study area.

This report is reproduced in full as an Attachment in the specialist studies. The conclusions are briefly restated here to back up the assertion that the greatest majority of residents living near the proposed Yass Valley Wind Farm are similar to those surveyed in other areas in Australia and overseas and all these studies support the view that the local residents are overwhelmingly in favour of a wind farm in their locality.

Results have shown an approval rating of almost 9 in 10 (89%) for respondents in favour of wind farm projects being developed in the Southern Tablelands. More than 9 in 10 (91%) respondents support wind farms in Australia (refer *Figure 3.1*).

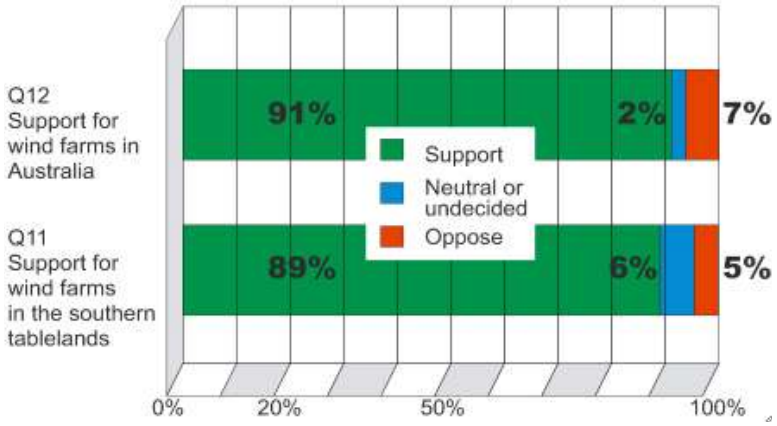


Figure 3.1 ***Support for wind farms***

Further to this, most respondents (83% favour, 8% opposed) were accepting of a wind farm set back 10 kilometres from their home, with a slight decrease to 7 in 10 respondents (71% Favour, 19% opposed) accepting a wind farm set one kilometre from their home (see *Figure 3.2*).

This is a very similar level of acceptance that has been identified in other studies.

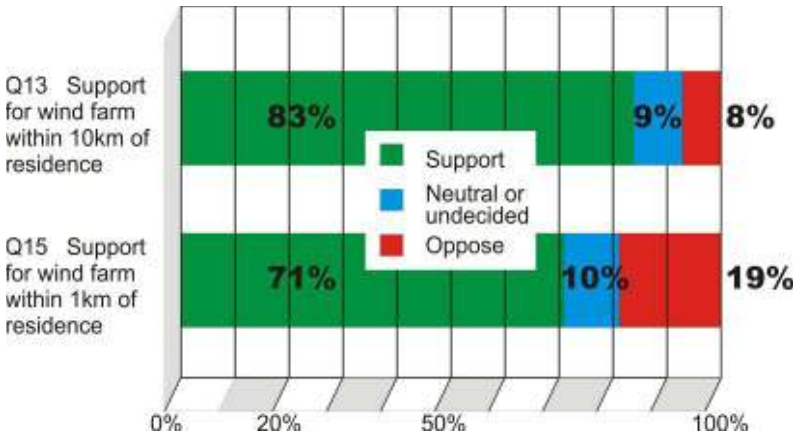


Figure 3.2 ***Support for wind farms near respondent's residence***

As well as the statistical similarity in the level of support between sites in Victoria and NSW, there is also a similarity ion the level of support when a wind farm is proposed within 1 km of a respondent's residence and if it is located on some of the most scenic of Victoria's coastline (Kanos & Quint, 2000, cited in Section 2.2.1).

In response to introducing the concept of multiple 'typical' (15 to 80 turbines) wind farms in the local rural area, respondents accepted 76% (19% opposed) for one typical wind farm. Three typical wind farms were accepted by 64% (27% opposed) (see *Figure 3.3*).

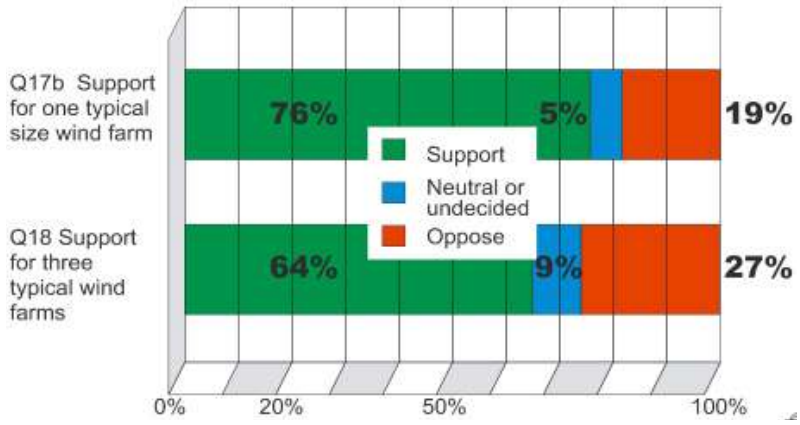


Figure 3.3 ***Support for multiple wind farms***

Figure 3.3 again highlights the remarkably consistent levels of approval for one or more wind farms in the area. The lowest level of acceptance at 64% for three wind farms is again very similar to the levels of support shown for the most sensitive of locations, whether within one kilometre of the respondent's house or on coastal headlands along Victoria's coast.

The study also found that the community has no clear preference between a few clusters close together or spread out at reasonable intervals along the highway. Therefore, it would seem that this landscape can absorb future wind farm developments as the community does not have a strong preference against it.

This study shows the adult residents in the survey area are concerned about global warming and are aware of the alternatives available. The study also shows respondents know and

understand what a wind turbine is, how wind farms appear in the landscape and are supportive of them.

Moreover, when it comes to locating wind farms, respondents are not averse to having them in their immediate locality and a majority still approve of a wind farm within one kilometre of their home.

It is suggested that respondents feel the creation of wind farms is positive and this study shows that many are prepared to embrace them in their local area.

These outcomes are remarkably consistent with results from other surveys conducted both within Australia and overseas and a clear pattern is emerging on the acceptance of wind farms in rural communities.

The results of several Victorian and overseas studies are appended to this report. Refer Annexure A.

3.2 *THE ROLE OF THESE PERCEPTION STUDIES ON THE VISUAL ASSESSMENT OF WIND FARMS*

Part of the assessment must consider if the landscape around the proposed Yass Valley Wind Farm is of such a quality that the majority of viewers would be disturbed by the presence of a wind farm. Research supports the proposition that the vast majority of the community supports the creation of additional wind farms in the Yass area.

It should also be acknowledged that while the older research may target viewers in the general community including visitors, tourists and residents viewing the wind farm from local roads, tourist locations and from other publicly accessible locations, the later research is focused on those who live in the area and those that are the most familiar with the local landscape.

These recent studies show a discernible rise in the level of public acceptance over the older studies on community perceptions to wind farms in Australia and overseas. The earlier research continually shows a level of community support at around 60-70% and a level of opposition between 5-30%, while the more recent research (Lal Lal and Ararat Wind Farms) shows a level of community support in excess of 90% and a level of opposition of between 3-5%.

The research for the area surrounding the Yass Valley Wind Farm shows similar levels of acceptance of wind farms to the recent Victorian examples where 5% of the people surveyed were in opposition of a wind farm development. However 81% of people surveyed in the local area were supportive of a wind farm development in the local area and 71% favoured a wind farm within 1 km of their home. Further to this, 64% of the people surveyed in the local area were accepting of three typical wind farms in their local area.

It is important to realise that this acceptance level is unique to wind farms. Similar research to the visual impact of a transmission line, a major road or other large infrastructure projects would show a greater degree of dislike for the changes these projects make on the landscape. The much greater acceptance of wind turbines in the landscape may well be a result of their clean lines and aerodynamic shape or perhaps with their perceptual link with green energy. Irrespective of the reason, it is clear that wind turbines are generally accepted by the majority of viewers in all but the most sensitive of locations.

Implications for the Assessment of Cumulative Visual Impact

Cumulative impact assessment for wind farms assesses the local communities' position in relation to several wind farms being constructed in their local area. Recent community-based perception studies in Victoria were asked for their acceptance of one additional wind farm in their local area (87% support, 7% oppose), and their acceptance of three additional wind farms (71% support, 18% oppose).

The response to introducing the concept of multiple 'typical' wind farms (15 to 80 turbines) in the local Yass area:

- 76% accepted one 'typical' wind farm;
- 75% accepted two 'typical' wind farms; and
- 64% accepted three 'typical' wind farms. 17% were opposed.

This level of acceptance for multiple wind farms in the area would suggest that the level of cumulative impact would be acceptable to the local community.

4 THE VIEWSHED

This section establishes the extent of the viewshed and the study area for this Landscape and Visual Assessment of the proposed Yass Valley Wind Farm.

The area that may potentially be visually affected by the wind turbines is called the viewshed. This is not the same as the extent of visibility as it may well be possible to see the turbines from areas outside the viewshed but, rather, it is a delineation of the area from which the wind turbines could create a recognisable impact within a man-modified landscape.

The viewshed for the Yass Valley Wind Farm is based on the parameters of human vision. For readers not familiar with basing a viewshed on these calculations and the parameters of the human vision, the reasoning is explained in Annexure A.

Given that the overall height of the wind turbines is 150 m, the viewshed can be considered to extend to a distance at which the 150 m wind turbines will take up less than 5% of the full vertical field of view. Typically the field of view of a person is 10°; therefore, 0.5° is less than 5% of the vertical field of view. Therefore a wind turbine 150 m high viewed from a distance of 17.0 km will take up 5% of the vertical field of view.

4.1 ZONES OF VISUAL IMPACT

Within the viewshed there are differing zones of visual impact. The visual impact of a wind turbine at 17 km is obviously less than the visual impact of a wind turbine seen from a distance of less than 1.5 km. Distance ranges are used as a guide only to determine zones of visual impact. However, it is recognised that visibility does not dramatically change when a viewer moves from 2.9 km to 3.1 km from the nearest wind turbine and therefore these zones are but a guide.

Table 4.1 Zones of visual impact

Distance from an observer to the nearest wind turbine	Zones of visual influence
>17km	*Outside the viewshed*
8.5-17km	*Visually insignificant –* A very small element which are difficult to discern and will be indistinct in different lighting and weather conditions.
3-8.5km	*Potentially noticeable, but will not dominate the landscape.* The degree of visual intrusion will depend on the landscape sensitivity and the sensitivity of the viewer; however the proposed wind turbines will not dominate the landscape.
1.5 – 3km	*Highly visible and will usually dominate the landscape* The degree of visual intrusion will depend on the wind turbines' placement within the landscape and factors such as foreground screening.
<1.5km	*Will be visually dominant in the landscape from most viewing locations.* The degree of visual intrusion will only be reduced by screening by nearby vegetation or buildings.

As shown in *Table 4.1*, high visual impacts of a wind farm are greatest within 3 km of the nearest turbine with potentially noticeable visual impacts out to 17 km from the nearest wind turbine. On days of good visibility, the wind turbines may be still visible beyond 17 km, however their visual impact would be insignificant.

Figure 4.1 below illustrates the viewshed and the proposed zones of visual influence around the proposed wind turbines located within the Coppabella Hills and Marilba Hills Precincts.

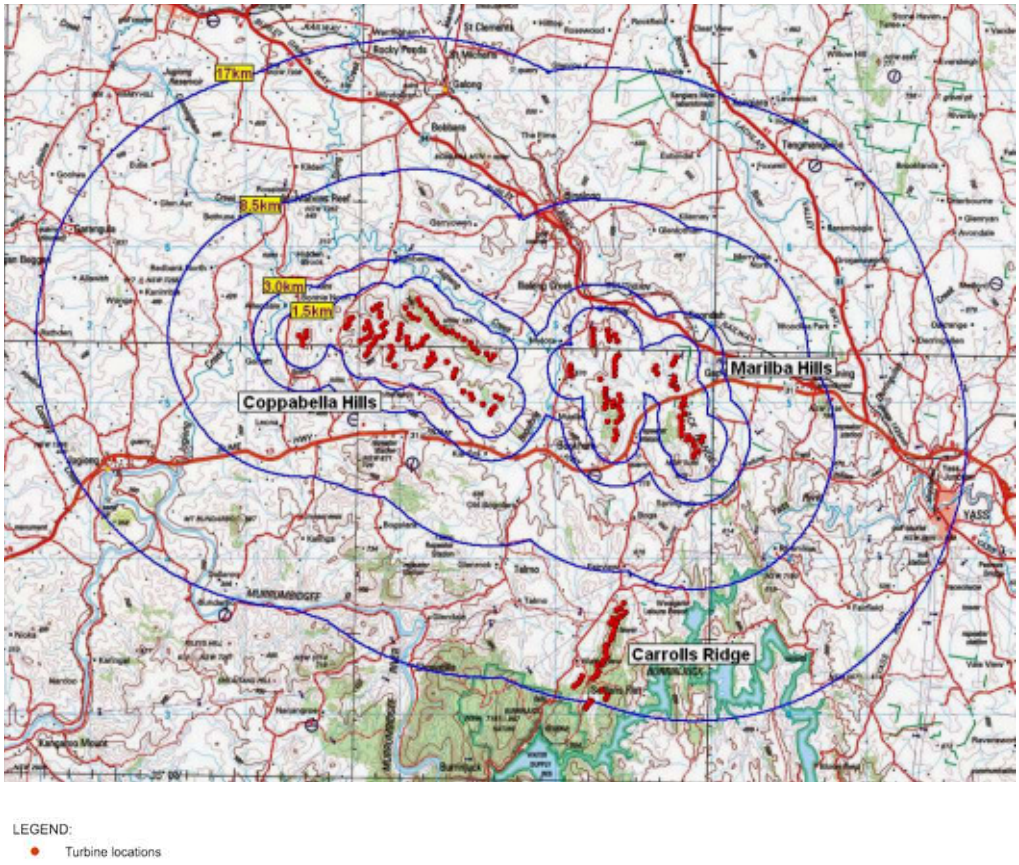


Figure 4.1 Viewshed and the Zones of Visual Influence for the Coppabella Hills and Marilba Hills Precincts

Figure 4.1 illustrates the viewshed for the wind turbines within the Project Application for this Development Approval. However to be conservative, this assessment will be based on the viewshed that is derived from the presence of the Carrols Ridge precinct as well as the Coppabella Hills and Marilba Hills Precincts.

Figure 4.2 below illustrates the viewshed and the proposed zones of visual influence around the proposed wind turbines, including those wind turbines within the Carrols Ridge Precinct.

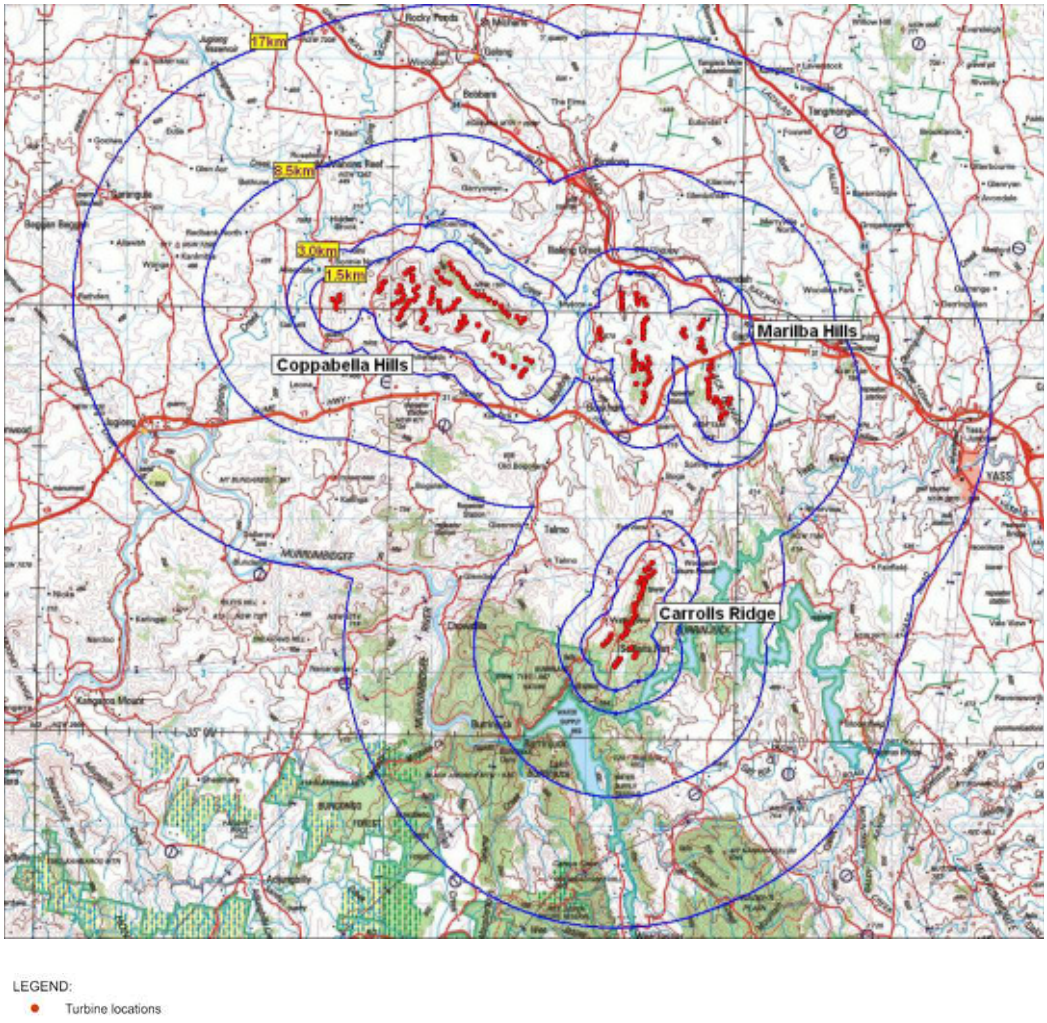


Figure 4.2 Viewshed and the Zones of Visual Influence for all three precincts

In the following chapters, the landscape within the 17 km viewshed of the Yass Valley Wind Farm will be based on the viewshed which include the Carrols Ridge Precinct and the landscape within this larger viewshed will be analysed to determine:

- The Landscape Character Types or Landscape Units that occur within this viewshed; and
- Indicative viewpoints from publicly accessible viewing locations.

5 LANDSCAPE UNITS WITHIN THE VIEWSHED

Landscape units are based on areas with similar visual characteristics in terms of topography, geological features, soil, vegetation, and land use. The following sections describe the underlying patterns of these elements to derive the landscape units within the viewshed.

The areas surrounding the Yass Valley Wind Farm are predominately cleared hilly farm land, with existing infrastructure including roads, rail, transmission lines, towers, power lines, and communication towers as well as the typical infrastructure and buildings associated with farming activities.

5.1 TOPOGRAPHY

The Yass Valley Wind Farm is located on low hills and ridgelines on the north and south side of the Hume Highway. The topography within the viewshed can be described as rolling hills, often creating enclosed visual corridors.

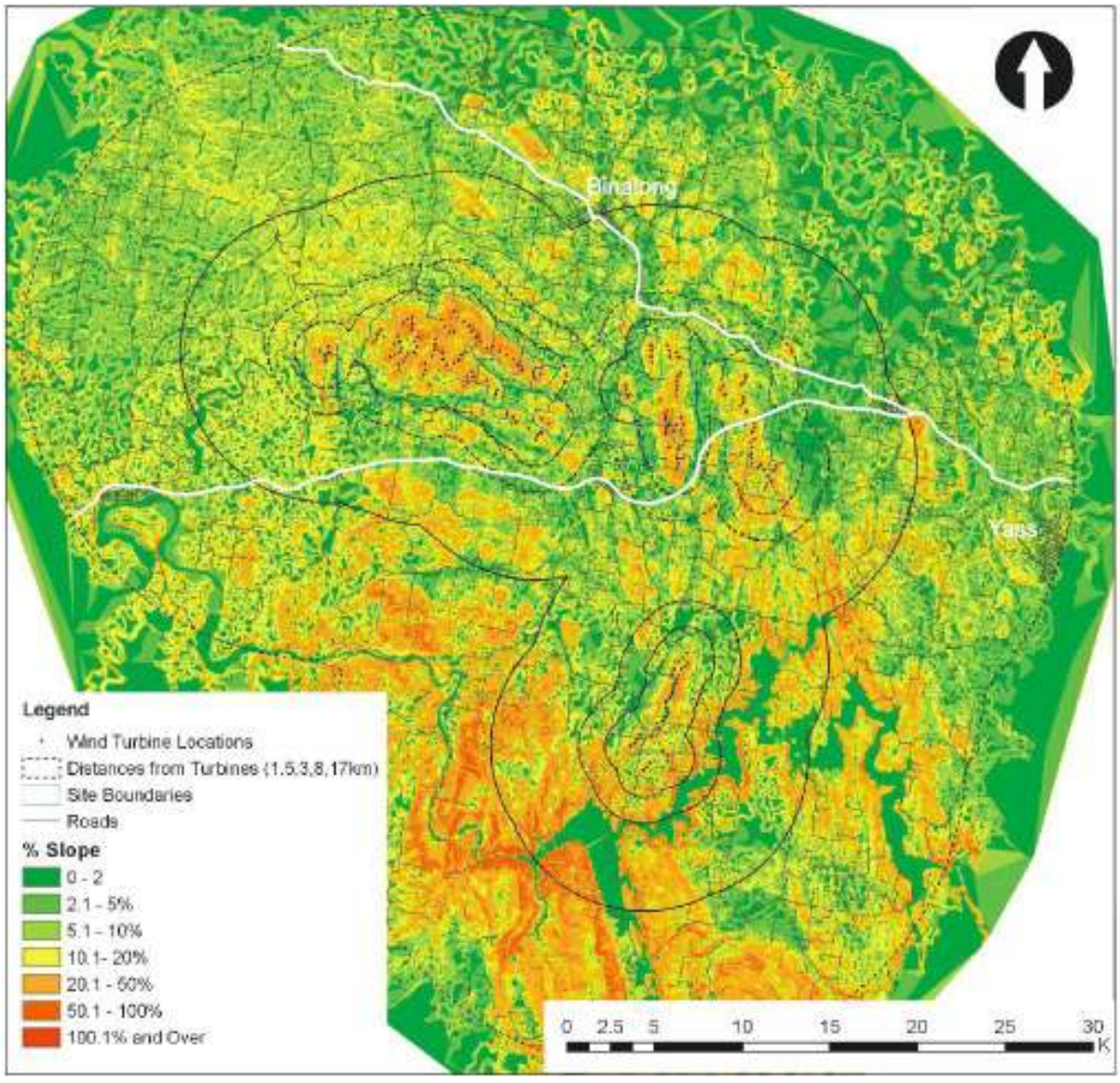


Figure 5.1 Slope Analysis

To the west of the site, there is a valley formed by Cunningham and Jugiong Creeks. Below the town of Jugiong, the valley continues east to join with the Murrumbidgee River and ultimately, Lake Burrinjuck.

5.2 VEGETATION

Typically the hills and valleys have been cleared for farming activities, however much of the existing farmland also contains scattered remnant trees.

As well, there are larger areas of native vegetation that include those steeper areas immediately adjacent to Lake Burrinjuck and including the Burrinjuck Nature Reserve.

Denser areas of vegetation also follow the creek lines that run through the area.

5.3 LAND-USE

The area is predominately cleared farmland and urban areas are few. Yass lies approximately 17 km to the east of the nearest proposed wind turbine. The small town of Binalong is the largest township, located within 8.5 km to the north of the proposed wind farm. The village of Bookham is located on the Hume Highway, approximately 3 km south of the nearest proposed wind turbine.

Lake Burrinjuck is a popular destination for fishing, camping and other water sports and activities and is surrounded on most sides by quite steep terrain. There are a number of small "resort" areas on the banks of the Lake.

However, by far the most dominant land use is farming. Much of the landscape is predominately cleared for agricultural uses.

5.4 LANDSCAPE UNITS

There are 5 distinct landscape character types in the area surrounding the proposed Yass Valley Wind Farm. These have been assessed on the basis of Topography, Geology and Vegetation. These landscape character types can be defined as the following:

- Landscape Unit 1 – "Gently Undulating and Flat Cleared Farmland";
- Landscape Unit 2 – "Steeply Undulating Cleared Farmland";
- Landscape Unit 3 – "Forested Hills";
- Landscape Unit 4 – "Rural Townships"; and
- Landscape Unit 5– "Recreation Resorts".

Each of these landscape units is described in the following sections.

5.5 LANDSCAPE UNIT 1 – "GENTLY UNDULATING & FLAT CLEARED FARMLAND"

Landscape Unit 1 – 'Gently Undulating & Flat Cleared Farmland' are areas that are generally cleared with only occasional remnant or planted tree lines. There are also many instances of constructed elements within this landscape type including road and rail network, farm buildings and fences.

Figure 5.2 shows a view from the Hume Highway to the west of the township of Bookham, opposite the intersection of Whitfields Road.

Figure 5.2 "Gently Undulating & Flat Cleared Farmland" Landscape Unit

Figure 5.3 shows a view from Graces Flat Road near the intersection with the Hume Highway.

Figure 5.3 "Gently Undulating & Flat Cleared Farmland" Landscape Unit

5.6 LANDSCAPE UNIT 2 – "STEEPLY UNDULATING CLEARED FARMLAND"

Landscape Unit 2 – 'Steeply Undulating Cleared Farmland' describes area of cleared hills used for agricultural practices which have often been selected as the site of proposed wind turbines.

Figure 5.4 "Steeply Undulating Cleared Farmland" Landscape Unit

Figure 5.4 shows a view from Burley Griffin Way, approximately midway between the intersection of Illalong Road and Bowning at the entry point to the Hume Highway.

5.7 LANDSCAPE UNIT 3 – "FORESTED HILLS"

Landscape Unit 3 – 'Forested Hills' describes areas that are typically quite steep and appear covered in indigenous vegetation.

Figure 5.5 ***"Forested Hills" Landscape Unit***

Figure 5.5 shows a view from near a boat launching ramp at the Burrinjuck Waters State Park. This location is on Lake Burrinjuck.

5.8 LANDSCAPE UNIT 4 – "RURAL TOWNSHIPS"

Landscape Unit 4 – "Rural Townships" describes those urban areas within the viewshed. The major townships within the viewshed are:

- Yass (approximately 15.7 km to the west of the nearest wind turbine); and
- Binalong (7.9 km north-west and 9.8 km north-east of the nearest wind turbine).

In addition to these, there are numerous smaller towns or localities which also occur within the viewshed. Some of these may be clusters of residences.

Figure 5.6 is a view within the township of Yass, taken on the corner of Polding Street and Comur Street.

Figure 5.6 ***"Rural Townships" Landscape Unit***

Figure 5.7 shows a view from Wellington Street on the southern outskirts of the township of Binalong. Wellington Street is a main road that runs southwards from the town centre over a small ridge.

Figure 5.7 ***"Rural Townships" Landscape Unit***

5.9 LANDSCAPE UNIT 5 – RECREATION RESORTS

Landscape Unit 5 – "Recreation Resorts" occur on the edge of Lake Burrinjuck and is characterised by converted caravans and small dwellings that serve as holiday accommodation. The overall impression of the resort is of an eclectic mix of sheds, temporary homes and caravans on stilts.

Figure 5.8 is a view of the Burrinjuck Resort located on the edge of Lake Burrinjuck. When this photograph was taken, the lake's edge was some distance from the resort, however when the Lake is at capacity, the water's edge would be immediately in front of these buildings.

Figure 5.8 ***"Recreation Resorts" Landscape Unit***

5.10 LANDSCAPE SENSITIVITY

Landscape sensitivity can be defined as the ability of a landscape to absorb visual change, and its visual influence thereof on the viewers. While change is an integral part of any landscape, development and infrastructure are significantly different to the natural processes that occur in a landscape. The sensitivity of viewers to change in the previously described landscape units will depend upon a number of factors, such as:

- **Location.** The sensitivity of a potential viewer varies according to location. For example, visitors to a National Park where the landscape appears untouched or pristine will be more sensitive to the imposition of new or artificial elements within that landscape. The same viewer travelling along a rural highway, which contains existing examples of modifications and artificial elements, will be less sensitive to the presence of new elements. Modifications or artificial elements are not confined to vertical structures or built form, they also include removal of native vegetation; visibility of roads, tracks, fences and other rural infrastructure all of which decrease the sensitivity of a landscape to further change.

- **The rarity of a particular landscape.** Landscapes that are considered rare or threatened are valued more highly by a particular community with an attachment to the particular landscape.
- **The scenic qualities of a particular landscape.** Landscapes that are considered scenic because of dramatic topographical changes, the presence of water, coastlines, etc, may be extensive, however viewers have greater sensitivity to alterations within these scenic landscapes. As discussed above the presence of modifications or artificial elements including built form, roads, tracks, fences, silos and rail as well as farming practices including land clearing, cropping and burning, all decrease the sensitivity of a landscape's scenic qualities.

The landscape sensitivity of landscape units is assessed as either low, medium or high.

High sensitivity ratings are given to landscape units which appear pristine, unique or dramatic. These often include National Parks and other significant landscape settings such as the natural landscape of the Burrinjuck Nature Reserve and other reserves on the southern banks of Lake Burrinjuck. Such a high sensitivity rating is supported by other factors which include:

- natural science factors – the geological, topographical, ecological and dynamic components for the landscape;
- aesthetic values including memorability and naturalness;
- expressiveness (legibility) – how obviously a landscape demonstrates its formative processes;
- transient values – e.g. the occasional presence of wildlife or natural phenomena;
- whether the values are shared or recognised;
- aboriginal heritage values; and
- historical associations.

Low sensitivity ratings are given to those landscape units which are common and do not exhibit features which the community value highly. These include:

- landscapes with little topographic relief;
- the obvious presence of structures and/or "obvious" human influence;
- the absence of water (lakes, rivers, sea); and
- the lack of vegetation (especially native vegetation) and other ecological patterns.

Therefore flat landscapes, lacking water and vegetation and relatively devoid of appealing visual patterns are usually given a low sensitivity rating.

Medium sensitivity ratings are those areas that may exhibit one or more visually appealing characteristics. For example the presence of water in an otherwise non-descript landscape. Landscapes with a medium sensitivity are commonly defined by being neither high nor low.

The pre-European landscape of the area surrounding the proposed Yass Valley Wind Farm has been heavily modified through agricultural practices that have included the clearing of native vegetation for cropping and grazing. The resultant cleared landscape is interspersed with agricultural buildings including farmhouses, outbuildings, sheds, stockyards, access roads, silos as well as road and rail networks. Associated with these structures are plantings along roadsides or as shelter belts.

The "Gently Undulating to Flat Cleared Landscape Unit" is not rare, nor is it high in scenic quality and for these reasons its landscape sensitivity is considered to be low sensitivity where the predominant character is that of cleared land.

However, it must be recognised that some areas have a greater topographic diversity that many people find very appealing. These areas have been included within the "Steeply Undulating Cleared Farmland Landscape Unit" and are given a "medium" sensitivity rating.

It must also be recognised that some people value the appearance of cleared farmland with minimal signs of built form such as houses and farm sheds. For these viewers the presence of wind turbines may be perceived as a "high" visual impact due to the presence of large-scale structures in a rural landscape.

The hills are an obvious and often dramatic feature when viewed from the flat surrounding farmland. Because they are a distinctive feature, their landscape sensitivity is rated as "medium" to "high", based on the degree to which they appear "natural".

Where the forested hills appear natural, their sensitivity is rated as "high" however, where they contain elements that are obviously man-made, their sensitivity is reduced to "medium".

Servicing the rural areas are settlements, which in the larger townships also include commercial and public buildings as well as recreational areas. These rural townships are not uncommon, nor are the scenic qualities particularly high as they often contain many forms of infrastructure and development. However given the concentration of housing, which is a sensitive land use these have been given a medium sensitivity rating.

The resorts around Lake Burrinjuck have been developed as a response to the recreational and scenic characteristics of the Lake. Therefore the resorts around the edge of the lake have been given a high sensitivity rating.

Table 5.1 rates the sensitivity of the various landscape units within the visual catchment of the Yass Valley Wind Farm.

Table 5.1 Landscape Sensitivity

Landscape Unit	Sensitivity
Unit 1 Gently Undulating and Flat Cleared Farmland	Low This unit is highly modified, contains visible infrastructure, is not topographically dramatic and does not contain large areas of water.
Unit 2 Steeply Undulating Cleared Farmland	Medium This landscape is largely cleared of vegetation however the steeply folded hills create an appealing landscape.
Unit 3 Forested Hills	Medium to High This landscape is attractive
Unit 4 Rural Townships	Medium The concentration of houses increases the visual sensitivity of this landscape unit.
Unit 5 Recreation Resorts	High Used for recreation and to enjoy views of the landscape.

These landscape sensitivity ratings will be used within the visual assessment of impacts from representational viewpoints within the viewshed included within this report.

However landscape sensitivity from residential properties will always be assessed as high, as this is usually the most important location for individuals.

6 SEEN AREA ANALYSIS

A Seen Area Analysis shows those areas within the viewshed from which wind turbines, or sections of wind turbines, may be visible.

The extent to which a wind farm is visible depends upon the nature of the intervening topography. The Yass Valley Wind Farm is located on hilly areas where the elevation change across the site may vary from 500-675 m. Intervening ridges, depressions and rises between a viewer and the wind turbines can screen views to part or all of the proposed wind turbines.

The areas from which part or all of the proposed wind turbines are potentially visible can be mapped using Geographical Information Systems (GIS) software.

The Seen Area Analysis for the Yass Valley Wind Farm was based on 10m contour data and is based solely on topography. The Seen Area Analysis in the following sections does not take into account screening by vegetation, minor topographic changes and buildings. These factors will obviously reduce the visibility from many locations and the GIS analysis is a conservative map of the extent of visibility.

Figure 6.1 and *Table 6.1* show the range of visibility options that have been mapped in the following GIS based analysis.

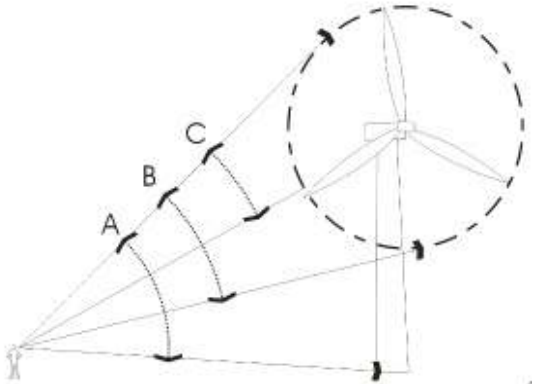


Figure 6.1 Visibility parameters (not to scale)

Table 6.1 Mapping visibility parameters

Zone	Extent that wind turbines are visible
Zone A	One or more wind turbines in their entirety
Zone B	The entire swept path of the blades of one or more wind turbines
Zone C	At least half of the swept path of one or more wind turbines
Zone D	Any part of the wind turbine blades of one or more wind turbines

These zones are not exclusive. For example a location that has the potential to view a wind turbine in its entirety falls into Zone A. A viewer at this location will also be able to see "any part of the wind turbine blades" and this location will also fall into Zone D.

6.1 *ZONE A – AREAS FROM WHICH VIEWERS CAN POTENTIALLY SEE ONE OR MORE WIND TURBINES IN THEIR ENTIRETY*

Zone A maps those areas from which viewers could potentially see entire wind turbines and the numbers of wind turbines that could be visible.

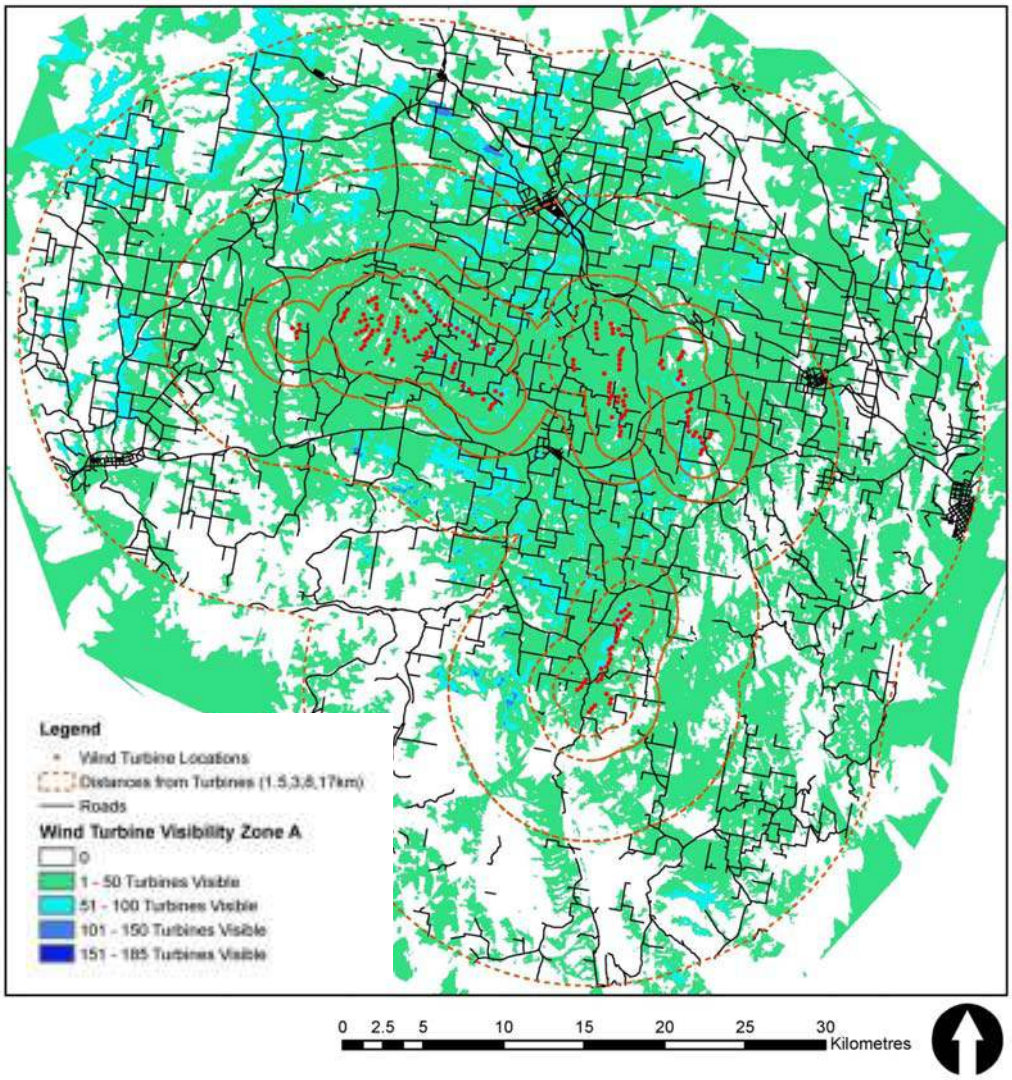


Figure 6.2 ***Zone A – Areas from where viewers can potentially see wind turbines in their entirety***

Zone A maps those areas from which one or more wind turbines may be visible in their entirety and this includes the majority of areas within the viewshed. This is partly due to the location of the three precincts on a range of hills stretching over 30 km. Areas that are most affected are those areas within the 8.5 km viewshed band, particularly those areas around the northern sites.

Towns that may be potentially visually impacted are the towns of Yass, Binalong, Murrumbateman and Jugiong.

The areas where the turbines are most visible are those areas which lie within 3 km of the nearest wind turbine. Within the centre of Binalong, there will be no visibility to any of the turbines. However there will be visibility around the periphery of the town. The towns of Bowning and Bookham may have views of between 1 and 50 entire wind turbines, as will parts of Yass and Jugiong.

6.2 *ZONE B – AREAS FROM WHERE VIEWERS CAN POTENTIALLY SEE THE ENTIRE SWEPT PATH OF ONE OR MORE WIND TURBINES*

Zone B is that area from where viewers could potentially see at least the entire swept path of the blades. Zone B also includes those areas from where viewers could potentially see entire turbines.

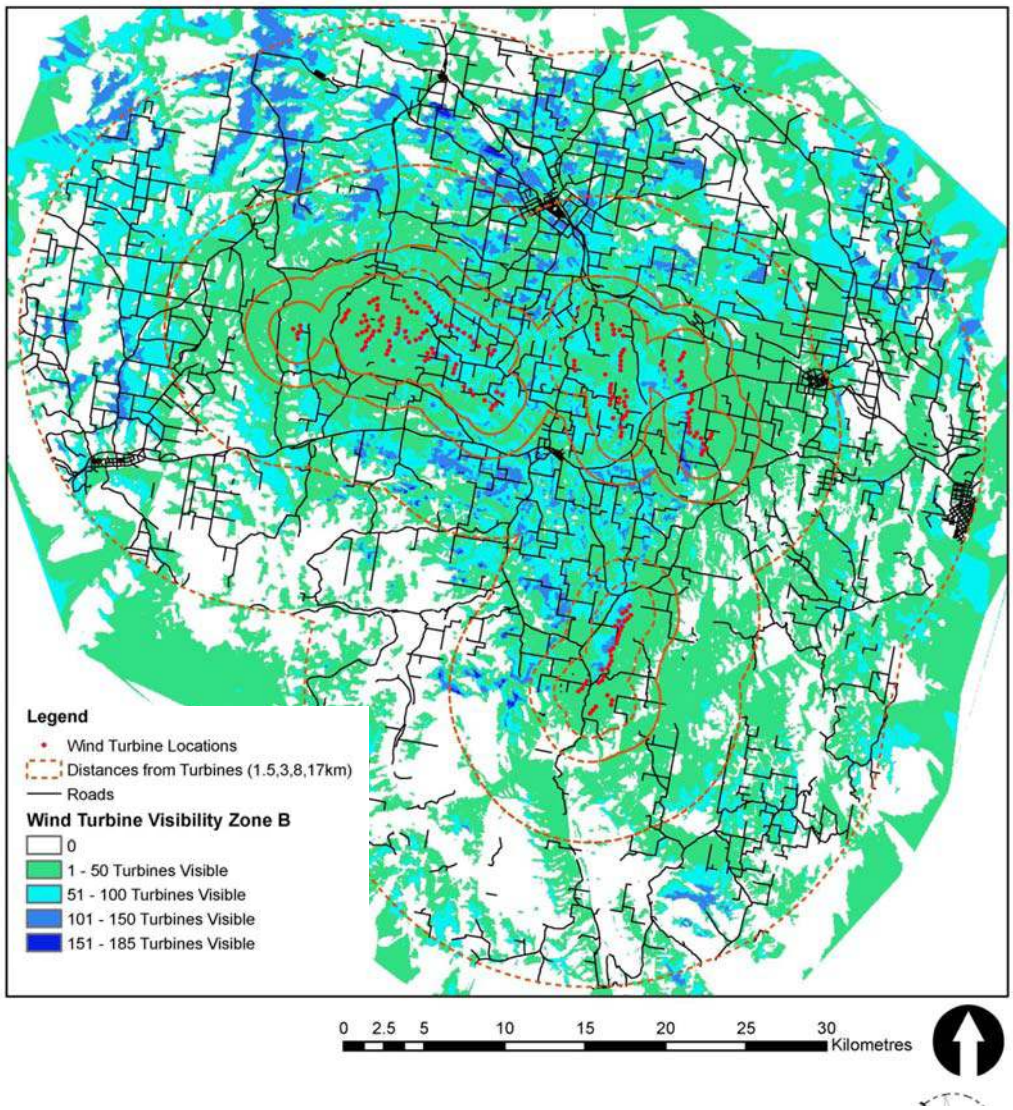


Figure 6.3 ***Zone B - Areas from where viewers can potentially see the entire swept path of wind turbines***

The overall pattern is similar to those areas mapped in Zone A however the number of potentially visible wind turbines has increased. The major area of visibility is out to 3 km however there are a greater number of turbines visible, especially to the north, in the 5-8.5 km zone. The large majority of areas that are able to view the swept path of 101-150 turbines are located to the north and north-west.

The towns that will experience the most visibility are Bowning and Bookham.

6.3 ZONE C – AREAS FROM WHERE VIEWERS CAN POTENTIALLY SEE THE NACELLE AND ABOVE OF ONE OR MORE WIND TURBINES

Zone C maps those areas from which a viewer can potentially see at least the nacelle and above. That is, at least the upper half of the swept path of the wind turbine blades and the numbers of wind turbines that are visible. Zone C also includes areas from where the entire turbine and the entire swept path are visible.

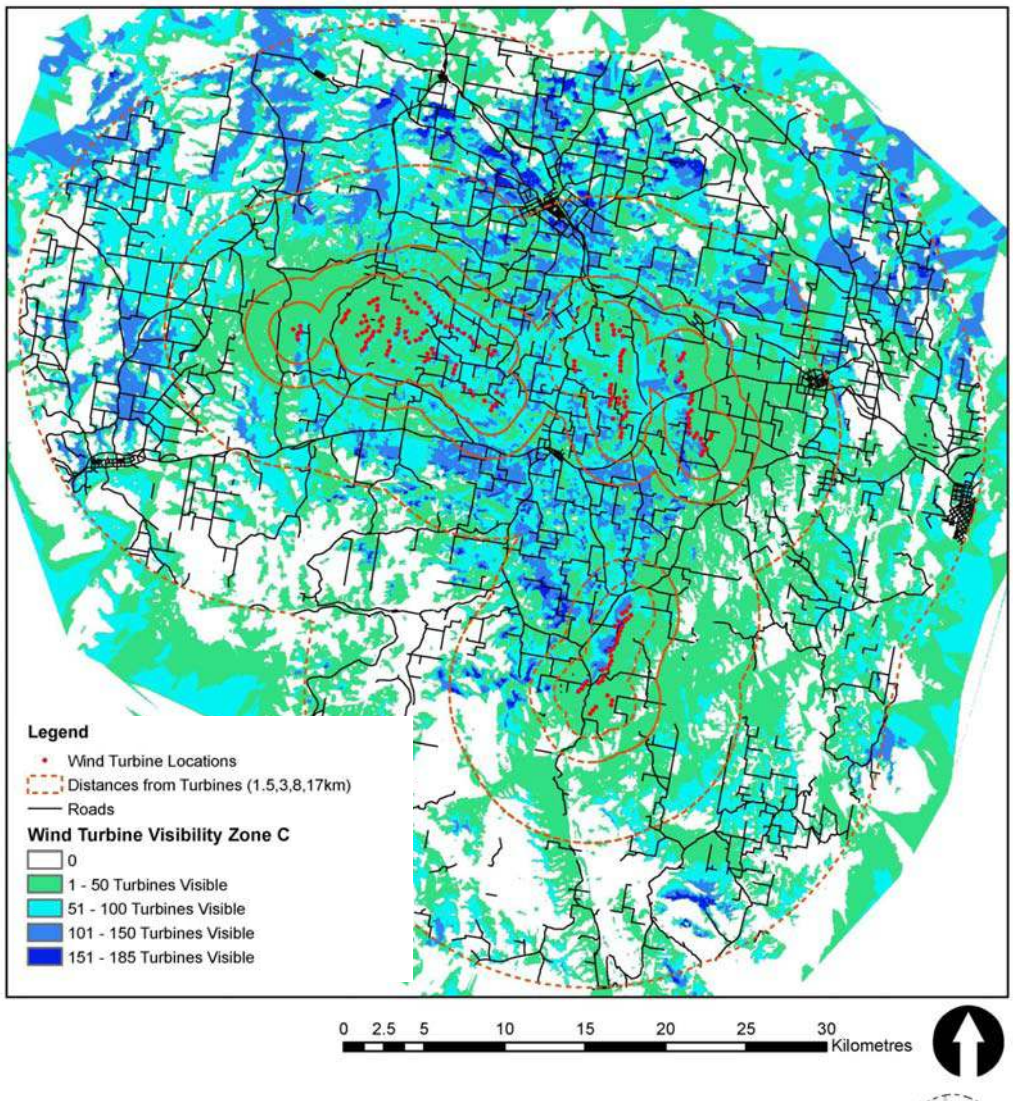


Figure 6.4 ***Zone C - Areas from where viewers can potentially see the nacelle and above of one or more wind turbines***

The pattern is again similar to that in *Figure 6.3*, however, as expected, there is an increase in the number of turbines visible, when the area that is mapped are those that can see the nacelle and above.

The main areas where multiple wind turbines are potentially visible are to the north, particularly around Binalong, and to the south along roads that run from the Hume Highway towards Lake Burrinjuck.

6.4 ZONE D – AREAS FROM WHICH VIEWERS CAN POTENTIALLY SEE ANY PART OF ONE OR MORE WIND TURBINES

Zone D maps those areas in which a viewer may be able to see any part of a wind turbine, even those areas in which only the very tip of a turbine blade may be visible above a ridge line visible. As such it is the most conservative seen area map.

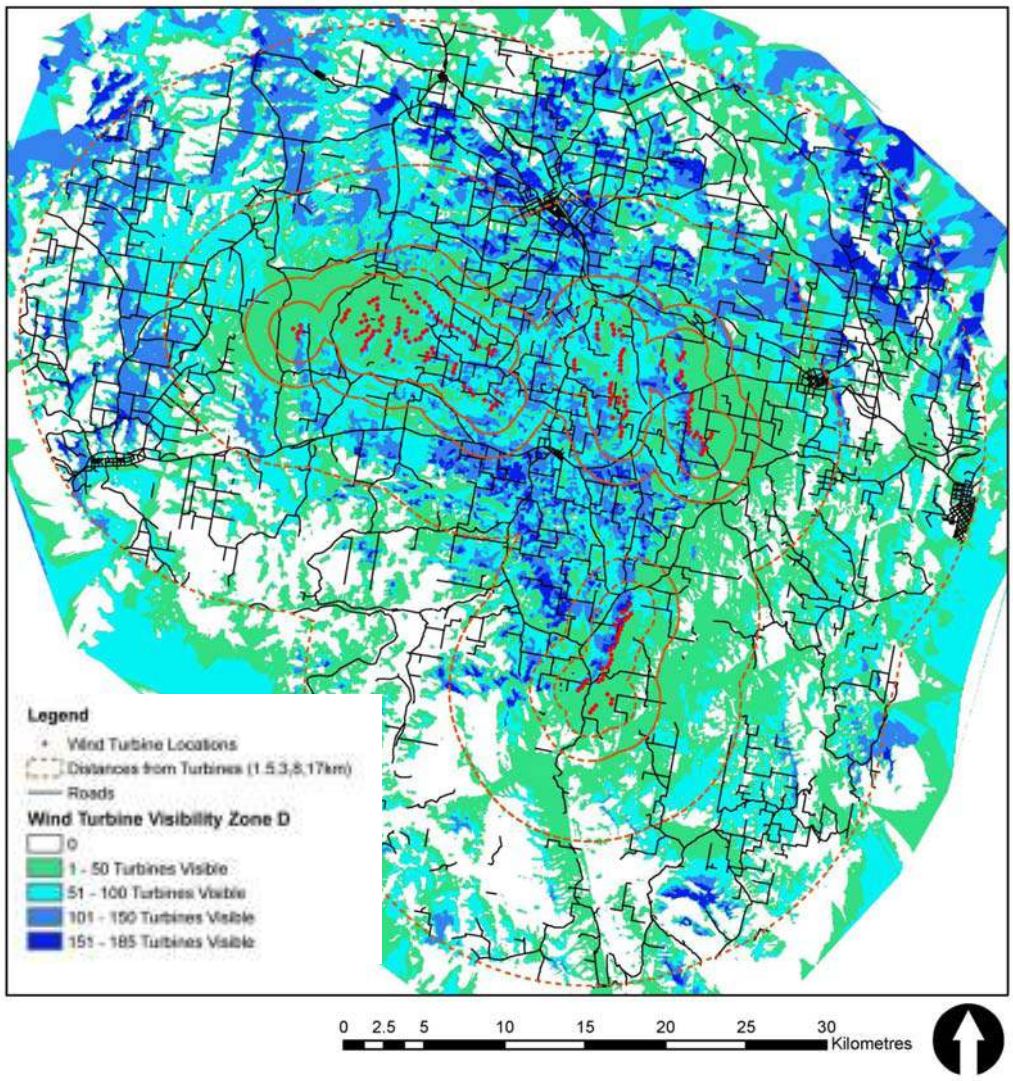


Figure 6.5 ***Zone D - Areas from where viewers can potentially see any part of one or more wind turbines***

This map shows the criteria set at its most conservative, as in this case where even the visibility of a blade tip is included. The results are similar to the previous Figures where the most affected areas are those around Binalong and south of Bookham as well as the section of the Hume Highway where it lies between the northern and southern sites.

Figure 6.5 also demonstrates that there is little visibility from Yass, even when the visibility criteria are set at the most conservative.

6.5 THE RELEVANCE OF THIS ANALYSIS TO VIEWPOINT LOCATION

The nature of the surrounding landscape means that there are no locations within the 18km viewshed from where viewers can potentially see all of the wind turbines in their entirety and there are very few locations within the viewshed that will view all of the proposed wind turbines from the nacelle and above.

The Seen Area Analysis has also been mapped with the Zones of Visual Influence also overlaid on the figures.

This mapping of areas of potential wind turbine visibility clearly shows those areas where indicative viewpoints should be selected. These should be in areas that lie closest to the wind farm, preferably within the 8.5 km viewshed zone as it is within the 8.5 km zone that the greatest visual impact occurs.

Areas with potential for views to the proposed wind turbines also include the low hills which lie between the Hume Highway and Lake Burrinjuck as well as areas around Binalong. This seen area analysis has also demonstrated that there may be views from Burley Griffin Way to the north-west and especially from the Hume Highway around Bookham.

Of particular significance to this assessment is that this seen area analysis clearly demonstrates that there is minimal opportunity to view the proposed wind turbines from within the Burrinjuck Nature Reserve and from Lake Burrinjuck itself, n area within the viewshed that would has been assessed as having the highest sensitivity.

Indicative viewpoint locations to assess the "worst case" visual impacts have been selected from these areas and are discussed in the following chapter. What must be considered in any overall assessment based on the visual impact from these viewpoints is that they do represent "worst case", in that the viewpoints have been deliberately chosen in areas of maximum potential visibility.

It is also important to reiterate that this seen area analysis only maps potential visibility based on topography. The screening effects of vegetation, buildings and small earthworks such as road side cuttings, are not taken into account. So the actual visibility from many areas will be far less than is mapped in the proceeding figures.

7 ASSESSMENT OF VISUAL IMPACT FROM PUBLICLY ACCESSIBLE VIEWPOINTS

This Project Application only seeks a

pproval for the Coppabella Hills and Marilba Hills precincts and a further application will be made for the Carrolls Ridge precinct. However this report assesses all three precincts and some viewpoints

This selection of viewpoints seeks to provide representative views from publicly accessible areas within the viewshed. These have been selected around the wind farm site primarily in areas that were identified in the ZVI analysis from which viewers would be able to potentially see wind turbines whilst generally within 8.5 km of a wind turbine.

This assessment looks at the potential visual impact from the following publicly accessible locations as well as major roads including the Hume Highway and Burley Griffin Way as well as from minor roads.

Potential viewing locations are also examined from the towns within the viewshed. Yass Valley has a population of 13,135 people (http://www.yass.nsw.gov.au/about/3872.html) and comprises the town of Yass and villages of Binalong, Bookham, Bowning, Gundaroo, Murrumbateman, Sutton and Wee Jasper. Yass and the villages of Binalong, Bowning and Bookham lie within the viewshed.

Table 7.1 Viewpoint numbers and locations of publicly accessible viewpoints

VP1 Yass Township, corner Yass Valley Way & Waroo Street
VP2 Yass Township, corner of Polding St & Comur St
VP3 Yass Valley Way adjacent to the Highway Service Centre
VP4 Hume Highway & Graces Flat Road
VP5 Hume Highway at the entry to the Crisp Galleries
VP6 Hume Highway at Conroy's Gap truck parking area
VP7 Hume Highway, 2.8 km south west of Conroy's Gap
VP8 Burrinjuck Road, south of the Hume Highway
VP9 Burrinjuck Resort, Lake Burrinjuck
VP10 Woolgarlo Road, near Black Range Road
VP11 Burrinjuck Road north of Burrinjuck Waters State Park
VP12 Burrinjuck Waters State Park, near the boat launching ramp
VP13 Sutton Grange Road
VP14 Hume highway & Childowla Road intersection, Bookham
VP15 Talmo
VP16 Illalong Road, 2.6 km south of Burley Griffin Way
VP17 Burrley Griffin Way, 8 km south of Binalong
VP18 Burley Griffin Way, 11.5 km south of Binalong
VP19 Yass Road, Taemas Bridge
VP20 Yass road, north of Bloomfield
VP21 Fishing location, Murrumbidgee River / Lake Burrinjuck
VP22 Hume Park Resort
VP23 Good Hope Resort
VP24 Black Range Road & Hume and Hovell Walking Track
VP25 Hume Highway, 3.5 km east of Bookham
VP26 Hume Highway & Whitfields Road intersection
VP27 Whitfields Road, north of the Hume Highway
VP28 Illalong Road, 3.6 km north of Bookham
VP29 Wellington Street, Binalong
VP30 Garryowen Road, Garryowen
VP31 Garryowen Road, 4 km west of Garryowen
VP32 Intersection of Coppabella and Cumbamurra Roads
VP33 Barramangra Road
VP34 Hume Highway, 13 km west of Bookham

The locations of each of these viewpoints are also shown on *Figure 7.1* and a larger scale location plan accompanies the discussion on each viewpoint.

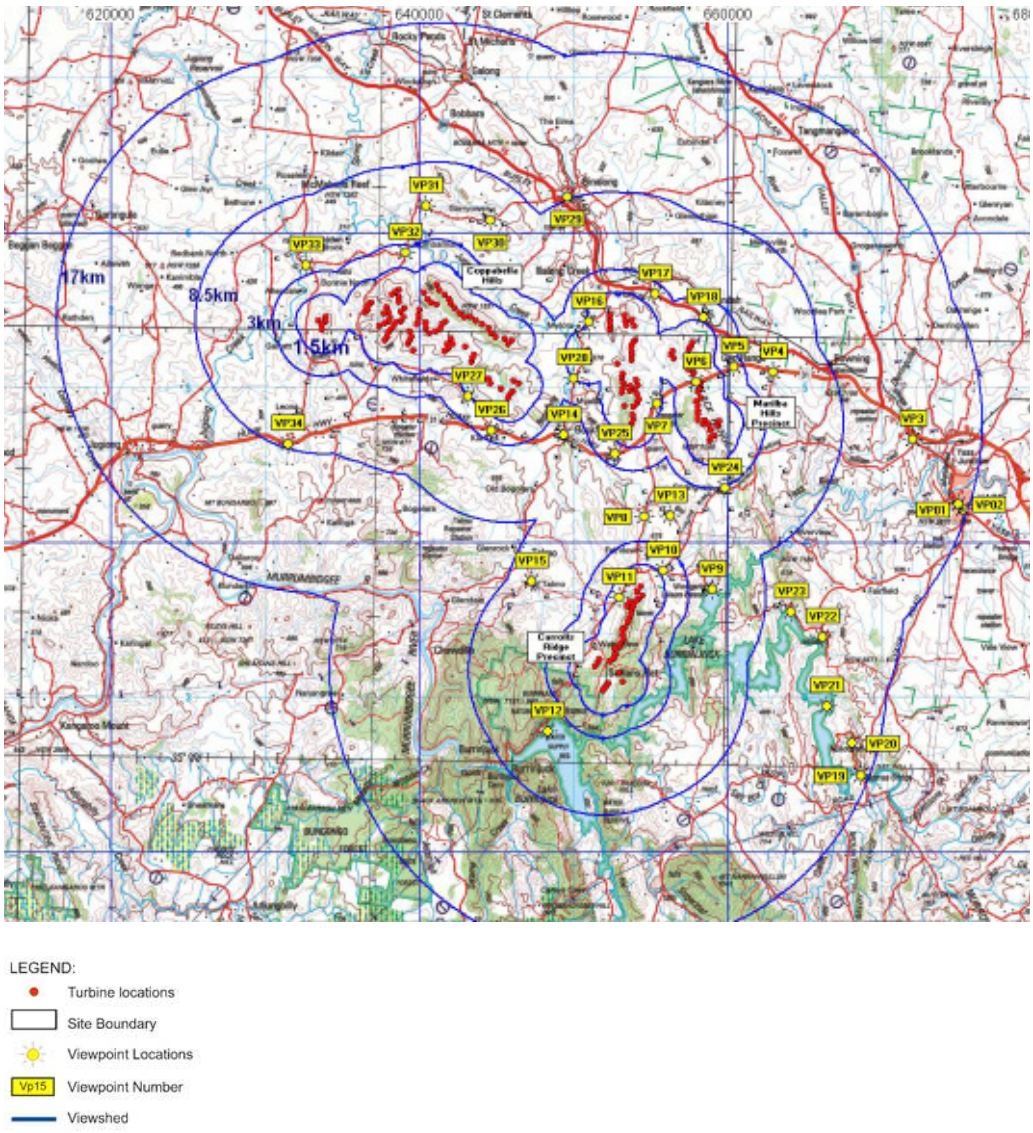


Figure 7.1 *Publicly accessible viewpoints* ***(Map prepared using OziExplorer, based on Natmap 2008, Zone 55, Geoscience Australia)***

The majority of viewpoints lie within the 8.5 km viewshed zone that, at its outer edge, is where the wind turbines become visually insignificant because they are small elements that are difficult to discern and will be indistinct in many different lighting and weather conditions (Refer *Chapter 4 – The Viewshed*).

Viewpoints were also located that fell within the areas that were shown to have the greatest potential to view multiple wind turbines. (Refer *Chapter 6 – Seen Area Analysis*).

The potential visual impact from of these viewpoints is discussed in the following sections to build up an overall assessment of the visual impact of the proposed Yass Valley Wind Farm. However it is stressed that this analysis is conservative, as the location for each of the viewpoints was selected as being a "worst case", a location from which the wind farm would be visible and in areas that were close to the wind farm.

Distance assumptions

The viewshed zones shown in *Figure 7.1* are measured from the wind turbine at the edge of the cluster. In the following sections, when describing distances from specific viewpoints to the wind farm, unless noted otherwise measurements are given to the nearest wind turbine to that particular viewpoint.

GPS Coordinates

GPS Coordinates are supplied for each viewpoint. The datum used is the Australian Geocentric 1994 (GDA 1994), Zone 55. The GPS coordinates were recorded from a hand held GPS unit, which is typically accurate to approximately +/-10 m horizontally, while the vertical elevation may be out by a larger margin. They are included within the report to assist others in locating viewpoints or photograph locations.

In this report the GPS Coordinates are given in the format (GPS 2731865, 6090612, E43); where the first coordinate is the Easting, the second the Northing and the figure prefaced by "E" is the approximate elevation.

Small key maps used to locate the individual viewpoints are shown on a map prepared using OziExplorer, based on Natmap 2008, Zone 55, Geoscience Australia.

Photomontages

Photographs and photomontages are used within the report to show the existing landscape and the visibility of wind turbines.

It is recognised that the small photographs and photomontages within this assessment are not indicative of the actual view or the visual impact. They have been included to reference discussion pertaining to the level of visual impact at each viewpoint.

A slightly better assessment can be made using the A3 images which are appended to this report, however to use these images as they were intended as part of a visual assessment they need to be printed and viewed on A1 or A0 sized sheets and held at arms' length.

Assessment Criteria

The scale of effects has been assessed using the following criteria:

- the distance of the viewer from the development;
- the nature of the surrounding landscape (including the landscape units represented and their sensitivity); and
- the number of viewers able to see the development.

Accordingly, the overall effect of the development of the proposed wind farm on each viewpoint has been assessed by evaluating the value of each of those criteria, ranking those as being either low, medium, or high, and subsequently making an assessment as to the overall effect by balancing each of those criteria and deriving an overall visual impact along a scale of effects.

Viewer numbers

Viewer numbers are rated as high, medium or low. For publicly accessible viewpoints the assessment of a high, medium or low viewer numbers are made on the basis of the road which provides access to the particular viewpoint under consideration. State Highways and roads within townships are assessed as having "high" number of users or viewers, while local connector roads are given a "medium" rating. "Low" viewer numbers apply to small local roads and other infrequently visited viewing locations.

Scale of Effects

The overall visual impact of the wind farm from an indicative publicly accessible viewpoint has been assessed using the following scale:

- Negligible – minute level of effect that is barely discernable over ordinary day to day effects.
- Minor adverse effect – adverse effects that are noticeable but that will not cause any significant adverse impacts.
- Medium – significant effects that may be able to be mitigated/remedied.
- High or unacceptable adverse effect – extensive adverse effects that cannot be avoided, remedied or mitigated.

Negligible: The assessment of a "*negligible*" level of impact is usually based on distance. That is, the wind turbines are at such a distance that, when visible in good weather, they would be a minute element in the view across a man-modified landscape. However sometimes the screening afforded by vegetation can lead to a similar level of assessment as can a minor change to an existing wind farm. For example where one wind turbine is added to a large existing wind farm the impact from a particular location could be a negligible effect.

Minor adverse effect: The assessment of a "*minor*" level of impact can be derived if the rating of any one of three factors, that is distance, viewer numbers and landscape sensitivity, is assessed as low. The reasoning for this "*minor*" assessment is as follows:

- If the distance to the wind farm is great (i.e. towards the edge of the viewshed) then even if the viewer numbers and the landscape sensitivity were high, the overall visual impact would be minor because the wind generators are only just visible in the landscape.
- If viewer numbers were low (i.e. few people can see the wind farm from the nominated publicly accessible viewpoint) then even if the wind farm was close to the viewpoint and the landscape sensitivity was high, the overall visual impact would be minor because the change to the landscape is not seen by many viewers. In a visual assessment it is important to differentiate between a "visual impact" and a "landscape impact". Viewer numbers are important in the assessment of a visual impact, as if no one sees a particular development then the visual impact is nil, even though there may be a significant change to the landscape and hence a large landscape impact.
- If landscape sensitivity was low (i.e. within a highly man modified landscape) then even if the wind farm was in close proximity to the viewpoint and it was visible to a large number of viewers, the overall visual impact would be minor because the viewpoint is not in a landscape of such sensitivity that further change would be unacceptable.

Medium adverse effect: The assessment of a "*medium adverse effect*" will depend upon all three assessment criteria being assessed as higher than "low"

High or Unacceptable adverse effect: The assessment of a "*high*" or "*unacceptable adverse effect*" from a publicly accessible viewpoint usually requires the assessment of all these three elements to be high. For example a highly sensitive landscape, viewed by many people, with the development in close proximity would lead to an assessment of an unacceptable adverse effect. This assessment is also usually based on the assumption that such a view cannot be mitigated. An example may be a well frequented viewpoint in a National Park, with wind turbines located in close proximity to a viewpoint that currently overlooks what appears to be a natural, pristine, un-modified landscape. Landscape treatment would block this view and even though it would mitigate the view to the wind farm such treatment would be unacceptable as it would also block the view from the lookout.

This scale will be used when describing the overall visual impact of the wind farm from indicative publicly accessible viewpoints which are discussed in the following sections.

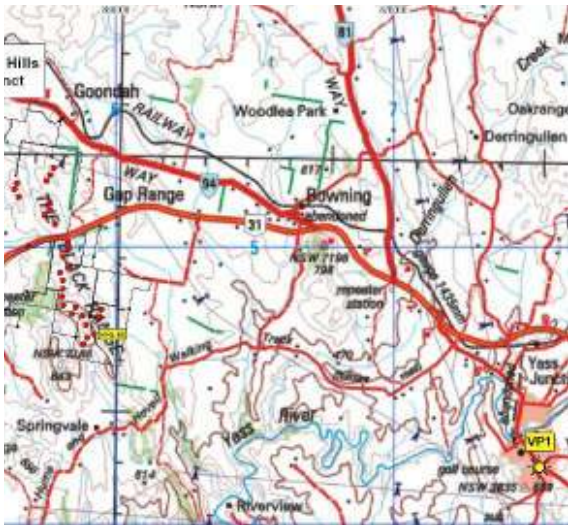
7.1 VIEWPOINT 1 – YASS TOWNSHIP, CORNER YASS VALLEY WAY & WAROO STREET

Viewpoint 1 is located in Yass on Yass Valley Way at the corner of Waroo Street. The township of Yass is situated near the Junction of the Hume Highway and the Barton Highway, which leads to Canberra. It has a population of 5,333 (2006 Census).

Yass Valley Way is the main road that runs through the centre of Yass. There are high viewer numbers along this road.

The nearest wind turbine is MRL68, 16.7 km to the west.

The most visible landscape unit in this location is Landscape Unit 4 – "Rural Townships".



VP1 (GPS 0675235,6142078, E514)

Figure 7.2 shows the view looking north-east toward the town centre. The proposed wind turbines will be situated to the left of this image on distant hills which are largely screened by vegetation.

Figure 7.2 View north-east toward centre of Yass Township

The ZVI analysis shows that the blade tips of between 1 and 50 turbines may be visible. This is unlikely to be the case however, due to the presence of roadside vegetation and houses which are likely to inhibit views to the wind farm.

As well, this is a highly modified urban landscape, whereby the addition of turbines in the far distance will not alter the quality of the view to any significant degree. It is for these reasons that the visual impact from this location is assessed as negligible.

Summary of visual impact from Viewpoint 1

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 4	Medium
Viewer numbers	High	High
Distance to nearest turbine	MRL68 - 16.7 km west	Low
Overall visual impact		**Negligible**

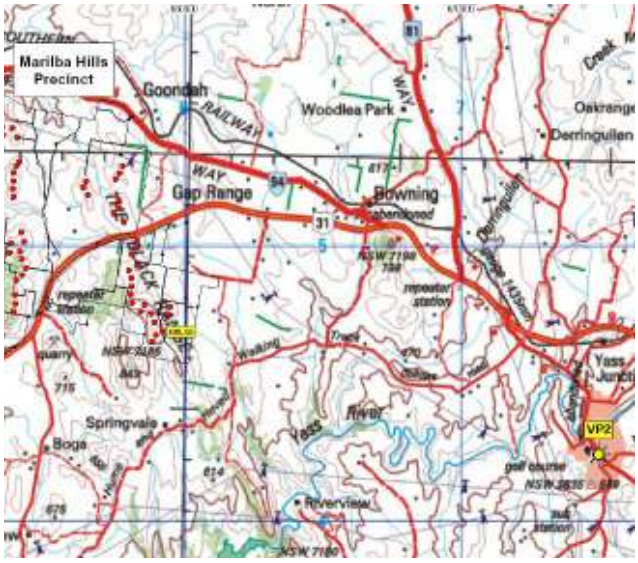
7.2 VIEWPOINT 2 – YASS TOWNSHIP, CORNER OF POLDING & COMUR STREET

Viewpoint 2 is located on corner of Polding and Comur Streets in the township of Yass.

This location is approximately at the centre of Yass where there will be high viewer numbers.

The nearest turbine MRL68 will be 16.4 km to the west.

The most visible landscape unit in this location is Landscape Unit 4 – "Rural Townships".



VP2 (GPS 0674991,6142437, E503)

Figure 7.3 shows the view looking west along the main road through the town centre. Both sides of the road are built up with few gaps where views of the surrounding hills are possible. There are also occasional street trees.

Figure 7.3 View west along Polding Street and Comur Street, Yass

The ZVI studies also show that no part of any turbine will be visible from this location. Therefore the overall visual impact is assessed as nil.

Summary of visual impact from Viewpoint 2

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 4	Medium
Viewer numbers	High	High
Distance to nearest turbine	MRL68 - 16.4 km west	Low
Overall visual impact		**Nil**

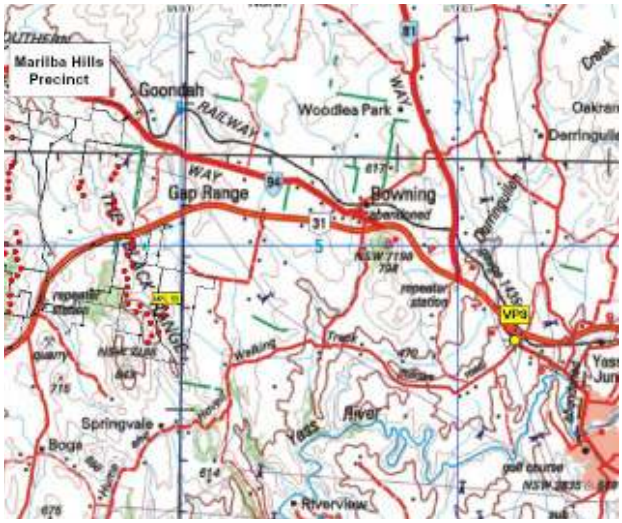
7.3 VIEWPOINT 3 - YASS VALLEY WAY ADJACENT TO THE HIGHWAY SERVICE CENTRE

Viewpoint 3 is located adjacent to a service station on Yass Valley Way near the on-ramp to the Hume Highway. It is approximately 5 km from the centre of Yass.

This is highly used road is traversed by motorists accessing the Hume Highway and the service centre; therefore visitor numbers would be high.

The nearest wind turbine MRL65 is 12.6 km to the west.

The most visible landscape unit in this location is Landscape Unit 1 – "Gently Undulating & Flat Cleared Farmland".



VP3 (GPS 0672032,6146624, E583)

Figure 7.4 shows a view toward the service station on Yass Valley Way near the on-ramp to the Hume Highway. The service station is on the opposite side of the road to where this photo is taken.

Figure 7.4 View to Service Station, Yass Valley Way, Yass

The view in *Figure 7.4* is looking away from the direction of the wind farm (eastwards) towards the service centre. The planting on the road reserve and around the service centre will screen views in a westerly direction towards the wind farm.

Figure 7.5 shows the view west towards the proposed wind farm from the same location.

Figure 7.5 View west toward proposed Wind Farm.

The Hills to the right in *Figure 7.5* may partially obscure views toward some of the turbines. The distance to the nearest turbine is approximately 12.6 km. The ZVI shows that some turbines may be visible in their entirety.

The turbines from the Marilba Hills Precinct turbines will appear on the distant ridgeline behind the predominantly cleared hills in the middle distance. The Copabella Hills Precinct turbines are situated behind these but may not be visible due to intervening ridges.

Although viewer numbers are high, the distance of the turbines from this location as well as the screening potential of the hills would reduce the visual impact. In addition, the landscape unit that is most visible is of low sensitivity. For these reasons the overall visual impact would be assessed as minor.

Summary of visual impact from Viewpoint 3

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 1	Low
Viewer numbers	High	High
Distance to nearest turbine	MRL65 - 4.7 km south west	Low
Overall visual impact		**Minor**

7.4 VIEWPOINT 4 – HUME HIGHWAY & GRACES FLAT ROAD

Viewpoint 4 is located on Graces Flat Road near the intersection with the Hume Highway.

Graces Flat Road has low traffic numbers. However the nearby Hume Highway would have high viewer numbers.

The nearest wind turbine MRL53 is 4.7 km to the south west.

The most visible landscape unit in this location is Landscape Unit 1 – "Gently Undulating & Flat Cleared Farmland".

VP4 (GPS 0662941,6150989, E563)

Figure 7.6 shows the view from this location toward the wind farm. There are scattered trees between this location and the proposed wind farm which may impede views of the wind turbines. There is also a power line visible in this view.

The proposed wind farm will be located in the distant hills at the centre of *Figure 7.6.*

Figure 7.6 View from Graces Flat Road

Existing vegetation will screen or at least filter views towards the wind farm from this location.

The Hume Highway can be seen in the centre of the view in *Figure 7.7* as it rises across the ridge towards the west.

Figure 7.7 View towards the Hume Highway

Views towards the Hume Highway and towards the wind turbines within the Marilba Hills Precinct in the west are also filtered by existing vegetation.

The ZVI studies show that between 1 and 50 turbines may be visible from the nacelle and above from this location. Although the distance to the nearest turbine would indicate that there would be a moderate level of visual impact, the presence of existing vegetation would reduce the overall visual impact which at this location is assessed as minor.

Summary of visual impact from Viewpoint 4

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 1	Low
Viewer numbers	Low on Graces Flat Road	Low
	High on the Hume Highway	High
Distance to nearest turbine	MRL53 - 4.7 km south west	Moderate
Overall visual impact		**Minor**

7.5 VIEWPOINT 5 - HUME HIGHWAY AT THE ENTRY TO THE CRISP GALLERIES

Viewpoint 5 is located alongside the Hume Highway at the entrance to "The Crisp Galleries" which is an art gallery with a cafeteria. This location is a tourist destination.

The Hume Highway carries the majority of traffic travelling between Sydney and Melbourne and has high viewer numbers.

The nearest wind turbine MRL53 within the Marilba Hills Precinct is 2.4 km to the south west.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland" as well as Landscape Unit 1 – "Gently Undulating & Flat Cleared Farmland".

VP5 (GPS 0660400,6151341, E592)

Figure 7.8 shows the view to the entrance of "The Crisp Galleries" from the Hume Highway.

Figure 7.8 Entrance to "Crisp Galleries"

The views from the Crisp Galleries is also analysed within the residential assessment section (Refer Viewpoint R7 in Chapter 8).

Figure 7.9 shows the view looking south-west toward the proposed wind farm.

Figure 7.9 View south-west from the Hume Highway at "Crisp Galleries"

The turbines will appear along the cleared ridge line in the distance in *Figure 7.9*. There are scattered trees within the road reserve medians as well as on adjacent land that may partly screen views to some of the proposed wind turbines. There are also numerous examples of man-made disturbances to the landscape within the existing view.

The distance away from the proposed wind farm would put this location into the high visual impact category. There are also high viewer numbers. However the landscape sensitivity is medium which would make the overall visual impact from this location medium.

Summary of visual impact from Viewpoint 5

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
	Landscape Unit 1	
Viewer numbers	High	High
Distance to nearest turbine	MRL53 - 2.4 km south west	High
Overall visual impact		**Medium**

7.6 VIEWPOINT 6 – HUME HIGHWAY AT CONROY'S GAP TRUCK PARKING AREA

Viewpoint 6 is located on the Hume Highway at Conroy's Gap Truck Parking Area. Conroy's Gap is the highest vantage point on the Hume Highway in this area and the truck parking area is located to the west of the cutting within the Marilba Hills Precinct.

There are no views to the wind turbines at Conroy's Gap, which runs through a large cutting as the Hume Highway cuts through the Black Range. The Hume Highway has high viewer numbers.

The nearest turbine MRL53 is approximately 300 m to the south-east.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".

VP6 (GPS 0657989,6150328, E651)

Figure 7.10 shows the view looking south-west toward the proposed wind farm. The proposed wind turbines will appear on the set of ridgelines at the centre of this image.

Figure 7.10 View South-west from the Truck Parking Area at Conroy's Gap

The turbines immediately adjacent to this location to the north and south of the Hume Highway may not be immediately apparent to the motorist within the cutting even though the wind turbines are approximately 300 m from the highway.

However, the wind turbines that would be visible in the centre of *Figure 7.10* are approximately 4.6 km south west of this location. The landscape sensitivity is considered medium. It is for these reasons that the overall visual impact of the proposed wind farm is assessed as medium from this location.

Summary of visual impact from Viewpoint 6

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	High	High
Distance to nearest turbine	MRL53 - 300 m south east	High
		Medium
Overall visual impact		**Medium**

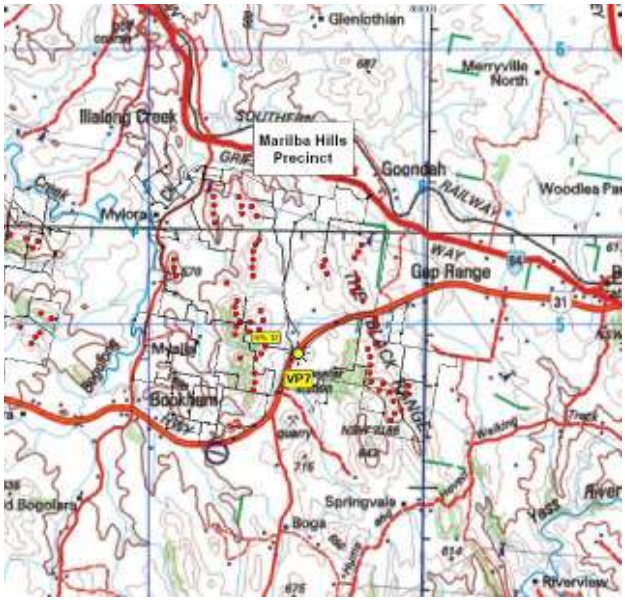
7.7 VIEWPOINT 7 - HUME HIGHWAY, 2.8KM SOUTH WEST OF CONROY'S GAP

Viewpoint 7 is located on the Hume Highway 2.8 km south-west of Conroy's Gap and still within the Marilba Hills Precinct. The Carrols Ridge Precinct may be visible to the south.

The Hume Highway has high viewer numbers.

The nearest turbine MRL32 is 1.2 km to the west.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP7 (GPS 0655458,6148960, E556)

Figure 7.11 shows the view south toward the Carrolls Ridge Precinct. Although the turbines are proposed to be located slightly to the left of the cone shaped hill at the centre of this image, they will be partly obscured by the ridgeline in the foreground.

Figure 7.11 View south from the Hume Highway towards the Carrolls Ridge Precinct

Figure 7.12 shows the view toward the south-west from this location. The turbines will appear on the ridgeline in the foreground.

Figure 7.12 View south-west along the Hume Highway towards the Marilba Hills Precinct

Figure 7.13 shows the view toward the west across the Hume Highway from this location. There will also be turbines along the ridgeline seen in the centre of this image.

Figure 7.13 View from the Hume Highway looking west across the Hume Highway

From this location there is little existing vegetation to impede views toward the turbines and there are also high viewer numbers. The sensitivity of the landscape within this view is medium. Therefore, the overall visual impact from this location is assessed as medium.

Summary of visual impact from Viewpoint 7

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	High	High
Distance to nearest turbine	MRL32 - 1.2 km west	High
Overall visual impact		**Medium**

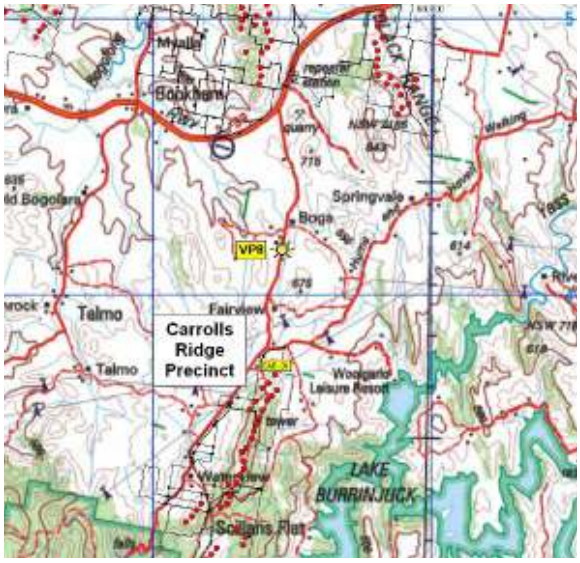
7.8 VIEWPOINT 8 - BURRINJUCK ROAD SOUTH OF THE HUME HIGHWAY

Viewpoint 8 is located on Burrinjuck Road which is the main tourist route from the Hume Highway to Lake Burrinjuck and the resorts that surround the lake. This viewpoint is approximately 5.1 km south of the Hume Highway.

The road also experiences a medium level of traffic.

The nearest wind turbine CAR01 is located 4.5 km to the south within the Carrolls Ridge Precinct, which is not part of this Project Application for Development Approval.

The most visible landscape unit in this location is Landscape Unit 2 - "Steeply Undulating Cleared Farmland".



VP8 (GPS 0654646,6141648, E560)

Figure 7.14 shows the view looking south along Burrinjuck Road toward the Carrolls Ridge Precinct of the proposed wind farm.

The proposed turbines will appear on the forested hills in the distance to the right of the image in Figure 7.14. The existing vegetation on the crest of the road may partially screen the views toward some of the proposed wind turbines.

Figure 7.14 View south towards proposed wind farm

The landscape sensitivity of this landscape unit is medium and therefore the overall visual impact is assessed as medium from this location.

Summary of visual impact from Viewpoint 8

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Medium	Medium
Distance to nearest turbine	CAR01 - 4.5 km south	Medium
Overall visual impact		**Medium**

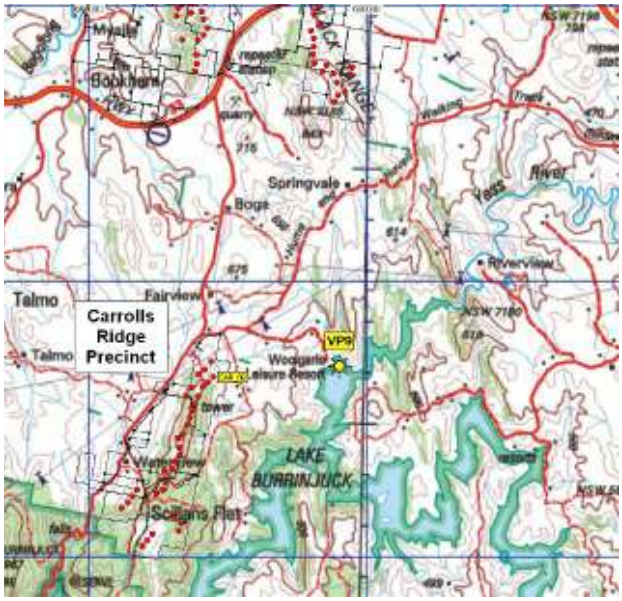
7.9 VIEWPOINT 9 – BURRINJUCK RESORT, LAKE BURRINJUCK

Viewpoint 9 is located on the edge of Lake Burrinjuck near the Burrinjuck Resort.

This location is used by tourists and holiday makers to make use of the recreational amenity of Lake Burrinjuck.

The nearest wind turbine CAR06 is 4.5 km to the south-west.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland" and Landscape Unit 5 – "Recreation Resorts".



VP9 (GPS 659015, 6136944, E365)

Figure 7.15 shows the view of the Burrinjuck Resort which is situated at the edge of Lake Burrinjuck. It consists of a number of converted caravans and small dwellings which serve as holiday accommodation and the overall impression of the resort is the eclectic mix of sheds, temporary homes and caravans on stilts.

Figure 7.15 View of Burrinjuck Resort

When this photograph was taken the lake's edge was some distance from the resort, however when the Lake was at capacity, the water's edge would run immediately in front of these buildings.

Figure 7.16 shows the view toward the proposed wind turbines from the edge of Lake Burrinjuck.

Figure 7.16 View south-west across Lake Burrinjuck

The turbines would be situated toward the right hand side of *Figure 7.16*. The hills to the right may partially obscure the view toward the turbines.

The landscape type which is most visible in this view is of low sensitivity. Although the distance to the nearest turbine would suggest a medium rating, due to the eclectic nature of the resort buildings, the visual impact of the proposed wind farm would be low from this location.

Summary of visual impact from Viewpoint 9

Item	Description	Evaluation
Landscape sensitivity-	Landscape Unit 5	High
	Landscape Unit 2	Medium
Viewer numbers	Medium	Medium
Distance to nearest turbine	CAR06 - 4.5 km south-west	Medium
Overall visual impact		**Medium**

7.10 VIEWPOINT 10 – WOOLGARLO ROAD, NEAR BLACK RANGE ROAD

Viewpoint 10 is located on Woolgarlo Road near the intersection of Black Range Road.

This road is primarily used by those accessing Lake Burrinjuck at Woolgarlo.

The nearest turbine CAR01 is 1.7 km to the south-west.

The most visible landscape units in this location are Landscape Unit 2 – "Steeply Undulating Cleared Farmland" and Landscape Unit 3 – "Forested Hills".

VP10 (GPS 655848, 6138121, E 569)

Figure 7.17 shows the view from Woolgarlo Road, near the intersection of Black Range Road.

Figure 7.17 View south-west towards the Carrolls Ridge Precinct

The proposed wind turbines would appear on the set of ridgelines at the centre of this image. The ridgeline is mostly cleared in the foreground but is forested further to the south (the left of the image). There is an existing powerline running directly toward the proposed wind farm There is little intervening vegetation in the foreground to obscure views toward the proposed turbines.

At 1.7 km, the wind turbines would be a dominant element in the landscape. The majority of the landscape is of medium sensitivity and viewer numbers are also assessed as medium. For these reasons the overall visual impact of the proposed wind farm is assessed as medium.

Summary of visual impact from Viewpoint 10

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
	Landscape Unit 3	High
Viewer numbers	Medium	Medium
Distance to nearest turbine	CAR01 - 1.7 km south-west	High
Overall visual impact		**Medium**

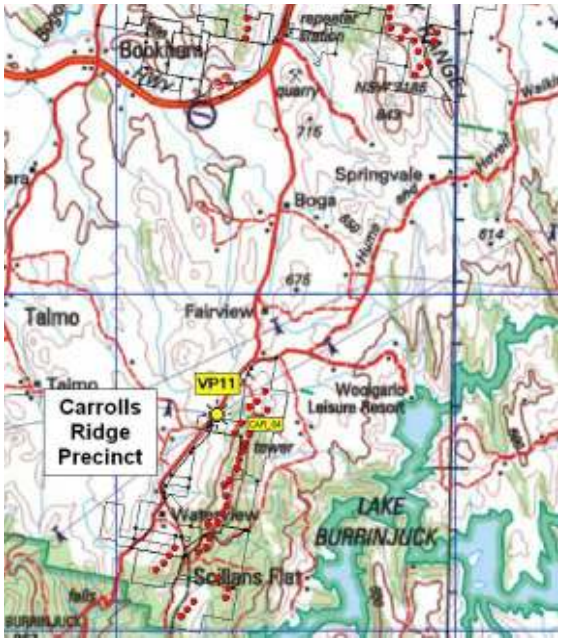
7.11 VIEWPOINT 11 – BURRINJUCK ROAD NORTH OF BURRINJUCK WATERS STATE PARK

Viewpoint 11 is located on Burrinjuck Road, immediately adjacent to the Carrolls Ridge Precinct.

Burrinjuck Road is used to access Burrinjuck Nature Reserve which lies to the south. The visitor numbers along this road is assessed as medium.

The nearest proposed turbine CAR04 is 800 metres to the south-east.

The most visible landscape unit in this location is Landscape Unit 3 – "Forested Hills".



VP11 (GPS 652961, 6136435, E651)

Figure 7.18 show the view from this location toward the proposed wind farm. An existing transmission line is visible in the foreground.

Figure 7.18 View east looking towards the forested hills

Figure 7.19 shows the view along Burrinjuck Road. This view represents one of a few breaks in the roadside vegetation that allows views toward the forested hills that will be the site of the proposed wind turbines.

Figure 7.19 View south-west along Burrinjuck Road

The wind turbines are at such close proximity that they would dominate the landscape. Although the "Forested Hills" landscape unit has a high sensitivity, the presence of the powerline does reduce the sensitivity to medium as this landscape already contains existing infrastructure. The visitor numbers would be assessed as medium. For these reasons the overall visual impact of the proposed wind farm from this location is assessed as medium.

Summary of visual impact from Viewpoint 11

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 3	High
Viewer numbers	Medium	Medium
Distance to nearest turbine	CAR04 - 800 m south-east	High
Overall visual impact		**Medium**

7.12 VIEWPOINT 12 - BURRINJUCK WATERS STATE PARK, NEAR THE BOAT LAUNCHING RAMP

Viewpoint 12 is located near a boat launching ramp at the Burrinjuck Waters State Park. This location is on Lake Burrinjuck, further to the south than the location of VP9.

The viewer numbers at this location would be high as this is a well used facility within the State Park.

The nearest turbine CAR33 is 4.5 km to the north-east.

The most visible landscape unit in this location is Landscape Unit 3 – "Forested Hills".

VP12 (GPS 648363, 6127774, E367)

Figure 7.20 shows the view toward the wind farm. The ZVI studies show that between 1 and 50 turbines may be visible from the nacelle and above. The turbines will be located behind the hill and up the gully to the left of the hill.

Figure 7.20 View north-east

Burrinjuck Nature Reserve camping area is an attractive location on the edge of the lake and surrounded by forested hills. A wireframe image (the basis for the photomontages) was prepared (refer *Figure 7.21*) to ascertain if any wind turbines would be visible from this location. This wireframe demonstrates that the proposed wind turbines are well below the level of the adjoining ridge.

Figure 7.21 Photomontage (wireframe)

No wind turbines will be visible therefore the overall visual impact will be nil.

Summary of visual impact from Viewpoint 12

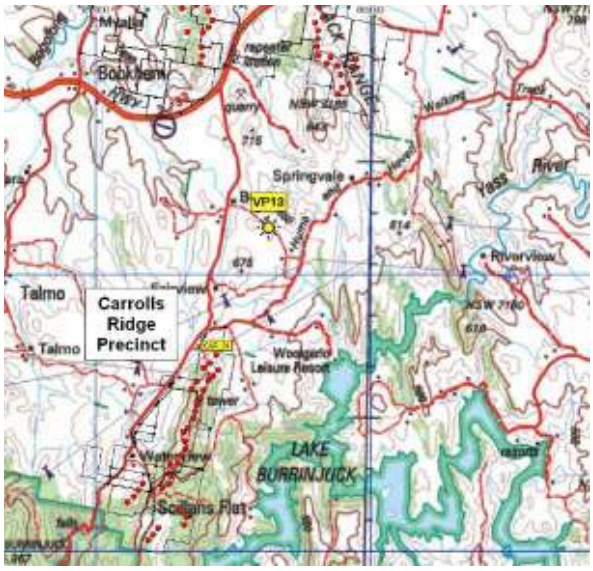
Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 3	High
Viewer numbers	High	High
Distance to nearest turbine	CAR33 - 4.5 km north-east	Medium
Overall visual impact		**Nil**

7.13 VIEWPOINT 13 - SUTTON GRANGE ROAD

Viewpoint 13 is located on Sutton Grange Road midway between Burrinjuck Road and Black Range Road. This viewpoint is also midway between the Marilba Hills and the Carrolls Ridge Precincts. This is a relatively little-used dirt road with few users.

The nearest wind turbine CAR01 is 4.9 km to the south-west.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP13 (GPS 656302, 6141710, E577)

Figure 7.22 shows the view toward the north-west from this location towards the Coppabella Hills and Marilba Hills Precincts. The proposed wind turbines will appear on the hills in the far distance in this view. There may also be some wind turbines closer and to the right of this image. However, they may be partially or fully screened by the topography.

Figure 7.22 View to the north towards the Marilba Hills Precinct

Figure 7.23 shows the view to the south-west from this location towards the Carrolls Ridge Precinct. It is highly unlikely that any of the turbines can be seen due to the impeding topography in the foreground.

Figure 7.23 View to the south towards the Carrolls Ridge Precinct

The low viewer numbers on this little used dirt road mean that the overall visual impact would be assessed as minor.

Summary of visual impact from Viewpoint 13

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	CAR01 – 4.9 km south-west	Medium
Overall visual impact		**Minor**

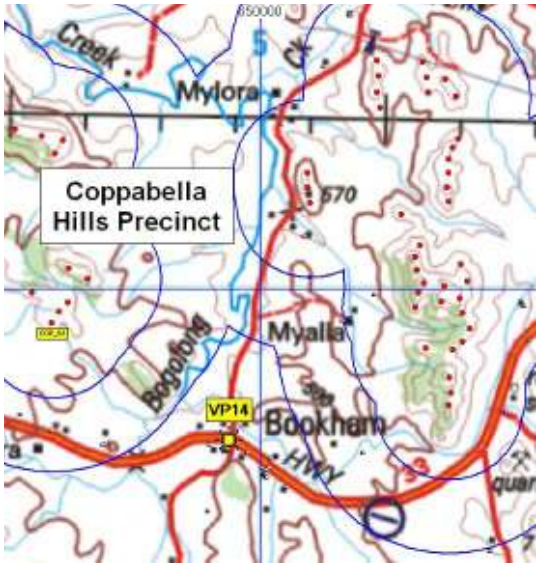
7.14 VIEWPOINT 14 - HUME HIGHWAY & CHILDOWLA ROAD INTERSECTION, BOOKHAM

Viewpoint 14 is located at the intersection of Childowla Road and the Hume Highway, near the town of Bookham. Bookham lies almost midway between the Marilba Hills and the Coppabella Hills Precincts.

The Hume Highway has high viewer numbers.

The nearest turbine COP68 is 4.3 km to the north-east.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP14 (GPS 649386, 6146908, E463)

Figure 7.24 shows the view looking across the Hume Highway toward the proposed wind farm. The proposed turbines will be clearly visible on the ridgelines which extend across this image.

Figure 7.24 View looking north-east across the Hume Highway

The turbines will be clearly visible from the highway in a landscape that has a medium level of sensitivity. Therefore the overall visual impact is assessed as medium.

Summary of visual impact from Viewpoint 14

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	High	High
Distance to nearest turbine	COP68 - 4.3 km north-east	Moderate
Overall visual impact		**Medium**

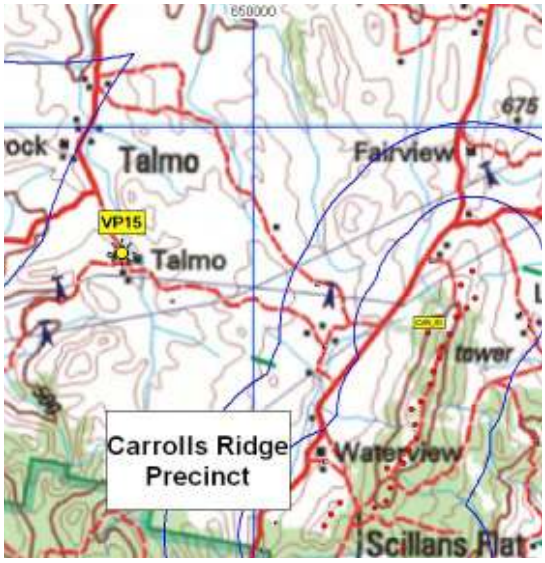
7.15 VIEWPOINT 15 - TALMO

Viewpoint 15 is located at Talmo, a rural property to the west of the Carrols Ridge Precinct and south of the Hume Highway.

This road is a little-used road with low viewer numbers.

The nearest turbine CAR05 is 6.2 km to the east within the Carrolls Ridge Precinct.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP15 (GPS 647346, 6137471, E550)

Figure 7.25 shows the view from this location toward the south-east. The turbines may be visible in the centre of this image. Some turbines may be visible to the left but will most likely be screened by the topography.

Figure 7.25 View to the east towards the Carrolls Ridge Precinct

The landscape sensitivity is medium however there are few viewers. For this reason the overall visual impact from this location is assessed as minor.

Summary of visual impact from Viewpoint 15

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Low
Viewer numbers	Low	Low
Distance to nearest turbine	CAR05 - 6.2 km east	Medium
Overall visual impact		**Minor**

7.16 VIEWPOINT 16A AND 16B - ILLALONG ROAD, 2.6 KM SOUTH OF BURLEY GRIFFIN WAY

Viewpoint 16 is located on Illalong Road which connects the Hume Highway at Bookham to Burley Griffin Way.

This is an asphalt road that is used by those travelling between Bookham and Binalong. This road has few users.

The nearest wind turbine MRL03 from this location is 1.3 km to the east.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".

VP16 (GPS 651021, 6154218, E451)

Figure 7.26 shows the view looking east from this location towards the Coppabella Hills Precinct. The proposed turbines will appear on the ridgeline in the centre of this image.

Figure 7.26 Viewpoint 16a (east toward Marilba Hills Precinct)

This view represents one of few locations along this road where breaks in the roadside vegetation allow views out onto the adjacent ridgelines. This location would represent a worse-case for the Marilba Hills Precinct because there is a clear view directly ahead to turbines which are within the zone of high visual impact. Motorists would experience this view for a limited time before passing by on their way to the Burley Griffin Way.

Figure 7.27 shows the view south-west toward the Coppabella Hills Precinct.

Figure 7.27 Viewpoint 16b (south-west toward Coppabella Hills Precinct)

The proposed turbines would appear on the distant hills at the centre of this image. This is a view that would be experienced mostly by motorists travelling from the Burley Griffin Way toward the Hume Highway. This view also represents one of few locations where there are breaks in the existing roadside vegetation.

While the distance to the nearest wind turbine within the Marilba Hills Precinct would mean a high level of visual impact, however, as there are few viewers using Illalong Road, the overall visual impact is assessed as minor.

Summary of visual impact from Viewpoint 16a

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	MRL03 - 1.3 km east	High
Overall visual impact		**Minor**

A similar assessment also applies to the view looking towards the Coppabella Hills Precinct towards the south west, where the distance from this location to the nearest wind turbine is greater than in the view to the east, the overall visual impact would be assessed as minor.

Summary of visual impact from Viewpoint 16b

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 3	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	COP15 - 5.2 km south-west	Medium
Overall visual impact		**Minor**

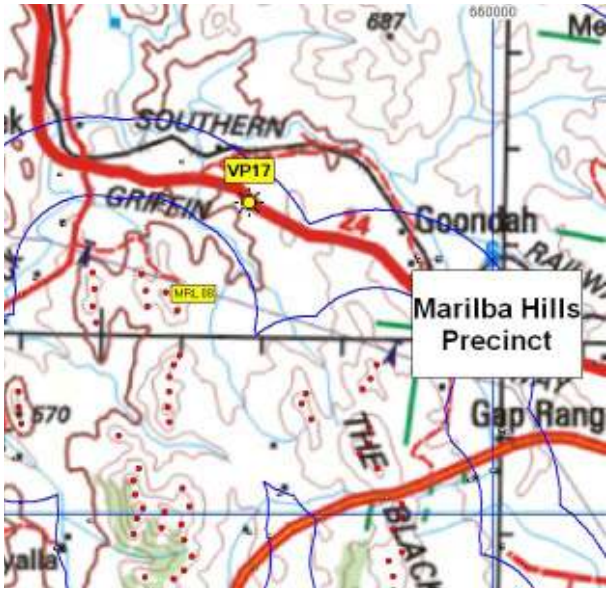
7.17 VIEWPOINT 17 - BURLEY GRIFFIN WAY, 8 KM SOUTH OF BINALONG

Viewpoint 17 is located on the Burley Griffin Way approximately 3.1 km east of the intersection of Binalong Road and 8 km south-east of Binalong.

This road passes through the towns of Harden and Binalong before joining onto the Hume Highway at Bowning. This road, whilst less used than the Hume Highway, is still assessed as having high viewer numbers.

The nearest turbine MRL08 is 2.3 km to the south-west in the Marilba Hills Precinct.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP17 (GPS 655348, 6155996, E527)

Figure 7.28 shows the view south-east of this location. Burley Griffin Way is close to the north-eastern edge of the Marilba Hills Precinct at this location.

Figure 7.28 View south-east on Burley Griffin Way

The turbines of the Marilba Hills Precinct will appear on the distant hills to the left of the dead tree seen in this image.

Figure 7.29 shows the view south-west from this location.

Figure 7.29 View south-west.

The wind turbines, also from the Marilba Hills Precinct, will be seen on the ridgeline to the left in this image. There will also be some wind turbines visible in the distance behind the dead tree seen in the centre of the image

There are numerous locations along this highway where existing roadside vegetation will screen views out into the landscape. However the distance to the nearest turbine will give this

location a high degree of visual impact as will the high viewer numbers. However, the medium sensitivity of this landscape unit means that the overall visual impact from this location is assessed as medium.

Summary of visual impact from Viewpoint 17

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	High	High
Distance to nearest turbine	MRL08 - 2.3 km south-west	High
Overall visual impact		**Medium**

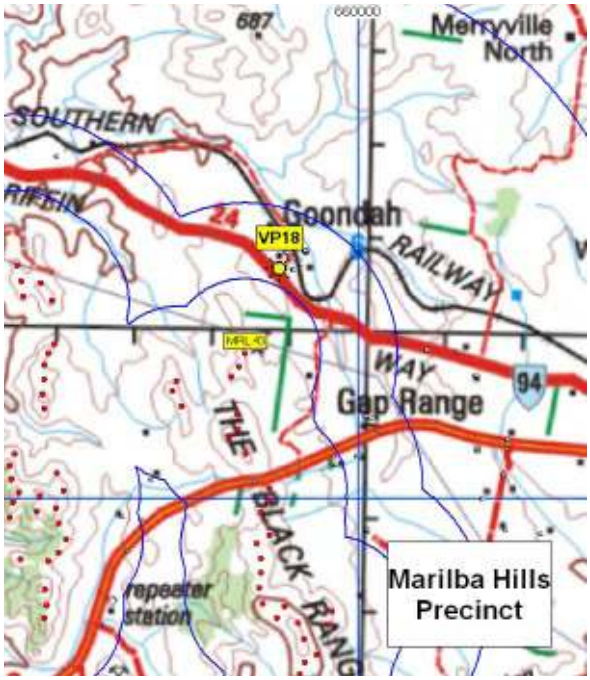
7.18 VIEWPOINT 18 - BURLEY GRIFFIN WAY, 11.5 KM SOUTH OF BINALONG

Viewpoint 18 is also located on Burley Griffin Way approximately midway between the intersection of Illalong Road and Bowning, the entry point to the Hume Highway.

This Highway passes through the towns of Harden and Binalong before joining onto the Hume Highway at Bowning. There are high viewer numbers along this road.

The nearest turbine MRL43 is 1.8 km to the south-west.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP18 (GPS 658449, 6154558, E544)

Figure 7.30 and *Figure 7.31* both combine to form a 180O panoramic view from this location, looking south. The proposed turbines would appear on the hills beyond the low rise in the foreground of both images.

This landscape is predominantly cleared however there are a few scattered trees in the foreground and on the intervening ridges which may screen some of the proposed wind turbines

Figure 7.30 South-east portion of the panoramic view

Figure 7.31 South-west portion of the panoramic view

At this distance the wind turbines will dominate the landscape due to the medium visual sensitivity of this landscape unit. Therefore the overall visual impact is assessed as medium.

Summary of visual impact from Viewpoint 18

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	High	High
Distance to nearest turbine	MRL43 - 1.8km south-west	High
Overall visual impact		**Medium**

7.19 VIEWPOINT 19 - YASS ROAD, TAEMAS BRIDGE

Viewpoint 19 is located on Yass Road on the Taemas Bridge as it crosses the Murrumbidgee River to the south-west of the Carrolls Ridge Precinct.

Yass road is a narrow, two-lane sealed road that connects Yass to Tumut and winds through the Wee Jasper State Forest and Red Hill State Forest. It has low visitor numbers.

The nearest wind turbine CAR30 is 16.5 km to the north-west and is part of the Carrolls Ridge Precinct.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".

VP19 (GPS 668648, 6124982, E402)

Figure 7.32 shows the view from a small pedestrian refuge on Taemas Bridge, looking north-west. The turbines will be located over the ridgeline as well as to the right in this figure.

Figure 7.32 View north-west along the Murrumbidgee River from Taemas Bridge

The ZVI studies show that there is one section near the centre of the bridge where the blade tips of between 1 and 50 turbines may be visible. This analysis is based on topography only and so does not take into consideration the height of the bridge above the ground level.

The intervening hill to the right in the image will screen views toward the Coppabella Hills and Marilba Hills Precincts which means that only wind turbines within the Carrolls Ridge may be visible.

Even with a medium level of landscape sensitivity, the low viewer numbers and the distance to the nearest wind turbines means that the overall visual impact is assessed as minor.

Summary of visual impact from Viewpoint 19

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	CAR30 - 16.5 km north-west	Low
Overall visual impact		**Minor**

7.20 VIEWPOINT 20 - YASS ROAD, NORTH OF BLOOMFIELD

Viewpoint 20 is located on Yass Road approximately 2.2 km north west of the Taemas Bridge. And just north of Bloomfield.

Yass Road is a narrow two lane road that connects Yass to Tumut and winds through various state forests such as Wee Jasper State Forest and Red Hill State Forest.

The nearest turbine CAR30 is 15.3 km to the north-west. These are part of the Carrolls Ridge Precinct.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".

VP20 (GPS 668087, 6127054, E532)

Figure 7.33 and *Figure 7.34* show a panoramic view looking west from this location toward the proposed wind farm site.

Figure 7.33 Part panoramic view looking south-west

Figure 7.34 Part panoramic view looking north-west

The proposed wind turbines of the Carrolls Ridge Precinct would appear on the darkened ridgeline in the far distance in both images.

The ZVI studies show that there could potentially be between 1 and 50 turbines visible in their entirety from this location. This is due to this elevated position allowing views across the valley and onto the distant ridgelines where the turbines are situated.

It is unlikely that many of the turbines from the Coppabella Hills and Marilba Hills Precincts will be visible from this location due to the existing topography and vegetation seen to the right in *Figure 7.34*. The wind turbines are at a considerable distance from this viewpoint and therefore the overall visual impact is assessed as minor.

Summary of visual impact from Viewpoint 20

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	CAR30 - 15.3 km north-west	Low
Overall visual impact		**Minor**

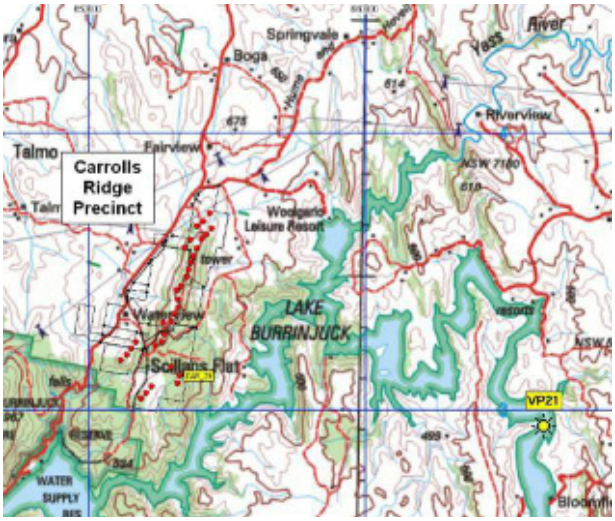
7.21 VIEWPOINT 21 - FISHING LOCATION, MURRUMBIDGEE RIVER / LAKE BURRINJUCK

Viewpoint 21 is located along a track which allows fishing access to the banks of the Murrumbidgee River and Lake Burrinjuck. There are no formed boat ramps at this location the River is edged by a vertical embankment several metres high.

This track is used primarily to access the Murrumbidgee River for fishing and camping. The road is rough in places and is mainly accessed by four wheel drives. Therefore viewer numbers would be low.

The nearest turbine CAR29 is 13.3 km to the north-west and forms part of the Carrolls Ridge Precinct.

The most visible landscape unit in this location is 'Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP21 (GPS 666461, 6129407, E367)

Figure 7.35 shows the view across the Murrumbidgee River toward the Carrolls Ridge Precinct. The ridgeline that the turbines are situated on is not visible in this image.

Figure 7.35 View west across the Murrumbidgee River

The ZVI studies show that from this location no turbines will be visible in whole or in part. The overall visual impact from this location is therefore assessed as nil.

Summary of visual impact from Viewpoint 21

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	CAR29 - 13.3 km north-west	Low
Overall visual impact		**Nil (Not Visible)**

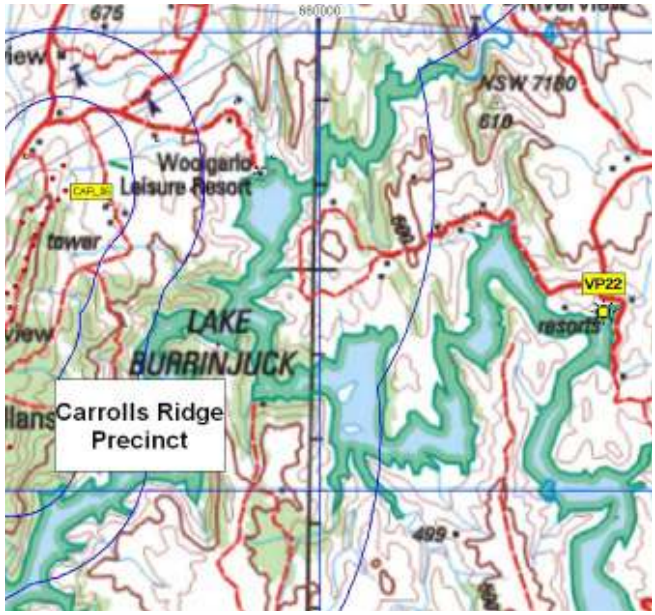
7.22 VIEWPOINT 22 - HUME PARK RESORT

Viewpoint 22 is located on Palmores Road at the Hume Park Resort.

This camping and caravan park is used primarily for fishing and other recreational activities.

The nearest turbine CAR06 is 11.9 km to the north-west and forms part of the Carrolls Ridge Precinct.

The most visible landscape unit in this location is Landscape Unit 5 – "Recreation Resorts".



VP22 (GPS 666162, 6133903, E382)

Figure 7.36 shows the view at the entrance to the Hume Park Resort.

Figure 7.36 View of entrance to Hume Park Resort

The ZVI studies show that no turbines will be visible from this location, either in whole or part. Therefore the overall visual impact from this location is assessed as nil.

Summary of visual impact from Viewpoint 22

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 5	High
Viewer numbers	High	High
Distance to nearest turbine	CAR06 - 11.9 km north-west	Low
Overall visual impact		**Nil (Not Visible)**

7.23 VIEWPOINT 23 - GOOD HOPE RESORT

Viewpoint 23 is located along Fifeshire Road at the Good Hope Tourist Resort.

This gravel road terminates at a 'No Through Road' sign at 'Fifeshire'.

The nearest turbine CAR06 from this location is 9.7 km to the west and is part of the Carrolls Ridge Precinct.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".

VP23 (GPS 664155, 6135531, E388)

Figure 7.37 shows the view from this location viewing west over Lake Burrinjuck. The turbines would be located beyond the ridgeline at the centre of this image. The ZVI analysis shows that no turbines will be visible from this location either in whole or part.

Figure 7.37 View West from Good Hope Resort

As there are no turbines visible from this location, the overall visual impact is assessed as nil.

Summary of visual impact from Viewpoint 23

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	CAR06 - 9.7 km west	Low
Overall visual impact		**Nil (Not Visible)**

7.24 VIEWPOINT 24 – BLACK RANGE ROAD & HUME AND HOVELL WALKING TRACK

Viewpoint 24 is located along Black Range Road 3.5 km from the intersection of Sutton Grange Road. The Hume and Hovell Walking Track also parallels Black Range Road.

This road is a little-used gravel road which would be primarily used for access to private properties located along this road.

The nearest turbine MRL70 is 3.2 km to the north and is included as part of the Marilba Hills Precinct.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".

VP24 (GPS 659862, 6143467, E633)

Figure 7.38 shows the view north-west from this location toward the Marilba Hills Precinct.

Figure 7.38 View north-west towards proposed wind farm

The turbines would be located on the mostly cleared ridgelines to the left in this image. This view represents one of few where breaks in the roadside vegetation allow unobstructed views toward the ridgelines. There are numerous examples of man-made disturbances to the landscape including farm sheds and associated equipment.

Although this location is close to the proposed wind farm, the low viewer numbers means that the overall visual impact is assessed as minor.

Summary of visual impact from Viewpoint 24

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	MRL70 - 3.2 km north	High
Overall visual impact		**Minor**

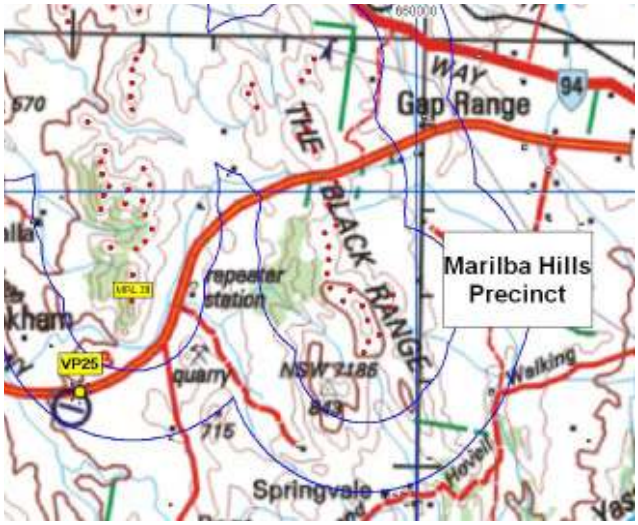
7.25 VIEWPOINT 25 - HUME HIGHWAY, 3.5KM EAST OF BOOKHAM

Viewpoint 25 is located along the Hume Highway approximately 3.5 km east of Bookham.

The Hume Highway has high viewer numbers.

The nearest turbine MRL39 is 2.3 km to the north-east and forms part of the Marilba Hills Precinct.

The most visible landscape unit in this location is *'Landscape Unit 2 - Steeply undulating cleared farmland'*.



VP25 (GPS 652724, 6145665, E509)

Figure 7.39 shows the view from west to north-east from this location. The wind turbines of the Marilba Hills Precinct would be located on the ridgelines to the right, while the wind turbines within the Coppabella Hills Precinct may be visible to the left.

Figure 7.39 View looking north across the Hume Highway

This location on the Hume Highway would have high viewer numbers and the wind turbines are close and would dominate the landscape. As the landscape sensitivity has been assessed as medium, the overall visual impact would also be medium.

Summary of visual impact from Viewpoint 25

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	High	High
Distance to nearest turbine	MRL39 - 2.3 km north-east	High
Overall visual impact		**Medium**

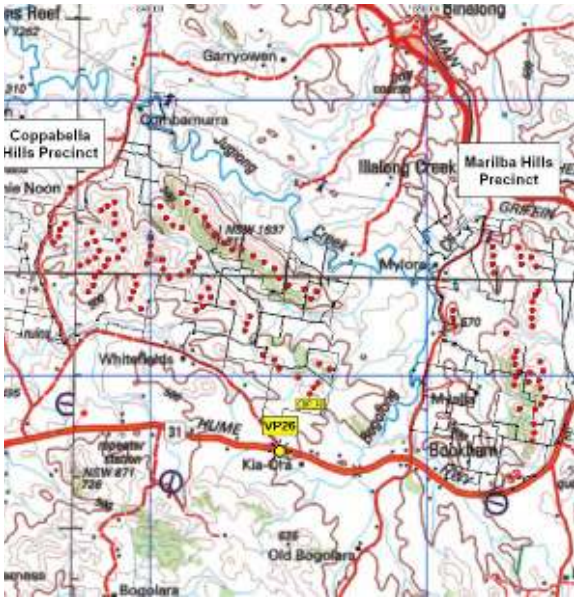
7.26 VIEWPOINT 26 - HUME HIGHWAY & WHITFIELDS ROAD INTERSECTION

Viewpoint 26 is located on the Hume Highway opposite the intersection of Whitfields Road.

The Hume Highway has high viewer numbers.

The nearest turbine COP68 is 2.4 km to the north-east and forms part of the Coppabella Hills Precinct.

The most visible landscape unit in this location is Landscape Unit 1 – "Gently Undulating & Flat Cleared Farmland".



VP26 (GPS 644696, 6147227, E508)

Figure 7.40 shows the view looking north to north-west from this location.

Figure 7.40 View looking north and east along the Hume Highway

The turbines would be located on the ridgelines beyond the low rise seen at the centre of this image. The ZVI studies show that from this location, between 1 and 50 turbines may be visible in their entirety and as there are few existing trees along the roadside that will filter views toward the proposed wind farm most of these will be visible from this location.

From this location there are high viewer numbers. The wind turbines will be visible and will dominate the landscape, however the landscape sensitivity of this relatively flat section along the Hume Highway has been assessed as having a low sensitivity and therefore the overall visual impact is assessed as minor.

Summary of visual impact from Viewpoint 26

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 1	Low
Viewer numbers	High	High
Distance to nearest turbine	COP68 - 2.4 km north-east	High
Overall visual impact		**Minor**

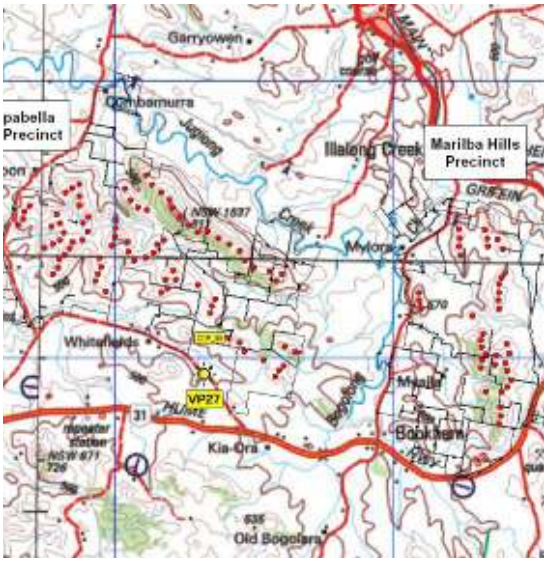
7.27 VIEWPOINT 27 – WHITFIELDS ROAD, NORTH OF THE HUME HIGHWAY

Viewpoint 27 is located at the termination point of Whitfields Road, north of the Hume Highway.

Whitfields Road is a little used gravel road that runs north from the Hume Highway near Kia Ora and re-joins the Hume Highway at a point 9.3 km further west. However it is not continuous and is blocked at this location by a farm gate. Viewer numbers using Whitfields Road would be low.

The nearest wind turbine COP85 is 1.5 km to the north-east.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP27 (GPS 643212, 6149413, E503)

Figure 7.41 shows the view looking north-east from this location. The proposed turbines will appear beyond the low rise in the foreground.

Figure 7.41 View from termination of Whitfields Road

This viewpoint is located at the end of the accessible section of this road. It is not possible for public access further along this road and closer to the turbines. There are many scattered trees in this view which may inhibit views toward the proposed wind turbines.

As this is a no-through road without an obvious destination point, viewer numbers will be low. Therefore the overall visual impact from this location is assessed as minor.

Summary of visual impact from Viewpoint 27

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	COP85 - 1.5 km north-east	High
Overall visual impact		**Minor**

7.28 VIEWPOINT 28 - ILLALONG ROAD, 3.6 KM NORTH OF BOOKHAM

Viewpoint 28 is located on Illalong Road, 3.6 km north of the Hume Highway at Bookham.

This is an asphalt road that is used by those travelling between Bookham and Binalong. There are few viewer numbers along this road.

The nearest wind turbine MRL18 from this location is 1.5 km to the north-east.

The most visible landscape unit in this location is Landscape Unit 1 – "Gently Undulating & Flat Cleared Farmland".

VP28 (GPS 650043, 6150533, E462)

Figure 7.42 shows the view looking west from this location.

Figure 7.42 View looking north-east towards the Marilba Hills Precinct

The turbines from the Coppabella Hills precinct would appear on the ridgelines. This view represents one of few breaks in the existing roadside vegetation in which views are obtainable of the surrounding landscape.

Even though wind turbines would be close to this viewpoint, the low landscape sensitivity and the low viewer numbers means that the overall visual impact from this location is assessed as minor.

Summary of visual impact from Viewpoint 28

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 1	Low
Viewer numbers	Low	Low
Distance to nearest turbine	MRL18 - 1.5 km north-east	High
Overall visual impact		**Minor**

7.29 VIEWPOINT 29 – WELLINGTON STREET, BINALONG

Viewpoint 29 is located on the southern outskirts of the township of Binalong. Wellington Street is a main road that runs southwards from the town centre over a small ridge next to the Mechanics Institute. Viewer numbers would be medium.

The nearest wind turbine MRL01 from this location is 8.0 km to the south east.

The most visible landscape unit in this location is 'Landscape Unit 2 - Steeply undulating cleared farmland' and 'Landscape Unit 4 –Rural Townships'.

VP29 (GPS 649645, 6162272, E493)

Figure 7.43 shows the view looking south west towards the Coppabella Hills Precinct.

Figure 7.43 View looking south-west along Wellington Street

The ZVI shows that between 1 and 50 turbines may be visible from the nacelle and above. The existing vegetation will screen the views many of these wind turbines.

This location is on a local high point within Binalong. Most of the town is situated on the eastern side of this ridge, which would screen all views to the Coppabella Hills Precinct. Even from this elevated location the overall visual impact is assessed as minor due to the screening by existing vegetation and the distance to the nearest wind turbine.

Summary of visual impact from Viewpoint 29

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
	Landscape Unit 4	Medium
Viewer numbers	High	Medium
Distance to nearest turbine	MRL01 - 8.0 km south east	Low
Overall visual impact		**Minor**

7.30 VIEWPOINT 30 - GARRYOWEN ROAD, GARRYOWEN

Viewpoint 30 is located on Garryowen Road near the locality of Garryowen. This is a little-used dirt road with low viewer numbers.

The nearest wind turbine COP01 from this location is 5.5 km to the south-west and at this distance the wind turbines will still be a dominant element in the landscape.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".

VP30 (GPS 644647, 6160795, E478)

Figure 7.44 shows the view towards the Coppabella Precinct.

Figure 7.44 View looking to the south

Wind turbines will be visible on the ranges in the far distance to the right. However the road is little used and there will be few viewers and therefore the overall visual impact from this location is assessed as minor.

Summary of visual impact from Viewpoint 30

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	COP01 - 5.5 km south-west	Medium
Overall visual impact		**Minor**

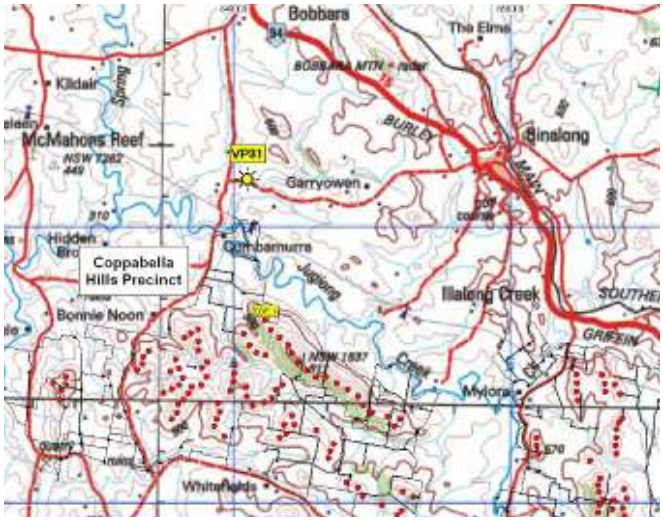
7.31 VIEWPOINT 31 - GARRYOWEN ROAD, 4 KM WEST OF GARRYOWEN

Viewpoint 31 is located on Garryowen Road approximately 4 km west of Garryowen and 770 m from the intersection of Coppabella Road.

This is a little-used gravel road which runs east-west at the north of the site.

The nearest wind turbine COP01 is 5.1 km to the south.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP31 (GPS 640595, 6161577, E432)

Figure 7.45 shows the view looking south from this location. The turbines of the Coppabella Hills Precinct will appear on the ridgelines in the centre of this image. This elevated viewpoint possibly represents the clearest vantage point to the Coppabella Hills wind turbines. It is an elevated location that has numerous breaks in the roadside vegetation to allow views across the landscape.

Figure 7.45 View looking south towards proposed wind farm

At this distance the wind turbines can have a moderate level of visual impact. However, as there are few visitors using Garryowen Road, the overall visual impact from this location is assessed as minor.

Summary of visual impact from Viewpoint 31

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	COP01 - 5.1 km south	Moderate
Overall visual impact		**Minor**

7.32 VIEWPOINT 32 - INTERSECTION OF COPPABELLA AND CUMBAMURRA ROADS

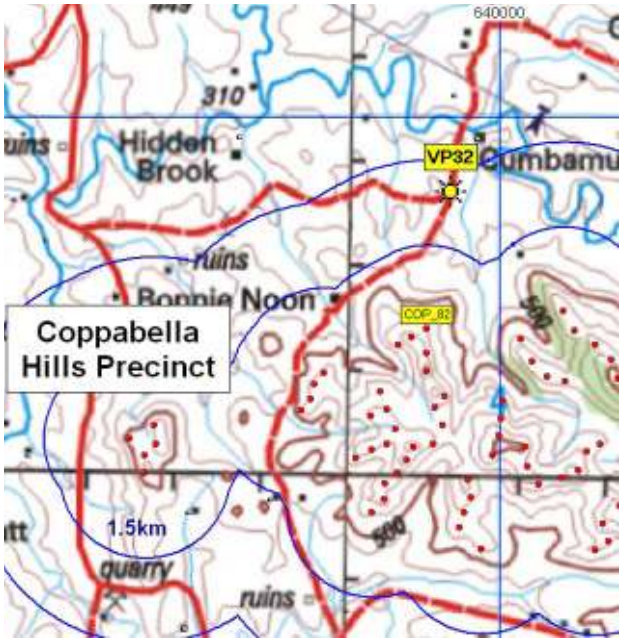
Viewpoint 32 is located on the intersection of Coppabella and Cumbamurra Roads on the northern side of the Coppabella Hills Precinct.

These gravel roads are primarily used for local landowner access and would have few users.

This location is the termination point of Coppabella Rd and there is no access further south along this road.

The nearest wind turbine COP82 is 2.4 km south from this location.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP32 (GPS 639138, 6158708, E420)

Figure 7.46 shows the view looking south toward the turbines of the Coppabella Hills Precinct. The turbines will appear as prominent features along the ridgeline in the centre of this image.

Along this section of the road there are few existing roadside trees to inhibit views toward the wind turbines.

Figure 7.46 View looking south from the intersection of Coppabella and Cumbamurra Roads

Although this location is very close to the wind turbines, the road is little-used. Therefore, the overall visual impact from this location is assessed as minor.

Summary of visual impact from Viewpoint 32

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	COP82 - 2.4 km south	High
Overall visual impact		**Minor**

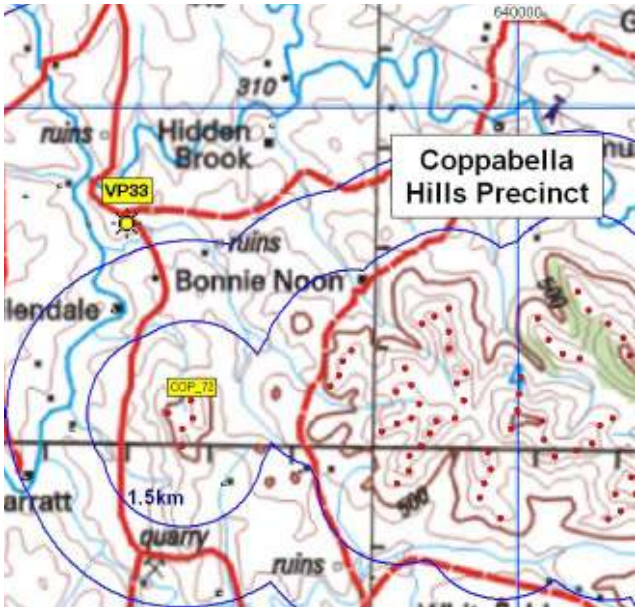
7.33 VIEWPOINT 33 - BARRAMANGRA ROAD

Viewpoint 33 is located near the intersection of Cumbamurra Road and Berremangra Settlement Road.

This is a little-used road that connects to the Hume Highway to the south with few users.

The nearest wind turbine COP72 is 3.5 km to the south-east.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP33 (GPS 632734, 6157861, E340)

Figure 7.47 shows the view south-east from this location looking toward the turbines of the Coppabella Hills Precinct.

Figure 7.47 View to the south-east from near the intersection of Cumbamurra Road and Berremangra Settlement Road.

The turbines will appear along the ridgeline in the far distance. This location is from an elevated position that allows unobstructed views toward the proposed wind farm.

Due to the low viewer numbers, the overall visual impact from this location is assessed as minor.

Summary of visual impact from Viewpoint 33

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	Low	Low
Distance to nearest turbine	COP72 - 3.5 km south-east	Medium
Overall visual impact		**Minor**

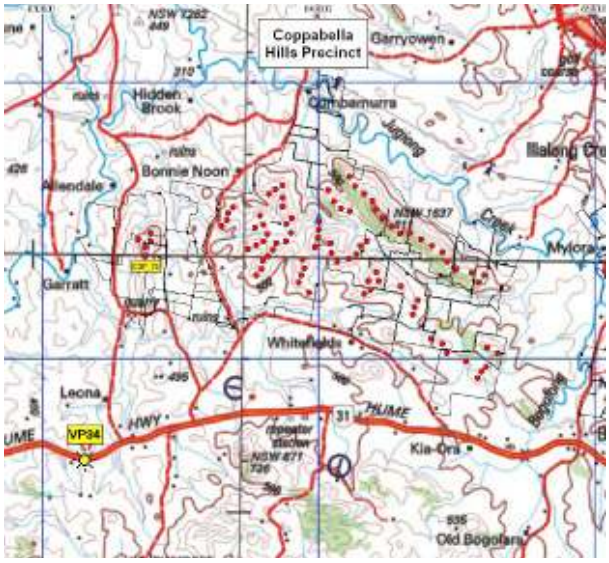
7.34 VIEWPOINT 34 - HUME HIGHWAY, 13 KM WEST OF BOOKHAM

Viewpoint 34 is located on the Hume Highway approximately 1.3 km west of Bookham

The Hume Highway has high viewer numbers.

The nearest wind turbine COP76 is 7.7 km north-east of this location.

The most visible landscape unit in this location is Landscape Unit 2 – "Steeply Undulating Cleared Farmland".



VP34 (GPS 631581, 6146345, E426)

Figure 7.48 shows the view looking north-east toward the turbines of the Coppabella Hills Precinct.

Figure 7.48 View north-east from the Hume Highway approximately 1.3 km west of Bookham

The turbines will appear on the distant ridgeline in the centre of this image. This location on the Hume Highway allows clear views to the Coppabella Hills Site. The ZVI studies show that there may be between 1 and 50 turbines visible in their entirety from this location and the lack of foreground planting means that most of these wind turbines will be visible from this location.

Although wind turbines will be visible, at this distance they will appear as relatively small elements in the landscape. For this reason the overall visual impact from this location is assessed as minor.

Summary of visual impact from Viewpoint 34

Item	Description	Evaluation
Landscape sensitivity	Landscape Unit 2	Medium
Viewer numbers	High	High
Distance to nearest turbine	COP76 - 7.7 km north-east	Moderate - Low
Overall visual impact		**Minor**

7.35 SUMMARY OF VISUAL IMPACT FROM PUBLICLY ACCESSIBLE VIEWPOINTS

Table 7.2 summarises the assessment rating of all publicly accessible viewpoints discussed in this section.

Table 7.2 Summary assessment of publicly accessible viewpoints

VP	Distance to nearest wind turbine (approx.)	Direction to wind farm	Dominant landscape units	Viewer numbers	Landscape sensitivity	Overall visual impact
1	16.7 km	W	4	High	Medium	Negligible
2	16.4 km	W	4	High	Medium	Nil
3	12.6 km	W	1	High	Low	Minor
4	4.7 km	W	1	Low on Graces Flat Road High on the Hume Highway	Low	Minor
5	2.4 km	NW	2 & 1	High	Medium	Medium
6	300 m	SE	2	High	Medium	Medium
7	1.2 km	W	2	High	Medium	Medium
8	4.5 km	S	2	Medium	Medium	Medium
9	4.5 km	SW	5 & 2	Medium	High	Medium
10	1.7 km	SW	2 & 3	Medium	Medium Medium	Medium
11	814 m	SE	3	Medium	High High	Medium
12	4.5 km	NE	3	High	High	Nil
13	4.9 km	SW	2	Low	Medium	Minor
14	4.3 km	NW	2	High	Medium	Medium
15	6.2 km	E	2	Low	Low	Minor
16	1.3 km	E	2	Low	Medium	Minor
17	2.3 km	SW	2	High	Medium	Medium
18	1.8 km	SW	2	High	Medium	Medium
19	16.5 km	NW	2	Low	Medium	Minor
20	15.3 km	NW	2	Low	Medium	Minor
21	13.3 km	NW	2	Low	Medium	Nil

VP	Distance to nearest wind turbine (approx.)	Direction to wind farm	Dominant landscape units	Viewer numbers	Landscape sensitivity	Overall visual impact
22	11.9 km	NW	5	High	High	Nil
23	9.7 km	W	2	Low	Medium	Nil
24	3.2 km	NW	2	Low	Medium	Minor
25	2.3 km	NE	2	High	Medium	Minor
26	2.4 km	NE	1	High	Low	Minor
27	1.5 km	NE	2	Low	Medium	Minor
28	1.5 km	NE	1	Low	Low	Minor
29	8.0 km	SW	4 & 2	Medium	Medium	Minor
30	5.5 km	SW	2	Low	Medium	Minor
31	5.1 km	S	2	Low	Medium	Minor
32	2.4 km	S	2	Low	Medium	Minor
33	3.5 km	SE	2	Low	Medium	Minor
34	7.7 km	NE	2	High	Medium	Minor

Overall, most of the visual impacts are minor or medium. There are no locations within the public domain where the visual impact is assessed as high. In part this is because the majority of the surrounding landscape has been assessed as having a medium level of sensitivity and therefore the highest visual impact in these areas would be medium. In the areas that have been assessed as having a higher degree of sensitivity, such as the recreation resorts around Lake Burrinjuck, locations within these areas have no views to the proposed wind turbines.

The main areas with higher levels of potential impact are along the Hume and to a lesser extent along Burley Griffin Way. However as mentioned in the previous chapter on Community Perception, for many viewers using the highways the presence of the wind farm may be a positive element within the roadside vistas. This conclusion is supported by the community perception studies which are described in Chapter 3 and in Annexure A.

The following Chapter will look at the possibility of sequential impacts on users of the surrounding road network, particularly the:

- Hume Highway
- Burley Griffin Way;
- and the local roads serving Lake Burrinjuck.

8 SEQUENTIAL VIEWPOINTS

This Project Application only seeks approval for the Coppabella Hills and Marilba Hills precincts and a further application will be made for the Carrolls Ridge precinct. However this report assesses all three precincts and some viewpoints discussed in this chapter relate to the Carrols Ridge precinct for which approval is not being sought.

The following chapter discusses the possibility of sequential views for users of the local road network

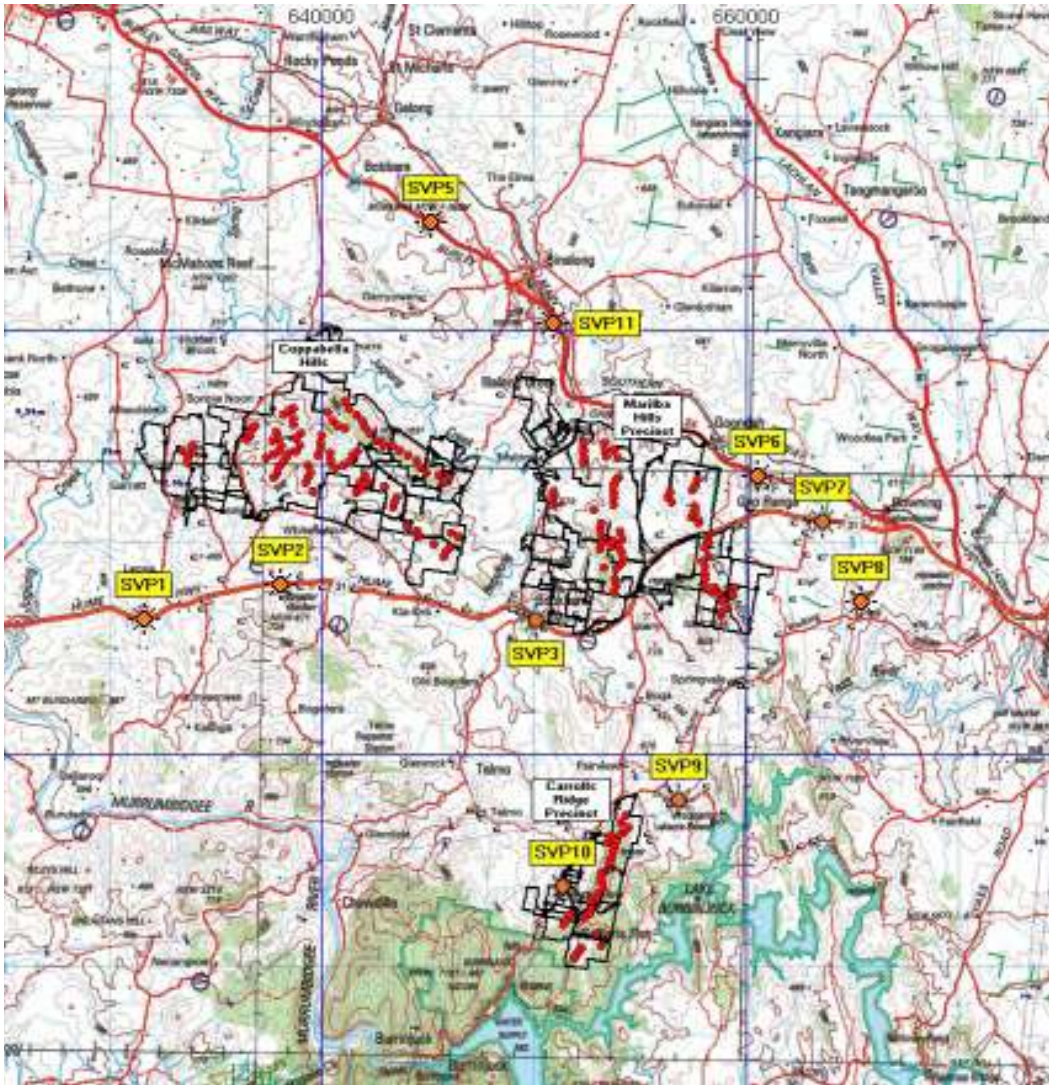


Figure 8.1 ***Sequential viewpoints around the Yass Valley Wind Farm*** ***(Map prepared using OziExplorer, based on Natmap 2008, Zone 55, Geoscience Australia)***

Sequential viewpoints (SVP's) have been selected from locations along the Hume Highway, along Burley Griffin Way and from the local road network to the south of the Hume Highway serving Lake Burrinjuck. The viewpoints are:

SVP1, SVP2, SVP3 look at the sequential views for a traveller heading east on the Hume Highway towards Yass.

SVP7 is also taken from the Hume Highway looking west.

SVP5, SVP6 and SVP11 look at the views from Burley Griffin Way for a traveller heading south towards Yass.

SVP8, SVP9 and SVP10 look at the views from near the Hume & Hovell Walking Track which parallels Black Range Road.

8.1 HUME HIGHWAY

For travellers heading east towards Yass and using the Hume Highway the wind farm will firstly appear to the north and then closer to Yass, wind turbines will be visible on both sides of the Highway. *Figure 8.2* and *Figure 8.3* shows the panoramic view from a location approximately 44km from Yass. The panorama has been shown in two figures, each of which show a field of view of approximately 60^{O}.

Figure 8.2 SVP1 – left hand side of view

The closest wind turbines visible from this location are approximately 7.6km to the north and are visible on the far left of *Figure 8.2*.

Figure 8.3 SVP1 – Right hand side of view

In *Figure 8.3* the wind turbines that are just visible on the hill in the distance are approximately 15.5 km from this location. Wind turbines to the left are more than 20 km from this location.

From this location on the Hume Highway the wind farm will be a visible element in the landscape and one which represents a further change to the landscape, however it is also a change which many viewers may find appealing.

The turbines will remain in view as a traveller moves closer to Yass. SVP2 is taken from a location on the Hume Highway approximately 37 km from Yass. From this location, for a viewer looking north through breaks in the roadside vegetation, the nearest wind turbines parallel the Highway and take up more than a 120^{O} field of view.

Figure 8.4 ***SVP2 – Left hand side of view***

At this location the nearest group of wind turbines which are visible on the left of *Figure 8.4* are approximately 7 km from the Highway.

Figure 8.5 ***SVP2 – Right hand side of view***

The wind turbines in *Figure 8.5* continue to parallel the Highway approximately 6 – 7 km from the roadway. At this distance they are a noticeable element but do not dominate the landscape. The movement of the turbine blades will attract the eye.

Figure 8.6 ***SVP3 – At a roadside stop near Bookham - right hand side of view***

No turbines are visible in *Figure 8.6* at this location looking back to the north west.

Figure 8.7 ***SVP3 – At a roadside stop near Bookham - right hand side of view***

However as a viewer looks towards the north east (the right hand side of this panorama) wind turbines are visible through a gap in the roadside vegetation approximately 4 km from this location. As can be seen in *Figure 8.7* these are very noticeable at this distance, however so too are existing elements in the landscape such as the light poles and toilet stop. This panorama highlights the fact that this landscape is one which includes many changes. Not only is it a rural landscape, but elements such as this road side stop are readily accepted by Highway users. The wind farm will provide another element in this landscape.

SVP7 is approximately 13.7 km from Yass. However from this area a viewer needs to be looking westwards along the Highway to view wind turbines.

Figure 8.8 SVP7 – Left hand side of view

From this location the nearest wind turbines are approximately 5-6 km away across the Marilba Hills. They are noticeably larger than other man made elements in the landscape, such as the sheds in the middle ground, but from this particular location the wind turbines are not larger that the power lines in the foreground.

Figure 8.9 SVP7 – Right hand side of view

The nearest wind turbines in the right hand side of this panorama are approximately 5 km from this location. As can be seen in *Figure 8.9* it doesn't require very large vegetation along the roadside to screen or filter views to wind turbines.

These views along the Hume Highway have shown that there will be a series of sequential views that users of the Highway will experience from the Highway to the west of Yass. From most locations the wind turbines will be several kilometres from the viewer, and these will be one further element in a man modified landscape. They may, for many viewers, be an appealing change in the landscape.

8.1.1 Assessment of the sequential views along the Hume Highway

These photomontages have demonstrated that the wind turbines will be noticeable for a number of kilometres along the Hume Highway, for travellers heading east or west, however the existing landscape remains relatively unchanged even with the addition of one element, namely the wind turbines. The sequential impact will not be significant.

8.2 BURLEY GRIFFIN WAY

Burley Griffin Way leaves the Hume Highway approximately 11 km west of Yass and heads in a north easterly direction towards Binalong. SVP6 is a location on Burley Griffin Way approximately 17 km from Yass.

Figure 8.10 SVP6 – Left hand side of view

The wind turbines within the Miralba Hills Precinct run between Burley Griffin Way and the Hume Highway to the south.

Figure 8.11 SVP6 – Right hand side of view

The nearest wind turbine in *Figure 8.11* is approximately 2.7 km from this viewpoint. At this distance the wind turbines are a dominant element in the landscape and the movement of the turbine blades will attract the eye. However for a traveller using Burley Griffin Way they may be a focus along this road, however for many they could also be an attractive focal point.

SVP11 is just south of the township of Binalong.

Figure 8.12 SVP11 – Left hand side of view

Wind turbines are not visible on the left, however they are visible on the right hand side of this panorama.

Figure 8.13 SVP11 – Right hand side of view

At this distance the nearest wind turbines are relatively small elements in the landscape. As a traveller on the Burley Griffin Way moves further to the north the wind turbines reduce in scale. This is illustrated in the views from SVP5.

Figure 8.14 SVP5 – Left hand side of view

In this view *(Figure 8.14)* the wind turbines are a small distant element in the landscape.

Figure 8.15 SVP5 – Right hand side of view

The turbines are also visible in the right hand side of this panorama, although they appear no larger.

8.2.1 Assessment of the sequential views along Burley Griffin Way

These photomontages have demonstrated that the wind turbines will be noticeable for a number of kilometres from the turn off on the Hume Highway, for travellers heading north or south along Burley Griffin Way.

However except for a short distance near the Hume Highway junction, the wind turbines will form a relatively small element in most of the views. The existing landscape remains relatively unchanged with the addition of one element, namely the wind turbines.

8.3 LOCAL ROADS AROUND LAKE BURRINJUCK

The Hume & Hovell Trial is a walking track which parallels Black Range Road. Three sequential viewpoints have had photomontages prepared to illustrate the range of views along this road, the trail and other local roads serving the tourist destinations around Lake Burrinjuck.

SVP10 is the closest viewpoint to Lake Burrinjuck.

Figure 8.16 SVP10 – Left hand side of view

In *Figure 8.16* the wind turbines can be seen on Carrols Ridge running parallel to the road.

Figure 8.17 SVP10 – Right hand side of view

In Figure 8.17 wind turbines appear on both sides of the road as a traveller looks towards the south east. At this location the nearest wind turbines are within 1.5 km and at this distance will be a dominant element in the landscape.

SVP9 is a little further away, with the nearest wind turbine approximately 2.5 km from this location.

Figure 8.18 SVP9 – Right hand side of view

At this distance the wind turbines do not dominate the landscape and are also reasdily screened by roadside vegetation.

Figure 8.19 SVP9 – Right hand side of view

Even vegetation in the middle distance reduces the visual impact of wind turbines at this distance. This is demonstrated in *Figure 8.19*.

SVP8 is some distance off the Hume & Hovell Trail at a location which has views back to the wind turbines within the Marilba Hills Precinct. The closest wind turbine is approximately 6.5 km from this location.

Figure 8.20 SVP8 – Left hand side of view

Figure 8.21 SVP8 – Right hand side of view

At this distance, even where there is a clear view, the wind turbines are noticeable but do not dominate the landscape.

8.3.1 Assessment of the sequential views on the Hume & Hovel Trail and roads serving Lake Burrinjuck

These locations were selected adjacent to or near to the Hume & Hovell Trail. They demonstrate that from these particular locations the wind turbines will be visible and will vary in their perceived scale in the landscape.

However it is stressed that from many locations along the trail and from the adjacent road network, views to all of the wind farm are screened by topography and / or vegetation. These are very conservative.

For these reasons it is considered that the sequential views from the roads and from the trail will have a very limited impact. The turbines will be a further man made element in access routes that pass many others, ranging from transmission lines to farms buildings and associated agricultural practices which also bring about changes to the landscape. In fact one of the appeals in driving through this country is the range of landscapes one passes.

9 ASSESSMENT OF VISUAL IMPACT ON RESIDENTIAL PROPERTIES

This Project Application only seeks approval for the Coppabella Hills and Marilba Hills precincts and a further application will be made for the Carrolls Ridge precinct. However this report assesses all three precincts and some viewpoints discussed in this chapter relate to the Carrols Ridge precinct for which approval is not being sought.

The major impact of wind turbines on residential properties occurs where wind turbines are within 1.5 km. However, wind turbines can be dominant out to 3 km. In this zone the greatest potential impact is on neighbouring non-participatory residential properties. That is residential properties whose owners have not elected to be part of the Yass Valley Wind Farm, as it can be assumed that those that have elected for their land to form part of the wind farm, the visual impact is acceptable.

The locations of participatory landowners' residences and non-participatory residences have been provided by Epuron Pty. Ltd. *Table 9.1* shows the number of houses that are within 1.5 km and 3 km of the nearest wind turbine. These are those properties which have the greatest potential visual impact.

Table 9.1 shows the residences that are located within three kilometres of the wind farm.. For clarity these are broken down to residences that fall within 1.5 and 3 km of each of the three precincts. Although there is an area of overlap between the Coppabella Hills and Marilba Hills precincts, there are no residences within this area and therefore there is no double counting.

Table 9.1 Residences within 3 km of the nearest wind turbine

Distance from house to the nearest wind turbine	Coppabella Hills		Marilba Hills		Carrols Ridge	
	Total houses	Non-participatory houses	Total houses	Non-participatory houses	Total houses	Non-participatory houses
Within 1.5 km	1	0	7	2	3	2
Within 1.5km to 3 km	10	5	24	19	6	5
TOTAL within 3 km	11	**5**	31	**21**	9	**7**

This table shows that of the 51 residences within 3 km of the proposed Yass Valley Wind Farm, there are only 33 non-participatory residences within this band. There are 26 houses within 3km of the Coppabella Hills and Marilba Hills and the addition of the Carrols Ridge Precinct impacts on an additional 7 houses within 3km of the nearest wind turbine. Given that the wind farm is located in an area that runs more than 25 km in an east west direction, and more than 26 km in a north south direction, then there are a relatively small number of residences that can be potentially impacted by the wind farm, even when the Carrols Ridge Precinct is included..

The following section will look at the potential impact of the proposed wind farm (including the Carrols Ridge Precinct) on a number of these residences.

During community consultation meetings and in private meetings with residents, addresses were sought of people interested in better understanding the visual impact of the wind turbines from their places of residence. Nine landowners sought or allowed Epuron Pty. Ltd. to visit their properties and undertake a visual assessment.

The addresses of these residences are listed in Table 9.2 and their locations are mapped in *Figure 9.1.*

Table 9.2 Residential viewpoints

Ref #	*Viewpoint location*	*Epuron House Ref #*
VP R1	"Tullyvale Hall", Hume Hiughway**	G14
VP R2	"The Pines", Goondah Road, Goondah	M04
VP R3	918 Burley Griffin Way	M22
VP R4	"Gwandoban", Burley Griffin Way	C53
VP R5	"Naranghi", Garrett Road	C54
VP R6	"Farirview", Burrinjuck Road	C27
VP R7	"The Crisp Galleries", Hume Highway	C34
VP R8	"Deepwater", Hume Highway, Bookham	C41
VP R9	55 Illalong Road	C42

** ***Photomontage locations***

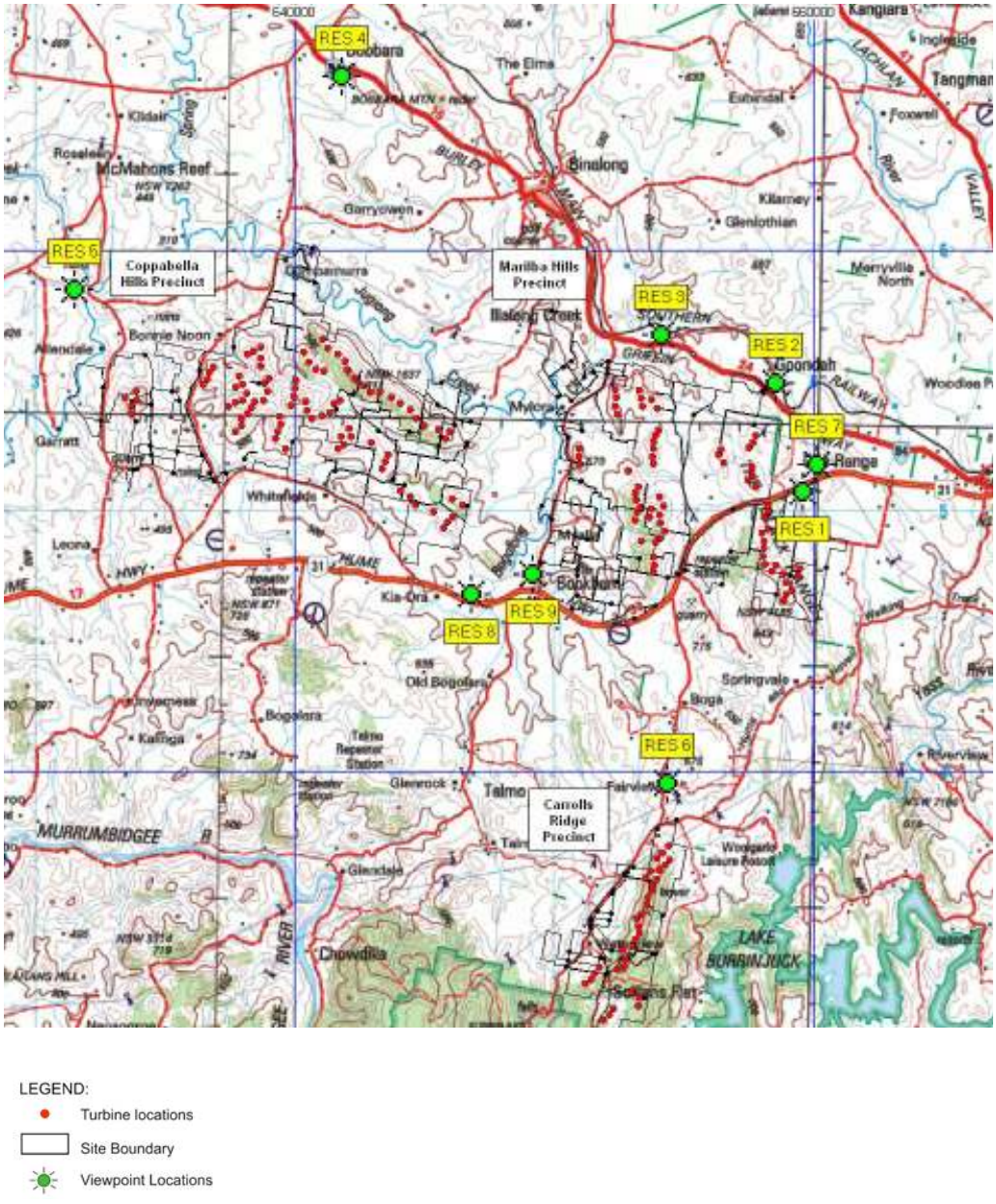


Figure 9.1 ***Selected Viewpoints around the Yass Valley Wind Farm*** ***(Map prepared using OziExplorer, based on Natmap 2008, Zone 55, Geoscience Australia)***

The following sections undertake a visual assessment of the likely impact of the Yass Valley Wind Farm on each of these nine residential properties.

GPS Coordinates

GPS Coordinates are supplied for each viewpoint. The datum used is the Australian Map Grid, GDA 94.. The GPS coordinates were recorded from a hand held GPS unit, which is typically accurate to approximately +/-10 m horizontally, while the vertical elevation may be out by a larger margin. They are included within the report to assist others in locating viewpoints or photograph locations.

In this report the GPS Coordinates are given in the format (GPS 2731865, 6090612, E43); where the first coordinate is the Easting, the second the Northing and the figure prefaced by "E" is the approximate elevation.

Sensitivity

As mentioned in the Methodology (refer Section 1.1) the assessment of visual impact from residences is different in two important aspects to one undertaken from publicly accessible viewpoints. Firstly, an assessment of visitor numbers is not applicable as the size of the household is immaterial to the impact. Secondly, the landscape sensitivity is always rated as "high", as it must be recognised that people feel most strongly about the view from their house and from their outdoor living spaces.

The major impact of wind turbines on residential properties occurs where wind turbines are within 1.5km. However wind turbines can be dominant out to 3.5km.

9.1 VIEWPOINT R1 7– "TULLYVALE HALL" (HOUSE #G14)

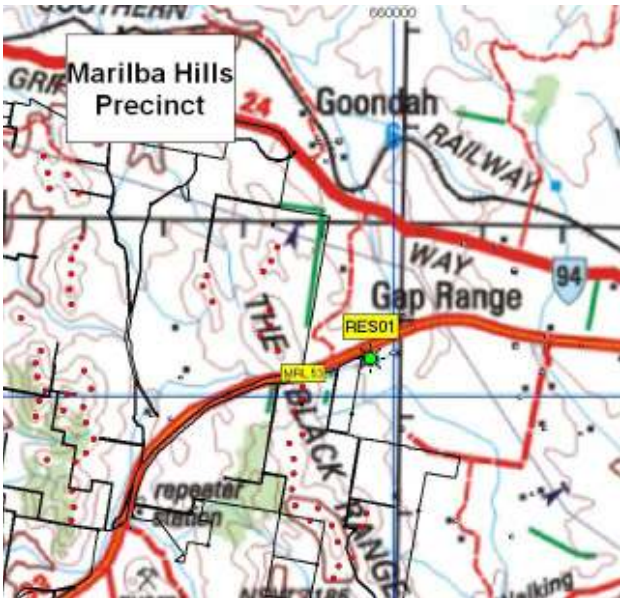
"Tullyvale Hall" (House #G14) is located

The nearest wind turbine MRL53 is 1.3 km to the south west.

The dwelling sits on a low hill located west of the township of Yass. The residence is south of the Hume Highway and the surrounding landscape is lightly vegetated.

The house is orientated to the west however views from the house are screened by existing vegetation.

Figure 9.3 shows the existing vegetation surrounding the dwelling.



VP R1 (0659544, 6150737, E605)

Figure 9.2 Aerial showing the existing vegetation around the residence

Figure 9.3 "Tullyvale Hall", view of front of house

Existing vegetation limits views from the house and its immediate surrounds, however there are views from further along the driveway.

Figure 9.4 View down driveway towards the existing house

Figure 9.4 is of a view down the driveway towards the house and shows the extensive planting around the existing house. The viewpoint below, and the photograph, was taken adjacent to the fence on the right of the driveway in *Figure 9.4*.

Figure 9.5 is taken from the driveway some distance before the house. The view is across the paddock towards the wind farm, but this view is still partially screened by existing vegetation.

Figure 9.5 View looking south-west from the driveway

The owner is not an objector. However the nearest wind turbine to this location is 1.3 km to the west. At 1.3 km the wind turbines "*will be visually dominant in the landscape from most viewing locations*". However there is extensive existing vegetation around the dwelling and for this reason the overall visual impact from this residence is assessed as low.

Summary of visual impact from Viewpoint R1

Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	MRL53 - 1.3 km south west	High
Overall visual impact		Low

9.2 VIEWPOINT R2 – "THE PINES" GOONDAH ROAD, GOONDAH (HOUSE #M02)

"The Pines" (House #M02) is located on Goondah Road just to the north of Burley Griffin Way.

The nearest wind turbine MRL43 is 2.1 km to the south within the Marilba Hills Precinct.

Figure 9.6 illustrates the existing vegetation around the residence.

The dwelling is located on the hills and is orientated towards the north, away from the wind farm.

Figure 9.7 shows the existing dwelling. Goondah Road is in the front of the dwelling, towards the north, and the wind farm is located to the south.

VP R2 (0658527, 6154905, E558)

Figure 9.6 Aerial showing the existing vegetation surrounding the residence to the south west

Figure 9.7 *"The Pines", view of house looking north (away from the wind farm)*

There is an existing shed at the south of the property from where the photograph in *Figure 9.7* was taken.

Figure 9.8 *"The Pines", view looking south (towards the wind farm)*

This view is taken from behind the dog kennels and shed at the rear of the property towards the wind farm and the wind farm will be located on the nearby hills. However because the dwelling is orientated away from the wind farm the overall visual impact from this residence is assessed as low.

Summary of visual impact from Viewpoint R2

Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	MRL43 - 2.1 km south	High
Overall visual impact		Low

9.3 VIEWPOINT R3 – 918 BURLEY GRIFFIN WAY" (HOUSE #M22)

The residence at 918 Burley Griffin Way (House #M22) is located just to the north of Burley Griffin Way.

The nearest wind turbine MRL05 is 2.2 km to the south.

The dwelling is located on the side of the hill with the main garden areas oriented towards the north and east.

The owners support the presence of wind turbines. *Figure 9.10* shows the existing dwelling and the existing garden

VP R3 (0654119, 6156776, E491)

Figure 9.9 Shows the existing vegetation around the residence

Figure 9.10 View of house from entry drive

The viewpoint discussed below is taken from the garden on the far side of this house.

Figure 9.11 View looking south

This view is taken towards the hills on which the wind farm is to be constructed. This view is obtained from a location at the western edge of the garden. As the main views are away from the wind farm the overall visual impact from this residence is assessed as low.

Summary of visual impact from Viewpoint R3

Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	MRL05 - 2.2 km south	High
Overall visual impact		Low

9.4 VIEWPOINT R4 – "GWANDOBAN" (HOUSE #C53)

"Gwandoban" (House #C53) is located to the north of the Coppabella Hills precinct.

The nearest wind turbine COP01 is 10 km to the south.

The dwelling sits on a hill located to the north of the wind farm. The main garden areas and the existing tennis court is located on the north side of the house.

Figure 9.21 shows the existing vegetation surrounding the dwelling.

VP R4 (0641839, 6166696, E508)

Figure 9.12 Shows the existing vegetation around the residence

Figure 9.13 "Gwandoban", view of front of house

The front of the house is orientated away from the wind farm. . There would be no views of the wind farm from this side of the house or from the entry drive.

Figure 9.14 "Gwandoban", view of rear of the house

Figure 9.14 shows the rear of this house. There are only small windows along the rear elevation and the house is further separated by existing hedgerows. However from the rear of this garden, some 50 m or more from the rear of the house, there will be a view towards the wind farm.

Figure 9.15 View from rear garden fence on the property boundary

From this location the Coppabella Hills are visible in the distance.

However there is extensive existing vegetation around the existing dwelling and the wind farm is more than 10km from this location. For these reasons the overall visual impact from this residence is assessed as negligible.

Summary of visual impact from Viewpoint R4

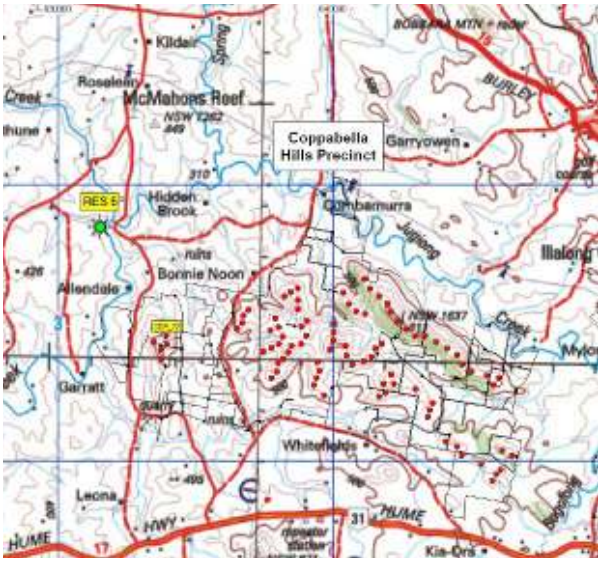
Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	COP01 - 10 km south	High
Overall visual impact		Negligible

9.5 VIEWPOINT R5 – "NARANGHI" (HOUSE #C54)

"Naranghi" (House #C54) is located north west of the Coppabella Hills.

The nearest wind turbine COP74 is 4.5 km to the south-east.

The dwelling sits on a hill located to the east of a small creek. *Figure 9.17* shows the existing dwelling with the creek visible to the right of this photograph.



VP R5 (0631542, 6158496, E313)

Figure 9.16 Shows the existing vegetation surrounding the residence

Figure 9.17 View of front of house from the entry driveway

The existing house is orientated to the east across the creek. However from the rear yard there are views to the wind turbines in the Coppabella Hills precinct to the south-east.

Figure 9.18 View from the entry driveway to the south east

Existing vegetation will filter the view to the wind turbines from some locations within this garden; however from this location the existing trees frame the Coppabella Hills.

Figure 9.19 Photomontage (60^{O} field of view)

The photomontage shows the proposed wind turbines on the Coppabella Hills.

However, even though the owner is supportive of wind farms, because of the views from the dwelling and the front verandah, the overall visual impact from this residence is assessed as medium.

Summary of visual impact from Viewpoint R5

Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	COP74 – 4.5 km south-east	High
Overall visual impact		Medium

9.6 VIEWPOINT R6 – "FAIRVIEW", BURRINJUCK ROAD (HOUSE #C27)

"Fairview" (House #C27) is located just to the north of the Carrols Ridge precinct and to the south of the Marilba Hills precinct.

This is the residence closest to the Carrols Ridge Precinct.

The nearest wind turbine within the Carrols Ridge Precinct is CAR01 is 2.4 km to the south. However if the Carrols Ridge Precinct is not constructed then the nearest wind turbine to the north will be MRL39 which is 8.1 km from this location.

The dwelling sits on a low rise with sheds and ancillary farm structures located at the rear. *Figure 9.21* shows the existing house which is orientated away from the wind farm.

VP R6 (0654371, 6139497, E589)

Figure 9.20 Shows the existing vegetation surrounding the residence

Figure 9.21 "Fairview", view of front of house

The panorama in is taken from the rear of the sheds, at a farm gate leading into the paddocks.

Figure 9.22 View of Carrols Ridge from the rear paddock gate

The wind farm will be visible on the hills from this location. However there is extensive existing vegetation around the dwelling separating the garden areas from views to the ridge. For this reason the overall visual impact from this residence is assessed as low.

Summary of visual impact from Viewpoint R6

Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	CAR01 - 2.4 km south MRL39 - 8.1 km north	High
Overall visual impact		Low

9.7 VIEWPOINT R7 – THE CRISP GALLERIES, HUME HIGHWAY (HOUSE #C34)

The Crisp Galleries (House #C34) is located on the Hume Highway.

The nearest wind turbine MRL53 is 2.4 km to the south west.

The gallery and dwelling is a tourist destination which not only contains a gallery, but is also a venue for weddings and other functions in which the extensive gardens are used as external entertainment areas.

Figure 9.24 shows the existing vegetation in a lavender garden behind the gallery.

VP R7 (GPS 0660018, 6151762, E571)

Figure 9.23 Shows the existing vegetation around the residence

Figure 9.24 The Crisp Gallery – lavender garden

This gravel area has views towards the Marilba Hills precinct to the west. On the left of this photo, behind the existing vegetation, the owners are establishing a bamboo garden, which is approximately 90m closer to the proposed wind farm, and as vegetation is not yet established, has a greater visual impact than from this location.

Figure 9.25 View from the bamboo garden

The bamboo garden is being established on the edge of a dam and is orientated towards the low hills to the west. This will be a pleasure garden which is proposed to augment the existing lavender garden. A photomontage has been prepared from this location as this was the closest viewing location to the proposed wind farm on this property.

Figure 9.26 Photomontage (60^{O} field of view)

The photomontage shows that the wind turbines, at a distance of less than 3 km, will be a dominant element in the landscape. However foreground vegetation will be able to screen or filter views if these are seen as inappropriate from this location.

The landscape that has been undertaken at this property to date, has established a series of external "rooms". If such a landscape theme was continued around this location, then the wind turbines could easily be screened from view. It is realised that such screen vegetation will take some time to establish and that this vegetation will screen the view to the hills. However as mentioned previously, this has been the case in the treatment of other external areas around the gallery.

The gallery owners also plan to develop a n eco-village on the hills some 1km further to the east of the bamboo and lavender gardens. The view from this location is shown in *Figure 9.27*

Figure 9.27 View from the site of the future eco village

A photomontage has been prepared from this location.

Figure 9.28 Photomontage (60^{O} field of view)

The photomontage of a section of this panorama shows both the existing high voltage lines as well as the proposed wind turbines. The owners have advised that they are planning to underground the high voltage line; however the cost may be prohibitive. In which case screen planting that screened both the overhead transmission lines in the foreground, as well as the wind turbines in the distance, may be an appropriate landscape response for the design of this eco-village. The suitability of such a response is difficult to determine as no plans of the layout have been provided.

As mentioned previously, there is extensive existing vegetation around the gallery and along the entry driveway and from these areas the overall visual impact would be negligible and in most locations, as the wind farm would be fully screened by existing vegetation, the visual impact would be nil.

However there are views from the rear lavender and bamboo gardens and for some people attending functions, it is likely that they would find the presence of wind turbines to be an unacceptable juxtaposition. Therefore for these reasons the overall visual impact from these gardens within the gallery demesne is assessed as medium. However this could be addressed by additional landscape planting.

The impact from the proposed Eco-village is assessed as low as responsive layout options as well as landscape of an unconstructed facility could alleviate visual impact issues.

Summary of visual impact from Viewpoint R7

Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	MRL53 – 2.4 km south west	High
Overall visual impact		Bamboo garden – Medium Eco village - Low

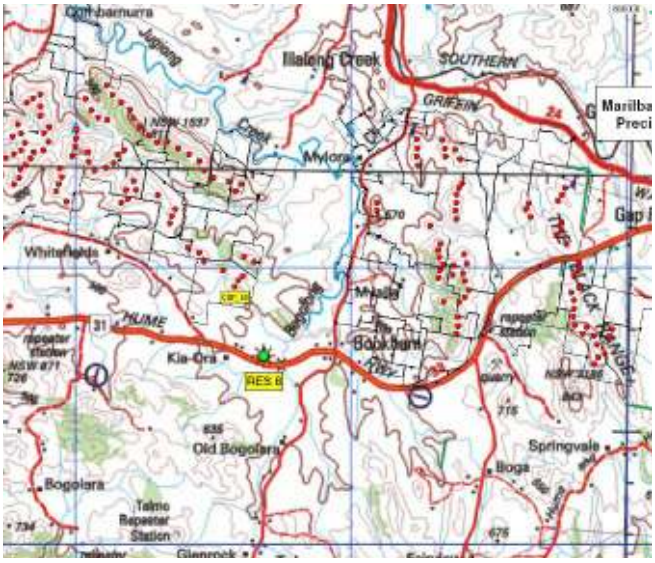
9.8 VIEWPOINT R8 – "DEEPWATER", HUME HIGHWAY, BOOKHAM (HOUSE #C41)

"Deepwater" (House #C41) is located on the Hume Highway.

The nearest wind turbine COP68 is 2.7 km to the north west, however the hill behind the residence screens views in this direction to the nearest wind turbine.

The closest wind turbine that are visible are part of the Carrols Ride Precinct some 12 km to the south east.

The dwelling is surrounded by vegetation; however there is a clear view towards the proposed wind farm from the rear veranda.



VP R8 (0646835, 6146817)

Figure 9.34 shows the existing vegetation surrounding the dwelling.

Figure 9.29 Shows the existing vegetation around the residence

The land rises behind the house (to the north) and vegetation also screens views to the east. The nearest wind turbines that are visible lie to the south east.

Figure 9.30 "Deepwater", view of front of house

Whilst from this garden and from the front of the house the wind farm would be well screened, there is a potential view from the rear veranda which is shown in *Figure 9.31*.

Figure 9.31 View from veranda at rear of house

From the veranda there is a view towards the hills to the south east.

Figure 9.32 Photomontage (60^{O} field of view)

Although the wind turbines are visible from this location, there is extensive existing vegetation around the dwelling and for this reason the overall visual impact from this residence is assessed as low.

Summary of visual impact from Viewpoint R8

Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	2.7 km north west	High
	12 km south east	Low
Overall visual impact		Low

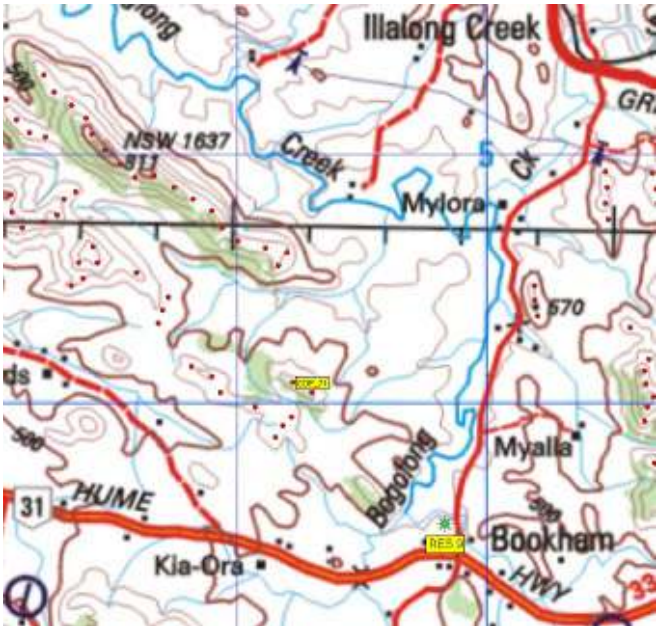
Such impact that does occur could be easily mitigated by appropriate landscape treatment.

9.9 VIEWPOINT R9 – 55 ILLALAONG ROAD (HOUSE #C42)

The residence at 55 Illalong Road (House #C42) is located near the Humne Highway between the Coppabella Hills precinct and the Marilba Hills precinct.

The nearest wind turbine COP71 is 3.7 km to the north west.

The dwelling is located on a hill with views towards the wind farm from the rear yard. *Figure 9.34* shows the existing dwelling.



VP R9 (0649167, 6147567, E478)

Figure 9.33 Shows the existing vegetation around the house

Figure 9.34 The rear of the house

There is a view towards the hills from the rear yard which is shown in the panorama in *Figure 9.36*.

Figure 9.35 Panorama from the rear yard

There is extensive existing vegetation around the dwelling however the nearest wind turbines would be visible and would be just over 3 km away. For this reason the overall visual impact from this residence is assessed as medium without additional landscape mitigation. However additional planting, supplementing that which the owner has commenced, could readily screen the turbines from view, if the owner felt this was desirable.

Summary of visual impact from Viewpoint R9

Item	Description	Evaluation
Landscape sensitivity	Residential	High
Distance to nearest turbine	COP71 – 3.7 km north west	High
Overall visual impact		Medium – without landscape mitigation

9.10 LANDSCAPE MITIGATION FOR RESIDENTIAL PROPERTIES

Landscaping is a mitigation option for residential properties. As the viewing location is relatively fixed, therefore planting may be designed to either screen the wind turbines from view, or significantly reduce the visual dominance of wind turbines through filtering.

Landscape mitigation is possible and desirable for houses located to the north of the wind farm. This screening vegetation on the southern boundaries will protect these properties from southern winds and will not affect solar access. Many properties already have substantial wind break planting along their southern boundaries.

However, it is recognised that the landholder may not wish to establish boundary planting, due to the decrease in viable farmland, or for aesthetic reasons.

The desirability of landscape mitigation measures for houses to the south is lower than for properties to the north. Such measures could affect the solar access to living areas or courtyards. Landscape mitigation measures should be determined on a case by case basis in consultation with landholders to minimise adverse impacts.

Such a process has occurred in past projects, after approval of the wind farm with advice and funding being supplied by the proponent. For example, the Portland Wind Energy Project (Pacific Hydro) involved negotiation with affected landowners to mitigate the visual impacts of the proposed wind farm by landscaping on or adjacent to residences within 2km of the proposed wind farm. This involved a site visit to affected residences and creation of a landscape concept to be implemented by the proponent.

Similarly, the Panel decision for the Bald Hills Wind Farm in Victoria also required the proponent (Wind Power Pty Ltd) to undertake "*specific off-site landscape program works to address residential amenity impacts….subject to agreement with the landowners"*. A similar process could occur on affected residences within 3km of the Yass Valley Wind Farm.

Figure 9.36 shows an example of landscape remediation for a dwelling. This example is based on a particular owner's desire that the views to the wind turbines should be screened or filtered.

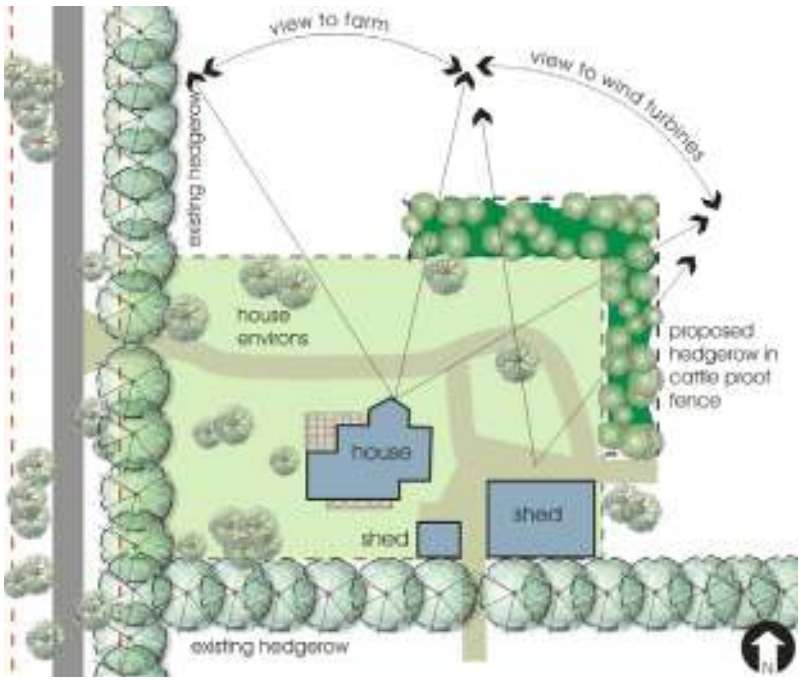


Figure 9.36 Potential Landscape mitigation measures

A site visit would determine the extent of planting between the proponent and the resident. Species selection would be determined in consultation with landholders using advice from the local Landcare group. This example used a mixture of Eucalyptus and Acacia species which was designed to filter the views to the north and to the wind farm.

Planting can be undertaken on residential properties within 3 km of the wind farm, after consultation and agreement with affected landowners. Any such offer should remain in place for a period of 1 year after construction, to allow people time to either adjust or to decide that landscape filtering or screening is warranted.

9.11 SUMMARY OF THE VISUAL IMPACT FROM RESIDENTIAL PROPERTIES

The preceding analysis has examined the potential impact on a number of residences within the viewshed, with the majority being within 3 km of the nearest wind turbine.

Table 9.3 summarises the overall visual impact of all the residential viewpoints discussed in this Chapter.

Table 9.3 Summary of the assessment of the visual impact on residential properties

VP #	Distance to nearest wind turbine	Direction to nearest wind turbine	Overall visual impact
R1	1.3 km	S	**Low** – without screening Existing screening
R2	2.1 km	S	**Low** – without landscape mitigation Screening may not be appropriate
R3	2.2 km	S	**Low** – without landscape mitigation Screening may not be appropriate
R4	10 km	S	**Negligible** – without landscape mitigation Extensive existing screening
R5	4.5 km	SE	**Medium** - without landscape mitigation
R6	2.4 km to the South 8.1 km to the north	S & N	**Low** – without screening Existing screening
R7	2.3 km	S	**Negligible** – Existing vegetation around gallery **Medium** – Bamboo garden without mitigation **Low** – Eco village site
R8	2.7 km	N	**Low** - without landscape mitigation
R9	3.8 km	NW	**Medium** - without landscape mitigation

In these assessments of residential viewpoints the overall visual impact was often assessed as being moderate to low when the wind turbines were visible and there was no existing screening.

The addition of the Carrols Ridge Precinct has only effected a single residence (R6). Should Carrols Ridge not proceed the overall visual impact would still be assessed as low, because of the presence of the northern wind turbines within the Marilba Hills Precinct.

10 CUMULATIVE VISUAL IMPACT

The presence of multiple wind farms in an area can create a cumulative visual impact. This can occur when either sequential and /or simultaneous views to wind turbines from publicly accessible viewpoints or from private viewing locations lead to a change in a community's, resident's or visitor's perception of a region.

Sequential views are those that occur when a viewer at one location observes a wind farm and then from a different location another wind farm. If for example multiple wind farms are located along a highway, then a series of sequential views can occur as a vehicle travels along the highway.

Simultaneous views are those where more than one wind farm is visible from the same location. This usually is defined as views within the same cone of view that is multiple wind farms visible within say a 60^{O} or 90^{O} cone of view. However, a simultaneous view can also occur where a viewer needs to turn their head to see more than one wind farm from a single location

10.1 WIND FARMS IN THE SOUTHERN TABLELANDS

Crookwell Wind Farm, which comprises eight wind turbines is the only constructed wind farm in the vicinity of the Yass Valley Wind Farm. There is an approval to extend this wind farm by a further forty-six wind turbines. The new wind farm boundary can be seen in *Figure 10.1.*

Other approved wind farms in the vicinity of the Yass Valley Wind Farm include the Gunning Wind Farm, which comprises 46 wind turbines and the Cullerin Range Wind Farm which comprises 15 wind turbines are located to the south west of the Yass Valley Wind Farm.

Table 10.1 shows the existing and proposed wind farms in the vicinity of the Yass Valley Wind Farm and their location is shown in *Figure 10.1.*

Table 10.1 Existing and proposed wind farms in the area

Project and Location	Proponent	Project Capacity	No. of Turbines	Status
Crookwell 1 WF, near Crookwell	Delta Electricity	4.8 MW Built 1997	8	(Operational)
Cullerin WF, near Goulburn	Origin Energy	30 MW	15	(Under construction)
Conroys Gap WF	Origon Energy	30 MW	15	(DA approved)
Capital WF, Bungendore	Renewable Power Ventures	126 MW	63	(Under Construction)
Woodlawn WF, near Tarago	Wind Energy JV	50 MW	25	(DA approved)
Taralga WF, near Taralga	RES Southern Cross	186 MW	62	(DA approved)
Gunning WF, near Gunning	Delta Electricity	64 MW	32	(DA approved)
Crookwell 2 WF, near Crookwell	TME	92 MW	46	(DA approved)
Gullen Range WF, near Gunning	Gullen Range Wind Farm P/L	Up to 278 MW	84	(proposed)

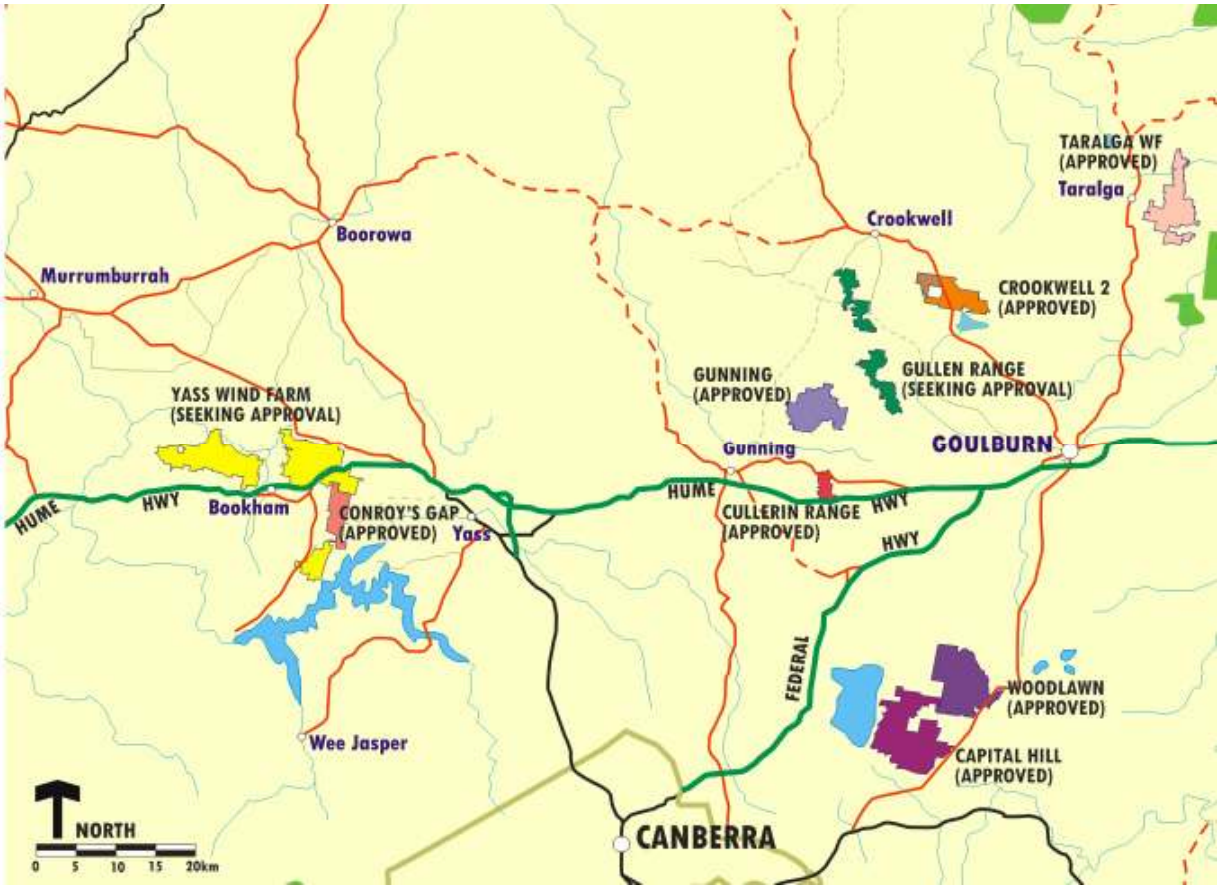


Figure 10.1 Existing and proposed wind farms

Figure 10.1 shows the approved and existing wind farms in the vicinity of the Yass Valley Wind Farm.

Conroy's Gap Wind Farm is the closest approved wind farm to the Yass Valley Wind Farm. The Carrols Ridge Precinct (which will be part of a future Development Application, is immediately adjacent and to the south of Conroy's Gap Wind Farm and this relationship is illustrated in *Figure 10.1*. Other existing and approved wind farms lie more than 50 km further to the east.

10.2 CHANGE IN PERCEPTION

The main cumulative visual impact is that which changes a visitor's or residents perception of an area through which they are travelling.

This is bought about by sequential and/or simultaneous views of multiple wind farms. The greatest chance of changing a viewer's perception of an area is when these views are available from the highways and roads that people use.

Views from towns and regional centres

There are no locations within the township of Yass where one can perceive the Yass Valley Wind Farm. Therefore as there are no views to multiple wind farms from Yass there would be no direct cumulative impact on the township of Yass.

The Yass Valley Wind Farm would be visible from the townships of Bookham and Bowning and there are limited views from Binalong. However there would be no township location where the proposed Conroy's Gap wind farms would add to the impact of the Yass Valley Wind Farm. Therefore there would ne no cumulative impact on the townships in the viewshed of the Yass Valley Wind Farm.

Views from residential dwellings

There will be simultaneous and sequential views of the proposed Yass Valley Wind Farm and the approved Conroy's Gap Wind Farm. The most effected residential properties will be those that are located to the east and west of the Conroy's Gap Wind Farms as illustrated in *Figure 10.2*.

Figure 10.2 Residential Impacts Cumulative

Simultaneous views of both the Yass Valley and Conroy's Gap Wind Farms may be possible from certain locations to the east and west of the Conroy's Gap Wind Farm. In areas south of the Hume Highway the main simultaneous views will be towards the Carrols Ridge Precinct and the Conroy's gap Wind Farm. Carrols Ridge does not form part of this Project Application, however where these two components are seen side by side they will read as a single wind farm.

Residential locations to the east and west of the Conroy's Gap wind turbines could potentially have views of the Conroy's Gap wind turbines. With the construction of the Yass Valley Wind Farm these views could potentially include wind turbines located within the Marilba Hills and Carrols Ridge precincts of the Yass Valley Wind Farm which would increase the level of visual impact. The extent to which this change would be apparent could only be assessed on a case by case basis, however it appears that there are few houses within this zone as seen in *Figure 10.3*.

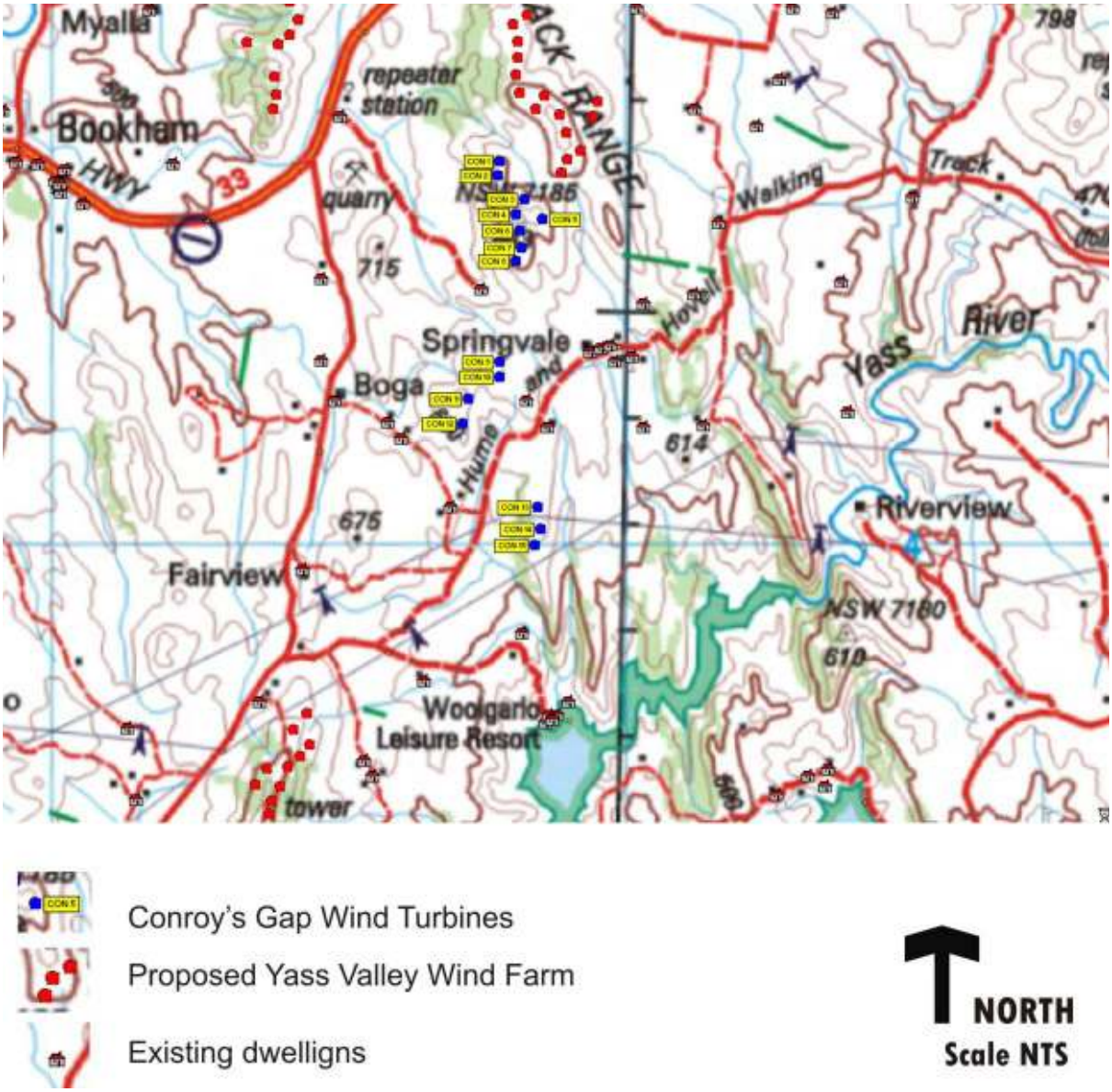


Figure 10.3 Residential Dwellings near to Conroy's Gap

An initial assessment has also shown that many of these houses are well screened by existing vegetation. Therefore the combination of few locations and this existing vegetation would lead to the assumption that the likely cumulative visual impact is probably low.

Residents to the north and south of Conroy's Gap Wind Farm will be potentially more affected by the proposed Yass Wind Farm and Conroy's Gap. From these locations turbines from both wind farms may be silhouetted against each other. However where this where to occur, it would be difficult to differentiate the Conroy's Gap and Yass Valley wind turbines and they would therefore appear as the one wind farm.

Therefore the additional visual impact will be relatively low in comparison to the level of impact that these properties will incur from the presence of the nearest wind turbines.

View from main highways

Travellers along the Hume Highway will pass by the Gullen and Cullerin Range Wind Farm more than 50km to the east of the Yass Valley Wind Farm site once they are constructed.

However as has been demonstrated previously, views from the Hume Highway to the Yass Valley Wind Farm are limited to the road between Bowning and some distance west of Bookham. The only wind farm with the potential to increase a viewers exposure to wind farms in this area is the Conroy's Gap Wind Farm to the south of the Carrols Ridge Precinct on the same range of hills. This would appear as part of the Yass Valley Wind Farm for viewers travelling along the Hume Highway and local roads. Therefore it would only be expected to marginally add to the visual impact of the Yass Valley Wind Farm.

For these reasons, whilst it may be possible for more than one wind farm to be viewed while travelling through the Yass Valley, the cumulative impact would be minimal.

Views from minor / local roads

There may be a cumulative visual impact for users of roads running near the Yass Valley Wind Farm and continuing past other wind farms. However these are typically small gravel roads, serving local farms and the cumulative impact would be negligible.

Overall cumulative impact

This assessment of the cumulative visual impact of the Yass Valley Wind Farm has concluded that there would be minimal cumulative visual impact and that the changes to peoples' perception of the surrounding area would not be significantly changed by the presence of multiple wind farms in the locality. This conclusion that there would be minimal cumulative visual impact has been assessed with the assumption that the wind turbines within the Carrols Ridge Precinct are also constructed.

However there would be no change to the assessment if these were not constructed as any impact that does occur, is present because of the adjacent location of the Marilba Hills Precinct and the Conroy's Gap Wind Farm. The presence of both the Coppabella Precinct and the Carrols Ridge Precinct adds little to the (minimal) cumulative impact of the wind turbines at these two locations.

11 NIGHT LIGHTING ASSESSMENT

Wind farms are generally located away from major population centres and in areas where there are few roads. The assessment of the viewshed of the Yass Valley Wind Farm has identified the low density of occupants within the surrounding area as well as the relatively low usage of the local road network. In essence this has highlighted the fact that the wind farm is located in an area with little night time lighting – albeit with few night time viewers.

There have been no trials of night lighting undertaken in NSW. However some trials have been undertaken in Victoria and night lighting is installed at the Mount Millar Wind Farm in South Australia. These Victorian trials and the existing night lighting at Mt Millar are used to benchmark the impact of night lighting at the Yass Valley Wind Farm.

11.1 PREVIOUS TRIALS

The visual impact of hazard identification lights erected on wind turbines is little tested in NSW while some trials have been undertaken in Victoria to assess the possible impact of various forms of night lighting. Hazard identification lights have been temporarily erected at two Victorian wind farms to assess their visual implications.

However, various options have been trialled in Victoria. Hazard identification lights had been temporarily erected at two Victorian wind farms to assess their visual implications. As well as these trials there have been permanent aviation hazard identification lighting installed at the Mount Millar Wind Farm in South Australia, south of Whyalla. Recently aviation hazard identification lighting was also installed at the Hallett and Snowtown Wind Farms, also in South Australia. A recent trial light installation was also installed on a wind turbine on Cape Bridgewater. This installation and its visual impact are discussed in the following section.

11.1.1 Trial at PWEP (II)

Pacific Hydro erected aviation hazard identification lights on a turbine adjacent to Blowholes Road on Cape Bridgewater for the trial. The installation was inspected on the 9th October 2008. Figure 11.1 shows the locations (VP1–VP4) from which the following photographs of the lit wind turbine were taken and the location of the lit wind turbine (Lit W/T).

Figure 11.1 ***Lit turbine and viewpoint locations*** *(Map Source: Spatial Vision Map Book, Victoria, South west 2007)*

VP1 is taken on Bridgewater Road from a location approximately 5.55km west of the lit turbine at a bearing of 246.5O The photo was taken with a 120mm lens on a Nikon D2X digital camera (0.5sec, F5.6). This lens is the equivalent of a 180mm telephoto lens on a 35mm film camera and it is a low telephoto lens which increases the apparent sizes of objects in the distance.

Figure 11.2 VP1 (GPS S38O 21′ 32.1″, E 141O 25′ 59.7″)

From this location, even when the photo is taken with a telephoto lens, the many other lights in the surrounding area are obvious, however the wind turbine light is elevated in the night sky and after dusk when taken against a black sky, the lit wind turbine will be more visible. On black nights the horizon line will not be visible and the wind turbine light will be one of many lights seen against a black background.

VP2 is taken on Bridgewater Road at a location approximately 2.12km from the lit wind turbine at a bearing of 261.4O. This photograph was taken with an 80mm lens (film equivalent 120mm) with an exposure time of 1sec at F5.3.

Figure 11.3 VP2 (GPS S38O 22′ 32.1″, E 141O 23′ 55.1″)

As one moves closer to the lit wind turbine the apparent size of the light does not dramatically change. Although slightly telephoto this photograph clearly shows the silhouette of the existing unlit wind turbines on the horizon at dusk as well as the visibility of the lit turbine against the sky, even at dusk. At this exposure length the turbine blades are blurred however at this distance there is no apparent flaring along the blades.

VP3 is taken from Blowholes Road at a location approximately 1km from the lit wind turbine at a bearing of 271O. This photograph was taken with a 60mm lens (film equivalent 90mm) with an exposure time of 2sec at F5.

Figure 11.4 VP3 (GPS S38O 22' 44.1", 141O 23' 7")

This longer exposure time from a closer distance allows the slight reflection along a blade to be captured, however this is a very small element above the light source and the reflection only extends a little way along a blade.

VP4 is taken from a location on Blowholes Road directly opposite the lit wind turbine at a bearing of 9O. The lit wind turbine is approximately 100m from this location to the north. This photograph was taken with a 60mm lens (film equivalent 90mm) with an exposure time of 2sec at F4.8.

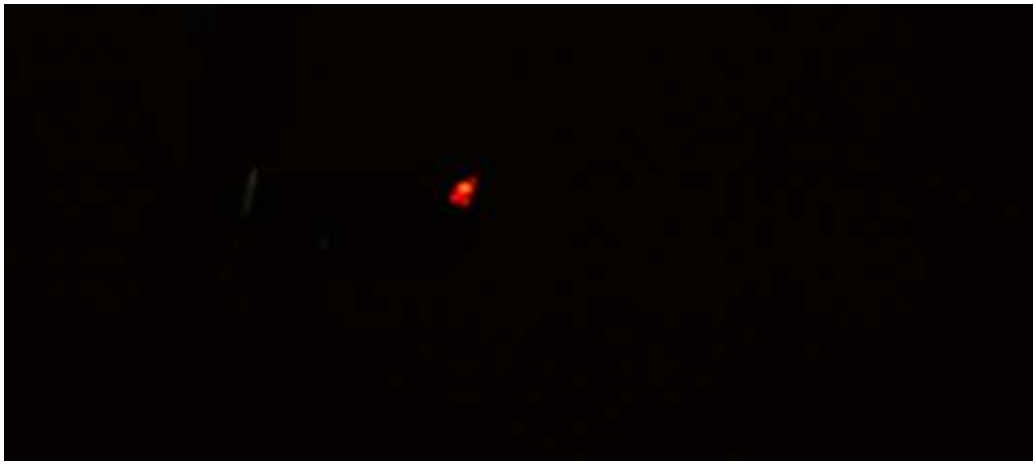


Figure 11.5 VP4 (GPS S38O 22' 42.2, 141O 22' 28.6")

The hazard identification lights, while very visible against the black sky, were a small element in the night sky.

These photographs from a range of locations between 5.5km to directly opposite the lit turbine have demonstrated that the lighting will be visible; however the impact is not great. Especially where there are other lights in the vicinity of the wind farm the impact will be minimal.

11.1.2 *Trial At Challicum Hills Wind Farm*

Trial hazard identification lights were installed at the Challicum Hills Wind Farm by Pacific Hydro in 2005 to assess the potential loss of visual amenity caused by hazard identification lighting during the assessment of the proposed Yaloak Wind Farm. The lights trialled were red flashing incandescent medium-intensity lights (2000cd). Challicum Hills Wind Farm is located on low lying cleared hills south of Ararat in central Victoria.

This trial demonstrated that the impact of this lighting configuration was high at ground level immediately adjacent to the tower on which the lights were installed particularly because of the light spill along the turbine blades which created a "strobing" effect which could be seen from some distance in the surrounding areas. There was little apparent diminution of visibility due to the horizontal baffles, which were fitted to the incandescent lights. The red glow was still visible against the darkened sky, even from immediately below the lights.

In a recent decision of Planning Panels Victoria, the Yaloak Panel came to the following conclusions after viewing a test site at Challicum Hills Wind farm:

> *A night-time inspection of the operating lights revealed that the obstacle lights are highly visible from distances of up to 25 kilometres with impact occurring from both the primary light source, and from reflection off the rear of the generator blades (thus increasing their impact). There was generally agreement at the site inspection that the amenity impacts of the lights is unacceptable and that the lights would have significant impacts on residents of the Parwan Creek valley.* (Yaloak Planning Panel 2005)

However, this assessment was primarily based on an inspection immediately adjacent to the installed lights and more emphasis should have been placed on assessing the potential visual impact from greater distances where residents and travellers on the local road network were more likely to be located.

Since the trial at Challicum Hills Wind farm other lighting options have been trialled to assess if they can reduce visual impact. One option was to replace the incandescent lights with light-emitting diodes (LED). LED's are a semiconductor device that emits coherent narrow-spectrum light. These can be in any colour, including red.

It is considered that LED's provide several advantages from a visual perspective over incandescent lights as they are easier to baffle and can be programmed to light to their peak intensity more slowly than incandescent lights.

11.1.3 Trials at Wonthaggi Wind Farm

Hazard identification lights of low-intensity (170cd) LED blinking type were erected at Wonthaggi Wind farm in December 2005 and again in April 2006. Wonthaggi Wind Farm is on the Victorian coast approximately 100km south east of Melbourne.

Trial #1 – Wednesday 14th December 2005

In December 2005, a blinking light was installed at the top of a single wind turbine on the Wonthaggi Wind Farm with photographs taken to record the visual impact from various distances.

These lights blink in intervals in an irregular cycle. (ON for 1sec, OFF for 0.5sec, ON for 1sec, OFF for 1.5sec). The irregular cycles are considered best for safety and act as a deterrent to birds. These low-intensity lights currently meet air safety standards in some European countries.

Figure 11.6 Low-intensity hazard identification lights and car lights at Wonthaggi Wind farm

Figure 11.6 illustrates the view from approximately 7.6km from the hazard identification lights. On the right of Figure 11.6 one can just discern the hazard identification lights visible in the distance. Although indistinct in this photo they were still quite clear when viewed against the night sky. In fact their visibility at this distance was a little surprising. The diminution of clarity of the lighting did not reduce with distance to the same extent that objects do during daylight. To the left of Figure 11.6 one can easily discern tail lights of moving traffic along the Bass Highway. It is evident that these car lights are much more prominent against the night sky than the aviation hazard identification lights at this distance.

This trial demonstrated that the visual impact on the surrounding areas of the low-intensity hazard identification lights was low. While the red glow of the light was visible against the dark sky, its intensity was comparable (and in many cases far less than) than lights on rural properties and on streetlights or vehicles.

Unlike the visual impact of the incandescent medium-intensity hazard identification lights seen at the Challicum Hills Wind Farm, the W-Red lights of 170cd trialled at Wonthaggi Wind Farm had reduced the visual impact and completely removed the "strobing effect" that was apparent in close proximity to the wind turbines seen at the earlier demonstration at Challicum Hills.

Trial #2, Wednesday 19th April 2006

CASA requires medium intensity lighting in Australia. A second trial at Wonthaggi Wind farm was undertaken in April 2006. In this trial two different hazard identification lights were erected. One was a MB80 medium intensity obstacle marker (2000cd), while the other was a Sealite AV 200 low intensity obstacle marker (170cd).

Whilst the low intensity light had less visual impact than the medium intensity light, both remained less visible than local display lighting, street lighting and the lighting spill from domestic locations (*Wonthaggi Windfarm Obstacle Marker Light Evaluation for Sustainability Victoria, Robert J Showers and Associates, Lighting Consultants, May 17, 2006*).

This report also commented on the narrow beam distribution and the lack of illuminance at ground level, which also agrees with the observations later in this report of medium intensity lights.

11.2 INSTALLATION AT THE MOUNT MILLAR WIND FARM, SOUTH AUSTRALIA

The Mount Millar Wind Farm is located on the Eyre Peninsula in South Australia, near the township of Cowell, which lies approximately 100 km south of Whyalla. The hazard identification lights at the Mount Millar Wind Farm are medium intensity lights (2000cd).

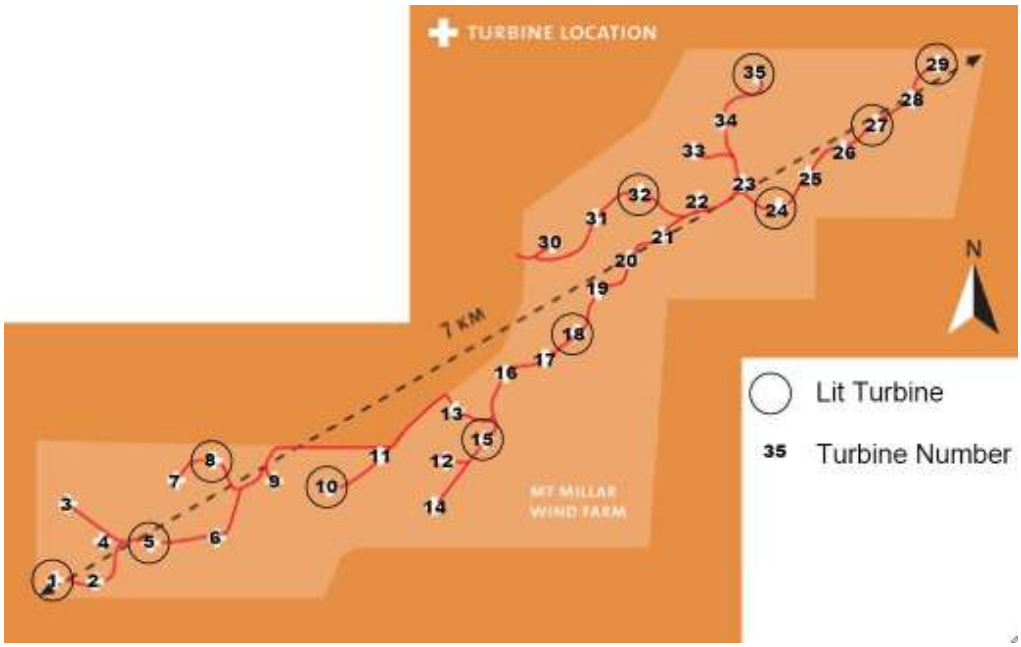


Figure 11.7 The layout of the 35 turbines and the lit turbines at the Mt Millar Wind Farm

The 35 wind turbines are laid out along a ridge running from the north east to the south west. At the time of the site visit 9 wind turbines were lit with flashing red medium-intensity LED hazard identification lights. The lights were not synchronised. Subsequently two additional lights became operational, bringing the total number of wind turbines with hazard identification lighting to eleven.

The wind turbines are 2 MW Enercon turbines, with a blade diameter of 71 m and a turbine hub height of 85 m giving an overall height of 120m.

The hazard identification lights are medium intensity lights (2000cd). However, unlike the medium intensity lights trialled at Challicum Hills Wind Farm, these are LED lights are designed to restrict the light spill to 3O as shown in **Error! Reference source not found.**.

The Mount Millar Wind Farm was visited in the evening of the 20th July 2006. It was a clear night, initially with some cloud cover on the horizon, and with very good visibility.

Figure 11.8 Mt Millar Wind Farm at dusk

When standing close to a lit wind turbine the difference between these lights and those used at the Challicum Hills trial was immediately obvious. At a distance of 350-400m there was a glow around the lights and only the faintest strobing effect along the moving blades.

Figure 11.9 Lighting on a Turbine at a distance of 250m

The strobing effect is indistinct and much less than was observed at Challicum Hills.

A comparison with the security lighting at the substation also revealed that the lighting used at this facility was of a much greater intensity than that used on the wind turbines.

Figure 11.10 Lighting on the substation and a turbine in the background

The substation is in the foreground of Figure 11.6, with the two hazard warning lights on a turbine immediately behind the substation. The hazard identification lights are less of a visual impact than this facility that has no more lights than many houses, dairies or farm working areas. At a distance of 1 km to 1.5 km the similarities between the Mt Millar aviation hazard identification lighting and the trial lights at the Wonthaggi Wind Farm became obvious.

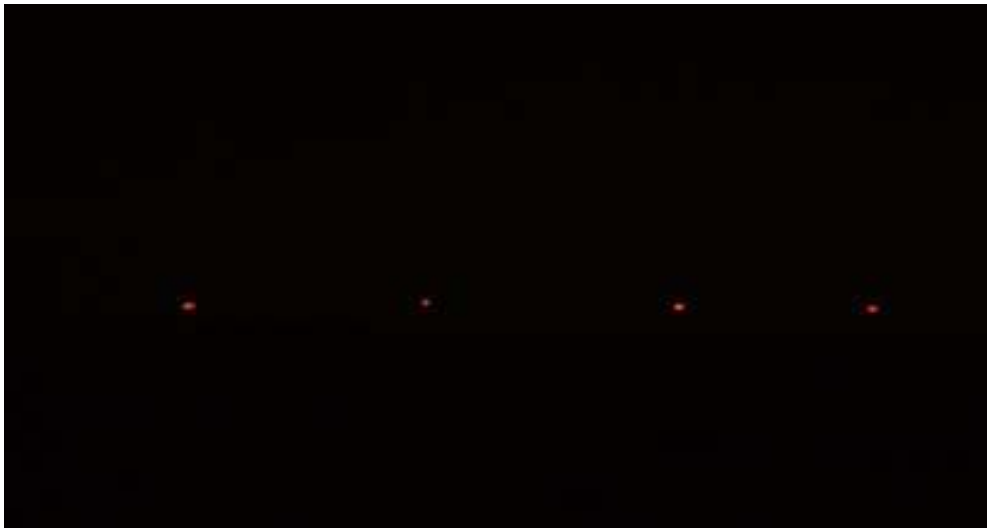


Figure 11.11 Lighting on the wind turbines from a distance of 2.0km

Although the Mt Millar lights are 2000cd medium-intensity hazard identification lights, at these distances there was no sign of any strobing along the blades and the visual impact was identical to that observed at Wonthaggi with W-Red lights of 170cd intensity at a similar distance. That is, the lights were visible, but they had none of the eerie character of the Challicum Hill lights at a similar distance.

11.3 ASSESSMENT OF VISUAL IMPACT OF THE PROPOSED NIGHT LIGHTING

These trials and inspection of an operating facility have clearly identified that the type of lights do make a difference to the visual impact.

The night lighting trialled at Wonthaggi gave an acceptable level of visual impact. The planet Venus in the night sky and car lights at similar distances, were both of greater intensity than the proposed hazard identification lighting.

The hazard identification lights at Mt Millar have also supported the assessment that there are forms of hazard identification lighting that do not create such a degree of visual impact as that exhibited in the Challicum Hills trial.

That being said the hazard identification lights are still an obvious element in the landscape. There are few light sources in the proposed location of the Yass Valley Wind Farm. Wind turbines will therefore be an obvious addition to the night panorama. However, as stated earlier, few light sources are also an indication of few viewers.

For locations both in the centre and on the edges of Crookwell there are many light sources. These include street lights, shop fronts, residential dwellings and vehicles.

If lights are required by CASA, it is considered that the solution constructed at Mt Millar provides an acceptable level of visual impact while providing the required level of night time hazard identification.

11.4 CUMULATIVE IMPACT OF HAZARD IDENTIFICATION LIGHTING

A cumulative impact can potentially be envisaged for travellers on the Hume Highway, passing multiple Wind Farms where hazard identification lighting may be visible. However, whilst the lighting may be visible, it will only be one further element in a traveller's experience which

obviously includes the frequent presence of rear tail lights, headlights and lights from nearby houses and farms. As such the cumulative visual impact for these road users will be minimal.

There would also be some residents located in the area around the Yass Valley Wind Farm which may also be able to see the hazard identification lighting from other wind farms. However, although residents may be able to see hazard identification lighting of multiple wind farms such impact would effect few houses, and be a relatively small visual impact because when people are at home at night and when inside lights are on, windows become mirrors, reflecting the interior of the house and not allowing views to the low level lights in the distance. Obviously when curtains or blinds are closed, there is also no visibility to the proposed lights in the surrounding area. Therefore at night in most situations, a viewer needs to be outside to even see the proposed hazard identification lights.

For these reasons there would be negligible cumulative impact from the proposed hazard identification lighting if they were installed both at the Yass Valley Wind Farm and other wind farms in the vicinity.

12 CONCLUSION

In summary, this landscape and visual impact assessment demonstrates that the proposed Yass Valley Wind Farm will have a generally low visual impact on its surrounds, and the site is a suitable landscape for the construction of a wind farm.

This conclusion was based on a landscape and visual assessment which included the Carrols Ridge Precinct (up to an additional 30 wind turbines) which is not part of this Project Application for Development Approval, but will be part of a future application.

This conclusion is supported by:

- Perception studies which continually show that the majority of viewers do not object to the construction of wind turbines on any but the most sensitive and localised landscapes. This is supported by the social research undertaken not only for the Yass Valley Wind Farm but also for other wind farms.
- Targeted social research on perception was also undertaken by the proponent and has clearly demonstrated that there is a very high level of support for wind farms amongst local residents in the area with 89% supporting wind farms on the Southern Tablelands and 71% supporting wind farms within 1km of their residence.
- The proposed Yass Valley Wind Farm site is located in a man-modified landscape. The landscape units in the viewshed are well represented across this area. Agricultural activity, associated structures and other signs of human intervention have also created a landscape that can absorb other changes.
- There is low visual impact on townships. There are limited locations from which long distance views are available from the townships of Yass to the east and the villages of Bowning and Binalong to the east and north-east. The visual impact from these towns would be negligible. There is also minimal to no visibility of the wind turbines from other smaller settlements in the area.
- The main visibility is from major roads. The Hume Highway, to the south and the Burley Griffith Way to the north are two major roads within the region. Although there will be views from these two highways the overall impact is expected to be medium due to the predominately medium landscape sensitivity.
- There will be a visual impact on viewers using the minor roads within the locality especially where these run along the wind farm precincts. These un-made roads run along and through the different precincts within the Yass Valley Wind Farm. Visibility from these minor roads, which have far fewer users than the highways and main roads, is sometimes, but not always, restricted by roadside vegetation, however there is no doubt that there will be extensive views from this road network. It is considered that the visual impact will be minor from these locations predominately because the viewer numbers are low. The addition (or removal) of the Carrols Ridge Precinct will make no difference to the impact from these minor roads, except from roads that run adjacent to the Carrols Ridge Precinct wind turbines..
- The zone of greatest potential visual impact for residential properties lies within three kilometres of the nearest wind turbine. There are 26 non-participatory residences within 3 km of the two precincts within the current Project Application for Development Approval. This increases by a further 7 houses to a total of 33 non-participatory residences, when the wind turbines within the Carrols Ridge Precinct are also included. However many of these existing residences have screening in the form of wind breaks. Landscape mitigation can be effective in lessening the visual impact on residential properties without existing screening.
- The cumulative visual impact of the proposed Yass Valley Wind Farm with other wind farms in the area is expected to be no greater than the visual impact of the Yass Valley Wind Farm by itself. Users of the Hume Highway and Burley Griffin Way will, in the future, pass other sites, and there is the probability that the acceptance levels will reduce. There is no doubt that this will be the case for users of the Hume Highway to the south, where there is the potential for sequential views to be afforded by the Yass Valley Wind

Farm and the proposed Conroy's Gap Wind farm.. Further away travellers will pass the Cullerin Range Wind Farm. The addition (or removal) of the wind turbines within the Carrols Ridge Precinct, will make little difference to the cumulative impact on Highway users as these additional wind turbines, should they be approved within a future Development Approval, will be read as part of the Conroy's Gap Wind Farm.

- The level of cumulative visual impact for users of Burley Griffin Way would be less as there are few opportunities for sequential wind farm views. It is therefore assessed as being a low adverse visual impact. The presence of the Carrols Ridge Precinct would make no difference to any assessment of the cumulative visual impact from this Highway.
- There are few local roads where multiple wind farms become visible, either sequentially or simultaneously and as it is these viewing experiences that can change peoples' perception of an area. Therefore the visual impact is no greater than that assessed from individual viewpoints and that the cumulative visual impact is considered to be low.
- If obstacle identification lighting is required by CASA the visual impact would be low. In part this assessment is based on the type of lights now used and also on the night time environment of the area which already contains multiple existing light sources, including lights from traffic using the Highways.

Annex A

Community Perception Studies

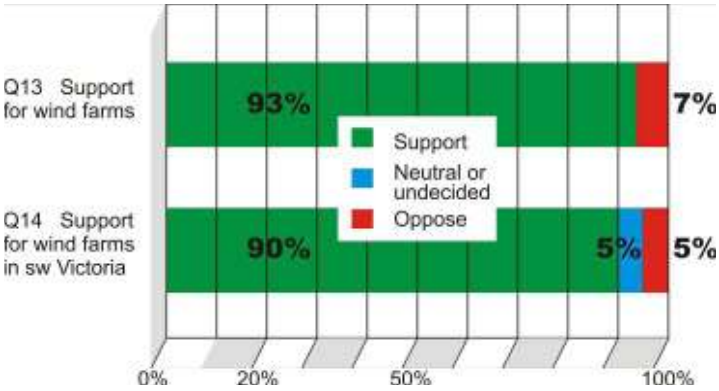
Annex A Community Perception Studies

The results summarised in 'Chapter 3 – Community Perception Studies' are also supported by many other studies undertaken in Australia, NZ, the UK and the USA. Some of these studies are summarised below.

A.1 LAL LAL WIND FARM – COMMUNITY PERCEPTION TOWARDS WIND FARMS

A study was undertaken in an area surrounding a proposed wind farm at Lal Lal. Lal Lal is located to the south east of Ballarat, between the Midland Highway and the Western Freeway. This study (*Lal Lal Wind Farm, Report on Community Perceptions towards Wind Farms in Victoria for West Wind Pty Ltd*, prepared by ERM & Reark Pty Ltd, September 2007) has shown that there is a high degree of acceptance of wind energy by residents within the area surrounding the Lal Lal Wind Farm.

Results show an approval rating of more than 9 in 10 (93%) despite the visibility of wind turbines, most people felt that "*we need to use wind power as a source of energy even if it means changing the appearance of some landscapes*".



FigureA.12.1 Lal Lal area: Support for Wind Farms

In fact most respondents (82% favour, 8% opposed) were accepting of a wind farm that was set back 5 or 10 km from the coast on flat or undulating grazing land (82% favour; 8% opposed). These acceptance figures are greater than those found in past Victorian and overseas studies; however they are very similar to the figures for the Ararat Wind Farm.

Similarly, the level of acceptance of a wind farms was also high when the proposed wind farm was near to a respondent's place of residence. This is summarised in *Figure A.12.2*.

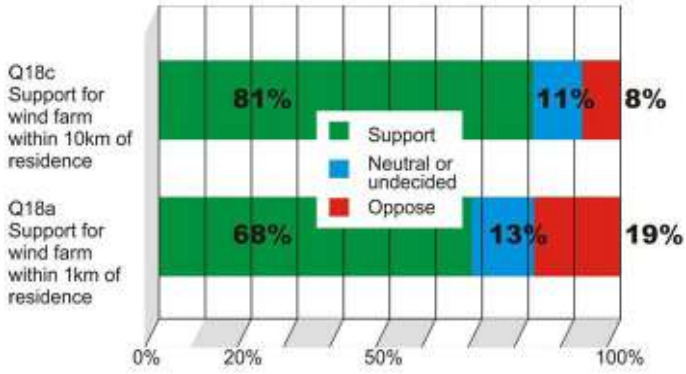


Figure A.12.2 Lal Lal area: Support for Wind Farms near Residence

This research has demonstrated an increase in acceptability of wind farms to previous studies although it may be hypothesised that the increasing political and community awareness of global warming and its impact on the environment has also increased the level of acceptance within this community.

A.2 ARARAT AREA – COMMUNITY PERCEPTION TOWARDS WIND FARMS

A similar study of community perceptions of wind farms in the Ararat area has been undertaken *(Report on Community Perceptions towards Wind Farms in the Ararat Region, Victoria* for RES Australia Pty Ltd, prepared by Environmental Resources Management Pty Ltd & Reark Pty Ltd, *November 2007*). This study has shown there is a high degree of acceptance of wind energy by respondents within Ararat and the surrounding area. While the entire perception study has been appended to the notification documentation, relevant sections are also included in this 'Preliminary Landscape and Visual Assessment' as appropriate.

Results have also shown an approval rating of over 9 in 10 (94%, 2% opposed) respondents in favour of wind farm projects being developed in south-western Victoria. With over 9 in 10 (96%) of respondents agreeing that '*wind energy is a good alterative energy source*', see *Figure A.12.3.*

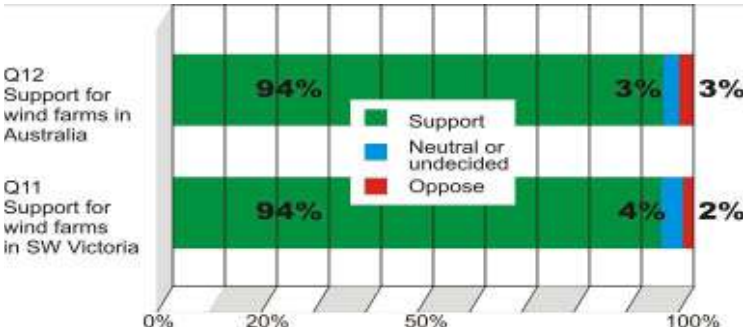


Figure A.12.3 Ararat area: Support for wind farms

Further to this, most respondents (82% favour, 2% opposed) were accepting of a wind farm set back 10 kilometres from their home, with a slight decrease to 7 in 10 respondents (71% Favour, 15% opposed) accepting a wind farm set 1 kilometre from their home, see *Figure A.12.4.*

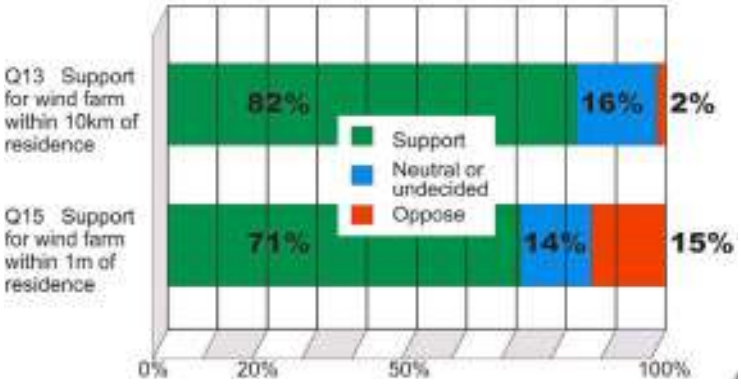


Figure A.12.4 Ararat area: Support for wind farms near respondents' residence

In response to introducing the concept of multiple 'typical' (30 to 40 turbines) wind farms in the local rural area, 87% respondents accepted (7% opposed) one typical wind farm, with three typical wind farms accepted by 71% (18% opposed), see *Figure A.12.5*.

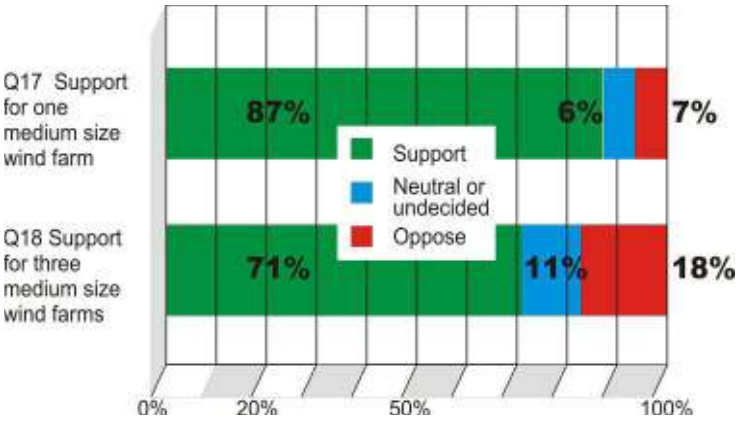


Figure A.12.5 Ararat area: Support for multiple wind farms

These results again highlight the remarkably consistent levels of approval for one or more wind farms in the area. The lowest level of acceptance at 71% for three wind farms is again very similar to the levels of support shown for the most sensitive of locations, whether within one kilometre of the respondent's house or on coastal headlands along Victoria's coast.

The study also found that the community has no clear preference between a few clusters, close together, or spread out at reasonable intervals along the highway. Therefore, it would seem that this landscape can absorb future wind farm developments, as the community has not a strong preference.

This is a very similar level of acceptance that has been identified in the recent Lal Lal Wind Farm study. Lal Lal Wind Farm was located in central Victoria in a landscape that was not dissimilar to that of the Ararat site.

A.3 OTHER AUSTRALIAN COMMUNITY PERCEPTION STUDIES

The following section builds upon ERM's discussion of perception issues in past visual assessments of other wind farms and is pertinent to the visual and landscape assessment of the proposed Ararat Wind Farm.

A.3.1 *Coastal Headlands*

In 2000, a study was undertaken for the Department of Natural Resources and Environment (Kantos & Quint, 2000) on the many issues concerning the Victorian Coastline including the construction of wind farms on coastal headlands.

Figure A.12.6 summarises the results of this particular component. The study involved a series of nine workshops as well as telephone interviews (n = 700).

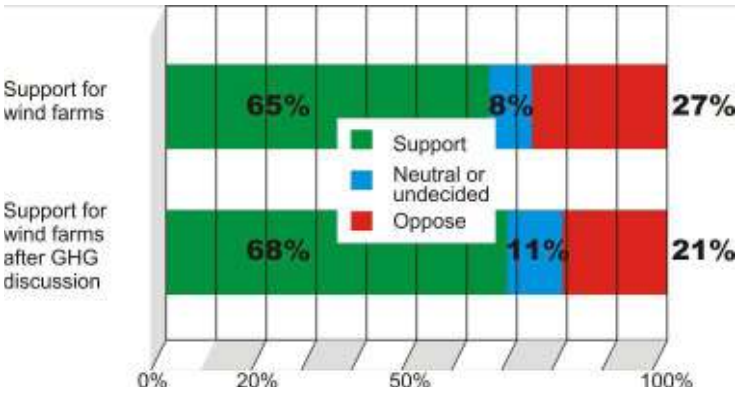


Figure A.12.6 Wind farms on Coastal Headlands – Participant Responses

Study participants initial support or opposition to the construction of wind farms on coastal headlands was measured. After being exposed to arguments on renewable energy, greenhouse gas emissions and climate change issues their responses were measured again. This study found that there was only a slight increase in participants' acceptance of wind farms on coastal headlands, from a 65% acceptance level before arguments on greenhouse gas emissions to 68% acceptance after these arguments were presented. However opposition reduced from 27% to 21%.

A.3.2 *Nirranda Wind Farm*

Similar figures have been found in a 2002 visitor survey undertaken for Stanwell Corporation Limited (Offer Sharp & Associates 2002) on the possible visual impacts of the proposed wind farm on the Bay of Islands viewing platform that is located adjacent to the Nirranda site, in the Shire of Moyne approximately 250km west of Melbourne.

Approximately 80% of people were generally in support of wind farms, however when presented with a proposal for a wind farm visible from a scenic coastal lookout (the Bay of Islands) the support for a wind farm at this location reduced to approximately 71%, whilst opposition to the presence of a wind farm at this location increased from 3% to 12%.

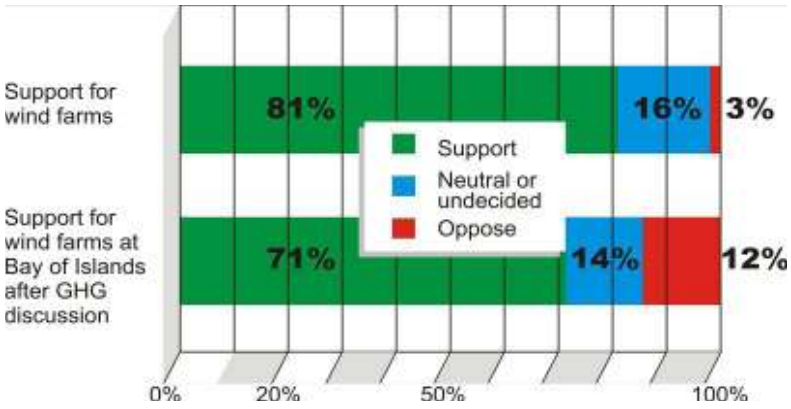


Figure A.12.7 Nirranda Wind Farm Respondents Attitudes to Wind Farms

This figure of 71% support for wind farms is similar to the Kantos & Quint result of 68% reported previously for wind farms on exposed coastal headlands (refer Figure A.12.6 Wind farms on Coastal Headlands – Participant Responses).

A.3.3 Yaloak Wind Farm

Research undertaken by Offer Sharp & Associates, 2004 presented at the Yaloak Wind Farm panel hearing in 2005 showed a similar level of community acceptance to wind farms on this inland site near Ballan, Victoria.

The study assessed community reaction to images of a wind farm in the Yaloak landscape as well as at another site at Crowlands in Western Victoria. Neither location was identified, however the Yaloak proposal had been publicised for some time before the survey and the landscape may have been recognised by some, and particularly local, respondents. Community reaction to the siting of wind turbines in these landscapes was based on interviews with 200 respondents from each of Melbourne, Bacchus Marsh and Ballarat.

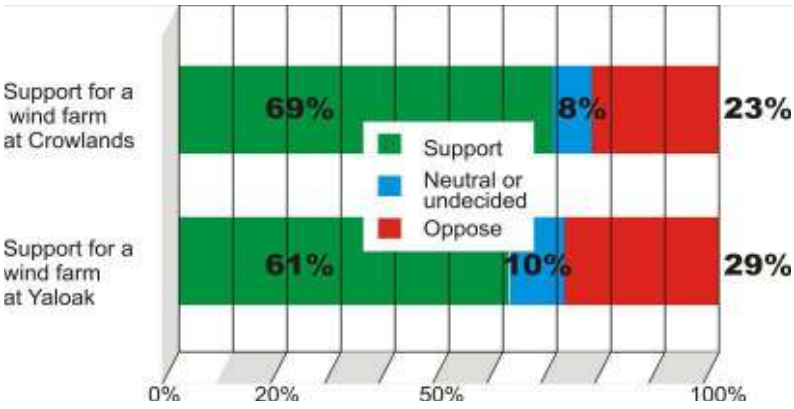


Figure A.12.8 Level of Support for Potential Wind Farms at Yaloak and Crowland

This data has been extracted from *Table 15 Crowlands* and *Table 19 Yaloak* in the Offer Sharp & Associates 2004 report and illustrates the acceptance levels for wind farms of each of these sites. The study also found slight differences in levels of support at Crowlands (67%, 66% and 73%) for respondents from Melbourne, Bacchus Marsh and Ballarat respectively, and slightly larger differences (61%, 55% and 68%) in support for the proposed wind farm at Yaloak.

However, the overall findings are similar of the earlier studies from the earlier Kantos & Quinn 2000 and Offer, Sharp 2002. All these Australian studies continually show a level of acceptance greater than 60%. Overseas studies show similar results.

A.4 OVERSEAS STUDIES

Community perception studies have also been undertaken overseas to gauge levels of community support and opposition to wind farms.

A.4.1 United Kingdom

A paper presented at the 20th British Wind Energy Association Conference (Anne Marie Simon Planning, 1996) gives an overview of thirteen studies undertaken between 1990 and 1996 by wind power proponents, opposition groups, the BBC, statutory authorities and a Liverpool University dissertation found that in all these studies:

- The overwhelming majority of respondents support the principal of development of wind power in the UK, and they also support their local wind farm;
- Those with direct experience of an operating wind farm are more supportive and positive than those without experience;
- Once wind farms are in operation, concerns about noise and visual impact decrease;
- The majority of people find the wind farms acceptable in the landscape and more find the wind turbines graceful than ugly; and
- A strong majority support and a small minority oppose wind farms, with more expressing no opinion than opposition (Freris 1998).

A summary of the results for eleven of these studies, which is taken from this paper (*Anne Marie Simon Planning, 1996*), are reproduced below.

Table A.1 Summary of Eleven Studies Conducted in the United Kingdom into Attitudes to Wind Power from 1990-96

Location	Sponsor/Organiser	Date	In favour	Against	Don't know
Delabole, England	DTI	1992/3	84%	4%	11%
Cemmaes, Wales	DTI	1992/3	86%	1%	13%
Llandinam & Llangwyryfon, Wales	CCW	1992/3	83% 78%	3% 8%	14% 14%
Llandinam Rhyd-y-Groes Taff Ely, Wales	BBC	1994	76% 61% 74%	17% 32% 9%	8% 7% 17%
Kirkby Moor, England	National Wind Power	1994	82%	9%	9%
Bryn Titli, Wales	NWP (pre construction) NWP (open day)	1996	68% 94%	14% 3%	19% 3%
Trysglwyn, Wales	NWP (open day)	1996	96%	4%	-
Coal Clough, England	Liverpool University Dissertation	1996	96%	4%	-

Notes
NWP = National Wind Power (a wind farm developer).
CCW = Countryside Council for Wales (a statutory body)
BBC = BBC (Wales) and the University of Wales

In all these studies between 61% and 96% of survey respondents were supportive of wind power.

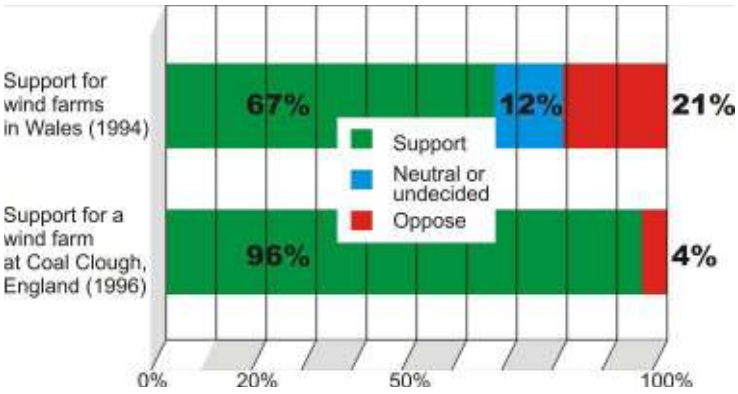


Figure A.12.9 ***Comparison of Selected Wind Farm Community Perception Studies in the United Kingdom***

The lowest level of acceptance was one area within the BBC 1994 study which looked at attitudes towards wind farms in Wales (Interviews with 268 respondents, conducted in two stages; stage one being just after the wind farm was built and stage two one year later). The BBC study also looked at three locations, Llandinam, Rhyd-y-Groes and Taff Ely) with the lowest support for the wind farm at Rhyd-y-Groes with 61% support and 32% against, whilst overall the BBC study found that 67% of respondents were in favour of the development of wind power in Wales, and 21% were opposed.

The highest approval was that reported in the Coal Clough (Lancashire, England) study (Questionnaire completed by face to face interviews, sample of 50) with 96% approval and 4% opposition.

These figures are similar to those reported in the Australian studies.

A.4.2 Scotland & Ireland

A recent study (November 2005) on community perception of wind farms in Scotland and Ireland also has similar, but higher approval ratings. (found at http://www.your-energy.co.uk/pdf/windfarmpaper121205.pdf).

Table A.2 Comparison of levels of acceptance between wind farms in Scotland and Ireland

	Strongly support		Support		Neutral		Oppose		Strongly oppose	
	DL (%)	BH (%)	DL (%)	BH (%)	DL (%)	BH (%)	DL (%)	BH (%)	DL (%)	BH (%)
A. Wind power is Scotland	55	55	35	22	6	16	2	0	2	7
B. Local wind farm	63	47	25	16	3	20	3	4	5	13

DL = Dun Law (operational site). BH = Black Hill (proposed site).

Table compiled from data from *Public Perceptions of Wind Power in Scotland and Ireland*, Charles R. Warren, Carolyn Lumsden, Simone O'Dowd & Richard V. Birnie, Journal of Environmental Planning and Management, Vol. 48, No. 6, 853 – 875, November 2005, Table 4, p862.

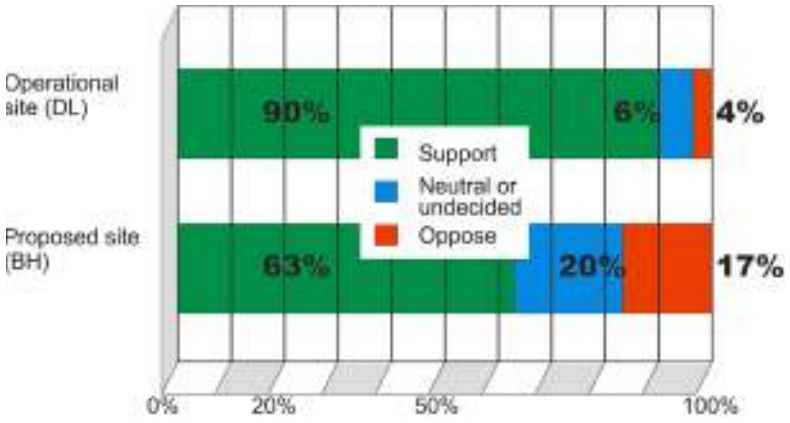


Figure A.12.10 Acceptance levels - Scotland and Ireland

Once again this reconfirms that the high level of acceptance, and this report also goes further and shows the increased level of acceptance within a community following construction. This is discussed in the next section of this report.

A.4.3 North Carolina, USA

Reported attitudes in a study from North Carolina (NC) in the USA are also similar. A paper prepared on public attitudes (Grady 2004) towards wind energy in eastern NC, which included coastal areas, and western NC, which includes mountainous areas, presented to the 'Efficient NC Conference' also found similar degrees of approval. Note: There was no information in this paper on the sample size.

Table A.3 Public Attitude to Placement of Wind Farms in Eastern NC

Placement	% Prohibited	% Not prohibited	% Don't know
Mainland	11.9	72.8	15.3
Mainland clustered	14.1	69.6	15.1
Sounds	16.6	63.6	19.8
Sounds clustered	28.0	50.2	20.5
Offshore	13.9	68.6	17.6
Offshore clustered	14.4	68.6	15.8

Table A.3 shows the level of acceptance for clusters of wind turbines reduced to 50% for the Sounds which are the coastal areas along the eastern seaboard of North Carolina. The level of acceptance for clustered groups of wind turbines in the mainland area rose to 69.6%.

This paper (Grady, 2004) also presented levels of acceptance within the more mountainous areas of Western NC.

Table A.4 Public Attitudes to Wind Farm Placement – Western NC

Placement	% Prohibited	% Not prohibited	% Don't know
Ridgetops	20	64	17
Ridgetops clustered	28	57	15
Ridgetops with other towers	16	75	10

The western area of Northern Carolina is mountainous; many parts are uncleared and show few signs of human intervention. The level of acceptance for clustered groups of wind turbines on ridge tops in this area is less (57%) than the level of acceptance reported for the mainland areas of Eastern NC (69%), however if there are other towers on the ridge tops (ie there are obvious signs of human intervention) then the level of acceptance rises to 75%.

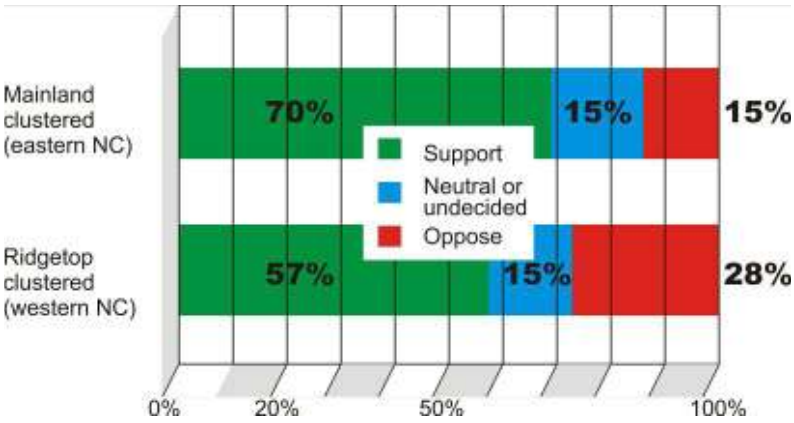


Figure A.12.11 Acceptance Levels - Northern Carolina, USA

In summary this paper reported that:

- *"within groups of middle aged, middle class, pragmatic, year round residents of the mountain and coastal regions of NC, there is support for developing renewable energy as a future source of fuel for electricity generation.*
- *More than 3 out of 4 would prefer to see more future electricity derived from solar and wind*
- *Less support for turbines in sounds or national forests*
- *2 out of 3 support turbines visible from home*
- *Over 80% support turbines for residential use."*(Grady, 2004)

The degree to which the respondents believe that wind farms on mainland sites should not be prohibited is very similar to the previously cited United Kingdom and Australian studies; with between 69-73% believing that wind farms should not be prohibited.

A.5 PERCEPTION ALTERATION AFTER CONSTRUCTION

There has been no research done on the visual impact of wind farms in Australia after construction, however overseas studies suggest greater acceptance levels by people who live in the vicinity of wind farms after their construction (Gipe n.d.)

Anne Marie Simon Planning and Research in the previously cited study also found that all studies that looked at perceptions before and after construction, reported an increase in acceptance after the Wind Farm was completed.

It is also interesting to note that the study on Scotland and Ireland (cited above) also shows a 27% increase in acceptance following construction, although the greatest proportion of people who changed their mind were in the "neutral or undecided" group, there was still a significant reduction from 17% to 4% in the group that opposed the wind farms.

This study supports the view that familiarity does not increase opposition to a wind farm, but rather increases acceptance and support for wind turbines in the landscape.

Annex B

Parameters Of Human Vision

Annex B Parameters Of Human Vision

The viewshed for the Yass Valley Wind Farm can be determined by determining the extent to which an object is part of an observer's static field of view. The viewshed in a man-modified landscape has in past projects been delineated to that area in which an object takes up at least 5% of the field of view.

The measurement of the field of view is based upon the parameters of human vision outlined below. These provide a basis for assessing and interpreting the impact of a development by comparing the extent to which the development will intrude into the central field of vision (both horizontally and vertically).

HORIZONTAL FIELD OF VIEW

The central field of vision for most people covers an angle of between 50^{O} to 60^{O}. Within this angle, both eyes observe an object simultaneously. This creates a central field of greater magnitude than that possible by each eye separately.

This central field of vision is termed the 'binocular field' and within this field images are sharp, depth perception occurs and colour discrimination is possible.

These physical parameters are illustrated *in* ***Figure B.1***.

The visual impact of a development will vary according to the proportion in which a development impacts on the central field of vision.

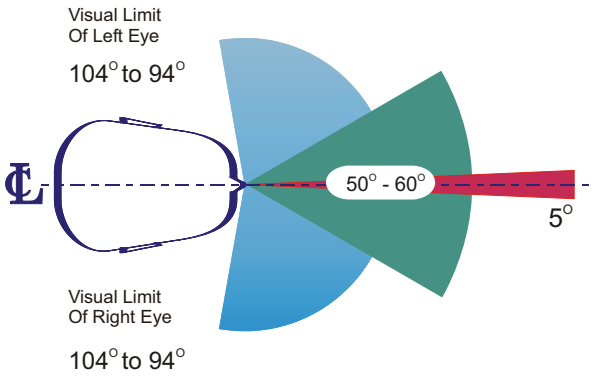


Figure B.1 Horizontal Field of View

Developments, which take up less that 5% of the central binocular field, are usually insignificant in most man-modified landscapes (5% of 50^{O} = 2.5^{O}).

Viewshed Based on the Horizontal Field of View

The viewshed of a single wind turbine is calculated on the extent to which a single wind turbine (in this example the widest section is the swept path of the rotor) would intrude into the 60^{O} central field of vision.

The table below analyses' the extent to which a swept path of a single rotor would interrupt the horizontal field of view.

Table B.1 *Viewshed based on the degree a swept path of a single rotor would take up in the horizontal field of view*

Horizontal Field of View	Visual Impact	Distance from an observer to a rotor with 100m diameter
<2.5^{O} of view (5% of 50^{O} = 2.5^{O})	Insignificant The swept path of the rotor would take up less than 5% of the central field of view. The rotor, unless particularly conspicuous against the background, will not intrude significantly into the view. The extent of the vertical angle will also affect the visual impact.	> 2290m
2.5^{O} – 30^{O} of view (60% of 50^{O} = 30^{O})	Potentially Noticeable The swept path of the rotor may be noticeable and its degree of visual intrusion will depend greatly on its ability to blend in with its surroundings and particularly the sky.	173m-2290m
>30^{O} of view	Potentially Visually Dominant At this distance the swept path of a single rotor will fill more than 50 percent of the central field of vision and will always be noticed and sympathetic treatments, such as paint colours to blend against a sky, will only be able to partially mitigate visual effects.	< 173 m

These calculations suggest that the impact of a 100m wide rotor would reduce to insignificance at approximately 2,290m, as the swept path of the rotor would, at this distance, form less than 5% or 2.5^{O} of the horizontal field of view. At distances less than 173m, a 92m wide rotor, would be visually dominant.

These calculations do not take into account the height of the wind turbines, nor do they allow for the placement of multiple wind turbines within the landscape.

The distances suggested by the analysis based upon horizontal field of view of a single rotor are far less than experience would suggest to be reasonable. The previous calculation is based on the visual impact of a single rotor in the horizontal field of view. A single wind turbine has the same height as many wind turbines sited across several kilometres, and the intrusion into the vertical field of view may better determine the viewshed for a wind farm.

The point from which the wind farm becomes an indistinct line on the landscape, better determines the viewshed. That is the point at which the vertical size of a range of wind turbines diminishes to an imperceptible component within the vertical field of view.

Figure B.2 shows how the viewshed of a long horizontal object is determined by its height and not by its width.

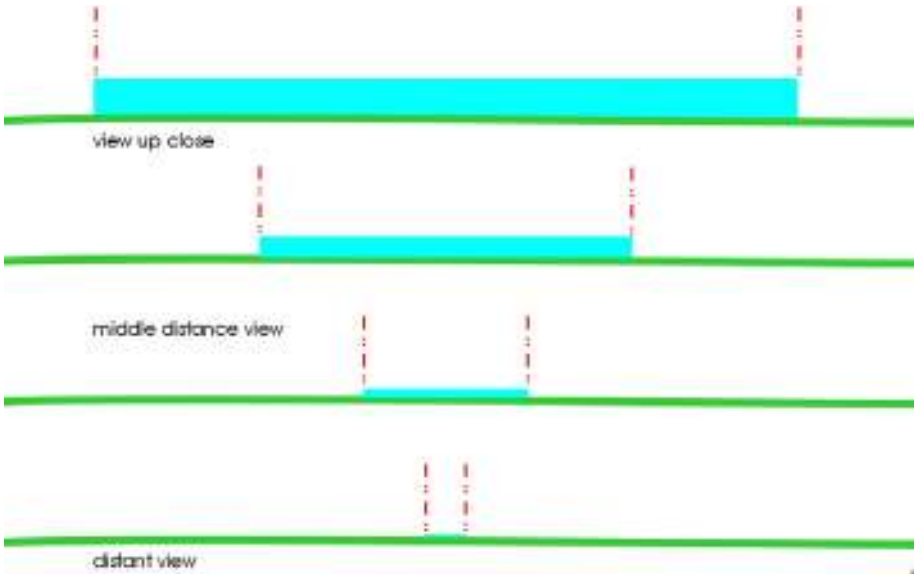


Figure B.2 The diminution in visibility with distance from a long horizontal object

As an observer moves further away from a horizontal object the width may still be apparent, however the vertical dimension reduces to insignificance

This effect can also be demonstrated by the example of a farm fence that may be several kilometres in width, yet as one moves further away, it becomes less apparent, until at some distance it is not possible to separate this element from the horizontal plane of the landscape. Similarly, the viewshed of a long horizontal object such as a wind farm can also be determined by its height.

As wind farms are comprised of many tall slim towers with rotating blades, wind farms are different to a solid structural mass such as buildings. At greater distances, the rotating blade becomes the most visible element and at closer distances, it is the overall height of the wind turbine that becomes most apparent.

For these reasons the extent of the viewshed is to be based on an analysis of the extent to which wind turbines extend into the vertical field of view.

VERTICAL FIELD OF VIEW

A similar analysis can be undertaken based upon the vertical line of sight for human vision.

These physical parameters are illustrated in ***Figure B.3***.

As can be seen in ***Figure B.3*** the typical line of sight is considered to be horizontal or 0O. A person's natural or normal line of sight is normally a 10O cone of view below the horizontal and, if sitting, approximately 15O.

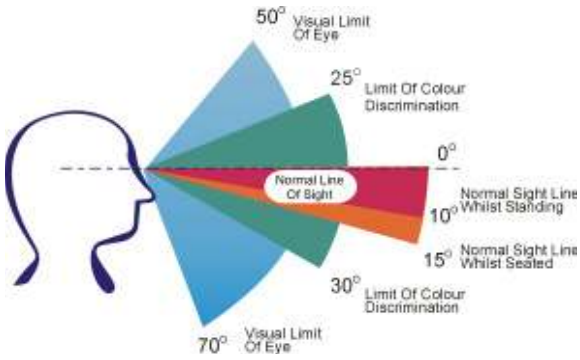


Figure B.3 Vertical Field of View

Objects, which take up 5% of this cone of view (5% of 10O = 0.5O) will only take up a small proportion of the vertical field of view, and are only visible when one focuses on them directly. However, they are not dominant, nor do they create a significant change to the existing environment when such short objects are placed within a disturbed or man-modified landscape.

Viewshed based on the vertical field of view

Objects that take up 5% of this cone of view (5% of 10O = 0.5O) are considered visually insignificant. That is not to imply that the objects become invisible at this distance, rather they become such a minor element in an already man modified landscape that their visual impact can be considered to be insignificant.

Once objects take up at least 10% of the vertical field of view, they can be more readily discernible (10% of 10O = 1O) and this visibility increases as the wind turbines increasingly take up a greater proportion of the vertical field of view.

When the wind turbines take up 25% of the vertical field of view, they become visually evident and when they take up 50% of the vertical field of view, they will dominate the view.

Table B.2 *Visual impact based on the vertical field of view to a wind turbine*

Vertical Line of Sight	**Visual Impact**	**Distance from an observer to a 135m high wind turbine**
< 0.5^{O} of vertical angle (5% of 10^{O} = 0.5^{O})	Insignificant A thin line in the landscape.	17,188m
0.5°-2.5°of vertical angle	Potentially noticeable The degree of visual intrusion will depend on the development's ability to blend in with the surroundings.	3,435 – 17,188
2.5^{O} – 5^{O} of vertical angle	Visually evident Usually visible, however the degree of visual intrusion will depend of the width of the object and its placement within the landscape.	<3,435m

The table above shows the distance at which a wind turbine approximately 150m high with a 100m diameter swept path of a rotor diminishes with distance within a vertical field of view.

In some lighting conditions, the rotor stands out in distant views and for this reason it is calculated separately for the outer edge of the viewpoint. As this calculation is intended as only a guide to setting the viewshed, all figures have been rounded to the nearest appropriate kilometre).

Proposed Viewshed & Zones of Visual Influence

The preceding analysis shows that a 150m high built form recedes into an insignificant element in the landscape at approximately 17.2km. It is proposed that the viewshed extend out to 17km and that the zones of visual influence are also set out *in Table B.3.*

Table B.3 *Viewshed and zones of visual influence*

Distance from an observer to the nearest wind turbine	Zones of visual influence
>17km	*Outside the viewshed*
8.5-17km	*Visually insignificant –* A very small element which are difficult to discern and will be indistinct in different lighting and weather conditions.
3-8.5km	*Potentially noticeable, but will not dominate the landscape.* The degree of visual intrusion will depend on the landscape sensitivity and the sensitivity of the viewer; however the proposed wind turbines will not dominate the landscape.
1.5 – 3km	*Highly visible and will usually dominate the landscape* The degree of visual intrusion will depend on the wind turbines' placement within the landscape and factors such as foreground screening.
<1.5km	*Will be visually dominant in the landscape from most viewing locations.* The degree of visual intrusion will only be reduced by screening by nearby vegetation or buildings

Insignificant visual impact & beyond the limit of the viewshed occurs at approximately 17km, at which point a 150m high wind turbine is no longer a significant visible element in a man modified landscape except for the most sensitive of locations. The swept path of the rotor also becomes the only visible element in some lighting conditions as the supporting tower becomes imperceptible and possibly this could reduce the viewshed to 11.5km in these lighting conditions.

The 17km viewshed is based on a conservative assumption that the wind turbines are a solid mass 150m high, similar to a building. In reality the wind turbines are widely spaced and the wind farm is a far more visually transparent object than a solid building mass some 150m high and many kilometres in width. However, it is also to be noted that the turning of the rotor also attracts the eye, extending the viewshed.

It is stressed that these calculations attempt to locate the distance at which a wind farm becomes imperceptible within a man-modified landscape. This is not to say that wind turbines at 18km, or even at 27km, are invisible. Wind turbines of this height will be discernible in good lighting conditions to an observer who knows where the wind turbines are located and therefore focuses in that direction. However the visual impact within a man modified landscape is not considered significant beyond this distance, aside from exceptional circumstances.

Visually insignificant visual impact occurs between 8.5km – 17km. At these distances the wind turbines are a very small element in the landscape and are often hard to discern. In any but exceptionally clear lighting conditions they are imperceptible.

Potentially noticeable visual impact occurs between 3km to 8.5km where the entire wind turbine is visible and lighting does not alter the visibility of the tower versus that of the rotor. Foreground vegetation and intervening landform can reduce the degree to which the wind turbines are noticeable.

Visually evident occurs at distances between 1.5km and 3km where the wind turbines have increased in visibility and are evident and potentially dominant in the landscape. Landscape is less effective at screening wind turbines unless it is close to the viewer.

Visually dominant occurs at distances closer than 1.5km. Wind turbines visible at this distance dominate will always the landscape.