## Site Context and Local Environmental Factors

### 5.1 Site Context

The Crookwell 3 wind farm sites are separated by the Wollondilly River and Goulburn Crookwell Road corridor. The sites are located on a system of broad ridges and low hills that are separated by a series of creeks generally flowing south. Views from the proposed Crookwell 3 wind farm locations and the context of the surrounding landscape is illustrated in Figures 5 and 6.

### 5.2 Climatic and Atmospheric Conditions

Local climatic and atmospheric conditions have the potential to influence the visibility of the Crookwell 3 wind farm from surrounding view locations, and more significantly, from middle ground and distant view locations.

The Bureau of Meteorology has collected meteorological data over the past thirty five years at the Goulburn TAFE weather station which indicates that there are:

- 88.4 clear days (annual mean average);
- $\quad 132.3$ cloudy days (annual mean average); and
- $\quad 75.3$ days of rain (annual mean average).

Rainfall would tend to reduce the level of visibility toward the Crookwell 3 wind farm from a number of surrounding view locations, with the degree of visibility tending to decrease over distance. Rain periods may also reduce the number of visitors travelling through the areas from which the Crookwell 3 wind farm may be visible, and potentially decrease the duration of time spent at a particular public view location with a view toward the Crookwell 3 wind farm.

Cloud cover would also tend to reduce the level of visibility of the Crookwell 3 wind farm and lessen the degree of contrast between the wind turbine structures and the background against which the wind turbines may be visible.

On clear or partly cloudy days, the position of the sun would also have an impact on the degree of visibility of the Crookwell 3 wind farm. The degree of impact would be largely dependent on the


Photo P1 - From Crookwell 3 South


Photo P2 - From Crookwell 3 South


Photo P3 - From Crookwell 3 South


Photo P4 - From Crookwell 3 East

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Extent of wind farm visibility illustrated on panoramic photographs is indicative only


Photo P5 - Crookwell 3 East


Photo P6 - Crookwel| 3 East (Little Vale Hill)


Photo P7 - Crookwell 3 East

relationship between the position and angle of the sun relative to the view location. Late afternoon and early evening views toward the west would result in the wind turbines silhouetted above the horizon line, and with increasing distance would tend to reduce the contrast between the wind turbine structures and the surrounding landform.

Figure 7 illustrates the extent to which local weather conditions can influence the visibility of wind farm turbine structures.


PHOTO A - DAY TIME VIEW FROM HUME HIGHWAY TOWARD CULLERIN WIND FARM AT AROUND 3.5KM (13th June 2010)


PHOTO B - DAY TIME VIEW FROM HUME HIGHWAY TOWARD CULLERIN WIND FARM AT AROUND 3.5KM (10th June 2010)


PHOTO C - DAY TIME VIEW FROM HUME HIGHWAY TOWARD CULLERIN WIND FARM AT AROUND 3.5KM (7th July 2010)

PHOTO A - Illustrates the visibility of wind turbines against a clear and blue sky backdrop with sunlight from above and to the right of the wind turbines creating a shadow line along the left hand side of the towers as well as portions of the rotor blades.

PHOTO B - Illustrates the visibility of wind turbines against a partly cloudy and overcast backdrop. The wind turbines in cloud shadow appear off white to grey in colour.

PHOTO C - Illustrates the visibility of wind turbines in fog/low cloud cover.

## Panoramic Photographs (Existing views)

### 6.1 Panoramic Photographs

A series of digital photographs were taken during the course of the fieldwork to illustrate existing views in the vicinity of a number of view locations inspected and assessed as part of this LVIA.

The photographs were taken with a tripod mounted digital Nikon D90 SLR camera with a prime 50 mm lens. Individual photographs were digitally stitched together to form a segmented panoramic image to provide a visual illustration of the existing view from each photo location.

The real world coordinate location for each panorama photograph was recorded with a hand held GPS unit to an accuracy of around plus or minus four meters. Additional information including the bearing or direction of each photograph, time of day and prevailing weather conditions was also recorded.

The panoramic photographs presented in this LVIA have been annotated to identify key features or structures located within the existing view, and indicatively illustrate the general extent and location of potentially visible wind turbines or portions of turbine structures associated with the Crookwell 1, Crookwell 2, Gullen Range and Crookwell 3 wind farms.

The panoramic photograph locations are illustrated in Figure 8, and the panoramic photographs illustrated in Figures 9 to 16.

The panoramic photographs should not be confused with the photomontages. The panoramic photographs do not include a representation or model of the wind turbine structures. The photomontages are discussed in Section 11 of this LVIA report, and are illustrated in Figures $\mathbf{2 6}$ to $\mathbf{7 0 .}$


CROOKWELL 3 WIND FARM

## Legend

(3) Photo Location

C. Panorama Photo

Proposed Crookwel 3 East Tutine

- Proposed Crookwell 3 South Turbine

4 Appoved Crookwell 2 Tubine

- Exsing Crookwell Tubine
- Approved Gullen Range Turbine

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WIND AUSTRALIA
gasNatural

CROOKWELL DEVELOPMENT PTY LTD


Photo Location C1 - View north west from Forest Siding Road


Photo Location C2 - View north west from Middle Arm Road


Photo Location C3 View west from Mount Pedlar Road


Photo Location C4 - View west from Middle Arm Road


Photo Location C5 - View west from Middle Arm Road


Photo Location C7 - View south west from Middle Arm Road


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fenosa

CROOKWELL DEVELOPMENT PTY LTD


Photo Location C9 - View south to south east from Woodhouselee Road


Photo Location C10 - View south to south east from Woochouselee Road


Photo Location C11 - View south from Woodhouselee Road


Photo Location C12 - View south to south east from Woodhouselee Road
CROOKWELL 3 WIND FARM

UNION FENOSA WIND AUSTRALIA gasNatural $\begin{gathered}\text { fenosa } \\ \text { fald }\end{gathered}$

CROOKWELL DEVELOPMENT PTY LTD

GREEN BEAN DESIGN tandscape architects


Photo Location C14 - View north to east from Woodhouselee Road


Photo Location C15 - View north west to north east from Woodhouselee Road



Photo Location C18 View west to north west from St. Stephens Road


Photo Location C19 - View west to north from Crookwell Road


Photo Location C20 - View north west to north from Pejar Dam (above boat ramp)

## CROOKWELL 3 WIND FARM

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Photo Location C21 - View south from Crookwell Road


Photo Location C22 - View south from Crookwell Road (adjacent Crookwell 1 Wind Farm)


Photo Location C23 View east to south east from Third Creek Road


Photo Location C24 - View south to south east from Dawsons Creek Road
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Photo Location C25 - View east to south east from Dawsons Creek Road


Photo Location C26 - View east to south east from Dawsons Creek Road


Photo Location C27 - View east to south east from Pejar Road


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Photo Location C29 - View east from Range Road


Photo Location C30 - View east from Range Road

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## Landscape Character Areas and Sensitivity Assessment SECTION 7

### 7.1 Landscape Character Areas

As part of the LVIA process it is important to understand the nature and sensitivity of different components of landscape character, and to assess them in a clear and consistent process. For the purpose of this LVIA, landscape character is defined as 'the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape' (The Countryside Agency and Scottish Natural Heritage 2002).

This LVIA has identified six Landscape Character Areas (LCA's), which generally occur within the viewshed of the Crookwell 3 wind farm site. The LCA's represent areas that are relatively consistent and recognisable in terms of their key landscape elements and physical attributes; which may include a combination of topography/landform, vegetation/landcover, land use and built structures (including settlements and local road corridors).

The LCA's are not definable as discrete areas, and characteristics within one LCA may well occur within adjoining or surrounding LCA's. The LCA's have not been assessed, described or illustrated as singular 'landscape units'. For the purpose of this LVIA the LCA's have been identified as:

- LCA 1 - Undulating grasslands;
- LCA 2 - River valley and drainage lines;
- LCA 3 - Water bodies;
- LCA 4 - Simple slope and ridgeline areas;
- LCA 5 - Timbered areas (cultural and remnant native); and
- LCA 6 - Settlements.


### 7.2 Landscape Sensitivity Assessment

The British Landscape Institute describes landscape sensitivity as 'the degree to which a particular LCA can accommodate change arising from a particular development, without detrimental effects on its character'.

The assessment of landscape sensitivity is based upon an evaluation of the physical attributes identified within each LCA, both singularly and as a combination that gives rise to the landscape's overall robustness and the extent to which it could accommodate the wind farm. The criteria used to determine landscape sensitivity are outlined in Table 6 and based on current good practice employed in the assessment of some wind farm developments and draws on the Land Use Consultants report on landscape sensitivity for wind farm developments on the Shetland Islands (March 2009). Landscape sensitivity is a relative term, and the intrinsic landscape values of the surrounding landscape may be considered of a higher or lower sensitivity than other areas in the New South Wales Southern Tablelands region.

Whilst the assessment of landscape sensitivity is largely based on a systematic description and analysis of landscape characteristics, this LVIA acknowledges that some individuals and other members of the local community will place higher values on the local landscape. These values may transcend preferences (likes and dislikes) and include personal, cultural as well as other parameters.

Table 6 - Criteria for the assessment of Landscape Sensitivity

|  |  | Landscape Sensitivity Assessment Criteria |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Characteristic | Aspects indicating lower sensitivity <br> to the wind farm development | $\leftrightarrow$ | Aspects indicating higher <br> sensitivity to the wind farm <br> development |  |
| Landform and scale: <br> patterns, complexity and <br> consistency | - Large scale landform | - Simple | - | Small scale landform |


| Characteristic | Aspects indicating lower sensitivity to the wind farm development | $\leftrightarrow$ | Aspects indicating higher sensitivity to the wind farm development |
| :---: | :---: | :---: | :---: |
| Movement | - Prominent movement, busy | $\leftrightarrow$ | - No evident movement, still |
| Rarity | - Common or widely distributed example of landscape character area within a regional context | $\leftrightarrow$ | - Unique or limited example of landscape character area within a regional context |
| Intervisibility with adjacent landscapes | - Limited views into or out of landscape <br> - Neighbouring landscapes of low sensitivity <br> - Weak connections, self contained area and views <br> - Simple large scale backdrops | $\leftrightarrow$ | - Prospects into and out from high ground or open landscape <br> - Neighbouring landscapes of high sensitivity <br> - Contributes to wider landscape <br> - Complex or distinctive backdrops |

The criteria set out in Table 6 have been used to evaluate each of the LCA's using sensitivity grades of higher, medium or lower. The sensitivity grades are illustrated in Tables $\mathbf{7}$ to $\mathbf{1 2}$ using shading against each of the criteria set out in Table 6.

The sensitivity of overall grades of higher, medium or lower were determined using the following definitions:

High (Rating of 19 to $\mathbf{3 0}$ ) - Key characteristics of the LCA may be adversely impacted by the wind farm, and may result in major alterations to perceived characteristics of the landscape. The degree to which the landscape may accommodate the wind farm development would potentially result in a number of perceived uncharacteristic and significant changes.

Medium (Rating of 12 to 18) - Some characteristics of the LCA may be altered by the wind farm, although the landscape may have the capability to absorb some change. The degree to which the landscape may accommodate the wind farm development would potentially result in the introduction of prominent elements but may be accommodated to some degree.

Lower Rating (11 or less) - The characteristics of the LCA are generally robust, and would be less affected by the wind farm. The degree to which the landscape may accommodate the wind farm would not significantly alter existing landscape character.

### 7.3 Analysis of Landscape Sensitivity

The following section of this LVIA provides an analysis of landscape sensitivity within the Crookwell 3 10 km viewshed and considers each of the six LCA's.

### 7.3.1 LCA 1 Undulating grassland



Plate 1 - Typical view across undulating grassland landscape

Table 7 - LCA 1 - Undulating grassland -Landscape Sensitivity

|  | Lower Sensitivity |  | $\leftrightarrow$ | Higher Sensitivity |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Low | Low to Med | Medium | Med to High | High |
| Rating | 1 | 2 | 3 | 4 | 5 |
| Landform and Scale |  |  |  |  |  |
|  | The low undulating grassland is a large scale and open landscape with a gently undulating landform. The structure of the landform is simple containing few distinct features and has a general absence of any strong topographical elements. |  |  |  |  |
| Landcover |  |  |  |  |  |
|  | Landcover is predominantly simple and predictable within the context of widespread pasture areas across the regional area of the Southern Tablelands. <br> The overall landscape pattern created by the grass pasture is smooth, regular and uniform. <br> Areas of cultural planting surround the majority of rural dwellings in the form of evergreen windbreaks. |  |  |  |  |
| Settlement and human influence |  |  |  |  |  |
|  | A dispersed settlement pattern occurs across the landscape and comprises rural farm homesteads including documented local historical structures. <br> There is a general absence of modern development throughout this landscape, excluding agricultural structures and local roads and access tracks. |  |  |  |  |
| Movement |  |  |  |  |  |
|  | Movement is generally restricted to occasional passing traffic, livestock as well as agricultural machinery. |  |  |  |  |
| Rarity |  |  |  |  |  |
|  | Undulating grassland is generally well represented and a common feature across the regional area of the Southern Tablelands. |  |  |  |  |
| Intervisibility |  |  |  |  |  |
|  | Undulating grassland areas appear as a simple backdrop in views from surrounding elevated areas. Undulating landform can retain and constrict views within the landscape, but generally contributes to the wider landscape. |  |  |  |  |
| Overall Sensitivity Rating | Medium (Score 18 out of 30) |  |  |  |  |

### 7.3.2 LCA 2 River Valley and Drainage Lines



Plate 2 - Typical view across river valley and drainage lines landscape

Table 8 - LCA 2 - River Valley and Drainage Lines - Landscape Sensitivity

|  | Lower Sensitivity |  | $\leftrightarrow \quad$ Hig |  | Higher Sensitivity |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Low | Low to Med | Medium | Med to High | High |
| Rating | 1 | 2 | 3 | 4 | 5 |
| Landform and Scale |  |  |  |  |  |
|  | River valley and drainage line areas are generally contained by the gently sloping landform resulting in a small to moderate scale landform. <br> The landform is simple containing few distinct features and has an absence of any strong topographical elements. |  |  |  |  |
| Landcover |  |  |  |  |  |
|  | Landcover is predominantly simple and predictable within the context of widespread drainage areas across the broader regional area of the Southern Tablelands. <br> The overall landscape pattern created by grass pasture within this landscape is smooth, regular and uniform, although mosaics of timbered stands on adjoining slopes and hillsides create some diversity and contrast in pattern. |  |  |  |  |
| Settlement and human influence |  |  |  |  |  |
|  | There is a general absence of settlement within this landscape with a small and dispersed number of agricultural structures (some abandoned), minor access tracks and fences occurring throughout. Some modifications to landscape have been carried out to accommodate road access and the former railway line. |  |  |  |  |
| Movement |  |  |  |  |  |
|  | A lack of any significant movement gives this landscape an overall still character. |  |  |  |  |
| Rarity |  |  |  |  |  |
|  | River valleys and drainage lines are generally well represented and a common feature across the broader regional area of the Southern Tablelands. |  |  |  |  |
| Intervisibility |  |  |  |  |  |
|  | Intervisibility is limited as views from within this landscape are often contained by sloping landform rising above the river valley and drainage lines. Views along drainage lines, as well as views from areas above and across river valley and drainage lines provide links with adjoining landscape areas. |  |  |  |  |
| Overall Sensitivity Rating | Medium (Score 16 out of 30) |  |  |  |  |

### 7.3.3 LCA 3 Water bodies



Plate 3 - Typical view across the Pejar Dam

Table 9 - LCA 3 - Water bodies - Landscape Sensitivity


### 7.3.4 LCA 4 Simple slopes and ridgelines



Plate 4 - Typical views along simple slope and ridgeline landscape

Table 10 - LCA 4 - Simple slopes and ridgelines - Landscape Sensitivity

|  | Lower Sensitivity |  | $\leftrightarrow$ | Higher Sensitivity |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Low | Low to Med | Medium | Med to High | High |
| Rating | 1 | 2 | 3 | 4 | 5 |
| Landform and Scale |  |  |  |  |  |
|  | Simple slope and ridgeline areas are represented by a generally open and large scale landform with distant views available from elevated areas within this landscape. <br> The landform is simple containing few distinct features and has a general absence of any strong topographical elements. |  |  |  |  |
| Landcover |  |  |  |  |  |
|  | Landcover is predominantly simple and predictable within the context of similar areas across the Southern Tablelands. <br> The overall landscape pattern created by grass pasture within this landscape is smooth, regular and uniform, although mosaics of timbered areas on surrounding slopes and cultural planting surrounding dwellings create some diversity and contrast in pattern. |  |  |  |  |
| Settlement and human influence |  |  |  |  |  |
|  | Settlement is occasional and dispersed within this landscape and does not generally occur along the top of ridgelines or on elevated and exposed slopes. The main influences of human activity are the effects of agricultural improvement within the landscape. |  |  |  |  |
| Movement |  |  |  |  |  |
|  | Movement is generally limited to local roads and access tracks. |  |  |  |  |
| Rarity |  |  |  |  |  |
|  | Simple slopes and ridgelines are generally well represented and a common feature across the broader regional area of the Southern Tablelands. |  |  |  |  |
| Intervisibility |  |  |  |  |  |
|  | Intervisibility is limited as views from within this landscape are often contained by undulating or sloping landform rising to ridgelines, however, potential distant views do occur from elevated landform to provide links to adjoining landscape areas. |  |  |  |  |
| Overall Sensitivity Rating | Medium (Score 16 out of 30) |  |  |  |  |

### 7.3.5 LCA 5 Timbered Areas



Plate 5 - Typical views across timbered areas

Table 11 - LCA 5 - Timbered Areas- Landscape Sensitivity

|  | Lower Sensitivity |  | $\leftrightarrow$ | Higher Sensitivity |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Low | Low to Med | Medium | Med to High | High |
| Rating | 1 | 2 | 3 | 4 | 5 |
| Landform and Scale |  |  |  |  |  |
|  | Timbered areas occur across a range of landform types that are generally defined by gently sloping or undulating landform resulting in a moderate scale landform. <br> The landform is simple containing few distinct features and has an absence of any strong topographical elements. |  |  |  |  |
| Landcover |  |  |  |  |  |
|  | Landcover is predominantly simple and predictable within the context of similar timbered areas across the Southern Tablelands. <br> The overall landscape pattern created by timbered areas creates diversity and contrast to the smooth, regular and uniform grass pasture and cultivated areas within this landscape. <br> The darker coloured foliage of timbered areas contrast against the surrounding backdrop of lighter toned pasture and cultivated areas. |  |  |  |  |
| Settlement and human influence |  |  |  |  |  |
|  | Settlement is occasional and dispersed within timbered areas with the majority of dwellings visually screened from surrounding landscape areas. The main influences of human activity are the effects of agricultural improvement within the landscape. |  |  |  |  |
| Movement |  |  |  |  |  |
|  | Movement is generally limited to local roads and access tracks. |  |  |  |  |
| Rarity |  |  |  |  |  |
|  | Timbered areas are reasonably well represented and an established feature across broader regional areas of the New South Wales Southern Tablelands. |  |  |  |  |
| Intervisibility |  |  |  |  |  |
|  | The level of intervisibility between this landscape and adjoining areas is generally determined by the location and extent of timbered area relative to view locations, but on the whole is limited as views from within this landscape are constrained by vegetation, combined with sloping landform. Views from scattered or lightly timbered areas provide links to adjoining landscape areas. |  |  |  |  |
| Overall Sensitivity Rating | Medium (Score 16 out of 30) |  |  |  |  |

### 7.3.6 LCA 6 Settlements



Plate 6 - Typical views across settlement areas

Table 12 - LCA 6 - Settlements - Landscape Sensitivity

|  | Lower Sensitivity |  | $\leftrightarrow$ | Higher Sensitivity |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Low | Low to Med | Medium | Med to High | High |
| Rating | 1 | 2 | 3 | 4 | 5 |
| Landform and Scale |  |  |  |  |  |
|  | Dispersed rural settlement is generally surrounded and contained by gently sloping and low undulating landform resulting in an overall small scale rural urban environment. |  |  |  |  |
| Landcover |  |  |  |  |  |
|  | The overall landscape pattern is defined by human scale indicators including houses, shops and roads together with a variety of urban structures which create some diversity and contrast in pattern. There are generally no elements that result in the presence of strong topographical variety. |  |  |  |  |
| Settlement and human influence |  |  |  |  |  |
|  | Dwellings are dispersed beyond the main settlement areas of Crookwell and Goulburn and are generally associated with individual farms and rural structures. |  |  |  |  |
| Movement |  |  |  |  |  |
|  | Movement is generally limited to local roads and access tracks. |  |  |  |  |
| Rarity |  |  |  |  |  |
|  | Small scale urban settlements are dispersed across the landscape, as well as the broader regional area of the Southern Tablelands. |  |  |  |  |
| Intervisibility |  |  |  |  |  |
|  | Intervisibility is limited where views are partially contained by buildings and structures, although views from elevated areas of the settlement extend beyond and across adjoining landscape areas. |  |  |  |  |
| Overall Sensitivity Rating | Medium (Score 18 out of 30) |  |  |  |  |

### 7.4 Overall Landscape Sensitivity

In terms of overall landscape sensitivity, this LVIA has determined that the landscape within the viewshed of the proposed Crookwell 3 wind farm has a Medium sensitivity to accommodate change,
and represents a landscape that is reasonably typical of landscape types found in surrounding areas of the Southern Tablelands.

As a landscape with an overall Medium sensitivity to accommodate change, some characteristics are likely to be altered by the wind farm; however, the landscape will have some capability to accommodate change. This capability is largely derived from the presence of predominantly large scale and open landscape across portions of the wind farm, together with the relatively low settlement density within the Crookwell 3 10km viewshed.

This LVIA has determined that the wind farm would not be an unacceptable development within the Crookwell 3 wind farm viewshed, which in a broader context also contains built elements such as roads, agricultural industry, aircraft landing strips, communication towers, power lines as well as approved wind farms within the vicinity of the Crookwell 3 wind farm site.

This LVIA notes that the Gullen Range and Crookwell 2 wind farms have been approved for construction within the Crookwell 310 km viewshed; however, as these had not been constructed and were not a visible element at the time of this LVIA preparation, they have not been included in the assessment of landscape sensitivity. The presence of existing wind farms would tend to decrease the level of sensitivity of any landscape character area in which it was located subject to an assessment and determination of cumulative impact on landscape sensitivity. Accordingly, the assessment of landscape sensitivity contained in this LVIA is conservative

The cumulative visual impacts of the proposed Crookwell 3, the existing Crookwell 1 and the approved Gullen Range and Crookwell 2 wind farms are assessed in Section 9 of this LVIA.

Despite being 'naturalistic' in appearance large portions of the Southern Tablelands landscape have been heavily modified by agricultural improvement for pasture and arable production post European settlement. Irrespective of the extent and nature of modifications to the landscape, it is not correct to assume that the landscape surrounding the wind farm should be any less valued as a result of modification. Physical change in the appearance of the landscape is an ongoing and constant process from both human and environmental influences and can result in both positive and negative effects.

