

INDEPENDENT REVIEW



CROOKWELL 3 WIND FARM PROPOSAL

*Prepared for
NSW DEPARTMENT OF PLANNING
& ENVIRONMENT*

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REVISION C

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1.1 Overview

O'Hanlon Design Pty Ltd has been engaged by the NSW Department of Planning and Environment (DP&E) to review and comment on the quality and accuracy of the Landscape and Visual Impact Assessment (LVIA) for the Crookwell 3 Wind Farm, provided as part of the Environmental Assessment (EA) submitted for development approval by Union Fenosa (the Proponent).

The engagement specifies the report is to include consideration of:

- Summary of significant landscape / visual issues or critical flaws focusing on the outcomes for the project from public and private viewpoints
- High level identification of
 - Critical flaws / gaps in the methodology documentation to be addressed by the Applicant, if applicable
 - Significant landscape features relevant to the project
- Provide a conceptual framework for how landscape issues will be addressed (e.g. residence clusters)
- Comment on the visual impact at each residence including comment on the ratings provided by the LVIA
- Preliminary recommendations on mitigation measures and identification of areas where recommendations significantly differ to VIA, if applicable.

Our methodology for preparation of this review has included two site visits, a desktop review of; residences and potential viewing locations, DP&E guidelines, the proponent's Environmental Assessment (EA), and the Landscape and Visual Impact Assessment (LVIA) prepared by Green Bean Pty Ltd 2012. We have also analysed topographic maps for the study area and wider areas to identify possible local issues and potential cumulative or regional issues.

In addition to the documents available on the notification website we have accessed an original draft report prepared by Scenic Spectrums Pty Ltd on the Crookwell 2 project dated Sept. 2005 and the Upper Lachlan Local Environmental Plan 2010. The purpose of the document reviews was to provide background information, a reference for the methodology and depth of assessment review that could be considered reasonable.

1.2 Introduction

The Crookwell 3 Wind Farm is broken into two distinct and separate areas either side of the approved Crookwell 2 Wind Farm. The southern section of Crookwell 3 (as amended) proposes 6 turbines of maximum 157m high. The eastern section comprises 17 turbines of maximum 157m high. Whilst part of a separate application the turbines will essentially form part of the overall visual continuum of the Crookwell area and as such have potentially significant cumulative effects in combination with the existing impacts of Crookwell 1 and 2.

1.3 Conceptual Framework

In setting a conceptual framework for the review of the project we have identified 5 clusters of residences within which each residence has similar location characteristics with individual height and screening variations that result in potentially similar turbine impacts from related groups of turbines. The tables contained in the **Section 3** provide a framework that allows for:

- comment on the visual impact at each residence and comparison between this and the original LVIA,
- advice on residences or public viewpoints with significant visual impact; and
- a summary of significant visual issues.

2.0 Review of Methodology

In general, the LVIA is professionally prepared and incorporates all the key elements of a standard visual assessment. The LVIA methodology is consistent with many similar, widely used methodologies based on professional opinion and assessment. The following is a summary of areas where the LVIA may require more depth of consideration.

Community and Stakeholder values

When assessing the visual impact of any development it is generally recognised that the landscape values forming the basis of the assessment should reflect the values of local and regional stakeholders and should not be based solely on a professional opinion. The LVIA does not identify any research in relation to community and stakeholder values of the local and regional visual quality. The assessment and findings in relation to landscape character therefore do not appear to be based on local surveys or consultations. Of particular note is the omission of any reference to the potentially higher scenic value of areas along the Goulburn-Crookwell Road, around Pejar Dam or the heritage items; St Stephen's Church which is not identified or discussed.

Landscape Features

At the time of submission by the proponent in 2012, the accepted practice for the assessment of visual amenity was described within the NSW Planning Guidelines – Wind Farms (draft). As part of this document, a description of Landscape Features that should have been considered are as follows;

The features of the landscape to include:

- *the topography of the land*
- *the amount and type of vegetation*
- *natural features such as waterways, cliffs, escarpments, hills, gullies and valleys*
- *visual boundaries between major landscape types*
- *the type, pattern, build form, scale and character of development, including roads and walking tracks*
- *flora and fauna habitat*
- *cultural heritage sites*
- *the skyline*

The LVIA has taken most of these factors into account but has omitted to consider the cultural heritage sites:

- St Stephen's Church;
- The Pejar Creek underbridge;
- The major recreational site at Pejar Dam

Also of note is the omission of the area of land zoned as E3 in the Upper Lachlan Local Environmental Plan 2010 that covers a large area east of Crookwell Road including the western half of Crookwell 3 East. The effect of the proposal on the views to and from these items and their associated curtilage have been considered in our review.

The effect of the location of the turbines on ridges, the relative heights to viewers, the resultant dominance and effect on the skyline appear to have been considered only generally without consideration of the effects on each individual viewpoint.

Night Lighting

The LVIA has provided some research and methodology regarding the assessment of the visual impact of night time lighting, however this methodology is partly based on "anecdotal evidence" in the absence of grounded research. The actual effect of night lighting mitigation measures and the likely extent of these are not clearly defined nor assessed.

Cumulative Impacts

Whilst the LVIA has assessed the relative cumulative impacts of the project, no justified methodology has been documented to formulate the assessment of the impact or the results of the assessment in relation to either public locations or individual residences.

Mitigation

Whilst mitigation measures are discussed within the report, the proposed mitigation measures and any commitment to these are not clearly set out. The LVIA does not specify where screening will occur, no mapping or details of plantings have been provided, only comment that mitigation may be provided. Therefore, the potential reduction of impact, feasibility, effectiveness and reliability of proposed mitigation measures cannot be determined.

2.1 Significant Landscape Features

As previously noted in this review, there are a number of significant landscape features not fully considered in the 2012 Green Bean LVIA. Significant landscape features play an important role in defining the overall landscape character, but this relationship works both ways. These significant features are also affected by the character of the surrounding landscape. Without proper stakeholder engagement it is difficult to gauge which elements within any landscape are significant and their level of significance to the community. In lieu of this base study data in the 2012 Green Bean LVIA, we relied on information gathered from the Upper Lachlan Local Environmental Plan 2010 and the earlier draft report prepared by Scenic Spectrums Pty Ltd on the Crookwell 2 project dated Sept. 2005.

Zoning

The Local Environmental Plan is a useful source of information when gauging landscape features. For example, within the immediate area of the Crookwell 3 Wind Farm, a large area of land is zoned E3. The objectives for this Zoning are set out below as they appear in the 2010 LEP:

Zone E3 Environmental Management

Objectives of zone:

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.*
- To provide for a limited range of development that does not have an adverse effect on those values.*
- To facilitate the management of environmentally sensitive land and areas of high environmental value to the local government area.*

It is clear from the above objectives that land within this zoning has been considered to have aesthetic and/or environmental value and may also be of an environmentally sensitive nature. This area of land should be considered a significant landscape feature and should be carefully considered when assessing the development.

The proposed development of Crookwell 3 would place several turbines within the area zoned 'E3 Environmental Management'. It is our opinion that this would adversely affect the aesthetic value of the landscape area covered by the E3 zoning.

Pejar Dam

Pejar Dam and its surrounds are significant landscape features that will be affected by the proposed development of Crookwell 3. The area serves as a public viewpoint as well as a public recreation space. The dam and its surrounds sit within the E3 Environmental Management zone noted above, this alone is cause for the areas classification as a significant landscape feature, however this classification is reinforced by the stakeholder engagement undertaken by Scenic Spectrums in their 2005 draft review of Crookwell 2. Whilst this stakeholder engagement was limited, it provides some base information from which to gauge public perception. Amongst other findings, Scenic Spectrums concluded from their stakeholder engagement that;

"a number of local hills are important to the horizon line profile and scenic character of this area, forming landmarks and/or visual focal points that draw viewers' attention to visually important backdrops or complementary elements of high scenic quality features such Mount Wayo and Pejar Dam."

The proposed development of Crookwell 3 would have considerable impact on the visual amenity to and from Pejar Dam. The Pejar Dam area is a key landscape feature and impacts on this feature should be limited to maintain the existing landscape character. It is our opinion that the development of Crookwell 3 would significantly extend the impact on the visual amenity of the Pejar Dam area beyond that created by the existing/approved wind farms in the area.

2.2 Night Lighting

As stated in the LVIA the Crookwell 3 Windfarm may require obstacle lighting at night and times of reduced visibility. The requirement for obstacle lighting will be set by the Civil Aviation Authority (CASA). The Proponent has commissioned an independent report to understand the number of obstacle lights and their layout that may be considered acceptable by CASA. Whilst this report is useful in understanding the basic requirements of obstacle lighting, it is important to note that CASA has not yet released their advice for the Project and that best practice dictates that at this stage, visual impacts should be assessed as a 'worst case' scenario.

With that in mind it is apparent that the assessment should at least consider a worst-case scenario where the Proponent may be required to place obstacle lighting on each proposed turbine as is the case at some wind farms.

It is our opinion that the addition of night lighting in any form would significantly increase visual impact of the Project and that even the limited lighting proposed by the independent aviation safety review would significantly increase the impact levels described in the tables in **Section 2** of this report.

When considering the potential effects of obstacle lighting at Crookwell 3, there are 3 key factors to consider:

The Limited Shielding/ Mitigation Allowable

The Independent aviation report commissioned by the proponent contains advice relating to the mitigation of visual impact on surrounding residences and public. Whilst this advice is taken from a CASA document [AC 139-18(O)] that has since been withdrawn, it is still relevant to understanding the limitations of acceptable shielding. The document states the following:

10.4 To minimise the visual impact on the environment, some shielding of the obstacle lights is permitted, provided it does not compromise their operational effectiveness.

(a) Shielding may be provided to restrict the downward component of light to either, or both, of the following:

(i) Such that no more than 5% of the nominal intensity is emitted at or below 5 degrees below horizontal; and Aeronautical Impact and Night Lighting Assessment – Crookwell 3 Wind Farm Page 37

(ii) Such that no light is emitted at or below 10 degrees below horizontal.

Roughly calculated, on a property located at the same elevation as the base of a turbine, these mitigation measures would:

- (i) Partially shield properties within 1.8km of that turbine [95% shielding of the nominal intensity].
- (ii) Fully shield properties within 900m of that turbine.

Given that most of the properties fall outside of these distances and that some of the properties have elevated positions in relation to the turbine sites, it is evident that the permissible shielding would do little to overcome the visual impact of the lighting.

It is our opinion that the night lighting is likely to be considered as significantly obtrusive in the night environment and would further contribute to the overall cumulative effects for most viewers.

Cumulative Effect of Obstacle Lighting

The cumulative visual effects of Crookwell 3 have been described in the tables of **Section 3** of this report. However, above and beyond these reviews would be the cumulative effect of night obstacle lighting.

Below is a description of lighting within other wind farms in the vicinity of Crookwell 3 taken from the LVIA:

An Aeronautical Impact Assessment was carried out for the approved Crookwell 2 wind farm and determined that up to 23 turbines would be lit with obstacle lighting. These turbines are illustrated in Figure 2. The Gullen Range wind farm would not have obstacle lighting installed on wind turbines and there is no obstacle lighting installed on the operational Crookwell 1 wind farm.

Whilst a number of projects in the area do not contain obstacle lighting, the cumulative effects of obstacle lighting in the Crookwell 2 and 3 developments have not been considered by the proponent. It is the opinion of OHD that the addition of obstacle lighting on Crookwell 3 would increase the duration and angle of observation and that this would cause significant increases to the overall visual impacts of the project.

The Effect of Night Lighting on the Overall Landscape Character

It is generally accepted that in order to maintain scenic integrity of the desired landscape character the landscape alterations must remain visually subordinate to the landscape character. In the event that night lighting is required in Crookwell 3 it is difficult to envisage a scenario where these lights remain subordinate to the existing evening/ night time landscape character of the area. Thus, it can be reasonably concluded that obstacle lights would change the

overall landscape character from the existing pastoral landscape to that of a wind farm/industrial landscape at night.

2.3 Cumulative Impacts

The Key elements of the increase in cumulative impacts created by Crookwell 3 are;

- an increase in the overall extent of the windfarm pastoral character; and
- the sense of enclosure created by the proposed turbines in conjunction with the existing approved turbines at Crookwell 1, Crookwell 2 and Gullen Range

The addition of the Crookwell 3 footprint to the existing wind farms in the area adds to the visible extent of what could be characterised as a windfarm pastoral landscape. This effect is most significant for residences in the Wayo and Roslyn Clusters [see **Section 3**].

The increased sense of enclosure has significant effects for residences in the Woodhouselee Road Cluster, the Roslyn Cluster and the Pejar Cluster where several residences would have turbines visible in excess of 4 x 60° sectors. This level of encirclement provides little relief from the potential change of landscape character.

2.4 Mitigation measures

The successful visual mitigation of any wind farm relies heavily on the individual location of residences and turbines as well as the surrounding topography. Whilst mitigation has been considered possible in the past, it has become increasingly difficult to shield turbine structures that have significantly increased height due to technological advancement. The optimal conditions for successful mitigation are created when closely clustered turbines, placed at similar relative levels are viewable at a reasonable distance. Due to the geography, layout and location of Crookwell 3, it is unlikely that mitigation will be successful for many of the residences.

Screening Cumulative Effects

A number of residences within the project space have considerable cumulative effects from Crookwell 1, Crookwell 2 and Gullen Range. Areas with high cumulative effects are unlikely to achieve meaningful screening without heavy planting along much of the residential curtilage. Whilst extensive curtilage planting may screen views to surrounding turbines, it will also screen many of the views from that property. This type of screening can lead to a sense of enclosure in or around the residence as views to the immediate and distant landscapes become significantly reduced, whilst this type of planting is unlikely to influence the broader landscape character, it does restrict established views to that landscape. Areas around Pejar Dam would likely require heavy screening along much of their curtilage to create meaningful mitigation and this would considerably affect the visual amenity around the recreational area.

Screening of Proximal Turbines

Turbines situated close to residences and/or elevated above residences are difficult to successfully mitigate. The height of the vegetation that would be needed to screen a turbine in such a location is difficult to attain and may take more than 10 years to achieve. Added to this, tall 'one off' screening' is only relevant to one given viewing point on the property and the effect of the screen may be negated by the repositioning of the viewer within the site.

3.0 Residence Key

This review includes reviews of residences compiled from a variety of data and site information. A number residence, identified in the proponent's VIA and considered as significantly impacted, were visited and individually assessed. The VIA assessed impacts for many of the remaining residences were reviewed from viewpoints on adjacent public roads. A lesser number of residences were considered with only a desktop review.

* Denotes a desktop review

Denotes a review from the adjacent public road.

3.1 Roslyn: North-east Cluster

This cluster of residences is located north of turbines A1-A25 along and in the vicinity of the northern end of Woodhouselee Road. They are elevated and may have significant views to the turbines south, to the west over Crookwell 2 and in the background, the string of Gullen Range turbines.

Residence	Approx. Distance	VIA Assessment		OHD Comments			Photo-montage
		South	East	South	East	Cumulative	
68 Meadowvale #	1.8km	Nil	High	Nil - Low	Mod-High A2, A3, A4 and A5 all less than 3km some vegetative screening	High >3 sectors with some curtilage screening	Fig. 49 and 50
69 Athol Vale	1.4km	Nil	Mod-High	Nil intervening veg.	Mod - High A2 at 1.4km A3, A4 <2.0km	Mod >2 sectors	Fig. 63 and 64
71 Lynross #	2.7km	Nil	Low	Nil - Low	Mod	Mod >2 sectors	
72 Highlands #	2.9km	Nil	Low	Nil - Low	Mod	Mod >2 sectors	
74 Rosslyn #	4.5km	Nil	Nil	Nil - Low	Low - Mod	Mod - High >2 sectors	
97 #	2.8km	Nil	Low - Mod	Nil	Low - Mod Top of A12 and A15 visible	Nil	
104 Highland Park	2.5km	Nil	Low	Nil intervening vegetation	Nil-Low intervening veg.	Mod - High >2 sectors	
106 Rosedale	1.7km	Nil	Low	Low intervening vegetation	High A2, A3, and A4 all less than 2km full views of A2-A9 to the south.	Mod - High >2 sectors	Fig. 47 and 48

Moderate to High levels of dominance at residences 68, 69 with some screening, and with open views at 106 indicate that consideration should be given to removal or amelioration of turbines A2, A3, A4 and A5.

3.2 Woodhouselee Road: Eastern Cluster

This cluster of residences is located around the middle section of Woodhouselee Road. Most residences are of inferior viewing locations with some screening provided by the ridge running parallel and east of Woodhouselee Road and individual curtilage vegetation.

Residence	Approx. Distance	VIA Assessment		OHD Comments			Photo-montage
		South	East	South	East		
60 Pejar Park #	2.6km	Nil	Mod	Nil	Mod-High All east turbines visible at between 2.2km and 3.5 km, in 2 sectors, light screening	Mod - High >3 sectors	
62 Cottonwood	1.6km	Nil	Mod-High	Nil	Mod-High A12, A16, A20 and A24 all visible at less than 2000m, some curtilage screening	High >3 sectors	Fig 57 and 58 Fig. 39 and 40 are in this vicinity
63 Rocky Corner #	1.1km	Nil	High	Nil	High A2, A3, A4, A5, A8, A9, A10, A12, A13, A16, A17, A20, A21, A22, and A24 all highly visible.	High over 5 sectors	

High levels of dominance and overall impact on the remaining non-associated residences in this cluster suggest that careful justification is required for most turbines to remain as all turbines except A15 are elevated above the viewing points and mostly within 2km of the remaining residences resulting in high levels of dominance.

3.3 Third Creek: North Western Cluster

This group of residences to the north and north-west of the turbines have substantial views south and east toward the Crookwell Road ridge.

Residence	Approx. Distance	VIA Assessment		OHD Comments			Photo-montage
		South	East	South	East	Cumulative	
1 Evermore #	3.5km	Mod-High	Low	Mod Approx. 40% visible some veg. screening.	Nil - Low	Mod - High 4 sectors incl. C2 and Gullen Range. 1 additional sector	
1A #	3.8km	Nil	Low	Low - Mod Approx. 30% visible	Negligible	Low 2 sectors with C2	
123 #	5.6km	Nil	Low	Low	Negligible	Moderate 4 sectors with C2 and Gullen Range	
125 #	4.6km	Mod	Low	Negligible	Negligible	Negligible	

No specific individual turbine effects above moderate. Cumulative effects could be reduced by removal of the southern turbine group, however the overall cumulative effect of C3 south is relatively low as Gullen Range and C2 are the major components.

3.4 Wayo: South Eastern Cluster

This cluster of residences is located to the South East and have potential views of all turbines in the Crookwell 3 development. They look over an area of high scenic value around Pejar Dam. St Stephen's Church (State Heritage item) and some residences will have views of the C3 turbines with Pejar Dam in the foreground and turbines located behind. Most residences, with the exception of St Stephen's Church and 37 Carinya, are desktop reviews. Residences between Woodhouselee Road and St Stephen's Road generally face north between C2 and C3 east.

Residence	Approx. Distance	VIA Assessment		OHD Comments			Photo-montage
		South	East	South	East	Cumulative	
16 Calamonda*	3.5km	Mod	Low	Mod-High Approx. 80% visible with some veg. screening	Nil-Low	Low	
36 Tyrendarra*	3.5km	Low	Low	Low-Mod	Mod	Mod-High over 3 sectors	
37 Carinya #	3.0km	Low-Mod	Low-Mod	Mod	Low-Mod	High over 3 sectors	
39 St Stephen's Church	2.3km	Low	Low	Mod-High	Low-Mod	High over 3 sectors	
54 Ginmara*	3.0km	Low	High	Mod-High	Mod	High over 3 sectors	
55*	2.8km	Low	High	Low	Mod	High over 3 sectors	
56*	3.2km	Low	High	Low	Mod	High over 3 sectors	
57 Kenrick*	2.7km	Low	High	Low-Mod	Mod	High over 3 sectors	
84 Nierrina Heights*	2.6km	Low	High	Low	Mod-High	Mod-High over 2 sectors	
134*	2.6km	Not rated	Not rated	Nil-Low	Mod-High	Mod-High over 2 sectors	
134A*	2.2km	Not rated	Not rated	Low	High	High over 3 sectors	
135A*	1.8km	Not rated	Not rated	Low	High	High over 3 sectors	

Note: The apparent difference in the ratings for Crookwell East for residences 54, 55, 56, 57, and 84 is likely to be due to the separation of the cumulative rating in the OHD review, whilst it appears that some assessment of the cumulative impacts may have been included in the VIA assessment.

The combination of Crookwell 2 and 3 would create high cumulative impacts at many locations in the Wayo cluster and this appears to be reflected in the VIA assessments. The cumulative change to the landscape character is also significant as Crookwell 3 east is highly visible from this area. The ratings are further elevated by the high scenic quality of the landscape within which they are located.

3.5 Pejar: South Western Cluster

This cluster has a wide variety of locations and most viewpoints are relatively elevated. Those residences in the east may have extensive views of most of the Crookwell 3 as well as Gullen Range and Crookwell 2.

Residence	Approx. Distance	VIA Assessment		OHD Comments			Photo-montage
		South	East	South	East	Cumulative	
2 Bendemere #	2.9km	Mod-High	Low	Mod-High Approx. 80% visible with Some veg. screening	Nil-Low	Low 2 Sectors with C2	
3 D'Ambrosio #	2.6km	Mod-High	Low	Mod-High Approx. 80% visible	Nil-Low	Low-Mod 4 sectors with C2 and Gullen Range	
4 #	3.2km	Mod-High	Low	Mod-High Approx. 80% visible	Nil-Low	Low 2 sectors with C2	
5 #	2.9km	Mod	Low	Moderate Approx. 80% visible	Nil-Low	Low	
6 #	2.9km	Mod-High	Low	Mod-High Approx. 80% visible. Some curtilage screening.	Nil-Low	Low	
7 Emohruo #	2.9km	Mod-High	Low	High. Fully visible, viewer elevated.	Nil-Low	Low	Fig. 26 and 27
8 Narangi	2.1km	High	Low	High Extensive views of A28, A29, A30, A31, A32, and A33	Low	High >4 sectors including C2 less than 2km and Gullen Range	Fig. 28, 29 and 30
19 Wombat Hollow	1.0km	High	Low	High Extensive views of A28, A29, A30, A31, A32, and A33 all from 1-2km distance	Low	High >4 sectors plus Gullen Range	Fig. 31 and 32

Residences 8 and 19 have significant impacts from individual turbines at reduced distances. These eastern residences also have high cumulative impacts due to the combination of Crookwell, 1, 2, 3 and Gullen Range to the west.

Consider removal of C3 South turbine cluster to ameliorate both cumulative and individual impacts. Removal of the southern group of turbines would reduce individual impacts at all residences and reduce the cumulative effects significantly.

4.0 Conclusions & Recommendations

In general, the LVIA is professionally prepared and incorporates all the key elements of a standard visual assessment. The LVIA methodology is consistent with many similar widely used methodologies based on professional opinion and assessment. There are however some gaps in methodology. These have been considered in **Section 2** of this review. The overall effect of these gaps in methodology is evident in the comparison of ratings found in the tables of **Section 3**.

The proposal for turbines at Crookwell 3 is split into the eastern and southern groupings. Considering the reduced and limited number of 6 turbines now proposed in the southern group, removal of these turbines would result in significant benefits for reduction of both cumulative effects and individual residences in the Pejar Cluster.

Within the eastern section of Crookwell 3, several turbines are proposed to be situated within an area zoned as E3 Environmental Protection. The placement of turbines within this area appears to be add odds with the objectives of the zoning and would significantly impact the visual amenity of what is a significant landscape feature.

The eastern group also has a large number of turbines in elevated locations above viewers at distances less than 2km. This combined with the height of 157m creates a range of dominance issues at adjacent residences that require justification, turbine screening or removal to reduce the overall impacts.

As noted in the introduction, whilst part of a separate application, the Crookwell 3 turbines will visually form part of the overall landscape character and the visual continuum of the Crookwell area. As such they have significant accumulation effects on the existing cumulative impacts.

The requirements for aviation obstacle lighting set by CASA has the potential to greatly increase the overall visual impact of the proposal. Effects of lighting may cause disruption to the current landscape character through an increase in observable duration and evening/night time observable angle, both of which will significantly increase the cumulative impact of the proposal.



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