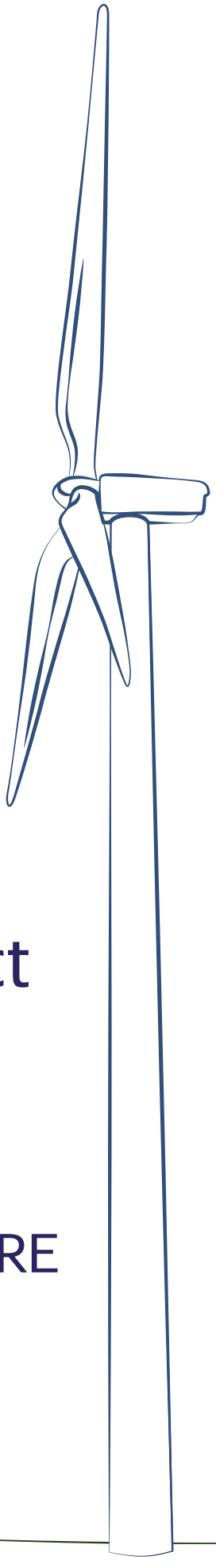

Attachment F

Landscape & Visual Impact Assessment

MOIR LANDSCAPE ARCHITECTURE

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LANDSCAPE & VISUAL IMPACT ASSESSMENT

PROPOSED BODANGORA WIND FARM












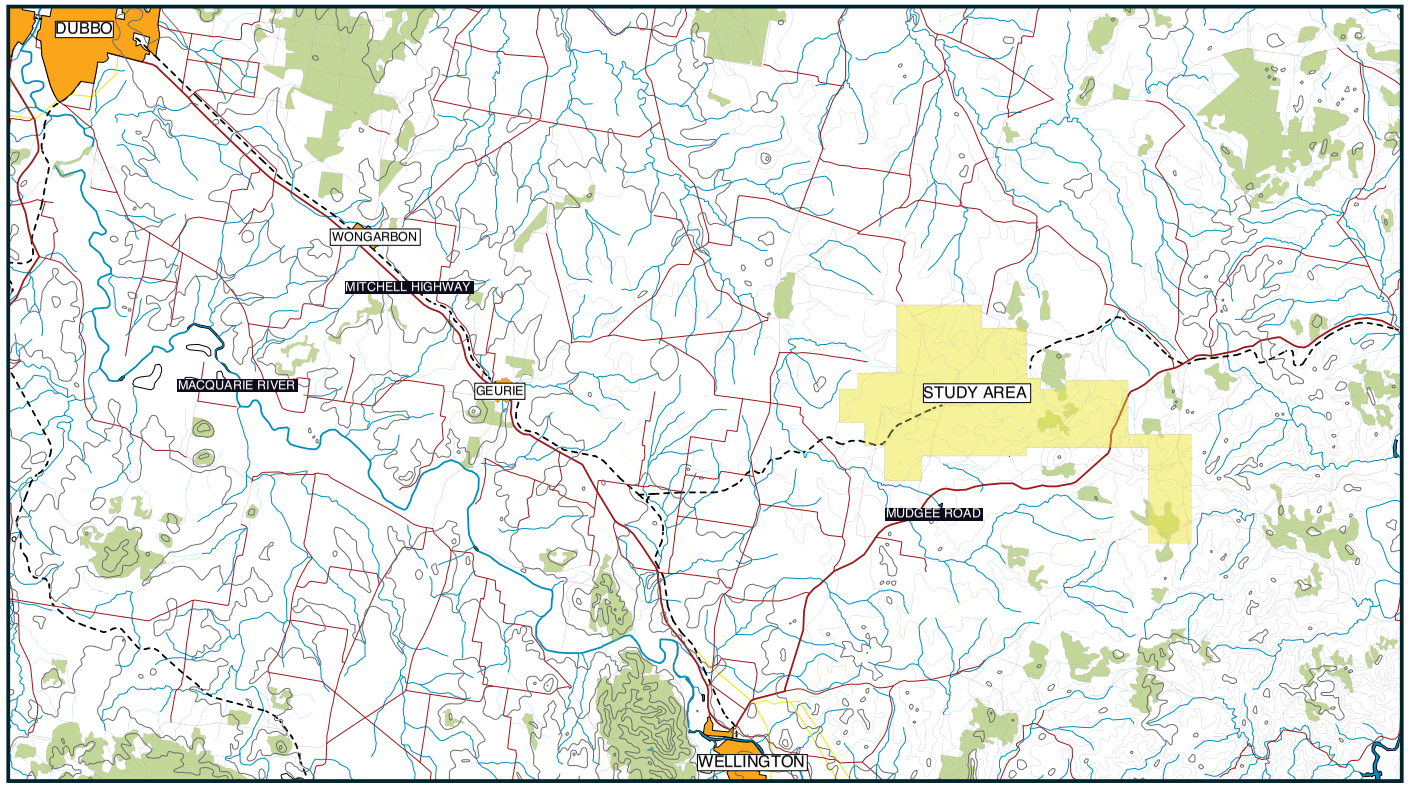

PREPARED FOR: INFIGEN ENERGY

PROJECT NO: 0740

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Moir Landscape Architecture
5 Woodstock Street PO Box 505 Mayfield, NSW 2304
Phone (02)4967 1000 Fax (02)4967 1500
admin@moirlandscapearchitecture.com.au
www.moirlandscapearchitecture.com.au

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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 proposed Bodangora Wind Farm, located north east of Wellington in NSW (See Figure 1). This LVIA will support the Environmental Impact Statement (EIS) document prepared for the proposal and lodged with the Department of Planning and Infrastructure (DOP) for assessment under Part 3A of the Environmental Planning and Assessment Act, 1979.

The purpose of this report is to provide an assessment of visibility and potential visual impacts and information to assist the community and the DOP to understand and assess the likely impacts.

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 between 8th -11th August 2011 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 to assist in the mitigation of any potential impacts resulting from the proposed development.

1.2 PROJECT OVERVIEW

The proposed Bodangora Wind Farm is situated approximately 15 km north east of Wellington and 40 km south east of Dubbo, New South Wales (NSW).

This LVIA has been developed based on the proposed layout which consists of the construction and operation of up to 36 wind turbines, each with a nominal capacity of between 2 MW and 5MW with the total wind farm capacity being between 60 MW and 110 MW. The assessment is based on wind turbines with a height of up to 150 metres and aims to present the worst case scenario.

In addition to the wind turbines, the associated ancillary works will be assessed. These include the construction of a facilities building, a 132 kV power line connecting to existing transmission lines, a switching substation temporary patching plants and access tracks.

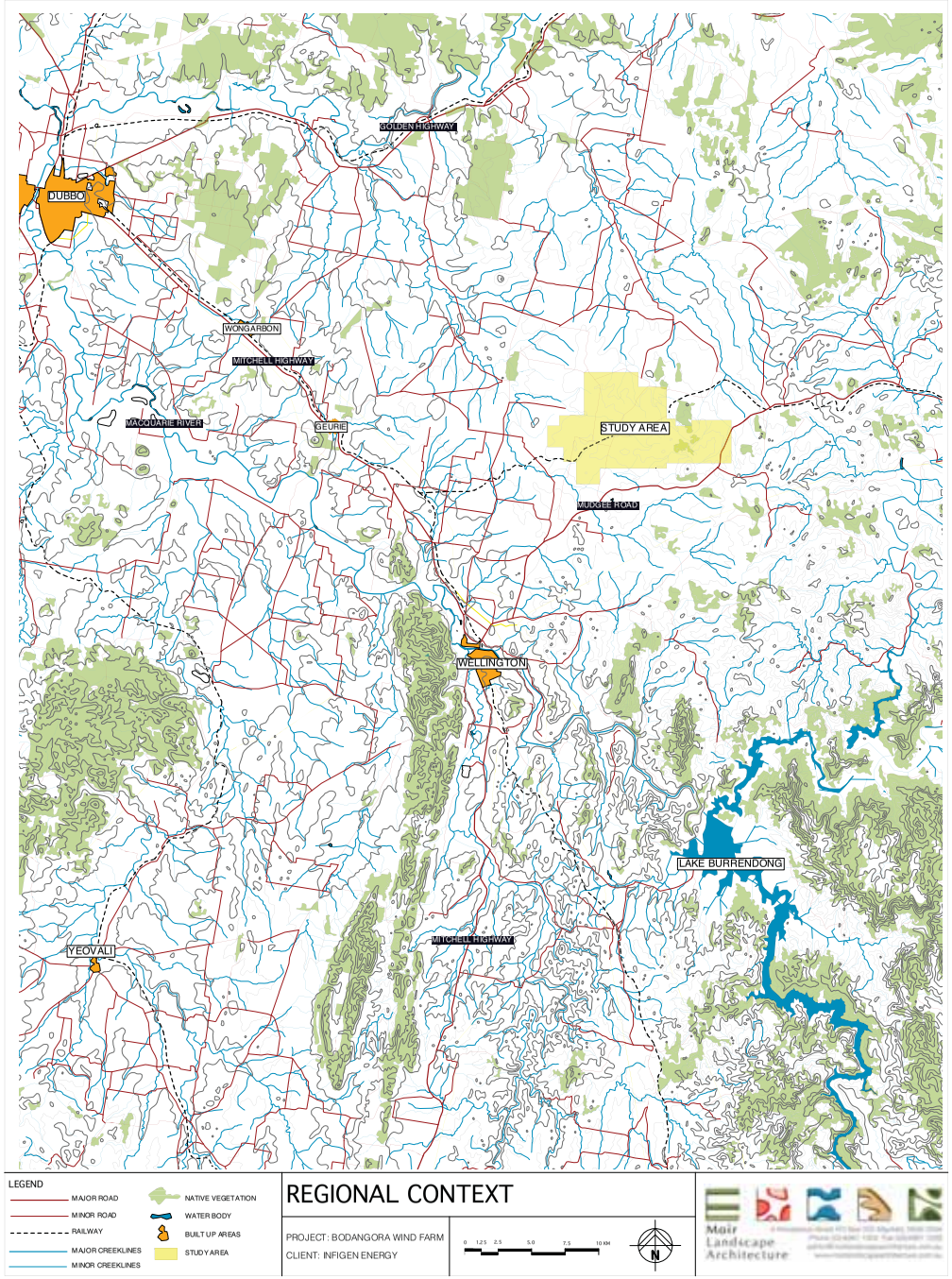

FIGURE 1: Regional Context

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 an assessment of the significance of landscape values and character in a local and regional context. 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 of the wind farm including consideration to night lighting (no less than 10 kilometres) and assess the visual impact of all project components on this landscape;
- include an assessment of any cumulative visual impacts from transmission line infrastructure;
- 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, 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 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 impacts after these measures have been implemented.

2.3 POLICY CONSIDERATIONS

There is not yet guidelines for the development of wind farms in NSW. The following provides an overview of the, guidelines, relevant frameworks and considerations of authorities utilised to form the methodology for this visual impact assessment.

In addition to these guidelines and frameworks, Wind Farm related literature and previous Visual Impact Assessments of relevance have been utilised throughout the Visual Impact Assessment process.

Best Practice Guidelines for Wind Energy Development

The Best Practice Guidelines for Wind Energy Development were developed in November 1994 by the British National Wind Energy Association to assist the development of appropriate wind energy projects in the UK

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.

National Wind Farm Development Guidelines

The Environment Protection and Heritage Council have developed a draft guideline (July 2010) to provide consistent framework and methods for assessing issues unique to wind farm developments. References to these guidelines have been made throughout the report.

Wellington Shire Council

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

Road and Traffic Authority

The assessment of shadow flicker, blade glint and reflectivity is to include an assessment of the impact on road users.

Civil Aviation Safety Authority

The LVIA includes an assessment of night lighting in accordance with the Civil Aviation Safety Authority (CASA).

3.0 STUDY METHOD

3.1 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

The purpose of a Landscape Assessment and Visual Impact Assessment is 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:

SITE & REGIONAL CONTEXT
- Overview of the regional and site context including both natural and cultural features.

LANDSCAPE CHARACTER
- Description of the regional landscape character and significant features.
- Classification of the local landscape into different character types and a description (Referred to as Landscape Character Units). A determination of the landscapes ability to absorb different types of development based on the physical and environmental character of the landscape.

THE PROPOSAL
- Overview of the proposed wind farm development and associated infrastructure.

VISUAL IMPACTS
- Computer modelling to determine the Zone of Visual Influence (ZVI) based on topography alone to represent worst case scenario.
- 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.
- 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)

VISUAL EFFECTS
- Overview of potential Visual effects including Shadow Flicker, Blade Glint and Reflectivity and Night Lighting.

CUMULATIVE VISUAL IMPACTS
- Assess the cumulative visual impacts based on existing and proposed development in the area.

VISUAL IMPACT SUMMARY
- Assessment of the overall visual impact, summary of visual impact on residents and public receptors.

COMMUNITY PERCEPTIONS
- Overview of the community perception, consultation process and outcomes.

MITIGATION METHODS
- Preparation of recommendations for impact mitigation and suggestions for suitable development to maintain the areas visual quality.

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 water forms (without becoming too common) and related to water quality and associated activity; and
- visual quality increases with increases in land use compatibility.

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 refers to the change in appearance of the landscape as a result of development. (EPHC, 2010). 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

3.2.6 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. Refer to section 9.0.

3.3 VISIBILITY 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).

3.3.1 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 WIND TURBINE	POTENTIAL VISUAL PROMINENCE
> 12 km	VISUALLY INSIGNIFICANT A very small element in the viewshed, which is difficult to discern and will be invisible in some lighting or weather circumstances. Rotor blade movement can often be seen on a clear day.
6-12 km	POTENTIALLY NOTICABLE BUT WILL NOT DOMINATE THE LANDSCAPE The development will be noticable. The degree that it intrudes on the view will increase as distance decreases.
2.5-6 km	POTENTIALLY NOTICABLE AND CAN DOMINATE THE LANDSCAPE The development may be highly noticable.
1-2.5 km	HIGHLY VISIBLE AND WILL USUALLY DOMINATE THE LANDSCAPE The development may be highly noticable.
<1 km	WILL ALWAYS BE VISUALLY DOMINANT IN THE LANDSCAPE The development is highly noticable.

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

3.3.2 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)

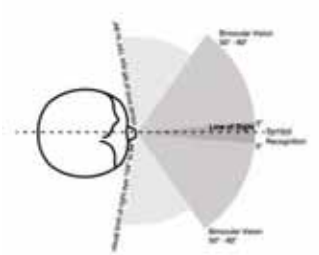

FIGURE 3: Horizontal Line of Sight

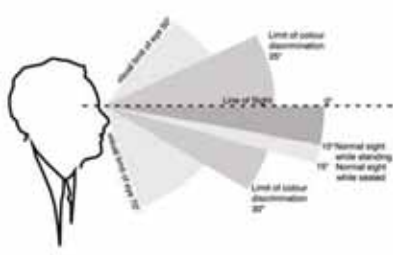

FIGURE 4: Vertical Line of Sight

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)