

9.0 PHOTOMONTAGES

PHOTOMONTAGE 5: BWF17 - 'Westview'



PHOTOMONTAGE 5A: Existing view from 'Westview'



PHOTOMONTAGE 5B: Proposed view from 'Westview'



PHOTOMONTAGE 5C: Proposed view zoomed and cropped from Photomontage 5B.



PHOTOMONTAGE 5D: Comparison of backgrounds.

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PHOTOMONTAGE 6: BWF18- Driel Creek Road



PHOTOMONTAGE 6A: Existing view from Driel Creek Road.



PHOTOMONTAGE 6B: Proposed view from Driel Creek Road.



PHOTOMONTAGE 6C: Proposed view zoomed and cropped from Photomontage 6B.



PHOTOMONTAGE 6D: Comparison of backgrounds.

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PHOTOMONTAGE 7. BWF19- Wandrona Lane



PHOTOMONTAGE 7A: Existing view from Wandrona Lane.



PHOTOMONTAGE 7B: Proposed view from Wandrona Lane.



PHOTOMONTAGE 7C: Proposed view zoomed and cropped from Photomontage 7B.



PHOTOMONTAGE 7D: Comparison of backgrounds.

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PHOTOMONTAGE 8: BWF22- Mudgee Road



PHOTOMONTAGE 8A: Existing view from Mudgee Road



PHOTOMONTAGE 8B: Proposed view from Mudgee Road.



PHOTOMONTAGE 8C: Proposed view zoomed and cropped from Photomontage 8B.



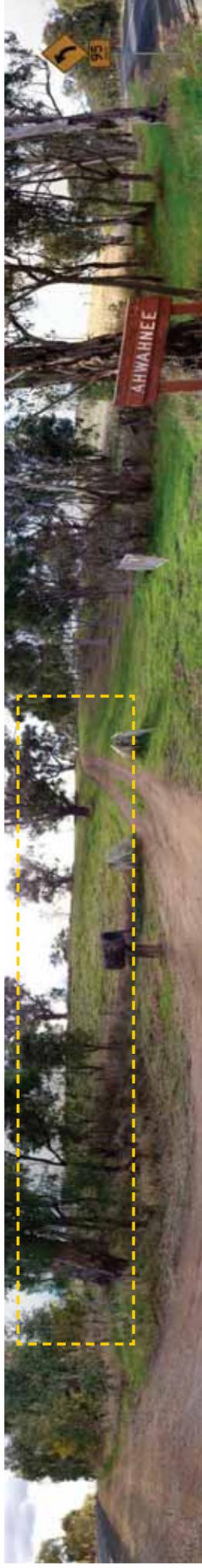
PHOTOMONTAGE 8D: Comparison of backgrounds.

9.0 PHOTOMONTAGES

PHOTOMONTAGE 9. BWF24- Mudgee Road



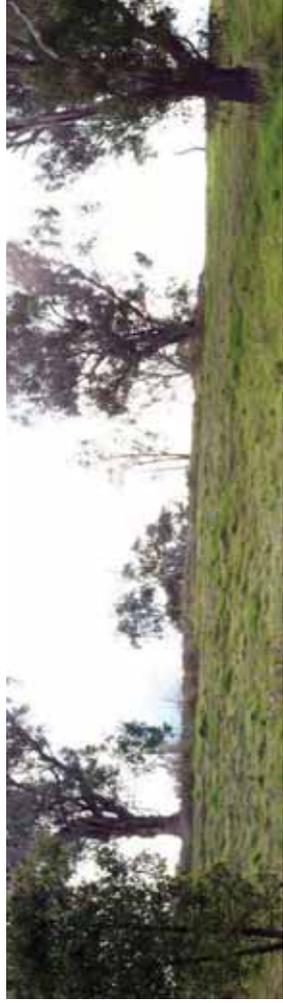
PHOTOMONTAGE 9A: Existing view from Mudgee Road



PHOTOMONTAGE 9B: Proposed view from Mudgee Road.



PHOTOMONTAGE 9C: Proposed view zoomed and cropped from Photomontage 9B.



PHOTOMONTAGE 9D: Comparison of backgrounds.



10.0 VISUAL EFFECTS

10.1 SHADOW FLICKER

Shadow flicker is a visual effect that occurs when rotating turbines cause intermittent shadowing as the blades momentarily block the sun's path. The effect will occur under circumstances where the turbine location is such that at certain times of the day the sun's rays pass through the swept area of the rotating blades and affect the viewpoint. The effect is diminished by distance between the turbine and the viewpoint. Shadowing is reduced by increased cloud cover and is dependent on the angle of the sun's rays. (Connel Wagner, 2006)

Infigen Energy engaged Aurecon Group to undertake a Shadow Flicker Assessment for the proposed Bodangora Wind Farm (Refer to Appendix A). The zones where there is potential for shadow flicker to occur have been assessed using WindFarmer software. The report was based on a proposal for Bodangora Wind Farm that consisted of 37 turbines, however the current proposal consists of 36 turbines. Whilst the Aurecon report has not been updated the Shadow Flicker diagram has been to remove the deleted turbine.

The shadow flicker study has been undertaken and depicts the worst case scenario with the proposed 36 wind turbines at a height of 150m. Variable factors which may significantly reduce the potential impact of shadow flicker include:

- the direction of the residence relative to the turbine(s);
- the distance from the turbine(s);
- the turbine hub-height and rotor diameter;
- the time of year;
- the proportion of day-light hours in which the turbines operate;
- the frequency of bright sunshine and cloudless skies (particularly at low elevations above the horizon);
- and,
- the prevailing wind direction. (Planning NI)

Local influences including screen planting should also be considered when assessing the potential shadow flicker resulting from the proposed development.



Example of shadow intensity variation with distance & turbine blocking small proportion of sunlight. (Source: Aurecon, 2011).

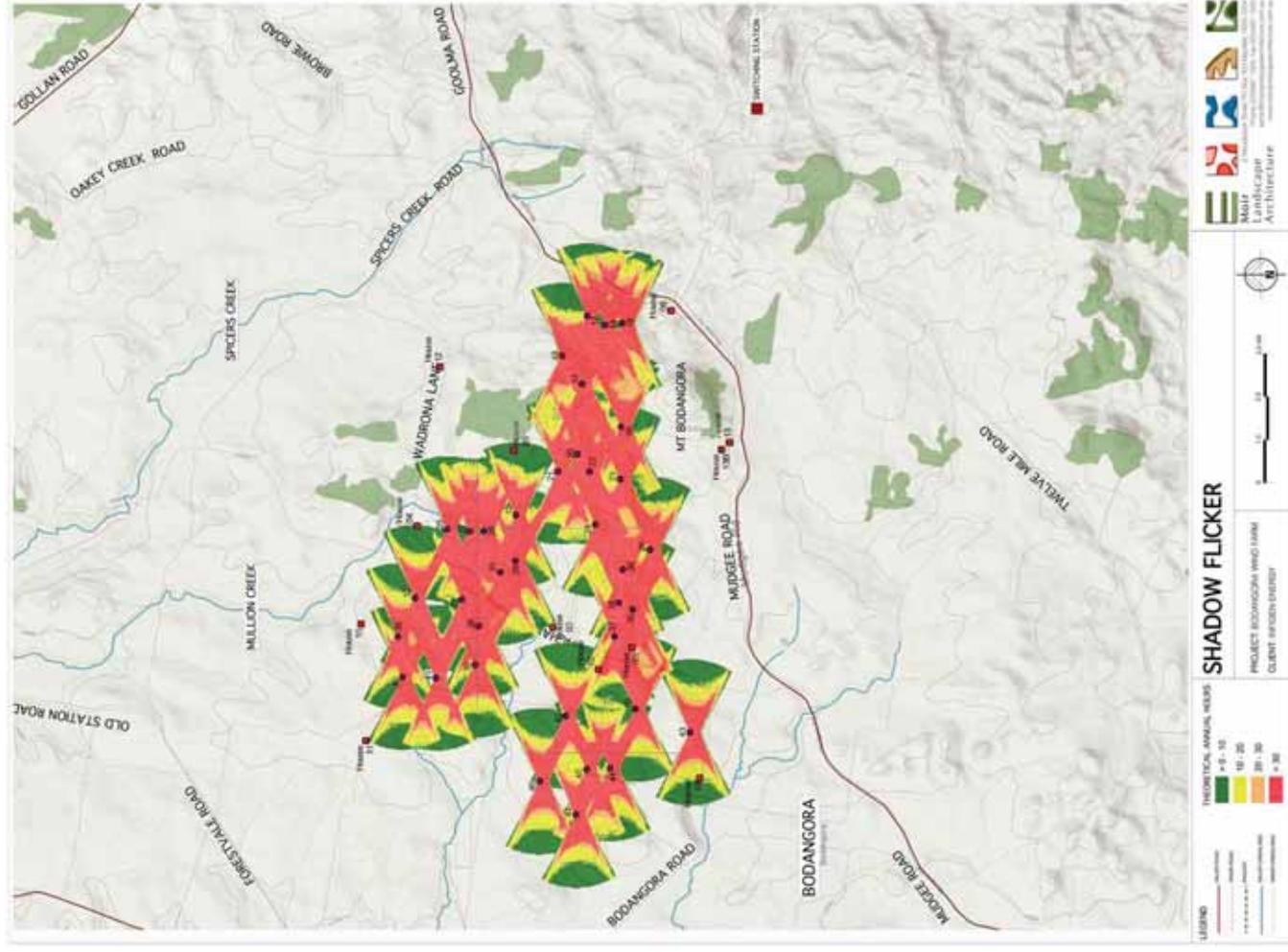


FIGURE 17: Shadow Flicker (Adapted from assessment by Aurecon, 2011).

10.0 VISUAL EFFECTS

10.1.1 Shadow Flicker Assessment Results- Homesteads

Overall the shadow flicker effects caused by the proposed Bodangora Wind Farm are minimal due to the location of the wind turbines in relation to nearby residential properties. Figure 17 shows the extent of shadow flicker as assessed by Aurecon.

The analysis found that only five homesteads will experience shadow flicker as a result of the proposed wind farm (refer to Table 14). All five of the properties likely to be affected by the shadow flicker produced by Bodangora Wind Farm are involved landowners. Of these five homesteads a few houses (house 04, house 05 and house 19) have shadow flicker durations that are under the proposed limit. Two houses (house 01 and house 02) have shadow flicker durations that exceed the proposed limits.

The proposed limit of acceptable shadow flicker duration is aimed at protecting the public. Higher limits may be acceptable to landowners involved in the project who will potentially experience shadow flicker. In addition, local influences such as screen and foreground planting are not taken into account when developing the shadow flicker analysis. Mitigation methods including screen planting

10.1.2 Shadow Flicker Assessment Results- Public Roads

Due to the nature of the Study Area, there are a number of unsealed minor local roads running through the Site. Driel Creek Road and Gillinghall Road will both potentially be affected by shadow flicker. A small section of Mudgee Road to the north east of Mount Bodangora will also be affected by shadow flicker.

There is a negligible risk associated with distraction of motorists who experience shadow flicker. The effects of shadow flicker are similar to the phenomenon created when a vehicle in motion passes a static object eg. travelling along a tree lined road.



Example of shadow flicker created by shadows from trees (Source: Green Bean, 2011).

| RESIDENT | INVOLVED LANDOWNER | SHADOW DURATION (HOURS PER YEAR) | SHADOW OCCURRENCE (DAYS PER YEAR) | MAX DAILY SHADOW DURATION (MINS PER DAY) |
|-----------|--------------------|----------------------------------|-----------------------------------|--|
| House 01 | YES | 32.3 | 78 | 43.0 |
| House 02 | YES | 30.7 | 103 | 30.0 |
| House 03 | YES | 0.0 | 0 | 0.0 |
| House 04 | YES | 2.6 | 20 | 11.0 |
| House 05 | YES | 4.7 | 24 | 16.0 |
| House 06 | YES | 0.0 | 0 | 0.0 |
| House 07 | YES | 0.0 | 0 | 0.0 |
| House 08 | YES | 0.0 | 0 | 0.0 |
| House 09 | YES | 0.0 | 0 | 0.0 |
| House 10 | YES | 0.0 | 0 | 0.0 |
| House 11 | NO | 0.0 | 0 | 0.0 |
| House 12 | NO | 0.0 | 0 | 0.0 |
| House 13 | NO | 0.0 | 0 | 0.0 |
| House 13B | NO | 0.0 | 0 | 0.0 |
| House 14 | NO | 0.0 | 0 | 0.0 |
| House 15 | NO | 0.0 | 0 | 0.0 |
| House 16 | NO | 0.0 | 0 | 0.0 |
| House 17 | NO | 0.0 | 0 | 0.0 |
| House 19 | YES | 11.5 | 34 | 26.0 |
| House 20 | NO | 0.0 | 0 | 0.0 |
| House 21 | NO | 0.0 | 0 | 0.0 |
| House 22 | NO | 0.0 | 0 | 0.0 |
| House NN | NO | 0.0 | 0 | 0.0 |

TABLE 14: Homesteads affected by Shadow Flicker (As assessed by Aurecon, 2011)

10.0 VISUAL EFFECTS

10.2 BLADE GLINT & REFLECTIVITY

Blade Glint refers to the regular reflection off one or more rotating blades. This can be a temporary effect at any particular location, though the vast bulk of any glint occurs where the viewer is located above the altitude of the turbine hub. The occurrence of blade glint depends on a number of conditions including the orientation of the nacelle, angle of the blade, and the angle of the sun. (Aurecon, 2009)

At present there are no formal regulations or guidelines in NSW pertaining to Blade Glint. However the Victorian Wind Farm Guidelines proposes the following recommendations for managing blade glint.

- Blades should be finished with a surface treatment of low reflectivity to ensure that glint is minimised.
- Blade glint can be effectively and cost effectively managed through the use of matt coatings on the turbine blades and, if so done, is not considered to be a visual impact.

Implementation of these recommendations should result in the mitigation of any actual or perceived impact.

10.3 NIGHT LIGHTING

Night lighting of the wind turbines would potentially result in the alteration of the night time landscape character of the region. The Civil Aviation Safety Authority (CASA) advisory circular provides recommends for obstacle marking and lighting of wind farms. The CASR 139.365 'requires a person proposing to construct a building or structure, the top of which will be 110m or more above ground level, to inform CASA of that intention'. Once notified of the proposal the CASA conducts an aeronautical study to determine whether the proposal will be a hazard to aviation.

Generally the minimal level for flight by civil aircraft is determined by the CASA at 152 metres above ground level. As the proposed Bodangora Wind Farm will be at a maximum height of 150 metres, there will be external night lighting of the wind turbines. Low intensity security night lighting may be required on associated infrastructure unless otherwise agreed by the Director General or required by CASA.

Existing night time illumination originates from isolated homesteads and motorists travelling along local roads. As night lighting will not be an used on the Wind Farm turbines it should not be perceived a visual issue for this development.

11.0 CUMULATIVE VISUAL IMPACT

11.1 CUMULATIVE VISUAL IMPACT

Cumulative landscape and visual effects result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it) or actions that occurred in the past, present or are likely to occur in the foreseeable future (The Landscape Institute et al 2008). Cumulative effects may also affect the way a landscape is experienced and can be positive or negative. Where they compromise benefits, they may be considered to form part of the mitigation measures.

The Planning NSW Guidelines state that “Cumulative impacts may result from a number of activities with similar impacts interacting with the environment in a region. They may also be caused by the synergistic and antagonistic effects of different individual impacts interacting with each other and may be due to temporal or spatial characteristics of the activities impacts.”

The landscape and visual assessment for the proposed Bodangora Wind Farm needs to consider the cumulative effects on the immediate and broader regional context it is part of. The proposal needs to take into account change of landscape character and the potential for the receiving landscape to accommodate the change.

The review of the cumulative impact has several dimensions:

- The impact of the wind farm, when added to the combined impacts of all other existing developments and environmental characteristics of the area.
- The impact of this development in the context of the potential for development of wind energy developments in the local, regional and national context.
- The impact of developments which are ancillary to or otherwise associated with the proposed wind farm eg. the development of transmission lines.
- The potential for future development of wind farms in the region.

The cumulative visual impact can be determined by the distance of the proposal to other developments (proposed or existing). The EPHC defines the potential cumulative visual impact with the following distances:

- <3 km = High Visual Impact
- 6 km = Medium Visual Impact
- > 12 km = Low Visual Impact

These distances have been mapped on figure 15.

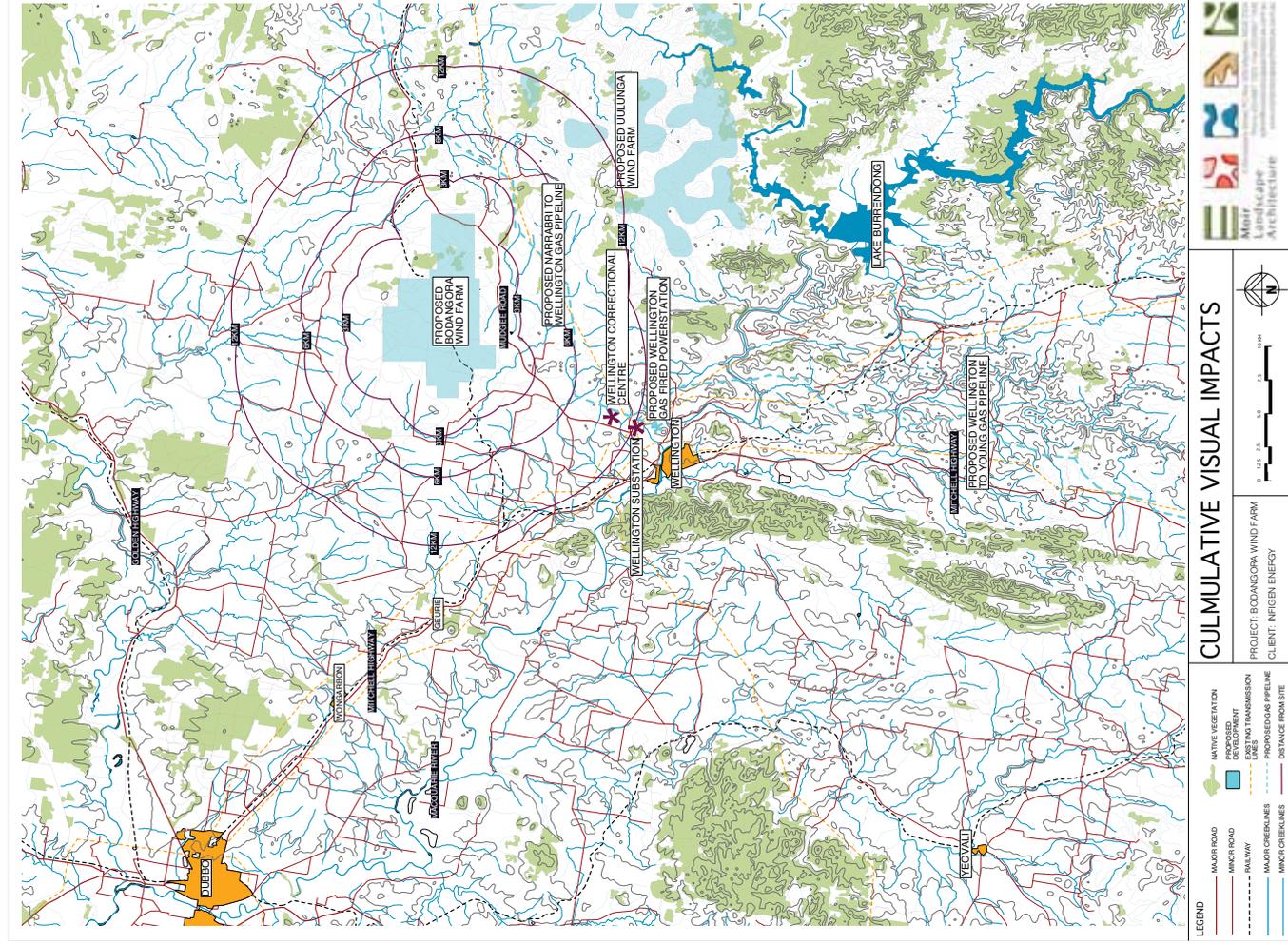


FIGURE 18: Cumulative Visual Impact