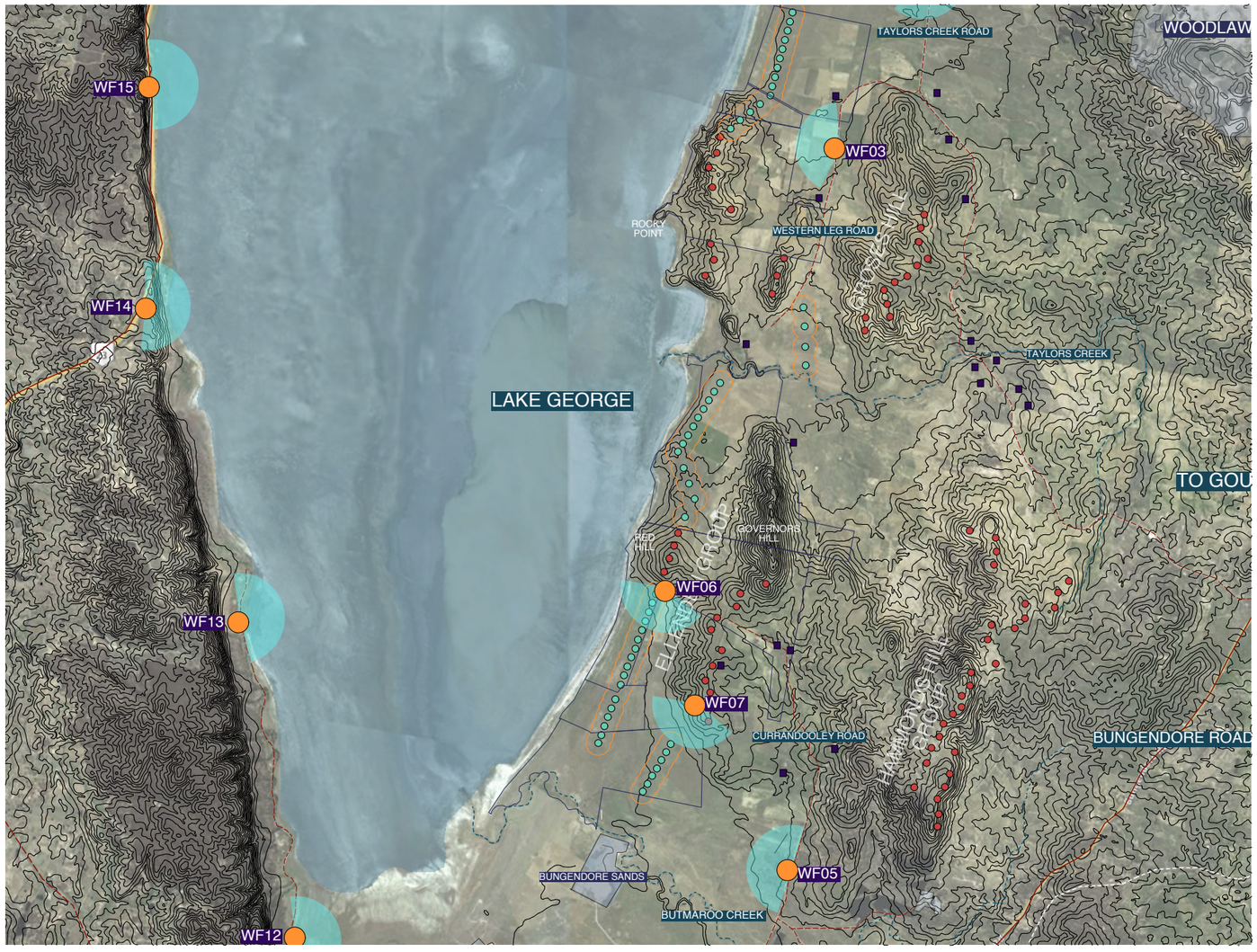
VISUAL Impact Assessment



LAKE GEORGE Capital II Wind Farm

Prepared for: INFIGEN ENERGY

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1.0 Introduction

1.1 Background

Moir Landscape Architecture have been commissioned by Infigen Energy to prepare a Landscape and Visual Impact Assessment (LVIA) for the extension to the Capital I Wind Farm on the eastern edges of Lake George near Bungendore, NSW (See Figure 1). The LVIA will support the Environmental Impact Statement (EIS) document prepared for the proposal and lodged with the Department of Planning (DOP) for assessment under Part 3A of the Environmental Planning and Assessment Act, 1979.

As cadastral information has little influence in defining visual catchments this assessment aims to identify the landscape character, and dominant features of the relevant visual catchments that the Study Site lies within. The purpose of this report is to provide an assessment of visibility and visual impacts and information to assist the community and the DOP to understand and assess the likely impacts.

Survey work for the study was undertaken during June 2010 using key viewpoints and locations with potential views towards the Study Site. The report details the results of the field work, documents the assessment of the landscape character and visual setting, and makes recommendations concerning ways to mitigate any impacts arising from potential development.

1.2 Overview of the Project

The initial stages of the 200MW Capital Wind Farm Project, occupying part of the Study Area, and commissioned by Renewable Power Ventures Pty Ltd is complete. The proposed development, Capital II Wind Farm, consists of 55 new wind turbines and associated infrastructure situated predominately to the west of Capital I on the eastern shores of Lake George.

This Visual Impact Assessment is based on the proposed layout with the following proposed wind farm characteristics:

- A total of 55 wind turbines, each with a proposed 200m development envelope
- Wind turbine tower height of 100m (to hub) with an overall height of approximately 157m

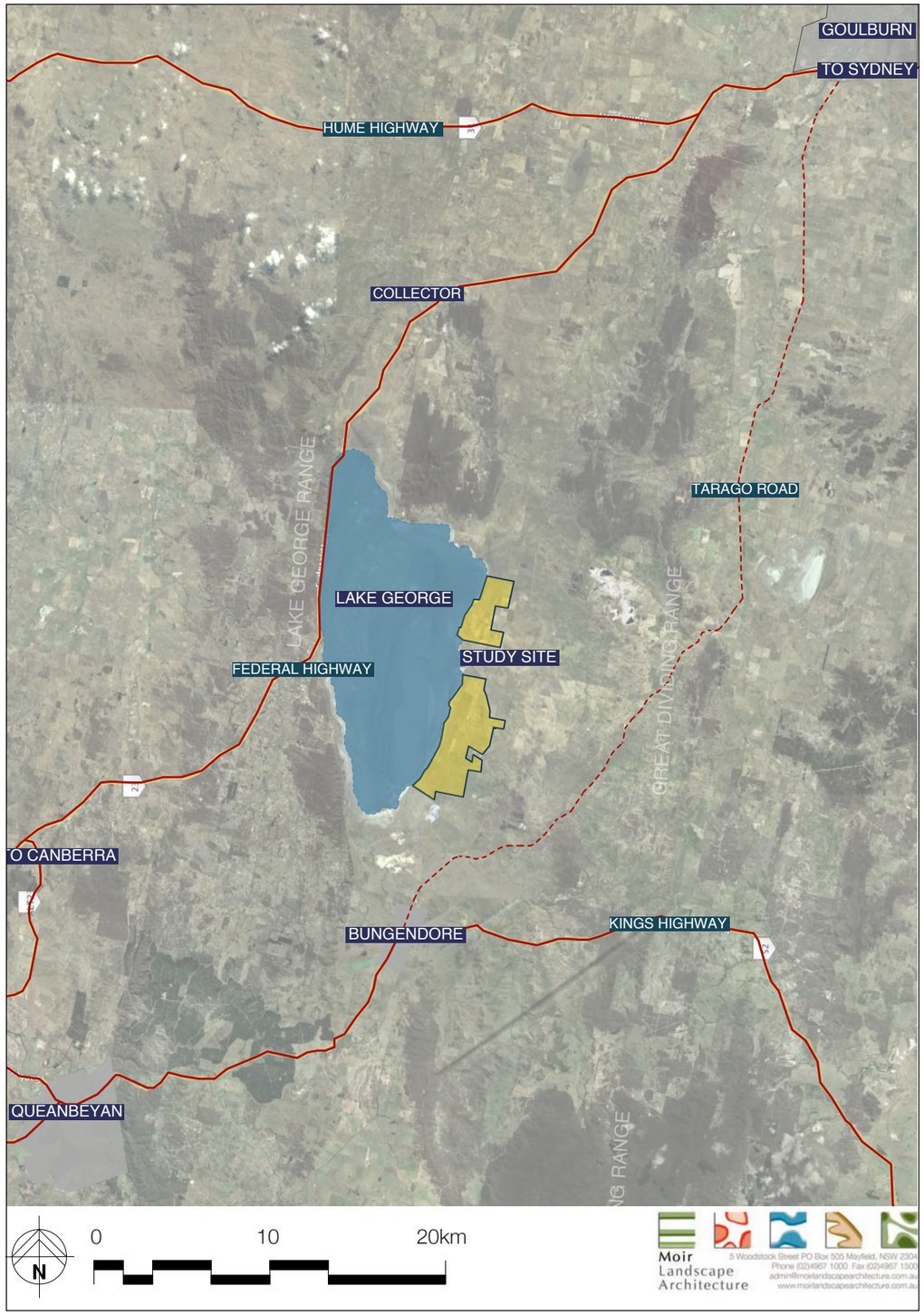


Figure 1: Regional Context.

2.0 Statutory Framework

2.1 Part 3A Project Process

The proposed development is a large scale, major infrastructure project of both regional and State environmental significance. Applications of this scale are determined by the Minister for Planning under Part 3A of the Environmental Planning and Assessment Act 1979.

The preparation of an Environmental Assessment (EA) forms the first step of the Part 3A Project Assessment. The Director-General requirements for the preparation of the EA are outlined in Section 2.2.

2.2 Director General Requirements

As part of the proposal the Director General has set a number of requirements which need to be addressed as part of the preparation of the EA. The requirements required for assessment of visual impact include:

- provide a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project (including the Lake George escarpment) taking into consideration cumulative impacts from surrounding approved or operational wind farms in the locality and proposed Solar infrastructure (Capital Solar Farm). This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project based on surveys and consultation;

- assess the impact of shadow 'flicker', blade 'glint' and night lighting from the wind farm;

- identify the zone of visual influence (no less than 10km) and assess the visual impact of all project components on this landscape;

- include photomontages of the project taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points (including the Lake George escarpment), and provide a clear description of proposed visual amenity mitigation and management measures for both the wind farm and the transmission line. The photomontages must take into account cumulative impacts from surrounding approved or operational wind farms in the locality and include representative views of turbine night lighting if proposed; and

- provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impact after these measures have been implemented.

2.3 Policy Considerations

Wind Farms and Landscape Values National Assessment Framework

The Australian Council of National Trusts (ACNT) and the Australian Wind Energy Association have prepared a report entitled: 'Wind Farms and Landscape Values. The purpose of the report is to develop a mutually agreed methodology for assessing landscape values for wind farm proposals. The National Assessment Framework, Stage 2 of the document, provides a rigorous and transparent method for assessing, evaluating and managing the impact of wind farms on landscape values. The step by step approach entails describing and modelling wind farms proposals in the landscape, assessing the positive and negative impacts on landscape values and finally managing those impacts.

The National Assessment Framework has four steps as follows:
Step 1: Assess the Landscape Value
Preliminary Landscape Assessment.
Full Landscape Assessment.
Step 2: Describe and model the wind farm in the landscape.
Step 3: Assess the impacts of the wind farm on landscape values.
Step 4: Respond to impacts.

Palerang Council

The proposed development is located within the Palerang Council. No relevant policies of landscape or scenic quality apply to the area within the Shire.

2.4 Previous Studies/Wind Farm Literature

Wind Farm related literature and previous Visual Impact Assessments of relevance have been utilised through the Visual Impact Assessment process. Connell Wagner prepared the Visual Impact Assessment for the existing Capital Wind Farm and references have been made to their findings throughout the report.

3.0 Study Method

3.1 Landscape and Visual Impact Assessment

A Landscape Assessment and Visual Impact Assessment is used to identify and determine the value, significance and sensitivity of a landscape. The method applied to this study involved systematically evaluating the visual environment pertaining to the site and using value judgements based on community responses to scenery. The assessment was undertaken in stages as noted below:

The LVIA process involves:

- Classification of the landscape into different character types and a description of those types. These are referred to as Landscape Character Units (LCU).
- Objective assessment of the relative aesthetic value of the landscape, defined as Visual quality and expressed as high, medium or low. This assessment generally relates to variety, uniqueness, prominence and naturalness of the landform, vegetation and water forms within each character type or LCU.
- Determination of the landscapes ability to absorb different types of development on the basis of physical and environmental character.
- An assessment of viewer sensitivity to change. This includes how different groups of people view the landscape (for example, a resident as opposed to a tourist), and how many people are viewing and from how far.
- The undertaking of a viewpoint analysis to identify sites likely to be affected by development of the site and a photographic survey using a digital camera and a handheld GPS unit to record position and altitude.
- An assessment of visual impacts; and the preparation of recommendations for impact mitigation and suggestions for suitable development to maintain the areas visual quality.

The purpose of the above methodology is reduce the amount of subjectivity entering into impact assessment and to provide sufficient data to allow for third party verification of results.

The second stage of the Assessment involves a quantitative approach. The quantification of the visual impacts is defined by methods including:

- Computer modelling to determine the Zone of Visual Influence (ZVI).
- Visual modelling of the wind farm from key viewpoints in the form of photomontages to depict the potential visual change. (AUS WEA 2007 or 2005)

3.2 Definitions

Definitions for terms used throughout the VIA have been included in this section of the report.

3.2.1 Landscape Values

Landscape values are the cultural attributes (social, indigenous, artistic and environmental) as well as the aesthetics of a place, as shown in figure 2.

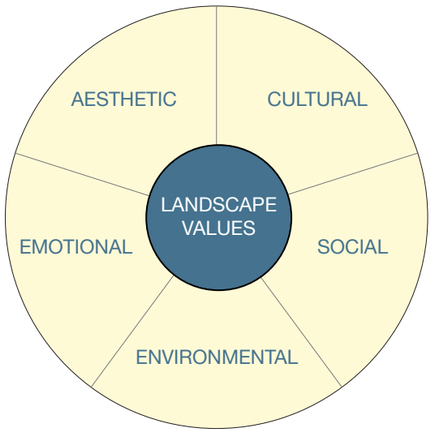


Figure 2: Landscape Values.

3.2.2 Visual Quality

Visual quality of an area is essentially an assessment of how viewers may respond to designated scenery. Scenes of high visual quality are those which are valued by a community for the enjoyment and improved amenity they can create. Conversely, scenes of low visual quality are of little value to the community with a preference that they be changed and improved, often through the introduction of landscape treatments.

As visual quality relates to aesthetics its assessment is largely subjective. There is evidence to suggest that certain landscapes are constantly preferred over others with preferences related to the presence or absence of certain elements. The rating of visual quality for this study has been based on scenic quality ratings and on the following generally accepted assumptions arising from scientific research (DOP, 1988):

- Visual quality increases as relative relief and topographic ruggedness increases;
- visual quality increases as vegetation pattern variations increase;
- visual quality increases due to the presence of natural and/or agricultural landscapes;
- visual quality increases owing to the presence of waterforms (without becoming too common) and related to water quality and associated activity; and
- visual quality increases with increases in land use compatibility.

3.0 Study Method (contd.)

In addition to the above, cultural items may also endow a distinct character to an area and therefore contribute to its visual quality due to nostalgic associations and the desire to preserve items of heritage significance.

3.2.3 Visual Sensitivity

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different areas. The assessment is based on the number of people affected, land use, and the distance of the viewer from the proposal. (EDAW, 2000).

For example, a significant change that is not frequently seen may result in a low visual sensitivity although its impact on a landscape may be high. Generally the following principles apply:

- Visual sensitivity decreases as the viewer distance increases.
- Visual sensitivity decreases as the viewing time decreases.
- Visual sensitivity can also be related to viewer activity (e.g. a person viewing an affected site whilst engaged in recreational activities will be more strongly affected by change than someone passing a scene in a car travelling to a desired destination).

Sensitivity ratings are defined as high, moderate or low and are shown in the table below (URBIS, 2009).

VISUAL SENSITIVITY					
VISUAL USE AREA	FOREGROUND		MIDDLEGROUND		BACKGROUND
	Local setting		Sub-Regional setting		Regional setting
	0-1	1-2km	2-4.5	4.5-7	> 7kms
Townships	High	High	High	Mod	Low
Rural residences	High	High	High	Mod	Low
Main Highway	Mod	Mod	Low	Low	Low
Local Roads	Mod	Mod	Low	Low	Low
Railway Line (Freight)	Low	Low	Low	Low	Low
Agricultural Land	Low	Low	Low	Low	Low

Table 1: Visual Sensitivity Table.

3.2.4 Visual Effect

Visual effect is the interaction between a proposal and the existing visual environment. It is often expressed as the level of visual contrast of the proposal against its setting or background in which it is viewed.

Low visual effect: occurs when a proposal blends in with its existing viewed landscape due to a high level of integration of one or several of the following: form, shape, pattern, line, texture or colour. It can also result from the use of effective screening often using a combination of landform and landscaping.

Moderate visual effect: occurs where a proposal is visible and contrasts with its viewed landscape however, there has been some degree of integration (e.g. good siting principles employed, retention of significant existing vegetation, provision of screen landscaping, appropriate colour selection and/or suitably scaled development).

High visual effect: results when a proposal has a high visual contrast to the surrounding landscape with little or no natural screening or integration created by vegetation or topography.

3.2.5 Visual Impact

Visual impact is the combined effect of visual sensitivity and visual effect. Various combinations of visual sensitivity and visual effect will result in high, moderate and low overall visual impacts as suggested in the below table (URBIS, 2009).

VISUAL IMPACT				
		VISUAL EFFECT ZONES		
		HIGH	MODERATE	LOW
VISUAL SENSITIVITY LEVELS	HIGH	High Impact	High Impact	Moderate Impact
	MODERATE	High Impact	Moderate Impact	Low Impact
	LOW	Moderate Impact	Low Impact	Low Impact

Table 2: Visual Impact Table.

3.0 Study Method (contd.)

3.2.6 Zone of Visual Influence (ZVI)

The Zone of Visual Influence (ZVI) represents the area over which a development can theoretically be seen, and is based on a Digital Terrain Model (DTM). The ZVI usually presents a bare ground scenario - ie a landscape without screening, structures or vegetation, and is usually presented on a base map. It is also referred to as a zone of theoretical visibility. (Horner and Maclennan et al, 2006).

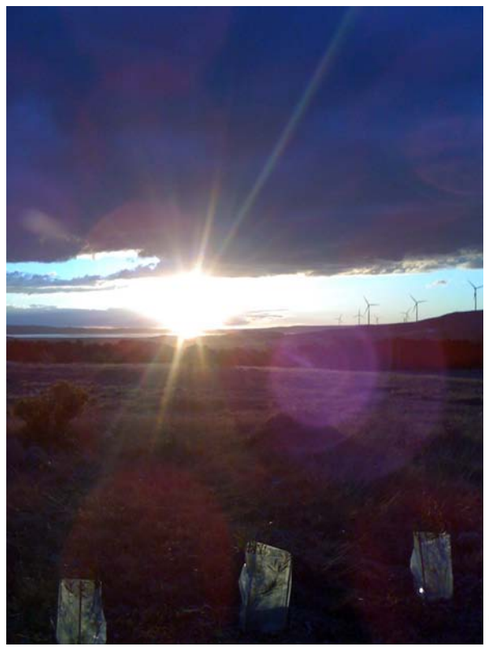
3.2.7 Visual Absorption Capability

Visual Absorption Capability (VAC) is used to assess the landscapes susceptibility to visual change caused by human activities. A landscape with a high VAC would be able to accept alterations caused by human alteration with little or no loss to the landscape character or visual condition.

3.2.8 Photomontage

A photomontage is a visualisation based on the superimposition of an image (ie turbine, building, road, landscape addition etc) onto a photograph for the purpose of creating a realistic representation of proposed or potential changes to a view. (Horner and Maclennan et al, 2006).

Photomontages have been utilised in this Visual Impact Assessment to assist in the impact assessment of the proposal.



Screen planting to residence on Taylors Creek Rd

3.3 Community Perceptions

Research from previous projects, both national and international has found that community perceptions and general acceptance of wind farms varies greatly. Viewers perception to cultural and natural elements is difficult to define and can differ on the basis of a variety of elements eg. whether the viewer is a resident or a visitor.

According to Gipe (1995) 'People unconsciously realise that opposition on aesthetic grounds is subjective, and is therefore, often dismissed by public officials. Opinion shapes policy and aesthetics or how the public views the wind industry, shapes opinion. Stanton (1995) puts forward that wind farms should not be judged solely on their visual properties ; indeed, they may be greatly valued for other qualities, such as what they symbolise.

As visual resources belong to the public it is of upmost importance to utilize guidelines derived from background research and past experience to ensure the outcomes contribute positively to the evolving landscape character of the area.

3.3.1 Community Consultation

Community consultation and engagement is key to the success and acceptance of large infrastructure projects. A community information day was held on the 8th of September 2010, at the War Memorial Hall in Bungendore. All landowners within 3km of the project were contacted directly and informed of the details in addition to a notice advertising the details in the Bungendore Mirror and the Tarago Times. Approximately 30 people attended throughout the day.

During the information day, members of the community had the opportunity to discuss their concerns with members of the project team. Due to the location of the proposed project and history of previous wind farms in the area, there were no new concerns raised about this proposal.

The major area of concern for residents was related to noise. There were general concerns how visual impacts were going to be addressed but no specific issues were raised.

As visual impact was not raised as a major concern it could be concluded that wind turbines already form part of the landscape character and the community is familiar and possibly quite comfortable with the presence of the wind turbines in the landscape.

A resident on Taylors Creek Road (Refer Table 9 - Receptor G16) who was unable to attend the public meeting was visited by representatives from Infigen to discuss concerns. Once on site it was determined that the residents concerns were related more to Capital Wind Farm One. Screen planting has since been undertaken to mitigate these perceived impacts (See Photo to left). Recommendation and design guidelines to reduce the visual impact are discussed further in Section 9.0 Mitigation Methods.

3.0 Study Method (contd.)

3.4 Visibillity Assessment Criteria

In order to facilitate objective assessment of visibility, a set of key assessment criteria was developed. The key criteria against which the visibility of the proposed development was assessed from each viewpoint are:

- the distance from the wind farm
- the potential visual prominence (in relation to the view field angle)
- the number of visible turbines
- the context in which the turbines are viewed

These methods of assessment have been summarised from each viewpoint, forming part of the Visual Impact section of this report (refer to section 7.0).

3.4.1 Distance from the wind farm

The distance of each viewpoint to the closest turbine was a significant determining factor in ranking the visual prominence of the development. The visual impact decreases or increases in direct relation to the distance.

Local setting: Up to 2km from the development

Sub regional setting: between 2km and 10km from the development

Regional setting: beyond 10km of the development

These distances have been established based on previous studies undertaken in association with Wind Farm development and by the requirements outlined by the Director General. The distance to the nearest proposed wind turbine has been measured for each viewpoint. Table 5 outlines the potential visual prominence of the development in relation to the distance from the object.

DISTANCE FROM OBJECT	POTENTIAL VISUAL PROMINENCE
10,000 metres	VISIBILITY DIMINISHING The visual prominence of the element progressively diminishes over distance.
2000-10,000 metres	POTENTIALLY NOTICABLE The development will be noticable. The degree that it intrudes on the view will increase as distance decreases.
Less than 2000 metres	POTENTIALLY DOMINANT The development may be highly noticable.

Table 3: Visual prominence in relation to distance and viewshed (URBIS, 2009)

3.4.2 View field angle

The view field angle is the angle subtended by the wind farm at the observers location (see Figures 2 & 3). This angle varies for differing viewpoints based on the distance from the wind turbines, the number of turbines, the layout and its orientation relative to the viewer and intervening topography. A person normally sees approximately 100° at any point and can easily see a much broader field by scanning from side to side. (Connel Wagner)

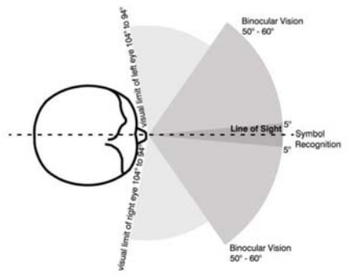


Figure 3: Horizontal Line of Sight

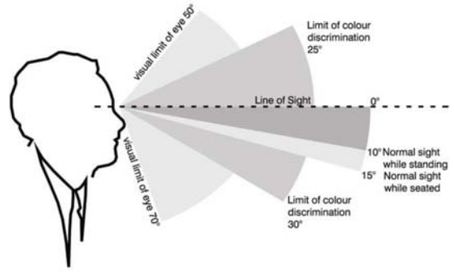


Figure 4: Vertical Line of Sight

The field of angle can be measured by both the horizontal and vertical line of sight (refer to figures 3 and 4). However due to the unique spatial arrangement of the proposed wind farm development, this VIA will focus on the vertical angle of view.

In this case the vertical line of sight is used to assess the visual prominence of the proposed development from each viewpoint. The field of view is based merely on the theoretical angle between the viewer and the wind turbine and does not take into account topography, vegetation or buildings which may lessen the visual prominence and is therefore based on worst case scenario. Table 4 outlines the potential visual prominence of the development based on the vertical field of view.

DEGREES OF FIELD OF VIEW OCCUPIED	POTENTIAL VISUAL PROMINENCE - VISUAL FIELD OF VIEW
Less than 0.5°	INSIGNIFICANT A small thin line in the landscape.
0.5°-2.5°	POTENTIALLY NOTICABLE The development may be noticable. The degree that it intrudes on the view will be dependent on how well it integrates with the landscape setting.
Greater than 2.5°	POTENTIALLY DOMINANT The development will be highly noticable, although the degree of visual intrusion will depend on the landscape setting and the width/spread of the object.

Table 4: Vertical line of sight- Visual impact/ visual prominence (URBIS, 2009)

3.0 Study Method (contd.)

3.4.3 Number of visible turbines

The number of visible turbines was determined from each viewpoint, based on topographic mapping and review of the wind farm layout in relation to the viewpoint. The number of turbines visible to the viewer is likely to contribute to the overall visibility ranking.

The proposed extension of the development has 55 turbines, and the existing Capital I wind farm has 67 wind turbines, resulting in the cumulative development having a total of 122 turbines.

The collective number of turbines visible for both the Capital I and Capital II was mapped at the following levels:

NUMBER OF TURBINES VISIBLE	PERCENTAGE OF DEVELOPMENT
98-122	100%
73-97	80%
49-72	60%
25-48	40%
1-24	20%

Table 5: Ranking of development visibility.

3.4.5 Viewing context

A number of factors existing on a local level can influence the visibility of the proposed wind farm development as viewed. The influences include but are not limited to the backdrop of the wind farm, local influences and visual desensitisation. These include but are not limited to:

- Visual backdrop of the proposal
- Local influences
- Visual desensitisation

VISUAL BACKDROP

The backdrop upon which the wind turbines are viewed can be a relevant factor in the assessment of the visual impact. For example most views of the wind turbines will have a backdrop against the sky. In clear weather, the wind turbines will appear prominent contrasting against the blue sky, where as on overcast days the wind turbines may be less noticeable with an overcast or cloudy background reducing the level of visual contrast.

Wind turbines against cloudy backdrop.

Turbines against blue sky.

LOCAL INFLUENCES

A variety of influences on a local level can directly impact the visibility of the proposed development. For example, wind break planting around homesteads are a characteristic of the existing landscape which effectively contain views from within surrounding properties. In effect this screens views to the distance and influences the visual impact from each viewpoint.

Roadside screen planting.

Homestead screen planting.

VISUAL DESENSITISATION

Another visual influence is the desensitisation of viewers to visual modification due to existing land use in the area. For example the presence of agricultural equipment surrounding homesteads and the presence of storage areas, farm equipment and sheds through the landscape can have a greater visual influence from viewpoints than the proposed development in the distance. Examples of this within the local context of the Site include the woodlawn mine, quarries and existing infrastructure.

Woodlawn Mine.

Existing Infrastructure.

4.0 Regional and Site Context

4.1 Regional Context

The Study Area is located approximately 35km north east of Canberra and 50km south of Goulburn. The closest town is Bungendore which is located roughly 6.5km south west of the site along Tarago Road. The Site is located along the eastern shores of Lake George, at the base of the Great Dividing Range. (Refer to Figure 1)

The Site is located on Southern Tablelands rural land, typical of the Bungendore/Tarago area. The Southern Tablelands is characterised by undulating topography and grazing land. The Great Dividing Range is a significant feature of the landscape, extending along the east and to the north of the Study Area.

BUNGENDORE

Bungendore is the main township in the area located at the crossroads of Bungendore and Tarago Roads, to the south of Lake George. Bungendore forms part of the Palerang Local Government Area (LGA). The town is a popular tourist centre, steeped in history with a number of buildings and precincts under heritage protection. The town has experienced recent growth in the form of residential houses, as a dormitory suburb or Canberra.

LAND FORM

The landform of the region is typically undulating topography with the flat expanse of Lake George and steep abrupt escarpments forming distinctive features of the landscape. Lake George is the main feature of the region, at a low lying elevation of approximately 680m above sea level. The Lake George Range to the west of Lake George has a distinct escarpment which forms a unique characteristic of the landscape. The Great Dividing Range runs through the region to the east of the Study Area, defining the undulating topography typical of the region. To the east of Lake George, the topography is undulating with steep rises reaching heights of 935 metres.

WATER BODIES

Lake George is the most prominent water body of the region, spreading approximately 25km long and 10km wide. Lake George can reach depths ranging from 1.5-4.5m when full, however in many areas it reaches only 1m in depth. Watercourses in the form of small streams and creeks drain into Lake George from the surrounding landscape. These watercourses are mostly minor drainage lines which do not feature prominently in the landscape having a general lack of riparian vegetation.

VEGETATION

The landscape typical of the region is predominately cleared, open grazing land with scattered groupings of remnant native trees. The Lake George Range, Great Dividing Range and Mt Baby to the north of Lake George are vegetated with dense woodland vegetation. Woodland vegetation occurs throughout the region along ridge lines and areas determined too steep for agricultural use.

ROADS

The Federal Highway west of Lake George follows the base of the Lake George Range, and is the main transport corridor connecting the ACT and Sydney. The Federal Highway is the most major road of the region and is recognised as being the gateway to Canberra. Three rest areas are located along the eastern side of the Federal Highway with views over Lake George towards the Study Site. A number of minor roads run through the region utilised mostly by heavy transport vehicles and residents.

LANDUSE

The land of the region is generally used for grazing purposes. A number of isolated homesteads are located throughout the region generally servicing agricultural industry.

Land to the east of the Lake George is occupied by the Capital I Wind Farm which harvests the strong winds of the region. The existing wind farm known as Capital I comprises 63 wind turbines each with a capacity of approximately 2.1 megawatts with a total generation capacity of about 132 megawatts. The existing layout of turbines occurs in three separate groups, located on elevated ridges of the Great Dividing Range east of Lake George up to 270m above the Lake.

CULTURAL SIGNIFICANCE

The heritage report prepared by Austral Archaeology states that;

“Professional archaeologists view aesthetic significance as an attribute that can only be culturally determined by Aboriginal stakeholders. The concept of aesthetic significance deals with the response that people have to a particular place. This criterion differs from the other two (Research Potential and Educational Potential) in that it is not so readily quantifiable but takes into account a subjective or emotive response to a place as opposed to providing comment upon a tangible item (such as an Aboriginal artefact) or an issue of research relevance (such as an area of PAD).” (Austral Archaeology 2010)

Austral Achaeology consulted with the Buru Ngunawal Aboriginal Corporation (BNAC) who are the traditional carers of the site and it’s surrounds. The BNAC made recommendations for the protection of artefacts and cultural heritage materials however the site was not deemed as being rare or significant on a local or regional basis.