

Ed Mounsey
CWP Renewables Pty Ltd
45 Hunter Street
Newcastle, NSW

26 February 2016

Dear Ed,

Sapphire Wind Farm Modification – summary Visual Impact Assessment report

Further to your email of the 25th November 2015 please find below our summary Visual Impact Assessment report for the Sapphire Wind Farm Modification. This summary report sets out our review and professional opinion of the potential visual impacts associated with the proposed modification to the approved Sapphire Wind Farm development.

1 Introduction

Green Bean Design Pty Ltd (GBD) has been commissioned CWP Renewables Pty Ltd on behalf of Sapphire Wind Farm Pty Ltd (the Proponent) to prepare a summary Visual Impact Assessment (summary VIA) report for a modification to the approved Sapphire Wind Farm development.

GBD previously prepared the Landscape and Visual Impact Assessment (EA LVIA) for the Sapphire Wind Farm included in the Environmental Assessment (EA) dated 9th November 2011.

GBD also prepared a supplementary landscape and visual impact assessment for a 1 metre increase to the EA wind turbine tip height dated 7th November 2011.

2 Project Approval

Project Approval for the Sapphire Wind Farm was granted on the 26 June 2013 under Part 3A of the NSW Environment Planning and Assessment Act 1979 (EP&A Act), and is subject to a number of Conditions of Approval (CoA).

3 Project information provided to GBD

GBD confirm the following information has been provided by the Proponent for consideration and/or incorporation into the summary VIA:

- an amended wind farm layout;
- location and description of proposed modified wind turbines;
- a modified comparative ZVI diagram;
- four amended photomontage illustrating proposed modified wind turbines; and
- an amended shadow flicker diagram.

4 Modification description

In general the proposed amendments involve:

- an overall reduction in wind turbines across the project, from 159 to approximately 109 wind turbines;

- the consolidation of two approved project layouts into one; and
- an increase to the maximum tip height and rotor diameter for the project to accommodate current wind turbine technology, from 157m to up to 200m with a rotor diameter increase from 126m to up to 140m.

5 Sapphire Wind Farm modification, wind turbines and layout

The Sapphire Wind Farm Project Approval permits the construction for up to 159 wind turbines and an installed capacity of 319MW. The Project Approval does not specifically reference permissible wind turbine tip heights; however, the wind turbine tip heights assessed in the EA LVIA (and supplementary report) were 146 metres and 157 metres for each of the two layouts presented in the EA. Table 1 outlines the approved and proposed modification turbine dimensions and numbers.

Table 1: Approved wind turbine and proposed modification design criteria

	Rotor diameter	Tip height	Total number
Project Approval (Layout A)	92m	146m	159
Project Approval (Layout B)	126m	157m	125
Proposed Modification	140m	200m	109
Difference (with Max. A or B)	+14m	+43m	-50

Figure 1 illustrates the approved wind turbine dimensions together with those of the proposed modified wind turbine.

Table 2 outlines the number of wind turbines within each of the 3 turbine clusters included in the EA LVIA. The proposed modification would:

- delete all approved wind turbines within the Wellingrove cluster;
- delete 4 wind turbines from the Swan Vale cluster; and
- delete 9 wind turbines from the Sapphire cluster.

Table 2 – Approved and proposed modified Sapphire Wind Farm wind turbine clusters

Turbine cluster	Approved 146m tip height layout option	Approved 157m tip height layout option	Proposed modified 200m tip height
‘Wellingrove’	37	29	0
‘Swan Vale’	66	51	62
‘Sapphire’	56	45	47
Total	159	125	109

The approved and modified wind turbine layouts, including location of wind turbines to be deleted are illustrated in Figure 2.

6 Ancillary structures

The approved Sapphire Wind Farm incorporates a range of ancillary structures which include:

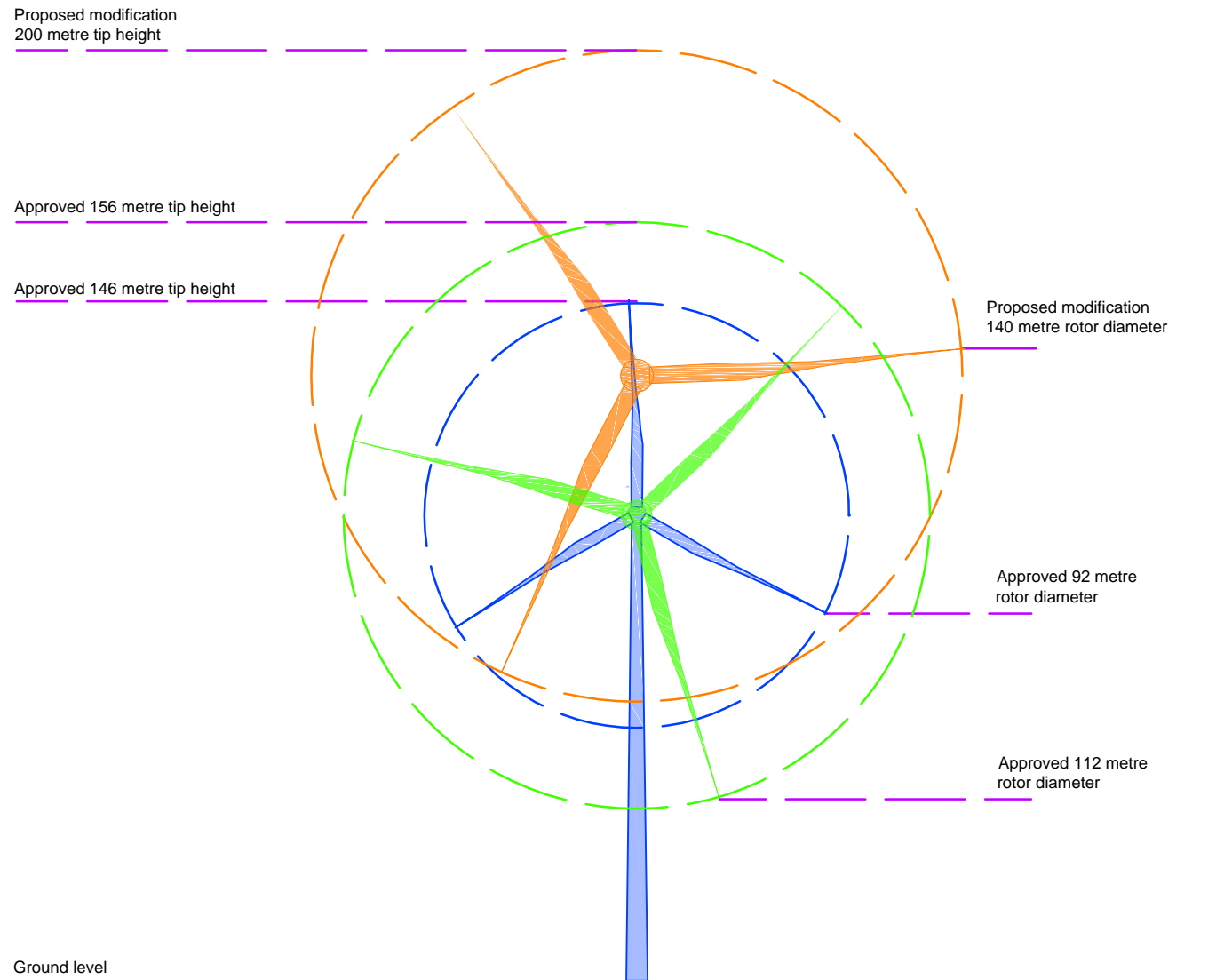
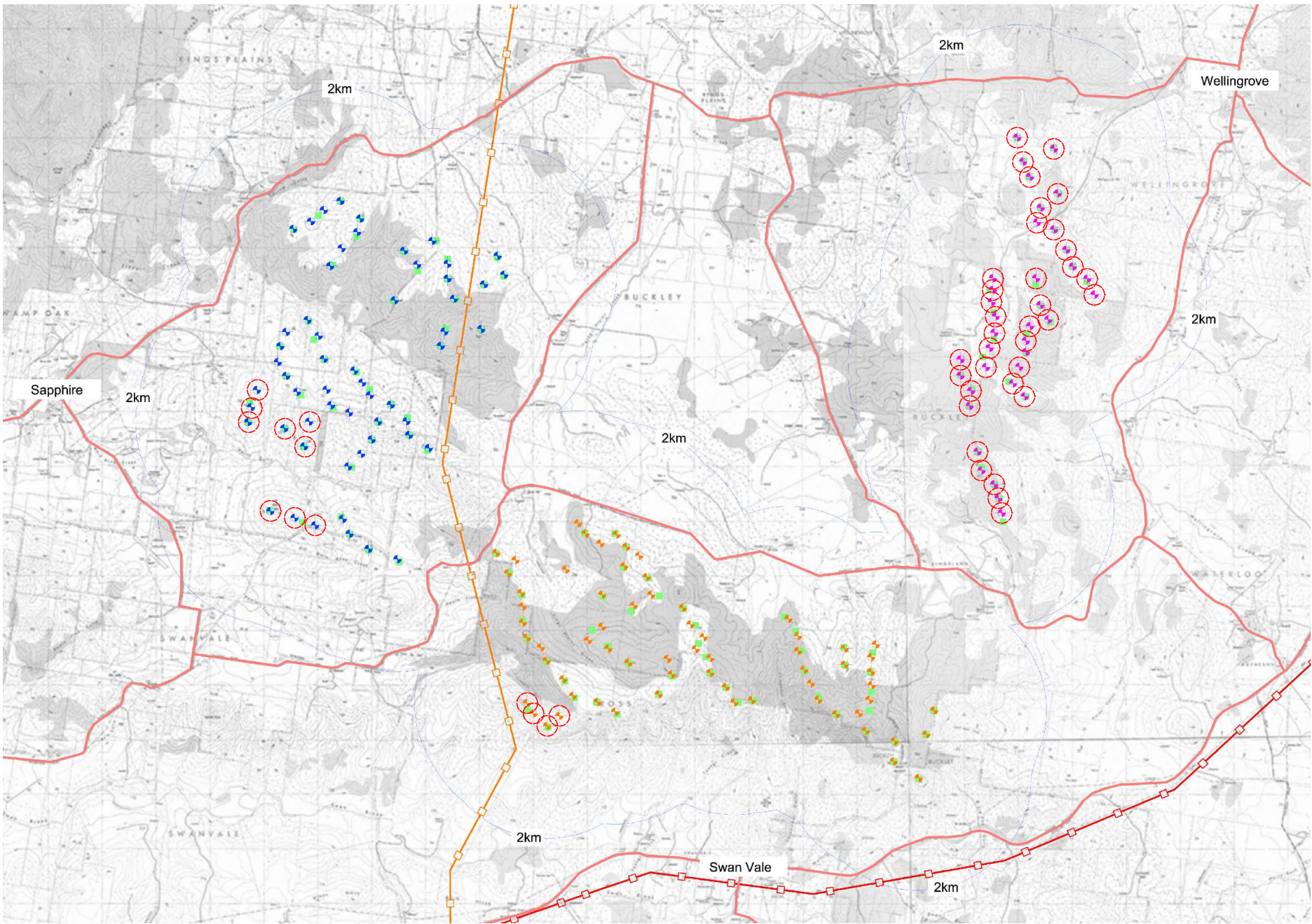


Figure 1 - Approved and proposed
modification wind turbine comparison



- Legend**
- Approved Sapphire wind turbine cluster
 - Approved Swan Vale wind turbine cluster
 - Approved Wellingrove wind turbine cluster
 - Approved 156 metre tip height wind turbine location
 - Existing 132kV transmission line
 - Existing 330kV transmission line
 - Local road or Highway
 - 2km offset

- Approved 159 wind turbine layout at 146 metre tip height (Sapphire turbine cluster)
- Approved 159 wind turbine layout at 146 metre tip height (Wellingrove turbine cluster)
- Approved 159 wind turbine layout at 146 metre tip height (Swan Vale turbine cluster)
- Deleted wind turbine

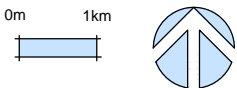


Figure 2 - Approved and modification wind turbine layout

- wind monitoring masts;
- on-site access tracks;
- substations;
- overhead powerline; and
- control and operation facilities building.

The proposed modification would not result in any fundamental change to these approved structures and would not result in any additional visual impacts to those outlined in the EA LVIA.

7 Comparative Zone of Visual Influence Diagram

Within the recognised limitations of Zone of Visual Influence (ZVI) diagrams, the overall extent of approved and proposed modified wind turbine visibility covers a similar extent of the landscape surrounding the wind farm site. Figure 3 compares the layout and dimensions of the approved 146m tip height layout with the proposed modification which presents a conservative (worst case) comparison.

The similarity in potential wind turbine visibility demonstrates the influence of topography on views toward the approved and proposed modified wind turbines. The ZVI diagram illustrates that the proposed modification will have no significant overall increase in visual presence across the project viewshed.

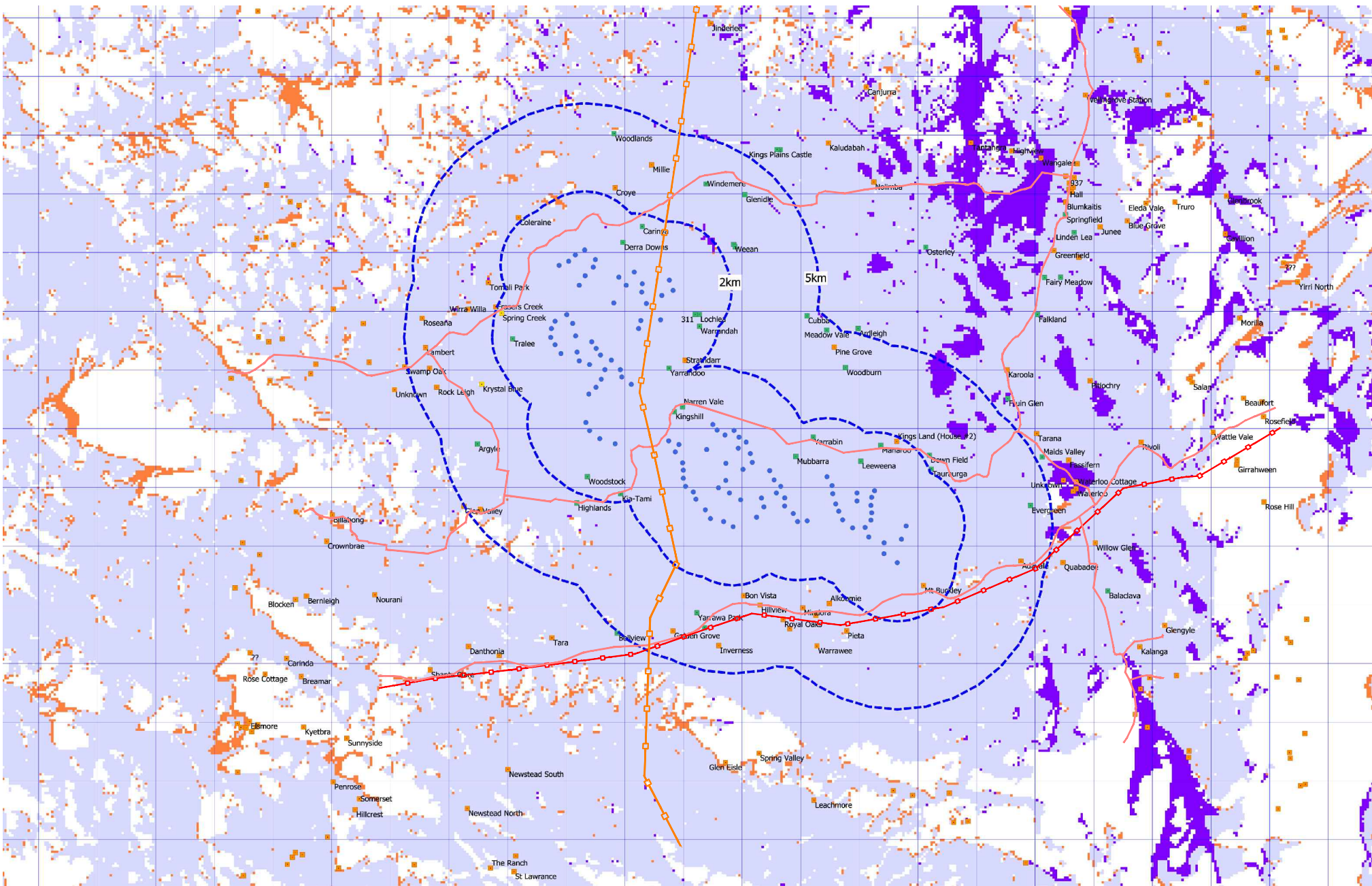
The removal of all wind turbines from the Wellingrove turbine cluster will result in a reduced visibility toward the modified wind turbine layout across discrete and scattered areas to the north and north-west of the Wellingrove turbine cluster. Whilst the overall extent of wind turbine visibility will be contained by topography for both the approved and modified wind turbine layouts, the number of wind turbines visible from elevated receiver locations within the wind farm viewshed is likely to increase. However, the increase in number of wind turbines visible will be largely restricted to the upper sections (hubs and blades) of wind turbine structures, rather than whole wind turbines.

8 Summary Visual Impact Assessment

The assessment of potential visual impacts associated with the proposed modification has followed the assessment processes and methodology applied in the determination of the EA LVIA visual impacts.

Whilst the EA LVIA included an assessment of associated residential dwellings, this summary VIA has not determined potential visual impacts for associated residential dwellings. Associated receiver locations have been deemed to have accepted the potential for visual impacts which may occur from their dwellings.

This summary VIA has not included an assessment or determination of visual impacts for receiver locations beyond 5 kilometres from the approved wind turbine locations. Whilst the proposed modified wind turbines will extend above the approved wind turbine layout, this summary VIA has determined that the overall scale of the proposed modified wind turbines at a 5 kilometre (and over) view distance will not result in an order of visual magnitude that is significantly above the visual magnitude of the approved wind turbines. It is also noted that the proposed modified wind turbines would be consistent with the approved wind turbines with regard to



- Proposed modification-109 wind turbine layout at 200 metre tip height visible
- Both proposed modification and approved wind turbine tip height visible
- Proposed modification wind turbine location
- Approved 159 wind turbine layout at 146 metre tip height visible
- Approved and proposed modification wind turbine not visible

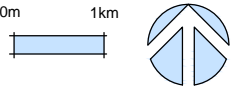


Figure 3 - Approved and proposed modification comparative ZVI

their visual form, design, pattern and colour. The extent of the magnitude of effect would also be greatly reduced by the proposed deletion of the Wellingrove turbine cluster, and a smaller number of wind turbines within the Swan Vale and Sapphire turbine clusters.

The location of non-associated residential dwellings within 5 kilometres of the proposed modified wind turbine layout is illustrated in Figure 4.

The degree of magnitude effect is illustrated in Figures 5 and 6. Figure 5 illustrates the elevated angle of view (toward tip height) for the approved and proposed modified wind turbines from a view distance of 2 kilometres and 5 kilometres respectively.

Figure 5 illustrates that the proposed modified wind turbine would include an additional and approximate one and a half degree view angle above the approved 146 metre tip of blade wind turbine from a 2 kilometre view distance. The additional view angle from a view distance of 5 kilometres would be an additional and approximate half of one degree increase in view angle.

Figure 6 illustrates the perceived and relative height difference between the approved 146 metre tip height wind turbine and the proposed modified 200 metre tip height wind turbine. At a view distance of 5 kilometres the approved and proposed modified wind turbines will be perceived at less than half the height of the proposed modified wind turbine when viewed at a distance of 2 kilometres. The relatively small increase in view angle toward the proposed modified wind turbine tip height, at a view distance of 5 kilometres (and beyond) is considered unlikely to result in a level of visual magnitude greater than the approved wind turbines.

Within the parameters of normal human vision, the proposed modified wind turbines are not considered to give rise to an increased level of visual magnitude over and above that determined for the approved wind farm development.

Table 3 outlines the assessment of non-associated residential dwellings which occur within 5 kilometres of the proposed modified wind turbine layout. The determination of visual impact has considered the factors included in the EA LVIA such as:

- the visibility or extent to which the proposed wind farm structures would be visible from surrounding areas;
- the degree of visual contrast between the wind farm structures and the capability of the surrounding landscape to visually accommodate the wind farm;
- the category and type of situation from which people could view the wind farm (examples of view categories include residents or motorists);
- the distance between the view location and the wind farm turbines;
- the potential number of people with a view toward the proposed wind farm from any one location;
- the duration of time people could view the wind farm from any static or dynamic view location; and
- the visual sensitivity of view location surrounding the wind farm.

The factors referenced from the EA LVIA (Table 17) have also been supplemented with the number of approved and proposed modified wind turbines potentially visible to tip of blade from non associated receiver locations and the resultant increase or decrease in the number of visible wind turbines.

It should be noted that the number of visible wind turbines included in Table 3 has been generated through the use of a desktop model that does not incorporate vegetation or other natural or built screens that exist in the landscape. The modelling only accounts for contours obstructing or displacing the view of either the approved or proposed modification, and should therefore only be considered as a very conservative guide to relative impact.

Legend

Sapphire modified 109 wind turbine layout



Existing 132kV transmission line



Existing 330kV transmission line



Road



Distance offset to wind turbines as noted



Associated residential dwelling



Non associated residential dwelling within 2km of Sapphire wind turbine



Non associated residential dwelling between 2 and 5km of Sapphire wind turbine



Non associated residential dwelling beyond 5km of Sapphire wind turbine



Timbered areas



0m 2km



Figure 4 - Residential dwellings

GREEN BEAN DESIGN

landscape architects

cwp
Renewables

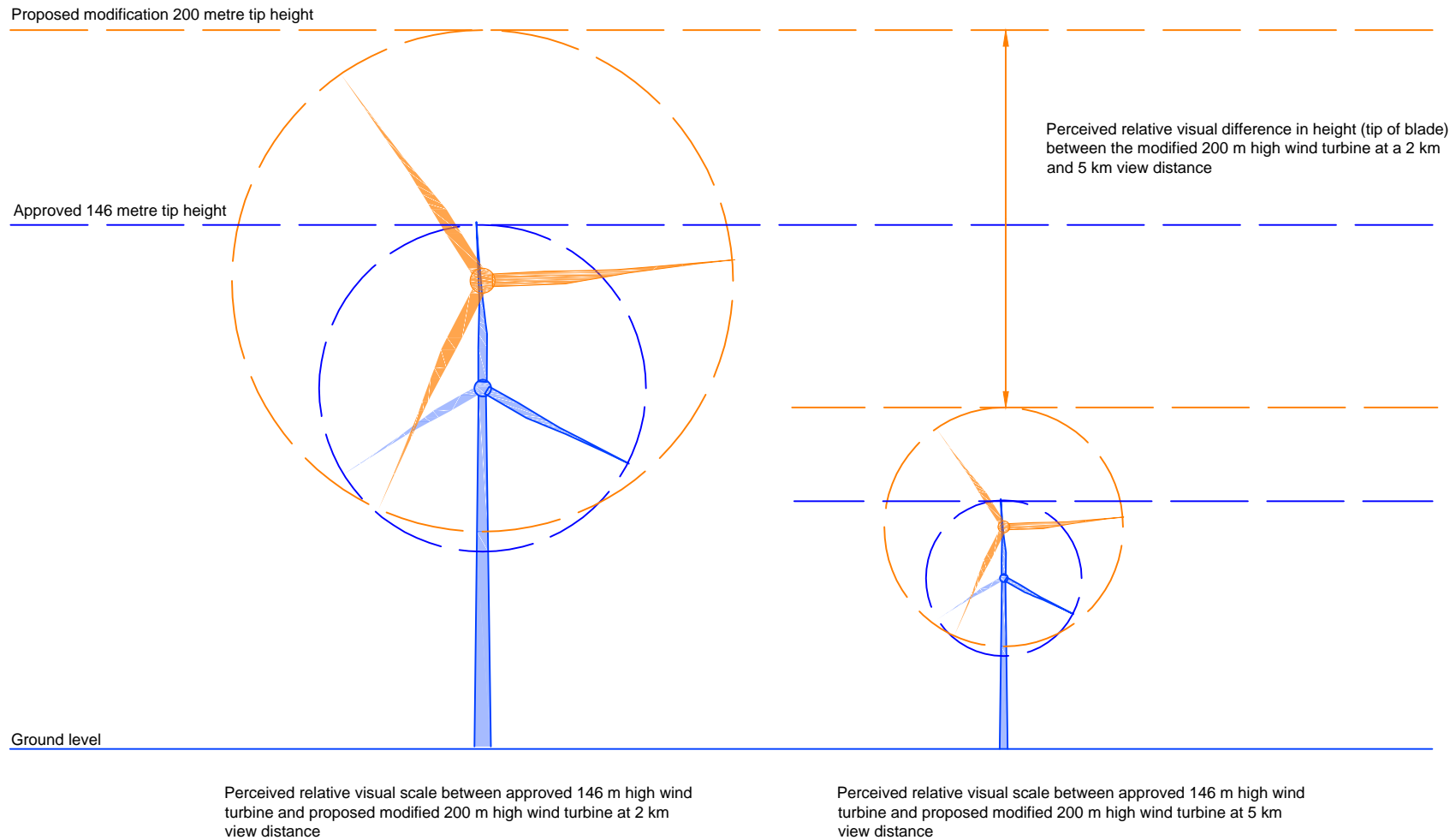
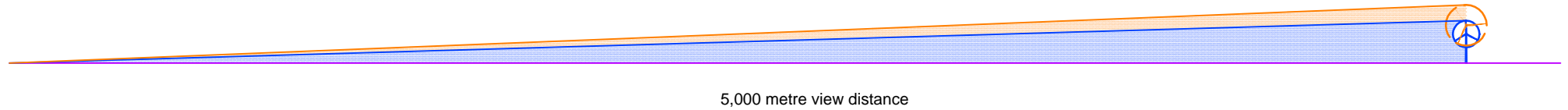
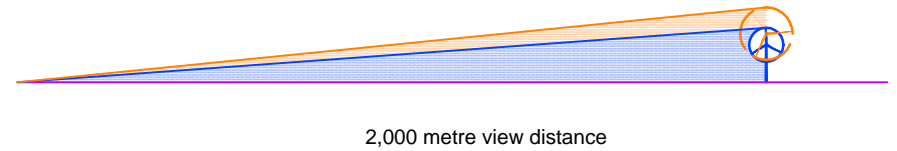
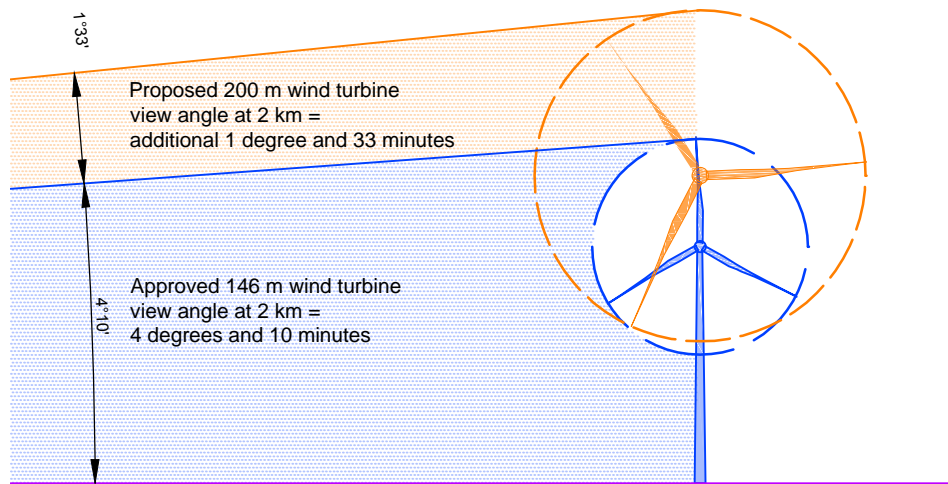


Figure 5 - Approved and proposed modification wind turbine comparison at 2 km and 5 km view distance

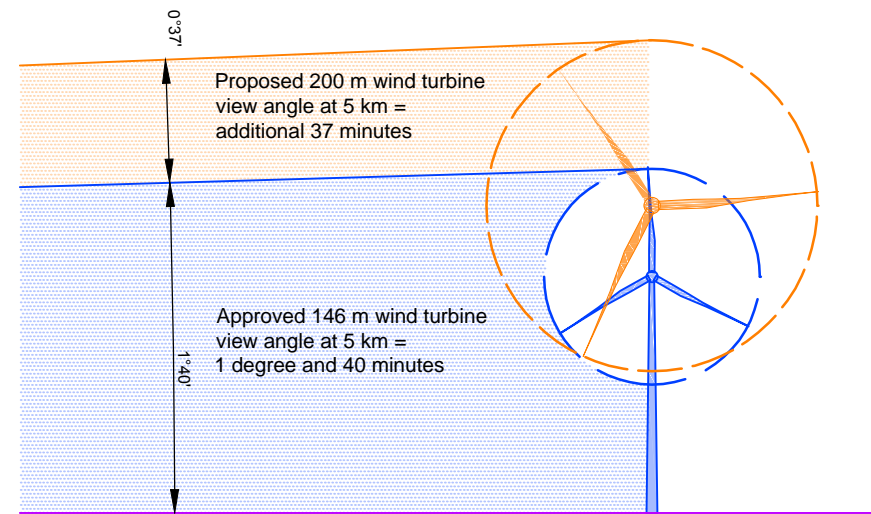
Blue line = view line toward tip height of approved wind turbine (146 metres)
 Orange line = view line toward tip height of modification wind turbine (200 metres)



View angle toward approved and modification wind turbines from a 2 km and 5 km view distance



View angle toward approved and modification wind turbines from a 2 km view distance



View angle toward approved and modification wind turbines from a 5 km view distance

Figure 6 - Approved and modification
wind turbine comparison

Table 3 – Summary Visual Assessment Matrix

Receiver location (Refer figure 4)	Associated or non associated (distance where within 2 km or determined as high impact)	Number of wind turbines visible to 146m tip	Number of wind turbines visible to 200m tip	Difference in number of turbines visible to tip height	EA LVIA 146 metre wind turbine visual impact	Modification 200 metre wind turbine visual impact
R4	1.1 Non associated	155	108	-47	Low	Low
R5	1.2 Non associated	142	109	-33	Low to Moderate	Low
R6	Associated	Not assessed				
R7	Non associated 1.85 km	140	109	-31	Low	Low
R8	Associated	Not assessed				
R9	Associated	Not assessed				
R10	Non associated 1.19 km	5	5	0	Low	High
R11	Associated	Not assessed				
R12	Associated	Not assessed				
R13	Associated	Not assessed				
R14	Associated	Not assessed				

Table 3 – Summary Visual Assessment Matrix

Receiver location (Refer figure 4)	Associated or non associated (distance where within 2 km or determined as high impact)	Number of wind turbines visible to 146m tip	Number of wind turbines visible to 200m tip	Difference in number of turbines visible to tip height	EA LVIA 146 metre wind turbine visual impact	Modification 200 metre wind turbine visual impact
R15	Associated	Not assessed				
R16	Associated	Not assessed				
R17	Non associated (uninhabitable dwelling) 1.61 km	121	91	-30	Low	Low
R18	Associated	Not assessed				
R19	Associated	Not assessed				
R20	Associated	Not assessed				
R21	Associated	Not assessed				
R22	Associated	Not assessed				
R23	Associated	Not assessed				
R24	Associated	Not assessed				
R26	Non associated 1.78 km	114	109	-5	High	High
R27	Non associated	119	109	-10	Low to Moderate	Low to Moderate

Table 3 – Summary Visual Assessment Matrix

Receiver location (Refer figure 4)	Associated or non associated (distance where within 2 km or determined as high impact)	Number of wind turbines visible to 146m tip	Number of wind turbines visible to 200m tip	Difference in number of turbines visible to tip height	EA LVIA 146 metre wind turbine visual impact	Modification 200 metre wind turbine visual impact
	2 km					
R28	Associated	Not assessed				
R29	Non associated 2.84 km	109	109	0	High	High
R30	Non associated	118	109	-9	Low to Moderate	Low to Moderate
R31	Non associated	122	109	-13	Low to Moderate	Low to Moderate
R32	Non associated	126	109	-17	Low to Moderate	Low to Moderate
R33	Associated	Not assessed				
R34	Non associated	102	104	2	Moderate	Moderate
R35	Non associated	85	102	17	Moderate	Moderate
R36	Associated	Not assessed				
R37	Associated	Not assessed				
R38	Non associated	78	80	2	Moderate	Moderate
R39	Non associated	47	49	2	Moderate	Moderate

Table 3 – Summary Visual Assessment Matrix

Receiver location (Refer figure 4)	Associated or non associated (distance where within 2 km or determined as high impact)	Number of wind turbines visible to 146m tip	Number of wind turbines visible to 200m tip	Difference in number of turbines visible to tip height	EA LVIA 146 metre wind turbine visual impact	Modification 200 metre wind turbine visual impact
R40	Non associated	49	51	2	Moderate	Moderate
R41	Non associated	46	53	7	Moderate	Moderate
R42	Non associated	51	54	3	Moderate	Moderate
R43	Non associated	59	62	3	Moderate	Moderate
R44	Non associated	29	33	4	Moderate	Moderate
R45	Non associated	44	47	3	Moderate	Moderate
R46	Non associated	45	51	6	Moderate	Moderate
R47	Non associated	59	62	3	Moderate	Low to Moderate
R48	Non associated	51	21	-30	Moderate	Low to Moderate
R49	Non associated	58	42	-16	Low	Low
R76	Associated	Not assessed				
R77	Associated	Not assessed				
R78	Non associated	148	109	-16	Low	Low
R79	Associated	Not assessed				

Table 3 – Summary Visual Assessment Matrix

Receiver location (Refer figure 4)	Associated or non associated (distance where within 2 km or determined as high impact)	Number of wind turbines visible to 146m tip	Number of wind turbines visible to 200m tip	Difference in number of turbines visible to tip height	EA LVIA 146 metre wind turbine visual impact	Modification 200 metre wind turbine visual impact
R80	Associated	Not assessed				
R81	Associated	Not assessed				
R84	Associated	Not assessed				
R85	Associated	Not assessed				
R86	Non associated	136	108	-28	Low	Low
R87	Non associated	119	88	-31	Low	Low
R88	Associated	Not assessed				
R89	Non associated	38	59	21	Low	Low
R90	Non associated	123	109	-14	Low	Low
R91	Mine site	n/a	n/a	n/a	n/a	n/a
R92	Non associated	63	74	11	Low	Low
R93	Non associated	123	109	-14	Low	Low
R94	Non associated	121	109	-12	Low	Low
R95	Non associated	119	109	-10	Low	Low

9 Visual Assessment Matrix summary

This summary VIA identified a total of 34 non associated residential dwellings within 5 kilometres of the proposed modified wind turbines.

An assessment of the potential visual impacts associated with the proposed modification indicates that:

- 3 of the 34 residential receiver locations (R10, R26 and R29) would have a high visual impact - these 3 dwellings are considered relevant to current CoA C23;
- 11 of the 34 residential receiver locations would have a moderate visual impact - these 11 dwellings are considered relevant to current CoA C23;
- 6 of the 34 residential receiver locations would have a low to moderate visual impact - these 6 dwellings are not considered relevant to current CoA C23; and
- 14 of the 34 residential receiver locations would have a low visual impact - these 14 dwellings are not considered relevant to current CoA C23.

1 receiver location (R91) has been determined as a non residential mine site and excluded from the assessment.

3 receiver locations (R5, R47 and R48) have been determined to have a reduced level of visual impact which is largely due to the deletion of wind turbines within the Wellingrove turbine cluster.

1 receiver location (R10) has been determined to increase from a low to a high visual impact. The increase in visual impact has been determined subject to a further site inspection at the residential property and confirmation of view toward the Sapphire wind turbines through preparation of a wire frame model.

It should be noted that there are six non-associated receiver locations located within 3 km of the modified project that will experience a low-to-moderate or low visual impact. Three of these locations are located on or within 2 km of the modified project. Despite proximity, the rationale in support of these ratings is the localised vegetation screening that exists at each location as determined through site inspection and desktop study.

10 Refined Assessment Matrix

This summary VIA report has included the preparation of a Refined Assessment Matrix (RAM) which is presented in Appendix A of this report. The RAM is currently being developed by the NSW Department of Planning and Environment (DPE) to provide site specific assessments from receiver locations with moderate to high visual impacts. The RAM identifies a range of visual criteria and determines an overall score against a pre-determined threshold for very low, low, medium and high visual impacts. These determinations of visual impact are made independently of the EA LVIA and utilised by the DPE during their review and assessment process.

Whilst the results of the RAM indicate that the majority of residential dwellings will experience a visual impact in the upper moderate rating (scoring 20 and 21), it is possible that some of these visual impacts could be mitigated through implementation of landscape screening strategies which are considered relevant to current CoA C23.

The RAM (Appendix A Table A.3) has determined receiver location R10 as a moderate, and not high visual impact as determined in the summary VIA matrix presented in Table 3. This reduction in visual impact has resulted from the application of the RAM criteria against a relatively small number of visible wind turbines from the R10 receiver location. The footnote to Appendix A, Table A.5 states that *‘observations and measurements for individual residential dwellings must also take into account the potential visual effect of single or small numbers of wind turbines within a proposed wind farm development. Single or small numbers of wind turbines may give rise to moderate and high visual impacts under certain circumstances’*. In this regard it has been determined that the proximity and dominance of a single wind turbine on this receiver location has initiated the change in rating from moderate to high.

Those dwellings assessed as having a high (3 in total) and moderate (11 in total) visual impact rating are considered relevant to CoA C23.

11 Shadow Flicker

Due to their height, wind turbines can cast shadows on surrounding areas at a significant distance from the base of the wind turbine tower. Coupled with this, the moving blades create moving shadows. When viewed from a stationary position, the moving shadows appear as a flicker giving rise to the phenomenon of ‘shadow flicker’. When the sun is low in the sky the length of the shadows increases, increasing the shadow flicker affected area around the wind turbine.

A shadow flicker assessment has been prepared by the Proponent to determine and illustrate the potential impact of shadow flicker on surrounding residential dwellings.

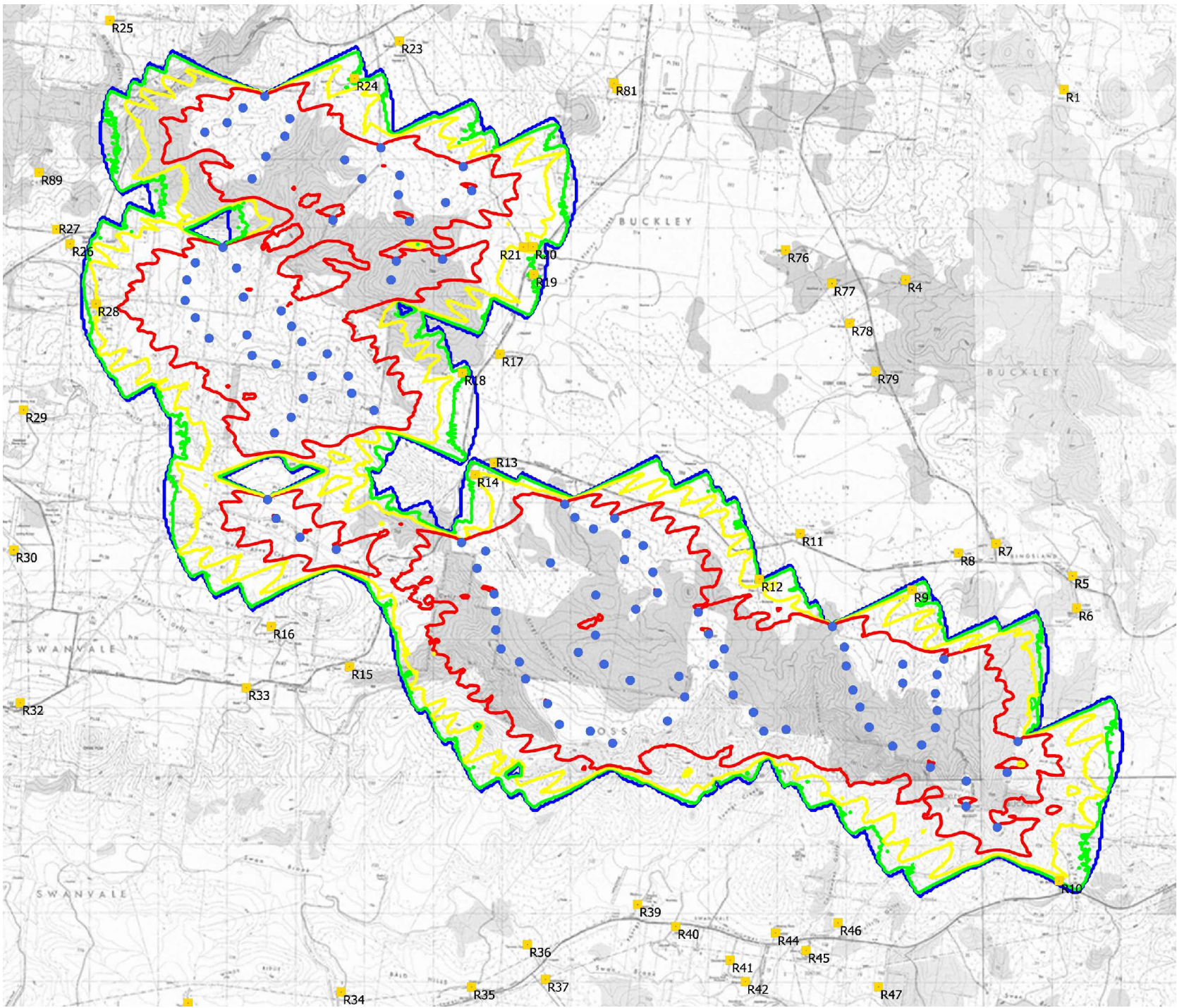
A shadow flicker assessment may over estimate the actual number of annual hours of shadow flicker at a particular location due to a number of reasons including:

- the probability that the wind turbines will not face into or away from the sun all of the time;
- the occurrence of cloud cover;
- the amount of particulate matter in the atmosphere (moisture, dust, smoke etc...) which may diffuse sunlight;
- the presence of vegetation; and
- periods where the wind turbine may not be in operation due to low winds, or high winds or for operational or maintenance reasons.

The Proponent has adopted the Victorian Planning Guidelines which state:

“The shadow flicker experienced at any dwelling in the surrounding area must not exceed 30 hours per year as a result of the operation of the wind energy facility”.

The results of the shadow flicker assessment for the proposed modified Sapphire Wind Farm determined that none of the associated or non-associated residential dwellings surrounding the wind energy development



Legend

**Worst Case Accumulated
Shadow Flicker Hours per Year**

- 0
- 10
- 30
- 100

- 109 Turbine Wind Farm Layout
- Dwelling

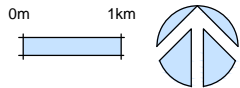


Figure 7 - Shadow flicker

would experience shadow flicker in excess of 30 hours per year. The shadow flicker diagram is illustrated in Figure 7.

12 Photomontages

Four photomontages have been prepared by the Proponent to illustrate the:

- approved 146 metre tip height wind turbines in the original layout; and
- proposed 200 metre tip height wind turbine in the modified layout.

Photomontages have been prepared from:

- Eastern Feeder Road (PM5);
- Kings Plains Road (PM7);
- Gwydir Highway, Swan Vale (PM9); and
- Krystal Blue residential dwelling (PM11).

The photomontages are illustrated in Figures 8, 9, 10 and 11.

13 Conclusion

The determination for a potential increase to visual impacts associated with the approved Sapphire Wind Farm has been based upon professional judgement in consideration of:

- the proposed modified wind turbine layout;
- the proposed deletion of up to 50 approved wind turbine locations;
- the vertical height difference between proposed modified wind turbines and the approved wind turbines;
- the overall visibility and visual magnitude of the proposed modified wind turbines; and
- the comparative visibility of the proposed modified and approved wind turbines.

This summary VIA has illustrated the proposed amendments to the approved wind turbine layout and considers that the removal of up to 50 wind turbines, including all approved wind turbines within the Wellingrove cluster, will result in an overall reduction in visibility and visual impact for residential dwellings to the north, north east and east of the approved wind farm site.

Whilst the proposed increase in wind turbine height would be discernible from surrounding view locations and, in a small number of locations, increase the number of wind turbines visible (including views toward partial sections of wind turbine structures, rather than whole turbines), the increase in height will not give rise to a significant increase in the magnitude of visual effect. This summary VIA has illustrated the potential for increase to the magnitude of visual effect and has determined that, within the parameters of normal vision, the proposed modified wind turbines would not give rise to an increased level of visual impact over and above those determined for the approved wind farm development.



Photomontage PM5 Eastern Feeder - View looking west to south west from the Eastern Feeder Road toward the approved Sapphire Wind Farm layout. This photomontage illustrates the 159 wind turbine layout at the 146 metre tip height. Nearest wind turbine 5 km.



Photomontage PM5 Eastern Feeder - View looking west to south west from the Eastern Feeder Road toward the proposed Sapphire Wind Farm modification layout. This photomontage illustrates the 109 wind turbine layout at a 200 metre tip height.

Coordinates: Easting 353400, Northing 6715217
Photo date: 18th January 2011, 11.45am
Elevation: 963m AHD (+/- 4m)
Camera: Canon EOS 4000, 30mm 1:1.4DC Lens (equivalent to 35mm SLR Camera with 50mm lens). F/16 at 1/400 sec
Original Page Format: A1 Landscape
This photomontage represents the likely view of the proposed Sapphire wind farm.

Figure 8 - Photomontage PM5 Eastern Feeder Road



Photomontage PM7 Kings Plains Road - View looking north east to south from Kings Plains Road toward the approved Sapphire Wind Farm layout. This photomontage illustrates the 159 wind turbine layout at the 146 metre tip height. Nearest wind turbine 1.75 km.



Photomontage PM7 King Plains Road - View looking north east to south from Kings Plains Road toward the proposed Sapphire Wind Farm modification layout. This photomontage illustrates the 109 wind turbine layout at a 200 metre tip height.

Coordinates: Easting 341880, Northing 6716075
Photo date: 18th January 2011, 3.00pm
Elevation: 835m AHD (+/- 5m)
Camera: Canon EOS 4000, 30mm 1:1.4DC Lens (equivalent to 35mm SLR Camera with 50mm lens). F/16 at 1/320 sec
Original Page Format: A1 Landscape
This photomontage represents the likely view of the approved and modified Sapphire Wind Farm layouts.

Figure 9 - Photomontage PM7
Kings Plains Road



Photomontage PM9 Gwydir Highway, Swan Vale - View looking north west to north east from Gwydir Highway toward the approved Sapphire Wind Farm layout. This photomontage illustrates the 159 wind turbine layout at the 146 metre tip height. Nearest wind turbine 2.8 km.



Photomontage PM9 Gwydir Highway, Swan Vale - View looking north west to north east from Gwydir Highway toward the proposed Sapphire Wind Farm modification layout. This photomontage illustrates the 109 wind turbine layout at a 200 metre tip height.

Coordinates: Easting 350658, Northing 6706029
Photo date: 17th January 2011, 2.42pm
Elevation: 791m AHD (+/- 5m)
Camera: Canon EOS 4000, 30mm 1:1.4DC Lens (equivalent to 35mm SLR Camera with 50mm lens). F/16 at 1/160 sec
Original Page Format: A1 Landscape
This photomontage represents the likely view of the approved and modified Sapphire Wind Farm layouts.

Figure 10 - Photomontage PM9
Swan Vale



Photomontage Location PM11 Krystal Blue - View looking north east to south toward the approved Sapphire Wind Farm layout. This photomontage illustrates the 159 wind turbine layout at the 146 metre tip height. Nearest wind turbine 1.8 km



Photomontage Location PM11 Krystal Blue - View looking north east to south toward the proposed Sapphire Wind Farm modification layout. This photomontage illustrates the 109 wind turbine layout at a 200 metre tip height.

Coordinates: Easting 341144, Northing 6713550
Photo date: 2nd August 2011, 4.20pm
Elevation: 769m AHD (+/- 4m)
Camera: Canon EOS 4000, 30mm 1:1.4DC Lens (equivalent to 35mm SLR Camera with 50mm lens). F/16 at 1/250 sec
This photomontage represents the likely view of the approved and modified Sapphire Wind Farm layouts.

Figure 11 - Photomontage PM11 Krystal Blue

In our professional opinion the proposed modified wind turbines and reduced wind farm footprint are unlikely to result in any significant increased level of visual impact when compared with the approved wind turbine design and locations.

Kind regards,

A handwritten signature in black ink, appearing to read 'Andrew Homewood', written in a cursive style.

Andrew Homewood, Registered Landscape Architect

GREEN BEAN DESIGN PTY LTD

PO Box 3178 Austral NSW 2179

Principal: Andy Homewood BSc (Dual Hons), DipLM, DipHort, Registered Landscape Architect, AILA
(ABN: 86 603 575 702)

Appendix A

Sapphire Wind Farm – Refined Visual Assessment (26 February 2016)

Table A.1 Refined Assessment Matrix Criteria

Criteria	Very low Scores 1	Low Scores 2	Medium Scores 3	High Scores 4
Distance	Over 3km	Between 2 km and 3 km	Between 1 km and 2 km	Up to 1 km
Elevation	At receiver level	50% above receiver level	50% to 100% above receiver level	100% + receiver level
Orientation	Opposite	Indirect	Partial Indirect	Direct
Field of view	Up to 30 degrees	30 to 60 degrees	60 to 120 degrees	180 degrees
Depth perception	Foreground up to 1km	Middle ground 1km to 5km	Background 1km to 10km	Distant 1km to 30km
Cognition	Blade tip (half blade)	Hub height and above	Half tower and above	Whole turbine
Sky lining	Less than 10% visible	Up to 30% of visible	30% to 50% of visible	50% and over of visible
Complexity	No overlap	Up to 30% overlap	30 to 50% overlap	50% + overlap
Cumulative	Visible minor contributory	Visible partial contributory	Visible contributory	Visible significant contributory

Table A.2 Criteria relevant to Sapphire Wind Farm

Criteria	Applied	Not applied
Distance	X	
Elevation	X	
Orientation	X	
Field of view	X	
Depth perception	X	
Cognition	X	
Sky lining	X	
Complexity	X	
Cumulative	X	

Table A.3 Refined assessment matrix

House ID	Distance	Elevation	Orientation	Field of view	Depth perception	Cognition	Sky lining	Complexity	Cumulative	Score
R10	3	4	3	1	1	3	1	1	1	18
R26	3	3	3	3	2	4	4	4	-	26
R29	2	3	3	3	2	4	4	4	-	25
R34	1	4	3	3	2	3	2	2	-	20
R35	1	4	3	3	2	3	2	2	-	20
R38	1	4	3	3	2	3	2	2	-	20
R39	2	4	3	3	2	3	2	2	-	21
R40	2	4	3	3	2	3	2	2	-	21
R41	1	4	3	3	2	3	2	2	-	20
R42	1	4	3	3	2	3	2	2	-	20
R43	1	4	3	3	2	3	2	2	-	20
R44	2	4	3	3	2	3	2	2	-	21
R45	2	4	3	3	2	3	2	2	-	21
R46	2	4	3	3	2	3	2	2	-	21

Table A.4 Sapphire modified scoring (minimum score 7, maximum score 28)

Score	Rating	Percentile
1 to 7	Very Low	25%
8 to 14	Low	50%
15 to 21	Medium	75%
22 to 28	High	+76%

Table A.5 Definitions and determinations

Criteria	Definition	Rating	
Distance	relates to the potential for achieving mitigation through planting and specifically heights required to screen to tip of blade (up to 200m tip height) – distance in this context is not necessarily about diminishing scale of effect.	Very low Low Medium High	>3km turbine distance <2m height required 2km to 3km turbine distance 2m to 3m height required Between 1km and 2km turbine distance 3m to 6m height required Up to 1km turbine distance >6m height required
Elevation	relates to height (at tip of blade) to receiver location and proportion of turbine within the human 65 degree field of view (upward)	Very low Low Medium High	4 degrees (at 3km for 200m tip of blade) 6 degrees (at 2km for 200m tip of blade) 11 degrees (at 1km for 200m tip of blade) 22 degrees (at 500m for 200m tip of blade)
Orientation	describes the position and attitude of receiver (dwelling) toward visible wind turbines	Very low Low Medium High	opposite indirect partial indirect direct
Field of view¹	measuring field of static human vision from side to side	Very low Low Medium High	between near peripheral and parafoveal vision (up to 20 degrees) up to near peripheral (20 to 60 degrees) beyond near peripheral (60 to 120 degrees) up to peripheral (180 degrees)
Depth perception¹	describes how far wind turbines (within the same development) may be visible into the foreground, middle ground, background and distant background zones.	Very low Low Medium High	foreground up to 1 km middle ground 1 km to 5 km background 1 km to 10 km distant background beyond 10 km

Table A.5 Definitions and determinations

Criteria	Definition	Rating	
Visual cognition	relates to the portion of wind turbine structure visible from receiver location	Very low Low Medium High	blade tip hub height half tower whole turbine
Sky lining	the relative percentage of wind turbines (from any visible group/array) which are visible and define a skyline as viewed from a receiver location	Very low Low Medium High	none up to 30% visible 30% to 50% visible 50% + visible
Visual complexity	the relative percentage of visible wind turbine rotors (within any visible group/array) that visually overlap with other wind turbines. Visual overlap will increase perceived density of turbines and create greater complexity in both form and pattern.	Very low Low Medium High	none up to 30% overlap 30% to 50% visible 50% + overlap
Cumulative	a relative and direct assessment which determines the contribution of other wind farm turbines to the receiver visual impact in regard to the above (all or some) criteria.	Very low Low Medium High	Visible minor contributory Visible partial contributory Visible contributory Visible significant contributory

¹Observations and measurements for individual residential dwellings must also take into account the potential visual effect of single or small numbers of wind turbines within a proposed wind farm development. Single or small numbers of wind turbines may give rise to moderate and high visual impacts under certain circumstances.