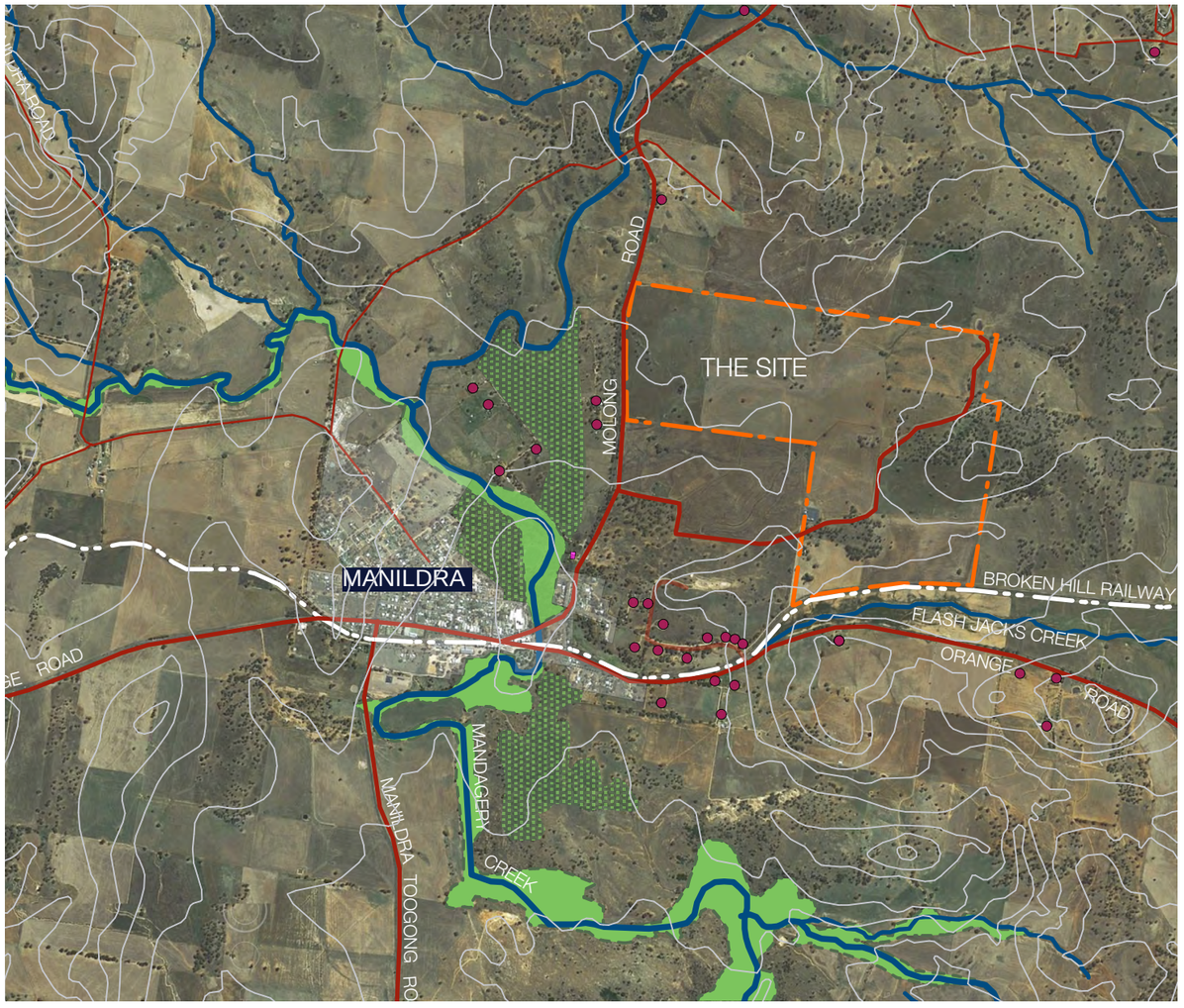
VISUAL Impact Assessment



MANILDRA Solar Farm

MANILDRA, NSW

Prepared for: INFIGEN ENERGY

Project No: 0635 Issue: B Date: 13/10/2010

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Contents

LIST OF TABLES AND FIGURES:

Introduction

1.1 Background

Moir Landscape Architecture have been commissioned by Infigen Energy to prepare a Landscape and Visual Impact Assessment (LVIA) for the proposed Manildra Solar Farm located adjacent to the Molong Manildra Road, Manildra.

As cadastral information has little influence in defining visual catchments this assessment aims to identify the landscape character, and dominant features of the relevant visual catchments that the Study Site lies within. The purpose of this report is to provide an assessment of the potential visual impact of the proposal within the defined visual catchments.

Survey work for the study was undertaken during August 2010 using key viewpoints and locations with potential views towards the Study Site. The report details the results of the field work, documents the assessment of the landscape character and visual setting, and makes recommendations concerning measures to mitigate any impacts arising from potential development.

1.2 Objectives

The report addresses the requirements related to the preparation of a visual impact assessment as part of the environmental assessment outlined in the Director-General's requirements (DGR). The DGR states the report must:

- provide a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project. This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project based on surveys and consultation;
- include a full assessment of the visual impacts associated with the solar farm, including identification and documentation of all key viewing points and corridors particularly from identified sensitive lands. This should also include the associated transmission line. Alternative pole designs should be presented and assessed and the potential for under grounding in sensitive locations should also be assessed;
- include photomontages of the project taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points, and provide a clear description of proposed visual amenity mitigation and management measures for the solar farm;
- provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented; and
- provide an assessment of the potential for reflectivity from the panels and associated infrastructure, and any safety impacts for motorists or aircraft.

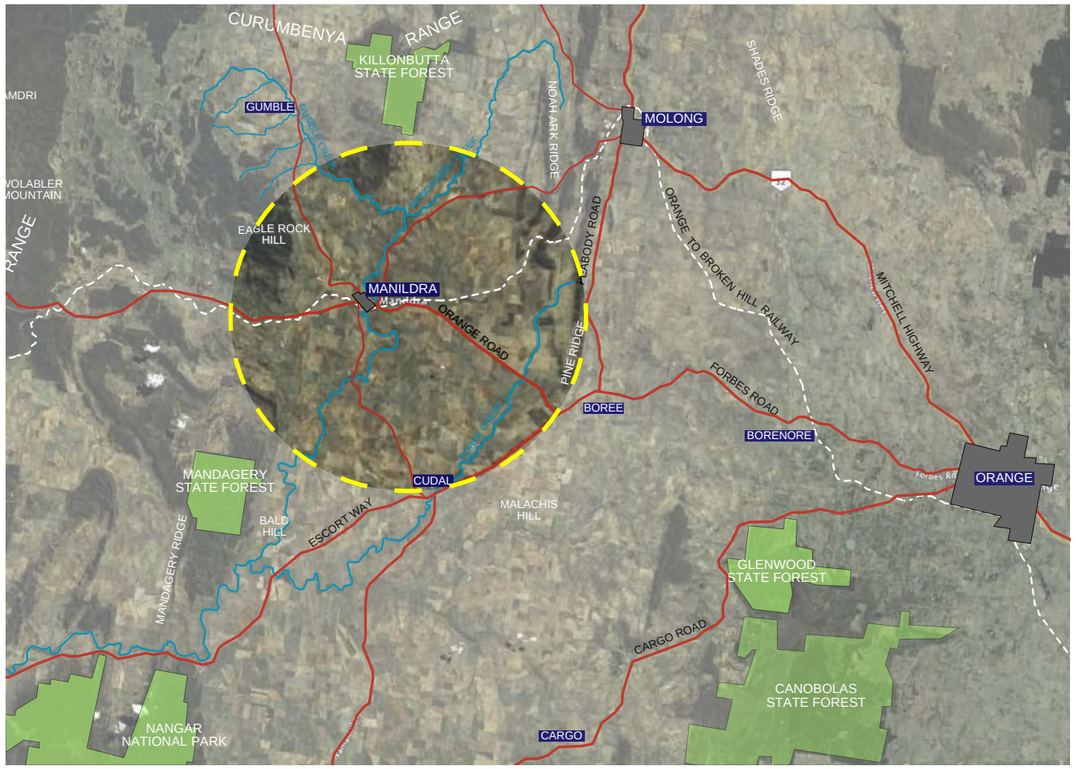


Figure 1: Regional Context- Site Locality Plan

2.0 Study Method

2.1 Visual Quality

Visual quality of an area is essentially an assessment of how viewers may respond to designated scenery. Scenes of high visual quality are those which are valued by a community for the enjoyment and improved amenity they can create. Conversely, scenes of low visual quality are of little value to the community with a preference that they be changed and improved, often through the introduction of landscape treatments.

As visual quality relates to aesthetics its assessment is largely subjective. There is evidence to suggest that certain landscapes are constantly preferred over others with preferences related to the presence or absence of certain elements.

The rating of visual quality for this study has been based on scenic quality ratings and on the following generally accepted assumptions arising from scientific research (DOP, 1988):

- Visual quality increases as relative relief and topographic ruggedness increases;
- visual quality increases as vegetation pattern variations increase;
- visual quality increases due to the presence of natural and/or agricultural landscapes;
- visual quality increases owing to the presence of waterforms (without becoming too common) and related to water quality and associated activity; and
- visual quality increases with increases in land use compatibility.

In addition to the above, cultural items may also endow a distinct character to an area and therefore contribute to its visual quality due to nostalgic associations and the desire to preserve items of heritage significance.

2.2 Visual Sensitivity

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different areas. The assessment is based on the number of people affected, landuse, and the distance of the viewer from the proposal. (EDAW, 2000).

For example, a significant change that is not frequently seen may result in a low visual sensitivity although its impact on a landscape may be high. Generally the following principles apply:

- Visual sensitivity decreases as the viewer distance increases.
- Visual sensitivity decreases as the viewing time decreases.
- Visual sensitivity can also be related to viewer activity (e.g. a person viewing an affected site whilst engaged in recreational activities will be more strongly affected by change than someone passing a scene in a car travelling to a desired destination).

Sensitivity ratings are defined as high, moderate or low and are shown in the table below (EDAW, 2000).

VISUAL SENSITIVITY TABLE (URBIS)					
VISUAL USE AREA	FOREGROUND		MIDDLEGROUND		BACKGROUND
	Local setting		Sub-Regional setting		Regional setting
	0-1	1-2km	2-4.5	4.5-7	> 7kms
Townships	High	High	High	Mod	Low
Rural residences	High	High	High	Mod	Low
Main Highway	Mod	Mod	Low	Low	Low
Local Roads	Mod	Mod	Low	Low	Low
Railway Line (Freight)	Low	Low	Low	Low	Low
Agricultural Land	Low	Low	Low	Low	Low

Table 1: Visual Sensitivity Table.

2.0 Study Method (contd.)

2.3 Visual Effect

Visual effect is the interaction between a proposal and the existing visual environment. It is often expressed as the level of visual contrast of the proposal against its setting or background in which it is viewed.

Low visual effect occurs when a proposal blends in with its existing viewed landscape due to a high level of integration of one or several of the following: form, shape, pattern, line, texture or colour. It can also result from the use of effective screening often using a combination of landform and landscaping.

Moderate visual effect occurs where a proposal is visible and contrasts with its viewed landscape however, there has been some degree of integration (e.g. good siting principles employed, retention of significant existing vegetation, provision of screen landscaping, appropriate colour selection and/or suitably scaled development).

High visual effect results when a proposal has a high visual contrast to the surrounding landscape with little or no natural screening or integration created by vegetation or topography.

2.4 Visual Impact

Visual impact is the combined effect of visual sensitivity and visual effect. Various combinations of visual sensitivity and visual effect will result in high, moderate and low overall visual impacts as suggested in the below table (EDAW, 2000).

VISUAL IMPACT TABLE				
		VISUAL EFFECT ZONES		
		HIGH	MODERATE	LOW
VISUAL SENSITIVITY LEVELS	HIGH	High Impact	High Impact	Moderate Impact
	MODERATE	High Impact	Moderate Impact	Low Impact
	LOW	Moderate Impact	Low Impact	Low Impact

Table 2: Visual Impact Table.

2.5 Methodology

The method applied to this study involved systematically evaluating the visual environment pertaining to the site and using value judgements based on community responses to scenery.

The assessment was undertaken in five stages as noted below:
1. A description of the existing visual environment, including the identification and appraisal of visual catchments/landscape units;
2. the undertaking of a viewpoint analysis to identify sites likely to be affected by development within the investigation zone;
3. a photographic survey using a 50mm fixed lens digital camera on a 1:6 ASP sensor (80mm 35mm SLR equivalent) and a handheld GPS unit to record position and altitude;
4. an assessment of visual impacts; and,
5. the preparation of recommendations for impact mitigation and suggestions for suitable development to maintain the area s visual quality. The purpose of the above methodology is reduce the amount of subjectivity entering into impact assessment and to provide sufficient data to allow for third party verification of results.

2.6 Community Consultation

The degree to which viewers will be impacted is a result of an individuals personal response to the solar farm. This report is intended to be a tool to assist individuals in making an informed decision on the visual impact.

Community consultation was undertaken on Tuesday 3 August 2010 at the Manildra Town Hall, Kiewa Street, Manildra

The response from the community was generally supportive of the proposed development. The main concern for residents was how the development would appear and the impacts on the existing character of the landscape.

3.0 Existing Visual Character

3.1 Regional Context

The Study Area is located immediately east of the small town Manildra in New South Wales. Manildra is located on the Central Tablelands approximately 305km west of Sydney and halfway between Orange and Parkes. The town is situated within the Cabonne Shire with the closest towns being Molong, which is approximately 20km to the northeast of Manildra, and Cudal, 16km in a generally south direction.

The town Manildra is a small agricultural town, populated by approximately 503 people (ABS, 2006). The Manildra Flour Mill which dominates the town centre is the largest in the Southern Hemisphere and has been operating since 1904. Settled in 1923 the oldest running picture theatre in Australia, The Amusu , is also located in Manildra.

To the southwest of Manildra, the Mandagery Ridge and adjoining Mandagery State Forest are the dominant feature of the landscape, and form a part of the Great Dividing Range.

TOPOGRAPHY

The landscape of the region is characterised by undulating hills. To the northeast densely vegetated mountains associated with the Crokers Range dominate the horizon line. To the east of Manildra, Pines Ridge and the Noahs Ark Ridge are the dominant features.

RIVERS AND TOPOGRAPHY

The Mandagery Creek bounds Manildra, defining the town, extending from the north to south and along the eastern edge of the town. The creek continues south through the undulating landscape with a series of creek and drainage lines branching off through the landscape.

VEGETATION

Dense riparian vegetation associated with the Mandagery Creek is a feature of the Manildra landscape. Paddocks within the area are generally cleared for agricultural purposes. Remnant woodland vegetation remains along ridges, creeklines, roads and uncleared paddocks.

AGRICULTURE

Manildra is a farming community with the main produce being wheat. The Manildra Flour Mill commenced in 1904 and is now the largest industrial wheat producer in Australia, exporting to the world. (Wikipedia)

3.2 Site Description

The Study Site is located on a 180 hectare site adjacent to the Molong Manildra Road, in Manildra within the Cabbone Shire. The subject site is located approximately 1.2km in a north easterly direction from Manildra at its nearest point. The southern edge of the Study Site is defined by the Broken Hill Railway, and the western edge is bordered by the Molong Manildra Road.

The character of the proposed solar farm site is defined by slightly undulating, grazing land, generally devoid of native vegetation. The majority of the Site is cleared with some tree coverage occurring in sparse patches.

The broader landscape is characterised by a mosaic of agricultural land with a sparse coverage of remnant native woodland and riparian vegetation. Creek and natural drainage lines branch from the Mandagery Creek through the low points of the slightly undulating landscape.

Dense vegetation occurs within the riparian zone associated with Mandagery Creek. Associated tributaries branching from Mandagery Creek have a sparse coverage of riparian vegetation. A moderate coverage of native vegetation extends down the east of Manildra and the Mandagery Creek.

Figure 2: Study Site Location

3.0 Existing Visual Character (contd.)

3.3 Visual Setting

Generally the first step in carrying out a landscape and visual assessment is to identify and map the Landscape Character of the surrounding area.

The landscape character can be defined as the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects a particular combination of geology, landform, soils, vegetation, land use and human settlement and creates a particular sense of place for different areas within the landscape (Homer and Maclennan et al, 2006).

The existing landscape context of the site and its surrounding environment are classified into homogenous units of landscape character. The Landscape Character Units are summerised below and form the elements of the local visual context, the quality of the LCU also reflects the visual amenity.

The Landscape Character Units identified for this report include:

- LCU 1- Manildra Town
- LCU 2- Rural Residential
- LCU 3- Open Pastoral Land
- LCU 4- Molong Manildra Road

Landscape Character Units are identified in Figure 3, and are described in detail in the following pages of this report.

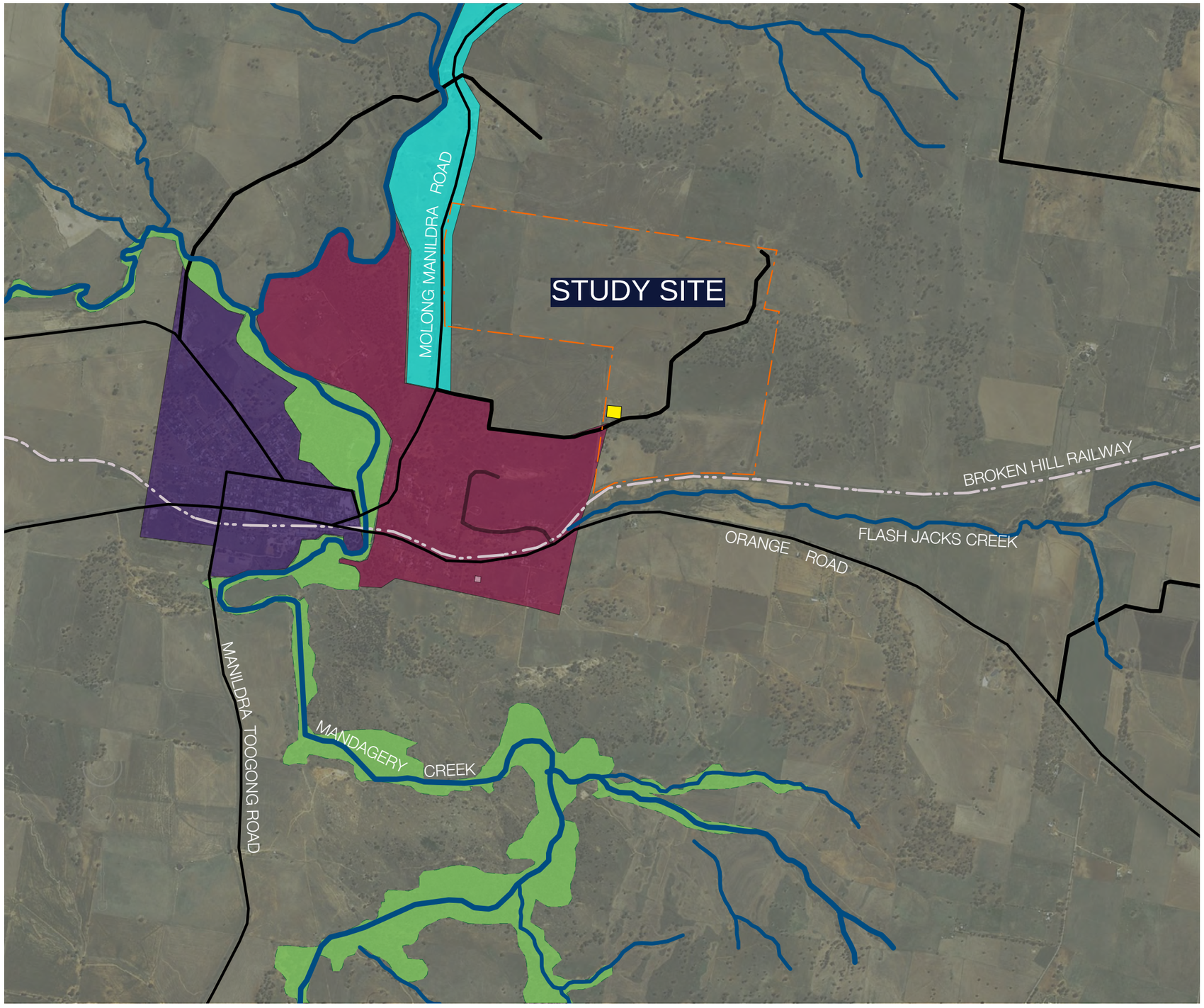
LCU1: Manildra Town.

LCU2: Rural Residential.

LCU3: Open Pastoral Land.

LCU4: Molong Manildra Road.

3.0 Existing Visual Character (contd.)



LEGEND

- Extent of the Site
- River/Creekline
- Railway Line
- Major Road
- Existing Substation
- Riparian Vegetation

LANDSCAPE CHARACTER UNITS

- Manildra Town
- Rural Residential
- Open Pastoral Land
- Molong Manildra Road

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0 0.5 1.0 1.5km

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Figure 3: Landscape Character Units.

3.0 Existing Visual Character (contd.)

3.4 Landscape Character Units

LCU1- Manildra Town

Location: For the purpose of this study this LCU encompasses the land and associated infrastructure to the west of the Mandagery creek. The area is predominately residential with an established main street precinct along Kiewa Street, dominated by th imposing Manildra Grain Silos.

Landform: The topography is generally flat. The Mandagery Creek is incised and wraps around the LCU to the north, east and south.

Vegetation: Native vegetation is most prominent along the Mandagery Creek and on the fringe of the town. A combination of exotic and native vegetation associated with residential gardens form apart of the local character. Established trees form apart of the main street scape.

Waterform: The main body of water within the area is the Mandagery Creek, which forms the boundary of this LCU.

Land use: Land use within the LCU is predominately residential, associated with the well established industry along Kiewa Street. Small scale commercial buildings are established along Kiewa Street and Derowie Street.

Significant features: Heritage Listed and older style commercial and residential buildings are located through the town. The most dominant feature of the town is the Manildra Flour Mill and associated agricultural infrastructure along Kiewa Street.

Views: The Study Site is not visible from the LCU due to the dense riparian vegetation associated with the Mandagery Creek. Views are generally contained within the LCU by existing buildings and vegetation. The Grain Silos are visible from many viewpoints around the Study Site and are a dominant feature of the landscape.

Scenic quality ranking: Heritage buildings and the rural character of the town give this LCU a scenic rural quality.

Kiewa Street.

Manildra Post Office.

View of Grain Silos along Kiewa Street, Manildra.

3.0 Existing Visual Character (contd.)

LCU2- Rural Residential

Location: For the purpose of this study the LCU encompasses the rural/residential development associated with Manildra, on the eastern side of the Mandagery Creek. These properties are generally located along Old Orange Road, Orange Road and Mandagery Lane.

Landform: This LCU is located on predominately flat, low-lying topography which slopes slightly towards Mandagery Creek.

Vegetation: Native vegetation associated with Mandagery Creek moderately covers the LCU with cleared areas associated with residential properties. Vegetation is prominent along road edges and a mix of native and exotic trees exist within residential properties.

Waterform: The Mandagery Creek forms the western boundary of this LCU dividing the precinct from the town centre.

Land use: The land use of the precinct is rural residential. The local public school is located along the Molong Manildra Road. The LCU forms the entry to the town from both the north and east. The Broken Hill Railway transverses the LCU parallel to Orange Road.

Significant features: The area is defined by rural residential properties. The Mandagery Creek and associated riparian vegetation is a dominant feature of the landscape.

Views: Views to the Study Site from this LCU are obscured as a result of a combination of vegetation and topography.

Scenic quality ranking: The area is defined by a distinct rural character giving the area a high scenic quality.

Mandagery Lane.

Manildra Entry Sign.

Entry to Manildra from Molong Manildra Road.

3.0 Existing Visual Character (contd.)

LCU3- Open Pastoral Land

Location: The open pastoral land surrounding Manildra is the dominant feature of the landscape. For the purpose of this report, the LCU encompasses the open, rural grazing land typical of the land surrounding Manildra. The Study Site is located within this LCU.

Landform: The landform character of this LCU is generally open, undulating pastoral land.

Vegetation: Vegetation consists of sparse coverage of remnant woodland vegetation, typically located on the ridge lines and high points. Lower lying ground is predominately cleared for grazing purposes.

Waterform: The Mandagery Creek is the main water body in the area. Some drainage and creek lines run through the LCU, draining into the Mandagery Creek. Some dams occur within the LCU, associated with homesteads and paddocks.

Land use: The pastoral landscape is typically utilised for a number of agricultural pursuits including, but not limited to, grazing, cropping and improved pasture.

Significant features: Homesteads, farm machinery and ancillary buildings are common features on rural land surrounding the site. The Study Site itself is mostly devoid of significant features with the exception of an abandoned cottage and the Manildra substation and associated power lines which transverse the landscape.

Views: Variations in the topography alter views throughout the LCU.

Scenic quality ranking: The open pastoral land is a dominant character of the landscape typical of the Manildra region. The LCU has a high scenic quality.

Pastoral Land.

Existing Substation within the landscape.

Abandoned Cottage located within the Study Site.

3.0 Existing Visual Character (contd.)

LCU4- Molong Manildra Road

Location: The Molong Manildra Road runs approximately 20km between the towns Molong and Manildra in a north easterly direction. For the purpose of this LCU, the Molong Manildra Road LCU consists of the road and associated homesteads which run along the western perimeter of the Study Site. The LCU extends through to Mandagery Creek to the west.

Landform: The landform varies throughout the LCU, however for the most part the topography is undulating. As a result, variations in the topography alter views when traveling along the road.

Vegetation: Remnant native trees typically follow the roadside. Vegetation associated with the Mandagery Creek screens views to the west.

Waterform: The road generally follows the form of the Mandagery Creek which is located approximately 100 metres from the road at its closest point.

Land use: The road is a relatively minor road which connects Manildra to Molong in the north. The road is utilised by local traffic with the occasional heavy transport vehicle. A number of homesteads are accessed off Molong Manildra Road.

Significant features: Homesteads, ancillary buildings and associated machinery are common features along the Molong Manildra Road.

Views: Views towards the Study Site and surrounding landscape vary due to the undulating topography of the road and coverage of roadside vegetation. Views are mostly fleeting due to the speed of travel along the road.

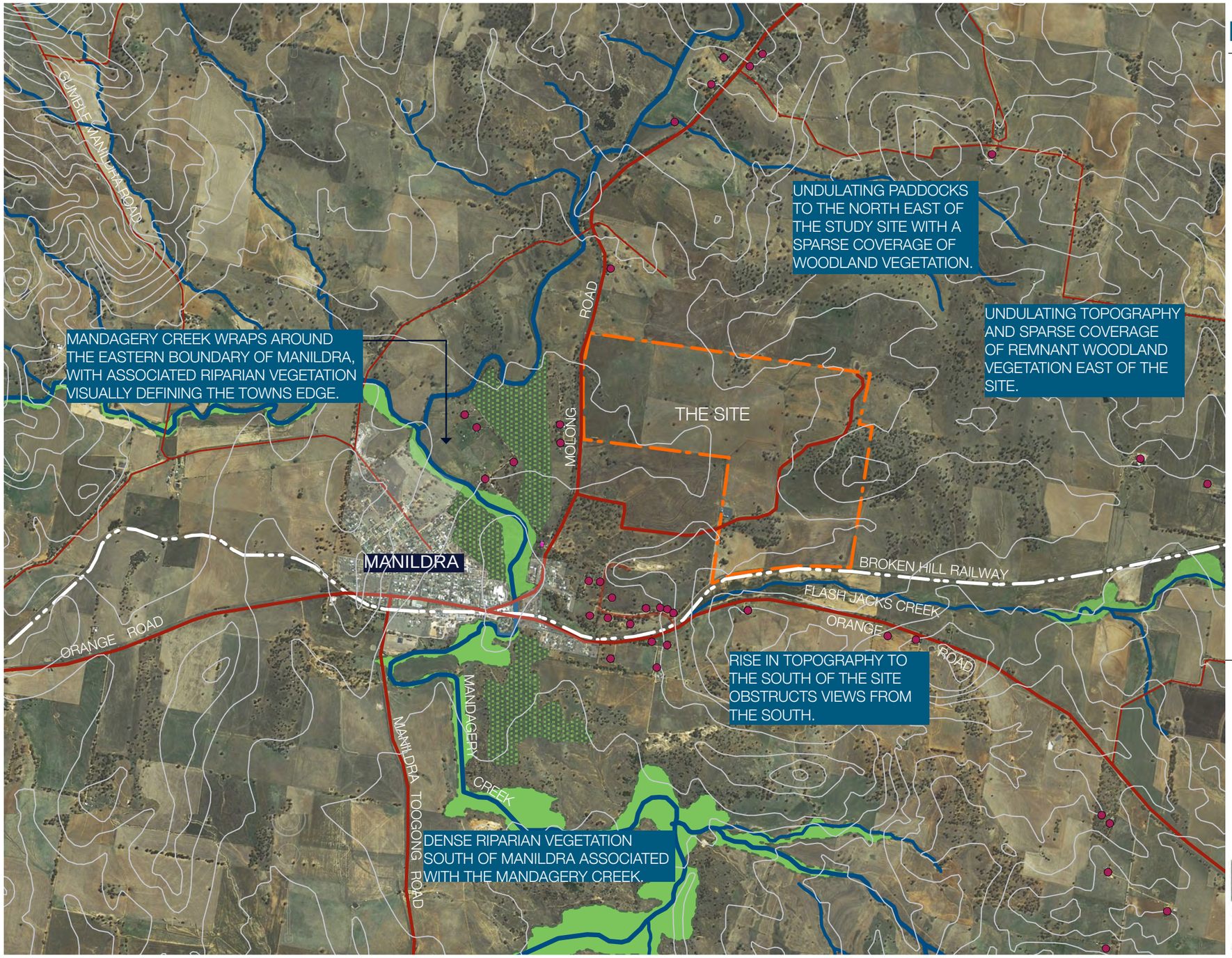
Scenic quality ranking: The landscape surrounding the Molong Manildra Road is generally open pastoral land with a high scenic quality.

Molong Manildra Road.

Pastoral land off Molong Manildra Road.

View along Molong Manildra Road.

3.0 Existing Visual Character (contd.)



LEGEND

- Extent of the Site
- River/Creekline
- Railway Line
- Major Road
- Existing Substation
- Riparian Vegetation
- Dense Woodland Vegetation
- Isolated Rural Property
- Extent of Manildra

N

0 0.5 1.0 1.5km

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Figure 4: Visual Site Analysis- Existing Site Conditions.

4.0 The Proposal

4.1 Proposal Description

Infigen Energy and Suntech power have identified Manildra as a potential site for a photovoltaic (PV) solar farm. The large scale, grid-connected, solar farm will have a significant role in contributing to Australia's Renewable Energy Target (RET) of 20% renewable energy by 2020.

4.1.1 MANILDRA PV SOLAR FARM LAYOUT

The proposal consists of the development of a photovoltanic (PV) Solar Farm located north east of Manildra. Manildra is a desirable location for a solar farm due to the solar radiation and close proximity to existing network infrastructure. The Solar Farm is proposed to cover an area of approximately 120ha on a 180ha site adjacent to Molong Manildra Road.

The Solar Farm is a renewable source of energy and has a potential operating capacity of 30-50MW, which is equivalent to powering 10,000 homes.

The Solar Farm is proposed to consist of approximately 150,000 solar PV panels mounted on fixed frames, approximately 2-3m above the ground. The layout of the solar panels, as shown in figure 6, are sited in rows and orientated towards the north.

4.1.2 ASSOCIATED INFRASTRUCTURE

To facilitate the construction and ongoing maintenance of an access road is proposed around the perimeter of the Site. Lateral roadways extend from the perimeter road providing access to the panels, inverters and transformers. It is proposed that the solar farm will be connected to the existing substation through an underground line. The proposed panels are connected to transformers (approximately 40 in total) which connect with underground cables circuits. The site is bounded by a security fence along the perimeter road.

The Manildra Solar Farm is proposed to connect to the existing Manildra 132kV substation which is immediately adjacent the Study Site.

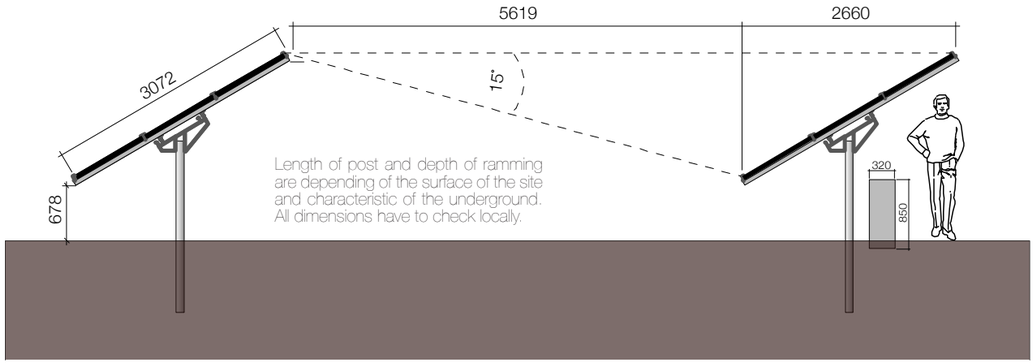

Figure 5: Typical Solar Panel Elevation.

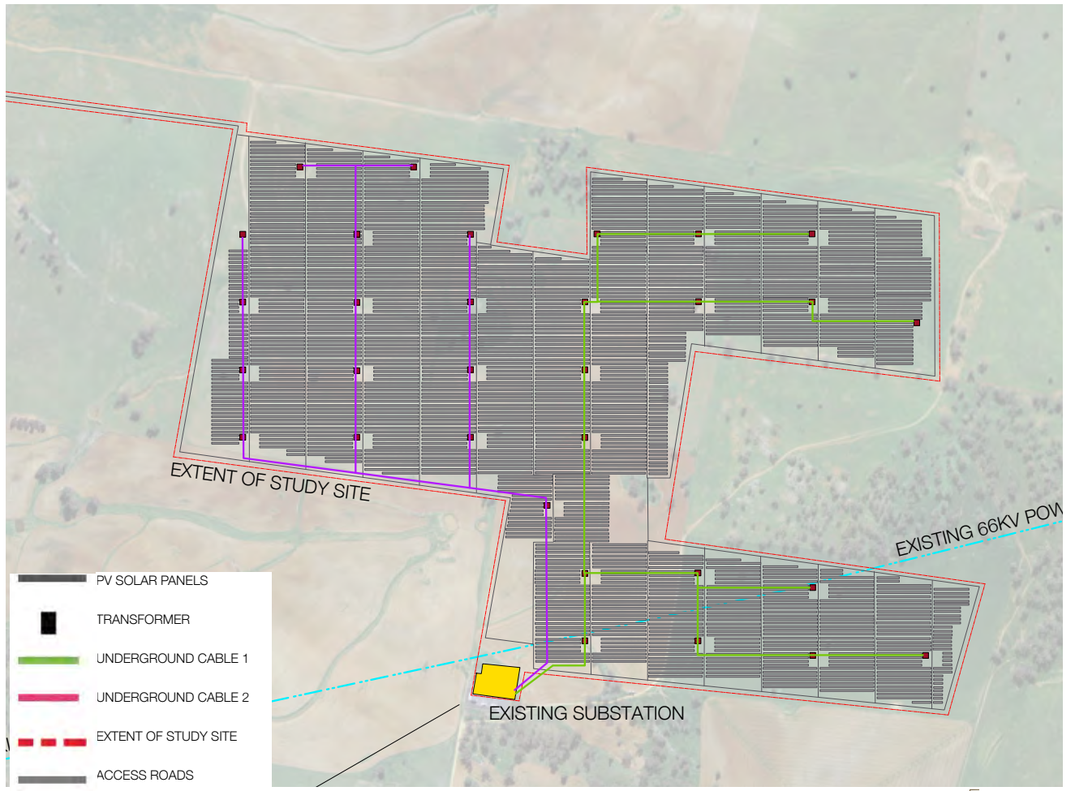

Figure 6: Proposed Solar Farm Layout.

5.0 Visual Impact

5.1 Visual Catchment

The visual catchment of the Study Site is the area of surrounding land from which the Solar Farm may be partially or completely visible. The zone of visual influence (ZVI) has been determined through the use of digital topographic information and 3D modelling software.

As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the ZVI is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario and in reality the visibility of the Solar Farm is far less than that shown in Figure 7.

The ZVI map is included as shown in Figure 7 on page 16 of this report. Areas shaded blue represent the extents from which the Solar Farm will be visible.

An inspection and analysis of the area was undertaken in August 2010 to ground truth the visual catchment. The field work identified landscape features which significantly alter views to the Study Site from the eye level perspective. Viewpoints were selected within the boundaries of the determined visual catchment and are analysed in section 5.2 of this report.

5.2 Viewpoint Analysis

This part of the visual assessment considers the likely impact that development would have on the existing landscape character and visual amenity by selecting prominent sites, otherwise referred to as viewpoints.

5.2.1 SELECTION OF VIEWPOINT ASSESSMENT LOCATIONS

Within the visual catchment of the proposed solar farm, 9 viewpoints were selected, from which the visual impact of the development was to be assessed.

Viewpoints were initially selected through an assessment of the ZVI mapping information. This was followed by field inspections of selected viewpoints to determine actual visibility and to define the boundaries of the visual catchment.

Viewpoints were selected on the basis of where development within the Study Site would appear to be most prominent, either based on the degree of exposure or the number of people likely to be affected.

Other key features that were considered in identifying viewpoints included:

- Location of major roads and railways
- Proximity of the site to residence
- Proximity to town
- Land use of the area

Areas identified for viewpoint analysis in Manildra were along the Molong Manildra Road and access roads both through the Site and on the boundary of the Site. The exact location of the viewpoints selected are identified in Figure 6 on page 17 of this report.

It is important to note that viewpoints for this study have been taken only from accessible public land however this does include viewpoints that are adjacent to residences potentially affected by the development. As part of the Viewpoint Analysis the Landscape Character and Visual Sensitivity are also assessed from each viewpoint.

5.2.2 PROCESS OF VIEWPOINT ANALYSIS

Once the viewpoint had been selected, panoramic photographs were taken at eye level from the viewpoint towards the site. Photographs were taken with a Canon 40D digital SLR through a 50mm fixed focal lens (Equivalent to 80mm on 35mm).

The visual impact of the viewpoint was then assessed both on site and with the topographic and aerial information to ensure accuracy.

Viewpoint photographs are show in the Plates 1-9 on pages 18 to 26 of this report.