MOREE SOLAR POWER STATION



LANDSCAPE & VISUAL IMPACT ASSESSMENT

Prepared for:

bp solar

December 2010

Prepared by:

GREEN BEAN DESIGN

landscape architects

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Introduction and Methodology

SECTION 1

1.1 Introduction

This Landscape and Visual Impact Assessment (LVIA) for the BP Solar Power Station (the Project) has been prepared by Green Bean Design Landscape Architects (GBDLA) on behalf of BP Solar Pty Ltd and Walsh Consulting Pty Ltd for a photovoltaic (PV) solar farm and associated works located south of Moree in far northern New South Wales.

This LVIA addresses one of the key requirements for the Project Environmental Assessment (EA) to be submitted and assessed under Part 3A of the Environmental Planning & Assessment Act 1979 (EP&A Act).

The LVIA methodology has been applied to a number of similar assessments prepared by GBDLA, including transmission lines, electrical infrastructure and power generation projects. The LVIA methodology adopts a number of principles outlined in the Guidelines for Landscape and Visual Impact Assessment, The Landscape Institute and Institute of Environmental Management and Assessment 2002, as well as drawing on current guidelines developed by State and Federal Government for the landscape and visual assessment of renewable energy projects.

The LVIA involved an evaluation of landscape character surrounding, the Project site together with an assessment of visual impact that may result from the construction and operation of the Project.

GBDLA is not aware of any areas of landscape within the immediate Project viewshed that may be subject to any Local, State or Federal statutory designations for high landscape values or scenic quality and/or scenic protection.

A primary objective of the LVIA was to determine the likely visual impact of the Project on people living and working in, or travelling through surrounding areas.

The LVIA methodology comprised the following key activities:

- Desktop study addressing visual character of the Project site and immediate surrounding area;
- Identification of the Project view catchment;
- Site inspection and fieldwork;
- Assessment and determination of Visual Absorption Capability;
- Preparation of photomontages;
- Assessment of visual impact from publicly accessible view points and residential dwellings; and
- Discussion of mitigation measures and how they may reduce levels of visual impact.

1.2 Desktop study

A desktop study was carried out to identify the potential view catchment of the Project. This was undertaken by reference to 1:25,000 topographic maps as well as aerial photographs of the alignment and immediate surrounding areas.

The desktop study identified the visual character of the surrounding landscape including features such as the site context, landform and elevation. The desktop study also identified and mapped a number of potential view locations from which the Project may be visible.

Although it is not feasible to assess each and every view that may exist toward the Project, the desk top study did seek to identify and assess key view locations, including views from areas close to residences and transport corridors.

1.3 Fieldwork

The fieldwork involved:

- A detailed site inspection to determine the potential extent of visibility of the Project and associated infrastructure;
- Determination of the various view locations from which the Project and associated infrastructure could potentially be visible from; and
- Preparation of a photographic and written record.

1.4 Assessment of visual impact

The visibility of the Project would primarily result from the combination of two factors:

- the extent to which the Project would be visible from surrounding areas; and
- the degree of visual contrast between the Project and the surrounding landscape that would be visible from key view locations.

The overall visual impact is generally determined by a combination of factors including:

- the category and type of situation from which people may view the components of the Project (e.g. resident or motorist);
- the potential number of people with a view toward components of the Project from any one view location;
- the distance between a person and components of the Project; and
- the duration of time that a person may view components of the Project.

An underlying rationale for this LVIA is that if people are not recorded at a particular location, or if views toward the Project are screened, then there is likely to be a nil visual impact at that location.

It should be noted that all residential dwellings identified through the desk top assessment of aerial photographs and mapping were assessed during the field work study; however the LVIA field work was undertaken from publicly accessible locations only.

The Project

SECTION 2

2.1 Project Location

The Project would be located in far northern New South Wales approximately 8km south of Moree, and 100km south the New South Wales and Queensland border. Moree is located at the junction of the Newell and Gwydir Highways and attracts a number of tourists who visit the Moree Hot Artesian Pool Complex established in 1896.

The Project would extend across two landholdings covering an area of approximately 1129ha, administered by the Moree Plains Shire Council. The Moree Plains Shire covers approximately 17,900km^2 of highly productive primary agricultural land including cultivation of wheat, pulses, cotton and livestock production. The Project area would therefore represent a very small portion of Council's administered area.

The Project is surrounded by a range of landuse types including rural agricultural or industrial installations and described as follows:

Landuse to the north of the Project includes Council's Waste Management Facility, the Saleyards and the Duvanant's Cotton Gin.

Landuse to the east of the Project includes rural residential subdivision areas and cultivated agricultural land.

Landuse to the south of the Project includes open and extensive tracts of agricultural land.

Landuse to the west of the Project includes the Northern Tablelands Explorer railway line, the Newell Highway road corridor and easements for 66kv and 132kV transmission lines.

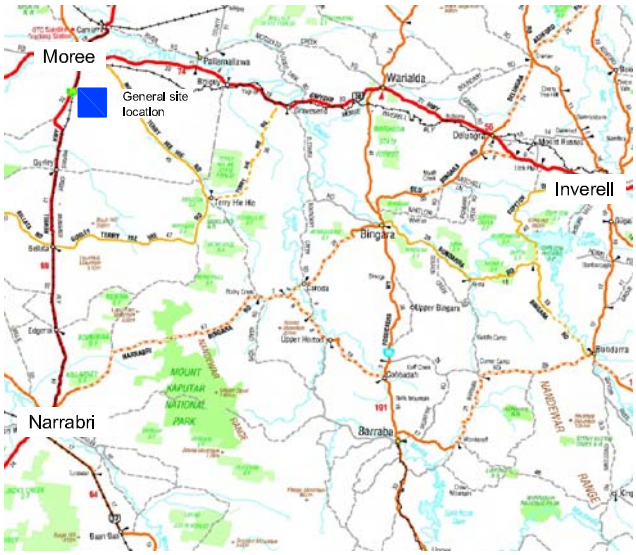
The Project would also include approximately a 10km length of 132kV transmission line from the Project site to the Moree Zone substation. The final alignment for the transmission line would be subject to detailed design; however, for the purpose of the LVIA the route is described as follows:

From the Moree Zone Substation the transmission would travel east toward Tycannah Street and then south along Industrial Drive. The transmission line would then continue along Tycannah Street toward the Burrington Road and then follow Burrington Road south east to Barton Plains Road. The transmission line would then travel south along Barton Plains Road to the Project site.

There are no known large publically accessible areas including National Parks, State Conservation Areas or Reserves from which views toward the Project would create any visual impact.

The general location of the Project is illustrated in **Figure 1**.

Figure 1
Location Plan



Regional Location Plan

Not to scale

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Panorama Avenue Bathurst 2795
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2.2 Project Description (Solar Power Station and 132kV transmission line)

The key visual components of the solar power station would comprise:

- Flat crystalline photovoltaic (PV) modules;
- Electrical inverters;
- Transformers;
- 22/132kV Substation (on site);
- 2m high perimeter security fence;
- Amenities building, workshop and small car park; and
- Low level lighting around amenities building, workshop, car park and substation.

The key visual components of the 132kV transmission line would comprise:

- Single tapered concrete poles spaced approximately 200m to 250m apart and up to 18.8m tall;
- Aluminium alloy 132kV conductors; and
- An aerial earth wire and communications link.

The 132kV transmission line would be approximately 10km in length between the Project Substation and Moree Zone Substation, with approximately 60 poles incorporating support and tension structures for angle locations. The transmission line would be constructed within a 45m wide easement located within Council road reservations or similar along the length of the route.

The majority of the proposed transmission line would be accessible for maintenance purposes from existing roads and tracks.

The proposed layout for the Project and general arrangement and details of the PV panels are illustrated in **Figures 2** and **3**.

Figure 2
Solar Power Station
Detail Layout

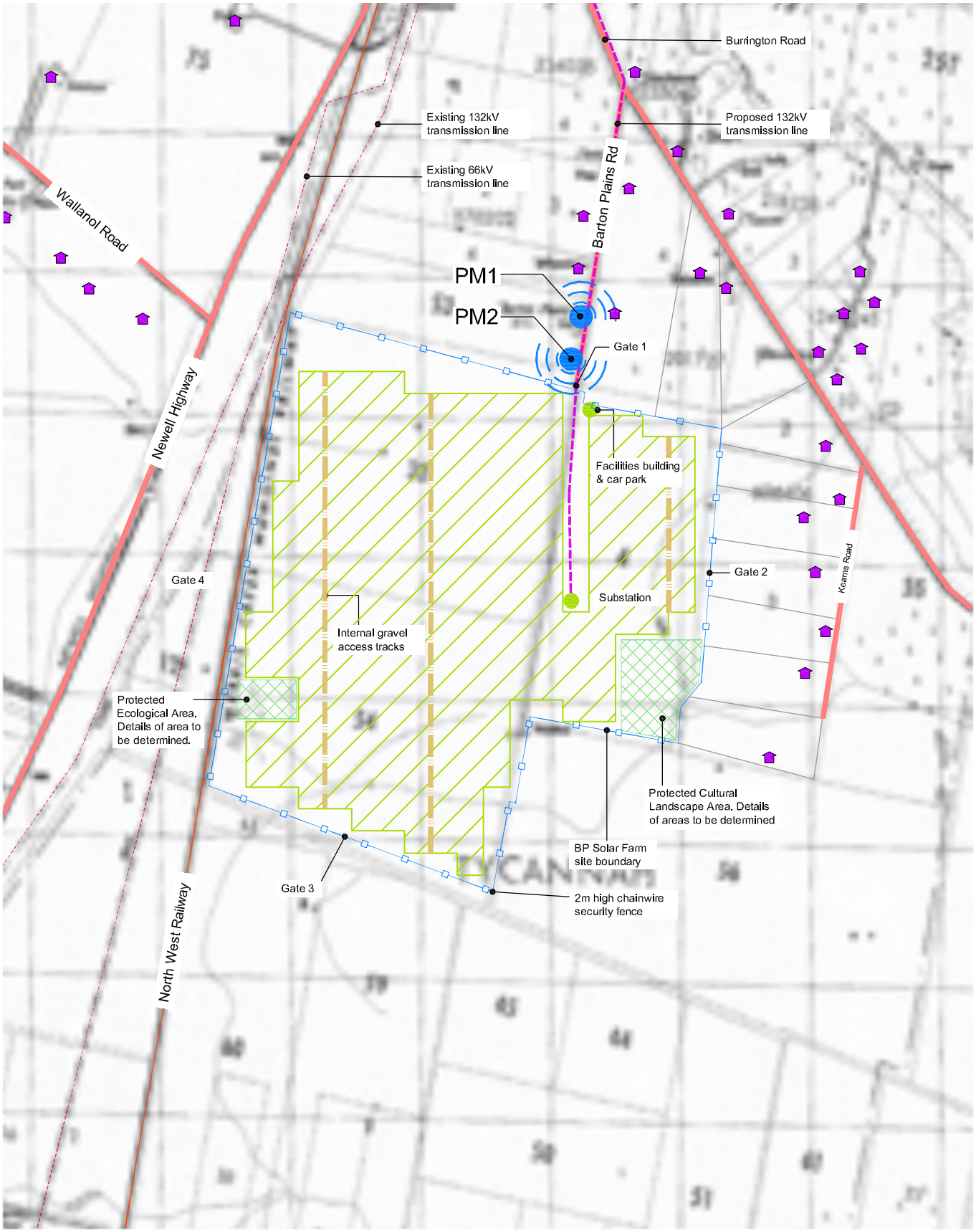

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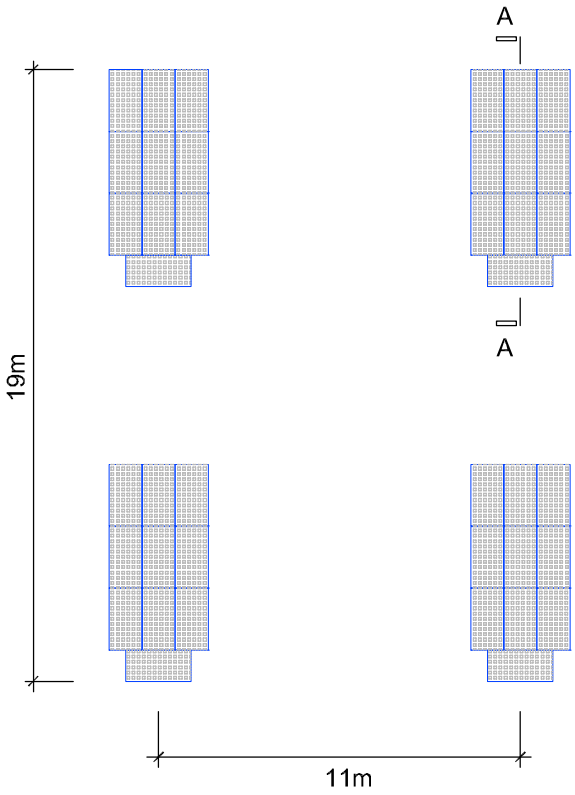
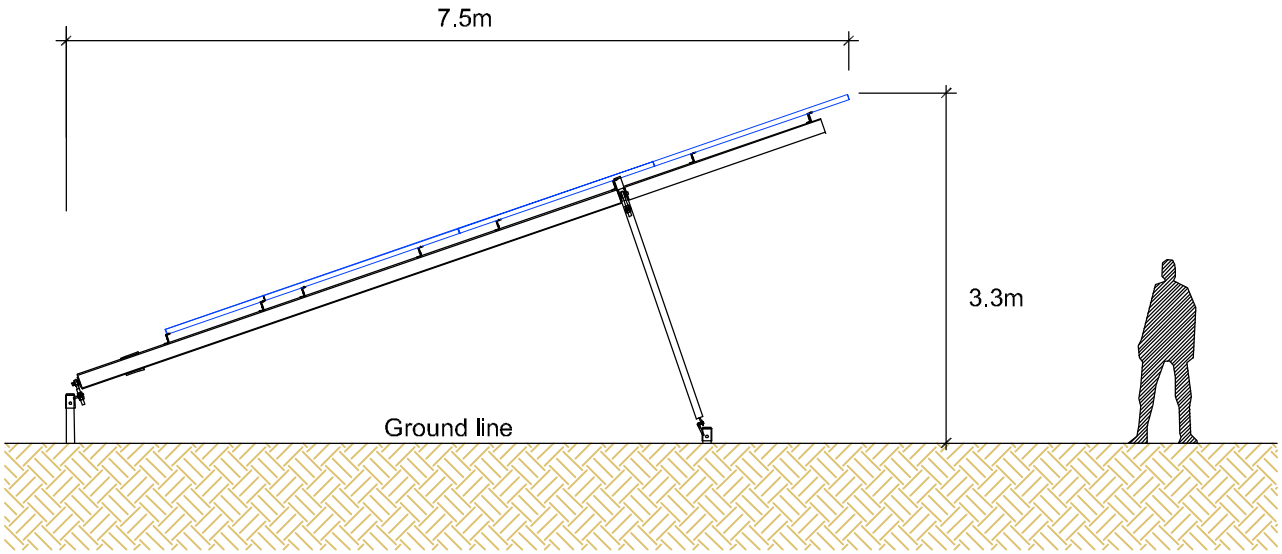
Figure 3
Photovoltaic
Panel Details

PV Panel - Typical Illustration



PV Panel - Typical Arrangement



PV Panel - Typical Cross Section A

Table 2 – Viewshed Descriptors

Distance from Project	Potential Viewshed Descriptors
>5km	The constructed elements within the Project would be indistinct from the surrounding landscape with a likely overall **Nil** or **Very Low** level visibility.
2-5km	The constructed elements within the Project may be visible in the landscape but tend to become less noticeable with increasing distance. Potentially noticeable but unlikely to be dominant within viewshed and potentially resulting in **Very Low** to **Low** level visibility.
500m-2km	The constructed elements within the Project would be visible within the landscape from some surrounding areas; however, the Project would be less noticeable with increasing distance. Potential for **Low** to **Moderate** visibility depending on the category of viewer and their location.
0-500m	The constructed elements within the Project would tend to be visible from the surrounding landscape. The majority of Project structures are likely to be recognisable within viewshed with a potential **High** level of visibility depending on the category of viewer, their location, and sensitivity.

The relationship between the Project viewshed and potential view locations is illustrated in **Figure 4**, and the relationship between the Project visibility and view location distance is illustrated in **Figure 5**.

3.3 132kV Transmission Line Viewshed

The view catchment for the transmission line has been determined as a one kilometre offset from either side of the transmission line. Beyond one kilometre views toward the Project may have a greater tendency to be screened by undulating landform or the presence of vegetation for portions of the west and east alignments. It is also considered that whilst some Project components would be noticeable from areas beyond one kilometre, they are unlikely to appear as a dominant visual element within the landscape at this distance.

The view catchment is a generalised assessment, where views toward the Project could, in some situations, be blocked by buildings, vegetation or local landform features at specific points within the one kilometre offset, and similarly glimpses of the Project would be available from isolated positions outside the view catchment area.

The photograph in **Plate 1** illustrates an existing 132kV transmission line south of the Moree Zone substation and demonstrates the influence of distance on visibility.

View Shed and Visibility

SECTION 3

3.1 Introduction

A key component of the LVIA is defined by the description, assessment and determination of the viewshed and visibility associated with the Project. It is a combination of these issues that sets out the framework for determining the significance and magnitude of potential visual impact of the Project on view locations within the landscape. In order to clarify and explain this component of the LVIA, the relationship between viewshed and visibility is outlined and defined in **Table 1**.

Table 1 – Definitions

	Definition	Relationship
Viewshed	An area of land surrounding and beyond the Project area which may be potentially affected by the Project.	Identifies the majority of the LVIA study area that incorporates view locations that may be subject to a degree of visual impact.
Visibility	A relative determination at which various locations elements of the Project can be clearly discerned and described.	Describes the likely extent and relative scale of the Projects constructed elements may be visible from any view location.

An overview of viewshed and visibility is discussed in the following sections.

3.2 Solar Power Station Viewshed

The Project viewshed has been illustrated as a series of concentric bands (in 1km widths) extending across the landscape up to 5km from the Project. The distance of the viewshed can vary between a range of power generation projects, and may be influenced and informed by a number of criteria including the height of structures together with the nature, location and height of landform that may limit visibility.

It is important to note that the Project may be visible from some areas of the landscape beyond the nominated viewshed; however, within the general parameters of normal human vision, the solar panels at a maximum height of approximately 3.3m would occupy a relatively small proportion of a person's field of view from distances in excess of 5km.

The viewshed is used as a framework and guide for visibility assessment, as the degree of visual impacts would tend to be gradated with distance although there are unlikely to be any distinct or abrupt noticeable changes between the nominated distance bands. For the purpose of the LVIA, the viewshed assumptions for the Project are outlined in **Table 2**.

Figure 4
View Shed

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0 0.5km 1km 2km

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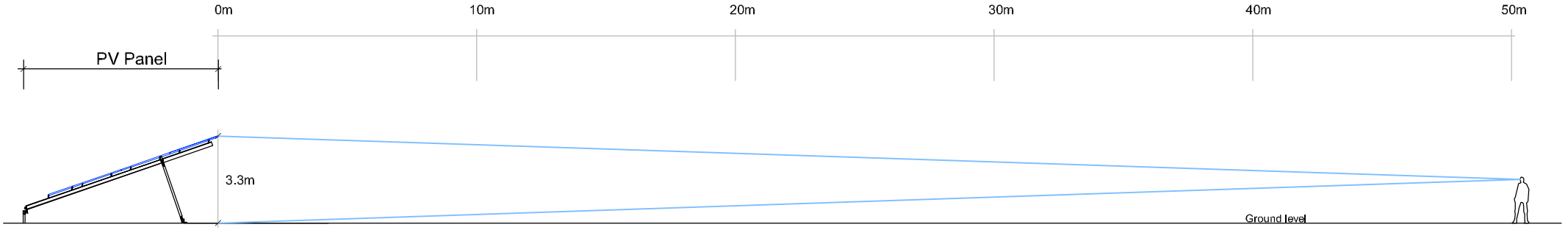
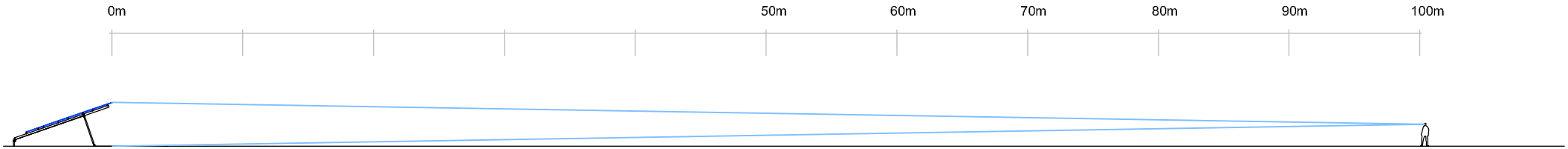
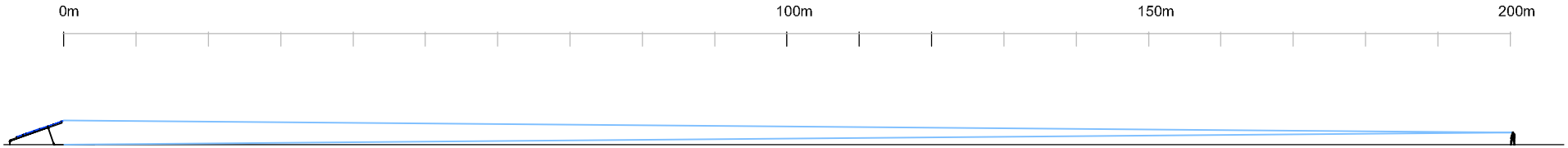


The PV Panels viewed from a 50m distance would occupy less than 4% of the vertical human view cone



The PV Panels viewed from a 100m distance would occupy less than 2% of the vertical human view cone



The PV Panels viewed from a 200m distance would occupy less than 1% of the vertical human view cone

Plate 1. Existing 132kV single pole transmission line north of the Moree Substation

3.4 Visibility

The visibility of the Project within the viewshed can result from a number of factors:

Distance

With an increase in distance the proportion of a person's horizontal and vertical view cone occupied by a visible structure, or group of structures, would decline.

As the view distance increases so do the atmospheric effects resulting from dust particles and moisture in the atmosphere, which makes the Projects structures appear to be grey thus potentially reducing the contrast between the structures and the background against which they are viewed.

Whilst the distance between a view location and Project is a primary factor to consider when determining potential visibility, there are other issues which may also affect the degree of visibility.

Movement

The visibility of the Project would vary between the categories of static and dynamic view locations. In the case of static views the relationship between the Project and the landscape would not tend to vary greatly. The extent of vision may be relatively wide as a person would tend to scan views back and forth across the landscape.

In contrast views from a moving vehicle are dynamic as the visual relationship between the Project is constantly changing as well as the visual relationship between the Project elements and the landscape

in which they are seen. The extent of vision can be partially constrained by the available view from within a vehicle at proximate distances.

Contrast

The level of contrast is influenced by the position of the sun relative to the Project and the view location. Where the sun is located in front of the viewer, the visible portion of the Project would be seen in shadow. Where the background and surrounds to the Project are dark toned the visual contrast would be reduced.

Where the sun is located behind the view location then the visible portion of the Project would be in full sun. If the background is also light toned then the contrast is less when compared to a dark background.

Local Environmental Factors

SECTION 4

4.1 Climatic and Atmospheric Conditions

Local climatic and atmospheric conditions have the potential to influence the visibility of the Project site from surrounding view locations, and more significantly, from distant view locations.

The Moree climate is generally categorised by the Bureau of Meteorology as 'long warm to hot summers, moderate and variable rainfall and a winter of cool clear days and cold frosty nights, with often a rapid transition of perhaps a month from summer to winter'.

The Bureau of Meteorology has collected meteorological data over the past fifteen years at Moree Airport which indicates that there are:

- 155 clear days (annual mean average);
- 80 cloudy days (annual mean average); and
- 56 days of rain (annual mean average).

Rainfall would tend to reduce the level of visibility toward the Project site from a number of surrounding view locations, with the degree of visibility tending to decrease over distance.

Cloud cover would also tend to reduce the level of visibility of the Project site and lessen the degree of contrast between the solar power station structures and the background against which they 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 Project. The degree of impact would be largely dependent on the relationship between the position and angle of the sun relative to the view location, and with increasing distance would tend to reduce the contrast between the Project structures and the surrounding landform.

4.2 Topography and Drainage

The Project site is generally level, with a very gentle slope extending east to west from RL222m along the eastern site boundary to RL216m at the railway line on the western boundary. There are no significant artificial or natural topographical features on the Project site.

A small number of minor drainage lines extend east to west across the site discharging to culvert structures alongside the railway line embankment. The Clarks Gully floodway crosses the south west corner of the Project site.

4.3 Vegetation

The extent and condition of vegetation across the Project site has been assessed and is detailed in the flora and fauna studies prepared for the EA. Groundcover across the majority of the Project site is

largely defined by agricultural crop production with very sparse individual trees occurring around small dams or within cultivated fields.

Plate 2. Typical view across north west portion of the Project site (from Barton Plains Road)

Panorama Photographs

SECTION 5

5.1 Panorama Photographs

A series of photographs were taken during the course of the fieldwork to illustrate existing views in the vicinity of the Project and a number of view locations close to residents and publically accessible areas.

The photographs were taken with a tripod mounted digital SLR camera and individual photographs digitally stitched together to form a segmented panoramic image to provide a visual illustration of the existing view from each photo location.

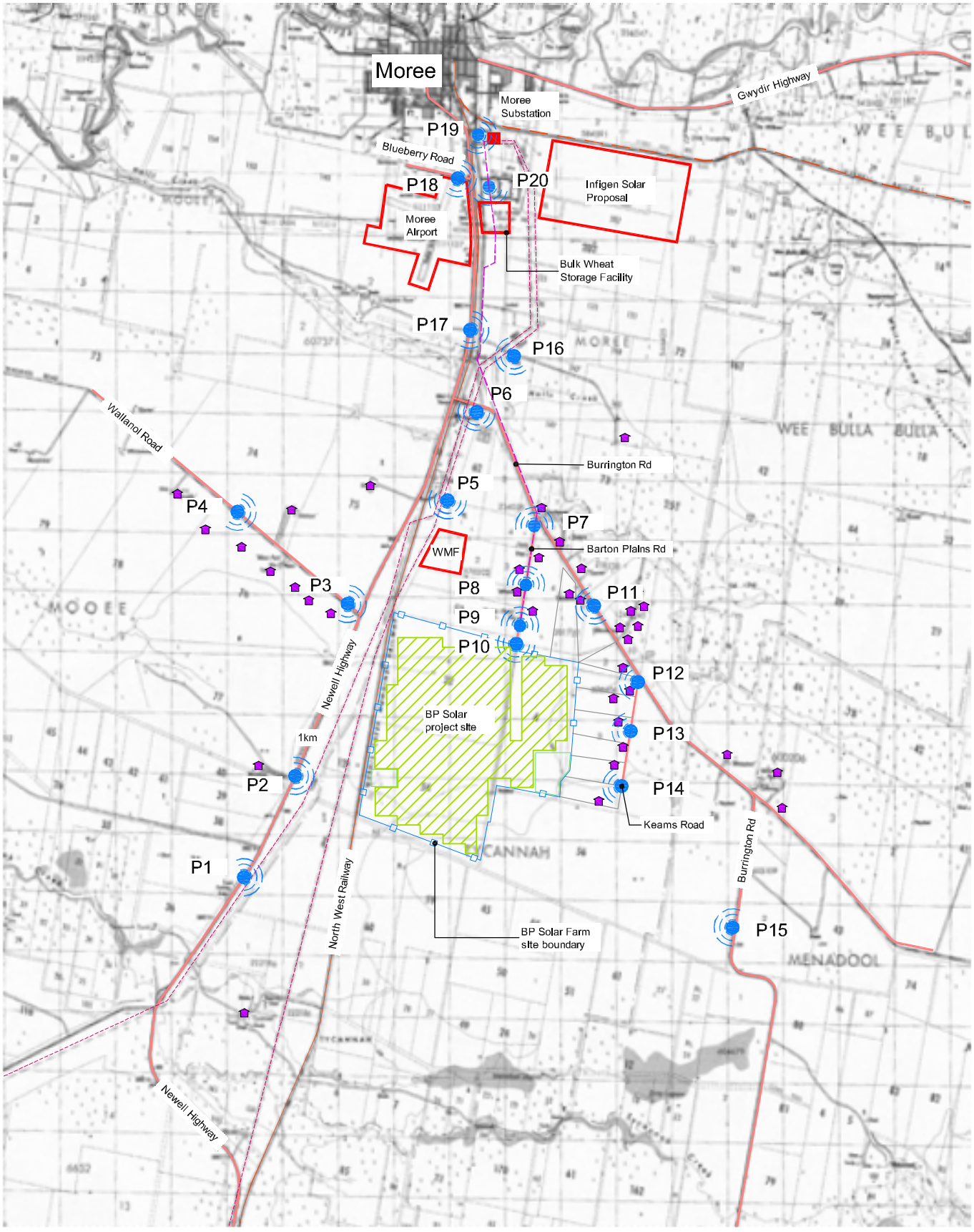
The real world coordinate location for each panoramic photograph was recorded with a hand held GPS unit to an accuracy of around plus or minus two meters. Additional information including the bearing or direction of each photograph, time of day and prevailing weather conditions was also recorded.

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 of the Project.

The panoramic photograph locations are illustrated in **Figure 6**, and the panoramic photographs illustrated in **Figures 7** to **11**.

The panoramic photographs are not to be confused with the photomontages. The panoramic photographs do not include a representation or model of the power station structures.

Figure 6
Photo Locations



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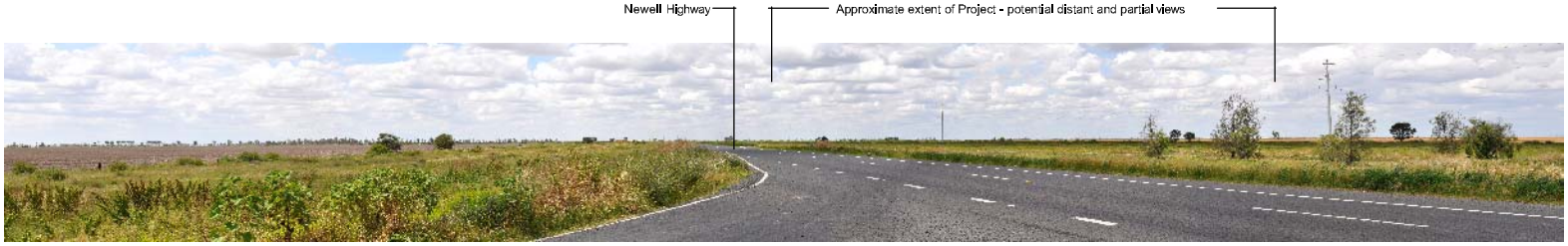

Photo Location P1- View north to east from Newell Highway truck stop (northbound) (approximate distance to Project boundary, 2.3km)

Photo Location P2 - View north to east from Newell Highway (approximate distance to Project boundary, 1.2km)

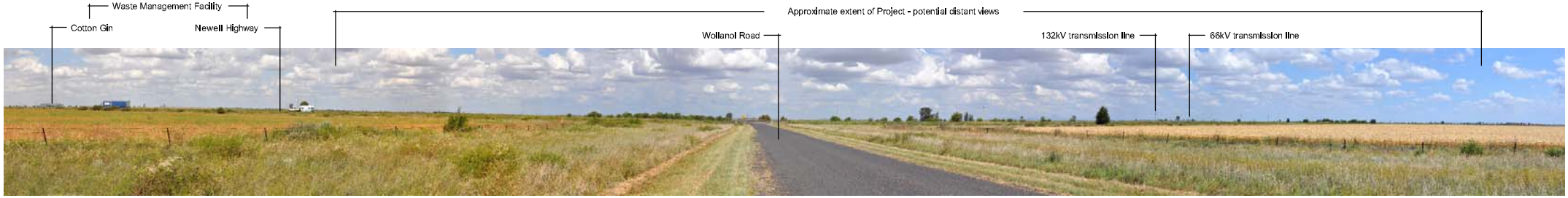

Photo Location P3 - View east from Wollanol Road (approximate distance to Project boundary, 915m)

Photo Location P4 - View east from Wollanol Road (approximate distance to Project boundary, 3.5km)

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Extent of Solar Farm visibility illustrated on panorama photographs is indicative only

Figure 7 Photo Sheet 1

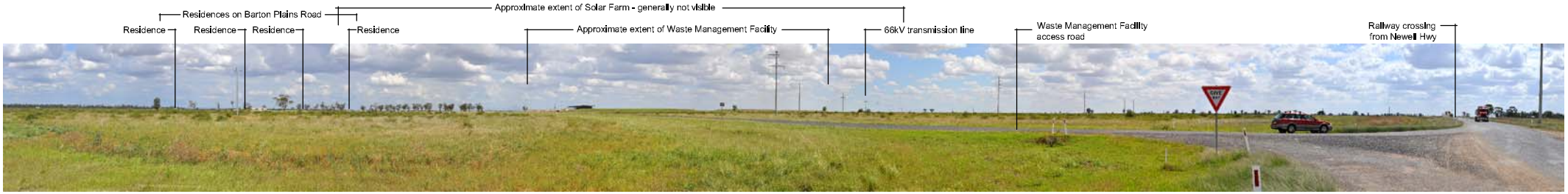

Photo Location P5 - View south from Cotton Gin & Waste Management Facility access road (approximate distance to Solar Farm boundary, 2.2km)

Photo Location P6- View south from Halls Creek - Burrington Road

Photo Location P7 - View north from Barton Plains Road (along proposed 132kV transmission line route)

Photo Location P8 - View north from Barton Plains Road (along proposed 132kV transmission line route)

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Extent of Solar Farm visibility illustrated on panorama photographs is indicative only

Figure 8 Photo Sheet 2

Photo Location P9 - View north from Barton Plains Road (along proposed 132kV transmission line route)

Photo Location P10 - View east to west from Barton Plains Road

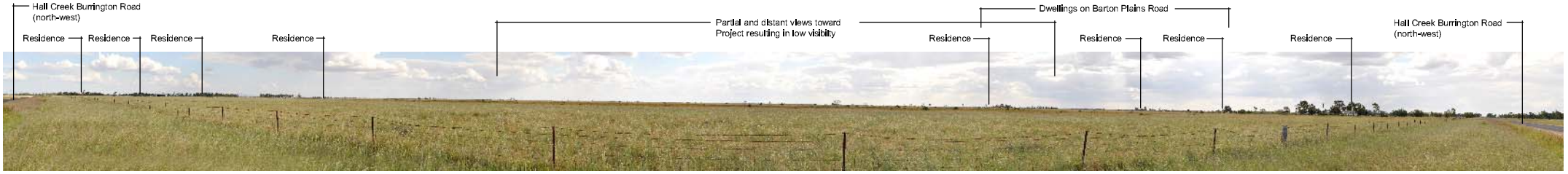

Photo Location P11- View south from Halls Creek - Burrington Road (approximate distance to Project boundary, 1km)

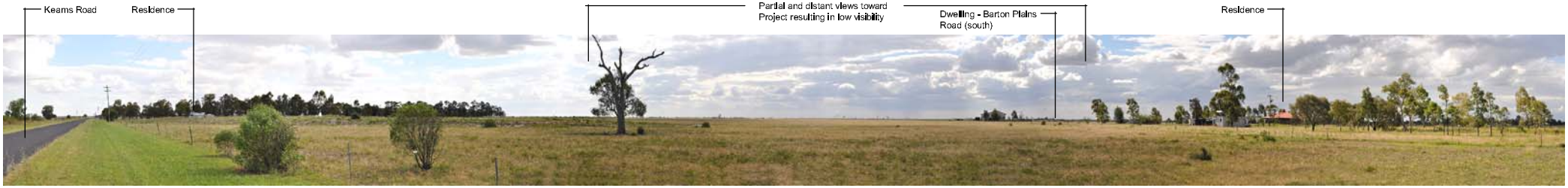

Photo Location P12 - View west from Keams Road (approximate distance to Project boundary, 1.2km)

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Extent of Solar Farm visibility illustrated on panorama photographs is indicative only

Figure 9 Photo Sheet 3

Photo Location P13 - View west from Keams Road (approximate distance to Project boundary, 1km)

Photo Location P14 - View west from Keams Road (approximate distance to Project boundary, 1km)

Photo Location P15 - View west from Halls Creek - Burrington Road (approximate distance to Project boundary, 4km)

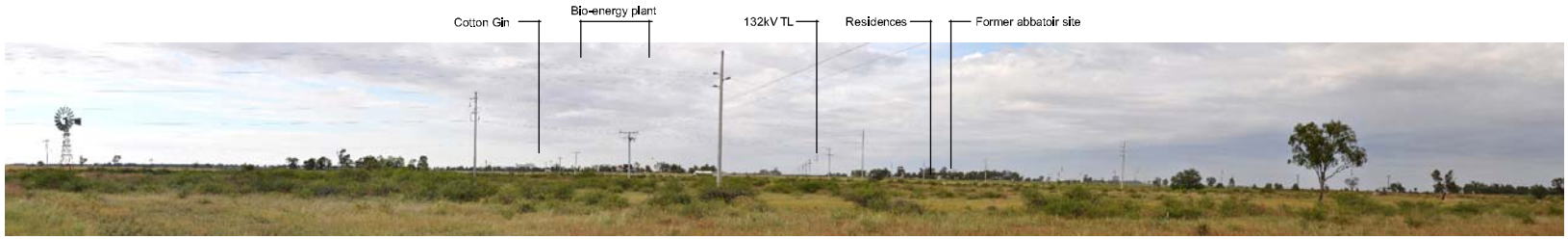

Photo Location P16- View south from Halls Creek along existing 132 and 66kV transmission line easements

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Extent of Solar Farm visibility illustrated on panorama photographs is indicative only

Figure 10 Photo Sheet 4

Photo Location P17 - View east toward railway line and transmission line easements

Photo Location P18 - View east from Blueberry Road

Photo Location P19 - View east from Bullus Drive toward substation.

Photo Location P20 - View south from Hannah Street along proposed transmission line easement

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Extent of Solar Farm visibility illustrated on panorama photographs is indicative only

Figure 11 Photo Sheet 5

Landscape Character Areas and Sensitivity Assessment

SECTION 6

6.1 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 four Landscape Character Areas (LCA's), which generally occur within the viewshed of the Project. 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).

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

For the purpose of this LVIA the LCA's have been identified as:

- LCA 1 – Rural agricultural;
- LCA 2 – Rural residential;
- LCA 3 – Agricultural/industrial; and
- LCA 4 – Transmission line and transport corridors.

6.2 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 Project. The criteria used to determine landscape sensitivity are outlined in **Table 3** and based on current good practice employed in visual assessment. Landscape sensitivity is a relative term, and the intrinsic landscape values of the

landscape surrounding the Project may be considered of a higher or lower sensitivity than other areas in the northern New South Wales region.

Table 3 – Landscape Sensitivity Assessment Criteria

Landscape Sensitivity Assessment Criteria			
Characteristic	Aspects indicating lower sensitivity to the Project development	↔	Aspects indicating higher sensitivity to the Project development
Landform and scale: patterns, complexity and consistency	• Large scale landform • Simple • Featureless • Absence of strong topographical variety	↔	• Small scale landform • Distinctive and complex • Human scale indicators • Presence of strong topographical variety
Landcover: patterns, complexity and consistency	• Simple • Predictable • Smooth, regular and uniform	↔	• Complex • Unpredictable • Rugged and irregular
Settlement and human influence	• Concentrated settlement pattern • Presence of contemporary structures (e.g. utility, infrastructure or industrial elements)	↔	• Dispersed settlement pattern • Absence of modern development, presence of small scale, historic or vernacular settlement
Intervisibility with adjacent landscapes	• Limited views into or out of landscape • Neighbouring landscapes of low sensitivity • Weak connections, self contained area and views • Simple large scale backdrops	↔	• Prospects into and out from high ground or open landscape • Neighbouring landscapes of high sensitivity • Contributes to wider landscape • Complex or distinctive backdrops

The criteria set out in **Table 3** have been used to evaluate each of the LCA's using sensitivity grades of higher, medium or lower.

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

High – Key characteristics of the LCA may be adversely impacted by the Project, and may result in major alterations to perceived characteristics of the landscape. The degree to which the landscape may accommodate the Project would potentially result in a number of perceived uncharacteristic and significant changes.

Medium – Some characteristics of the LCA may be altered by the Project, although the landscape may have the capability to absorb some change. The degree to which the landscape may accommodate the Project would potentially result in the introduction of prominent elements but may be accommodated to some degree.

Low – The characteristics of the LCA are generally robust, and would be less affected by the Project. The degree to which the landscape may accommodate the Project would not significantly alter existing landscape character.

6.3 LCA 1 – Rural Agricultural Areas

Plate 3. Typical photos across rural agricultural areas

Landform and scale

Rural agricultural areas occur across large scale and open landscape. Patterns and complexity are simple in nature with little variation in topography. Views are occasionally interrupted by limited areas of vegetation along field boundaries and drainage lines.

Landcover

Landcover is predictable and defined by the predominant agricultural economy of the region with cultivated areas contributing to an overall smooth and uniform cover.

Settlement and human influence

Settlement is dispersed with simple large scale backdrops provided by adjoining rural agricultural areas. The landscape contains a range of contemporary structures including roads, fences, agricultural buildings and structures as well as transmission lines.

Intervisibility

There is a generally high level of visibility between this LCA and adjoining areas; however, backdrops to views are simple and large scale in nature toward areas that are low in sensitivity.

Landscape Sensitivity

The landscape sensitivity for the Rural Agricultural Landscape Character Area has been determined as Low.

6.4 LCA 2 – Rural Residential

Plate 4. Typical photos toward rural residential dwellings

Landform and scale

Rural residential dwellings are located within the large scale and open landscape surrounding the Project site. Patterns and complexity are simple in nature with little variation in topography. Views are occasionally interrupted by vegetation along field boundaries, drainage lines as well cultural planting surrounding dwellings installed as wind breaks or privacy screens.

Landcover

Landcover is predictable and defined by surrounding agricultural areas with cultivated gardens surrounding the majority of rural dwellings contributing to an overall smooth and uniform cover.

Settlement and human influence

Settlement is sparse and dispersed with simple large scale backdrops provided by adjoining rural agricultural areas. The landscape contains a range of contemporary structures including residential dwellings, roads, fences, agricultural buildings and structures.

Intervisibility

There is a generally high level of visibility between this LCA and adjoining areas; however, backdrops to views are simple and large scale in nature toward areas that are low in sensitivity.

Landscape Sensitivity

The landscape sensitivity for the Rural Residential Landscape Character Area has been determined as Low.

6.5 LCA 3 – Agricultural & Industrial Development

Plate 5. Typical photos toward agricultural and industrial structures

Landform and scale

Agricultural and industrial areas occur to the south of Moree and north of the Project site within a simple and large scale landscape. Patterns and complexity are simple in nature with little variation in topography. Views are occasionally punctuated by vegetation or screened by large scale structures depending on the location of the viewer.

Landcover

Landcover is predictable and defined by the agricultural nature of the industrial development.

Settlement and human influence

Settlement is sparse and generally set back from industrial structures. The landscape contains a range of contemporary structures including roads, fences, agricultural buildings and structures as well as transmission lines.

Intervisibility

There is a moderate level of visibility between this LCA and adjoining areas with backdrops to views created by simple and large scale in nature toward areas that are low in sensitivity.

Landscape Sensitivity

The landscape sensitivity for the Agricultural and Industrial Development Landscape Character Area has been determined as Low.

6.6 LCA 4 – Transport and Transmission Line Corridors

Plate 6. Typical photos along transmission line and transport corridors

Landform and scale

Transport and transmission line corridors tend to pass through large scale and open landscape areas. Patterns and complexity are simple in nature with little variation in topography. Views are occasionally interrupted by lines of vegetation and buildings approaching the Moree industrial area.

Landcover

Landcover is predictable and defined by the predominant agricultural economy of the region with overall smooth and uniform cover.

Settlement and human influence

Settlement is largely dispersed and generally set back from transport and transmission line corridors with backdrops provided by adjoining rural agricultural areas and industrial infrastructure to the south of Moree.

Intervisibility

There is a generally high level of visibility between this LCA and adjoining areas; however, backdrops to views are simple and large scale in nature toward areas that are low in sensitivity.

Landscape Sensitivity

The landscape sensitivity for the Transport and Transmission Line Landscape Character Area has been determined as Low.

Visual Assessment

SECTION 7

7.1 Introduction

The potential visibility of the Project is largely dependent on a number of criteria that include:

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

An overall determination of visual impact at each view location has also been assessed and determined against the criteria outlined in **Table 3** below:

Table 3 - View Location Assessment Criteria

Criteria	Definition	
Category of Viewer		
Static	Residence	
Dynamic	Motorist or passenger	
Number of Viewers		
High	>500 people per day	
Moderate	100 - 500 people per day	
Low	<100 people per day	
View Distance	**Solar Farm**	**Transmission Line**
Long	>5km	>1km
Medium	2km – 5km	500 – 1km
Short	500m – 2km	200 – 500m
Very short	<500m	<200m
Period of View		
Long term	> 4 hours	
Moderate term	1 – 4 hours	
Short term	0.5 – 1 hour	

Table 4 - Visibility Criteria Matrix

	Long Distance			Medium Distance			Short Distance			Very Short Distance		
Period of View	**L**	**M**	**S**	**L**	**M**	**S**	**L**	**M**	**S**	**L**	**M**	**S**
High No. of Viewers	M	L	L	H	M	M	H	H	M	H	H	H
Moderate No. of Viewers	L	L	L	M	M	L	H	M	M	H	H	M
Low No. of Viewers	L	L	L	M	L	L	M	M	L	H	M	L

- **Period of View** L=Long term, M=Moderate term , S=Short term
- **Levels of visibility** L=low, M=medium and H=high

The visibility criteria matrix is used as a guide to determine visual impact. The visual impact for each view location is also considered against other factors, which include the sensitivity and VAC of the view category. The general relationship between view category and its potential level of sensitivity is outlined in **Table 5**:

Table 5 – View Sensitivity

View Category	Sensitivity
Residential Properties	**Highest Sensitivity**
Pedestrians (recreational)	▽
Public Recreational Space	▽
Rural employment/farming	▽
Motorists	▽
Business (commercial)	▽
Industry	Lower Sensitivity

The overall visual impact has been determined by considering the combined outcomes of visibility for each view location together with the sensitivity of the landscape within which the view is located. The visual impact is expressed as a visibility rating of High, Moderate, Low or Nil. For the purposes of this LVIA visibility ratings have been defined as:

High – The construction and operation of the Project may result in a very prominent physical change to the landscape, and includes the potential for proximate views toward extensive portions of the Project from sensitive view locations.

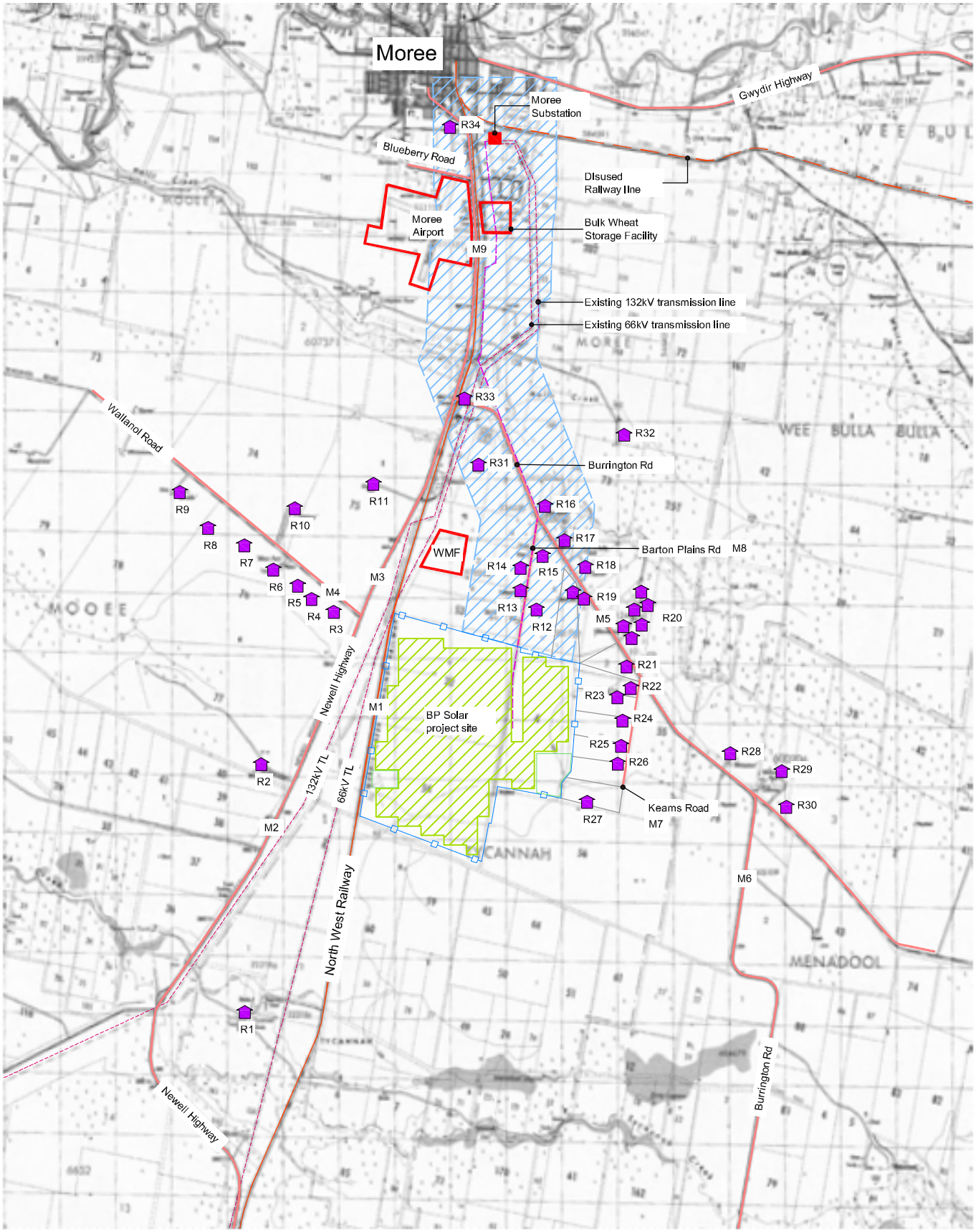
Moderate – The construction and operation of the Project may result in a noticeable physical change to the landscape although the Project would not appear to be substantially different in scale and character to the existing landscape from surrounding view locations.

Low – The construction and operation of the Project is unlikely to result in a prominent change to the landscape and views from surrounding locations toward the Project may be difficult to distinguish from elements within the surrounding landscape.

Nil – The construction and operation of the Project would not create a noticeable change to the landscape and is unlikely to result in views toward the Project from surrounding view locations.

The visual impact ratings in brackets ( ) within the Table 4 Visibility Matrix indicate a potential visual impact rating that would be likely to occur subject to an assessment from private property.

Figure 12
View Locations



Source: Copyright Department of Lands
Panorama Avenue Bathurst 2795
(www.lands.nsw.gov.au)

bp solar

MOREE SOLAR POWER STATION

GREEN BEAN DESIGN
landscape architects

7.2 Visibility Matrix

Table 4 presents the results of the visual assessment from the various potential residential view locations identified during the field inspection. The view locations are illustrated in **Figure 12**.

Table 4 Visibility Matrix – Residential Views

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCAPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
R1	Resident	4.3km	Varies with daily occupancy – but potential for long term views.	Low	Low	Distant views north from residence toward the Project site are generally screened by a combination of landform and vegetation. No views toward the proposed 132kV transmission line.	Nil
R2	Resident	2km	Varies with daily occupancy – but potential for long term views.	Low	Low	Mid distance views east from residence toward the Project site are partially screened by a combination of landform (rising embankment to the Newell Highway) and vegetation surrounding the dwelling. No views toward the 132kV transmission line.	Nil
R3	Resident	1.1km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence extend east toward the Project site, but components within the Project are generally obscured by distance. Potential distant views toward the 132kV transmission line poles.	Low
R4	Resident	1.7km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCAPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
R5	Resident	2km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R6	Resident	2.6km	Varies with occupancy.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R7	Resident	3.2km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R8	Resident	4km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R9	Resident	4.7km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCAPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
R10	Residents	3km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R11	Resident	2.8km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R12	Resident	840m	Varies with daily occupancy – but potential for long term views.	Low	Low	Views extend south from the residence toward the north portion of the Project including views toward the PV panels beyond the security fence. Views would also take in other project infrastructure including buildings and electrical infrastructure. The 132kV transmission line would be visible to the west of the residence, as well as portions extending north and south along Barton Plains Road toward Burrington Road and the Solar Power Station.	Moderate to High
R13	Resident	1km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views extend south from the residence toward the north portion of the Project including views toward the PV panels beyond the security fence. Views would also take in other project infrastructure including buildings and electrical infrastructure. The 132kV transmission line would be partially visible, but generally screened by vegetation surrounding the dwelling.	Moderate

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCAPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
R14	Resident	1.4km	Varies with daily occupancy – but potential for long term views.	Low	Low	Potential views south from residence toward the Project site are screened by vegetation surrounding the dwelling, as well as the residential dwelling and cultural planting to the south.	Low
R15	Resident	1.7km	Varies with daily occupancy – but potential for long term views.	Low	Low	Potential views extend south from the residence toward the north portion of the Project site, including views toward the PV panels beyond the security fence. Views would also take in other project infrastructure including buildings and electrical infrastructure. The 132kV transmission line would be visible along portions of Barton Plains Road.	Low
R16	Resident	2.6km	Varies with daily occupancy – but potential for long term views.	Low	Low	Distant views south from residence toward the Project site are screened by vegetation surrounding the dwelling, as well as the residential dwelling and cultural planting to the south.	Low
R17	Residents	2.1km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residences toward the Project site area are generally screened by vegetation within and surrounding residential property boundaries. Medium distance but generally restricted views toward the 132kV transmission line.	Low

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCAPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
R18	Resident	1.8km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. Medium distance but generally restricted views toward the 132kV transmission line.	Low (Nil)
R19	Residents south of Burrington Road	1.2km	Varies with daily occupancy – but potential for long term views.	Low	Low	Potential views south from residences toward the Project site occur across open and cleared farmland. Views would extend to north extent of PV panels beyond security fence as well as warehouse and office buildings. Medium distance views toward the 132kV transmission line would extend along a portion of Barton Plains Road.	Low to Moderate
R20	Residents	1.3km	Varies with daily occupancy – but potential for long term views.	Low	Low	Views from residences toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R21	Resident	1.2m	Varies with daily occupancy – but potential for long term views.	Low	Low	Views south west to west from residence toward the Project site are partially screened by tree planting within the property boundary. Views toward the 132kV transmission line	Low
R22	Resident	1.2km	Varies with daily occupancy – but potential for long term views.	Low	Low	Potential views west from residence toward the Project site are generally screened by tree planting surrounding the dwelling. Views toward the 132 kV transmission line are generally screened by tree planting surrounding the dwelling.	Low (Nil)

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCAPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
R23	Resident	1km	Varies with daily occupancy – but potential for long term views.	Low	Low	Potential views west from residence toward the Project site are generally screened by tree planting surrounding the dwelling. Views toward the 132 kV transmission line are generally screened by tree planting surrounding the dwelling.	Low (Nil)
R24	Resident	1.1km	Varies with daily occupancy – but potential for long term views.	Low	Low	Potential views west from residence toward the Project site are generally screened by tree planting surrounding the dwelling. Views toward the 132 kV transmission line are generally screened by tree planting surrounding the dwelling.	Low (Nil)
R25	Resident	1km	Varies with daily occupancy – but potential for long term views.	Low	Low	Potential views west from residence toward the Project site are generally screened by tree planting surrounding the dwelling. Views toward the 132 kV transmission line are generally screened by tree planting surrounding the dwelling.	Low (Nil)
R26	Resident	1.1km	Varies with daily occupancy – but potential for long term views.	Low	Low	Potential views west from residence toward the Project site are generally screened by tree planting surrounding the dwelling. Views toward the 132 kV transmission line are generally screened by tree planting surrounding the dwelling.	Low (Nil)

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCAPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
R27	Resident	800m	Varies with daily occupancy – but potential for long term views.	Low	Medium	Potential views west to north west from residence toward the Project site are generally screened by tree planting around the dwelling, together with large agricultural sheds and structures to the west of the dwelling. Distant and partial views toward the 132kV transmission line.	Low (Nil)
R28	Resident	3km	Varies with daily occupancy – but potential for long term views.	Low	Medium	Views from residences toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R29	Resident	4km	Varies with daily occupancy – but potential for long term views.	Low	Medium	Views from residences toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R30	Resident	4.3km	Varies with daily occupancy – but potential for long term views.	Low	Medium	Views from residences toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Low (Nil)
R31	Resident	3km	Varies with daily occupancy – but potential for long term views.	Low	Medium	Views from residence toward the Project site are generally screened by vegetation within and surrounding the residential property boundary. No views toward the 132kV transmission line.	Nil

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCAPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
R32	Resident	4.3km	Varies with occupancy.	Low	Medium	No views toward the Project site. Restricted views toward the 132kV transmission line.	Low (Nil)
R33	Residents	4.4km	Varies with daily occupancy – but potential for long term views.	Low	Medium	No views toward the Project site. Restricted views toward the 132kV transmission line.	Low (Nil)
R34	Residences (Moree South)	Varies	Varies with daily occupancy – but potential for long term views.	Low	Medium	No views toward the Project site. Generally restricted views toward the 132kV transmission line within the context of surrounding industrial development.	Low

Table 5 presents the results of the visual assessment from the various potential transport corridor and public space view locations identified during the field inspection. The view locations are illustrated in **Figure 12**.

Table 5 Visibility Matrix – Transport Corridors and Public Space

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
M1 North West railway	Passenger	Varies (Generally very short, following the western boundary of the Project site).	Short term <4 minutes	Low (2 passenger services a day, one inbound and one outbound between Moree and Sydney).	Low	Short term views toward the Project site from trains travelling north and south along the western boundary of the Project site. Views would extend east across the Project site, including Medium and Distant views toward the 132kV transmission line, buildings and electrical infrastructure.	Low
M2 Newell Highway (northbound)	Motorist	Varies (between 1 and 2km)	Short term <4 minutes	High	Low	Short term views toward the Project site, from vehicles travelling north to north west along the Newell Highway, are generally indirect from the road corridor alignment. Views toward the Project site would be partially screened by occasional roadside vegetation and the low railway embankment. No views toward the 132kV transmission line from the Newell Highway travelling north toward the Burrington Road junction.	Low

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
M3 Newell Highway (southbound)	Motorist	Varies (between 1 and 3km)	Short Term <4 minutes	High	Low	Short term views toward the Project site, from vehicles travelling south to south west along the Newell Highway, are generally indirect from the road corridor alignment. Views toward the Project site would be partially screened by occasional roadside vegetation and the low railway embankment. No views toward the 132kV transmission line from the Newell Highway travelling south toward, and beyond, the Burrington Road junction.	Low
M4 Wallanol Road - southeast	Motorist	Varies (between 1 and 5km)	Short term <2 minutes	Low	Low	Short term views from vehicles travelling south east along Wallanol Road toward the Newell Highway junction. Views toward the Project site are largely screened by vegetation between the Highway and the railway line. No views toward the 132kV transmission line.	Low
M5 Burrington Road – view southwest	Motorist	Varies (between 1.2 and 2km)	Short term <1 minute	Low	Low	Short term and indirect views from vehicles travelling north west and south east along Burrington Road. Views toward the Project site would be occasionally screened by roadside vegetation. The 132kV transmission line would span Burrington Road north of Barton Plains Road, and then follow to the north of the Burrington Road corridor for approximately 2km. Short term views would extend along the length of the 132kV transmission line for	Low

VIEW LOCATION	CATEGORY OF VIEWER	APPROX. DISTANCE TO SOLAR PANELS	APPROX. PERIOD OF VIEW	NUMBER OF VIEWERS	LANDSCPE SENSITIVTY	PROJECT VISIBILITY	VISUAL IMPACT RATING
						this portion of Burrington Road.	
M6 Burrington Road – view west to north west	Motorist	Varies (between 3.5 and 4km)	Short term <2 minutes	Low	Low	Short term and indirect distant views from vehicles travelling north and south along Burrington Road. Views toward the Project site are occasionally screened by roadside vegetation. No views toward the 132kV transmission line.	Low
M7 Keams Road	Motorist	-	Short term <2 minutes	Low	Low	Short term and indirect views toward the Project site would be partially obscured by vegetation surrounding residential dwellings on Keams Road.	Low
M8 Barton Plains Road	Motorist	-	Short term <2 minutes	Low	Low	Short term and direct views toward the Project site from vehicles travelling south along Barton Plains Road. Short term and direct views toward 132kV transmission line from vehicles travelling north and south along Barton Plains Road.	Low to Moderate
M9 Newell Highway – view east	Motorist	-	Short term <3 minutes	High	Low	Short term views from vehicles travelling north and south along the Newell Highway toward the proposed transmission line are partially screened by existing buildings and but indirectly visible south of Moree Airport for approximately 2km.	Low

7.3 Visual Impact Assessment

A total of 34 residential view locations (including grouped residences) were identified through the desk top aerial photograph and mapping study. An assessment of the visual impact rating for each residential view location determined that:

- 1 of the 34 view locations have been determined to have a high visual impact rating.
- 2 of the 34 view locations has been determined to have a moderate visual impact rating;
- 28 of the 34 view locations have been determined to have a low visual impact rating;
- 3 of the 34 view locations have been determined to have a nil visual impact rating; and
- 21 of the residential view locations were determined to have a low (nil) visual impact rating.

This LVIA also considered potential visual impacts for motorists and rail passengers at 9 locations surrounding the Project site (M1 to M9). This LVIA determined that the potential visual impact for all motorists and rail passengers travelling along local roads, the Newell Highway and portions of the North West railway line would be low.

For motorists, the determination of a low visibility rating generally results from a combination of the very short period of view available from vehicles travelling at the permitted road speeds (generally between 80 and 100 kilometres per hour on the main roads and highways) and the partially restricted view beyond the majority of the road corridors due to roadside tree planting or tree cover. Elevated views from trains travelling along the North West railway line would extend across the site; however, views would be transitory in nature for a short period of time.

Photomontage

SECTION 8

8.1 Photomontage

In order to illustrate how the Project may appear following construction, photomontages were prepared from 2 typical view locations. The photomontage locations were selected to illustrate views from areas where view locations (including residences) were determined to have a moderate to high visual impact.

A number of other view locations were considered for photomontage but were not selected due to the overall low level of Project visibility and the likelihood that the Project would not be discernable in a photographic illustration. The extent and overall potential for Project visibility from other surrounding areas is illustrated in the panorama photographs **Figures 7** to **11**.

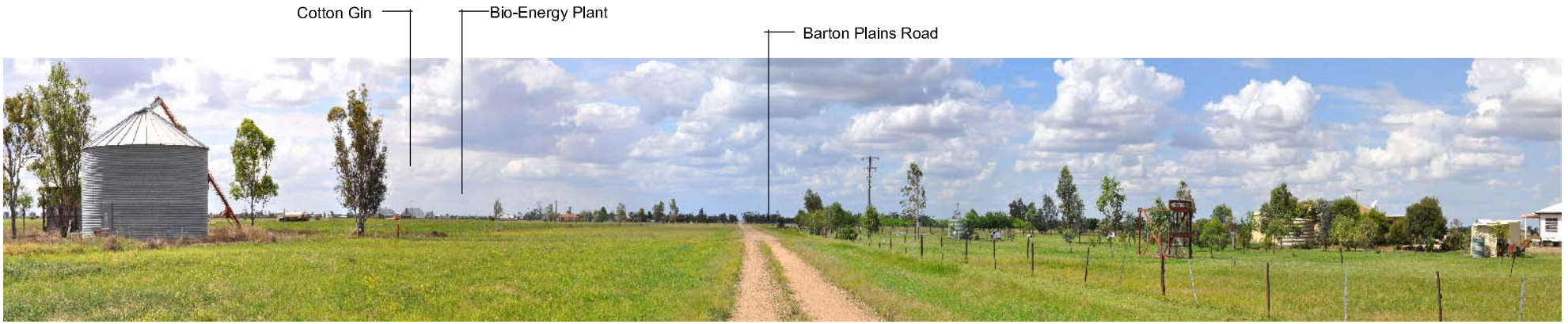
The photomontage locations are shown in **Figure 2**, and include views from:

- Location A – Barton Plains Road, View north along 132kV transmission line easement.
- Location B – Barton Plains Road, view south toward the Solar Power Station and 132kV transmission line.

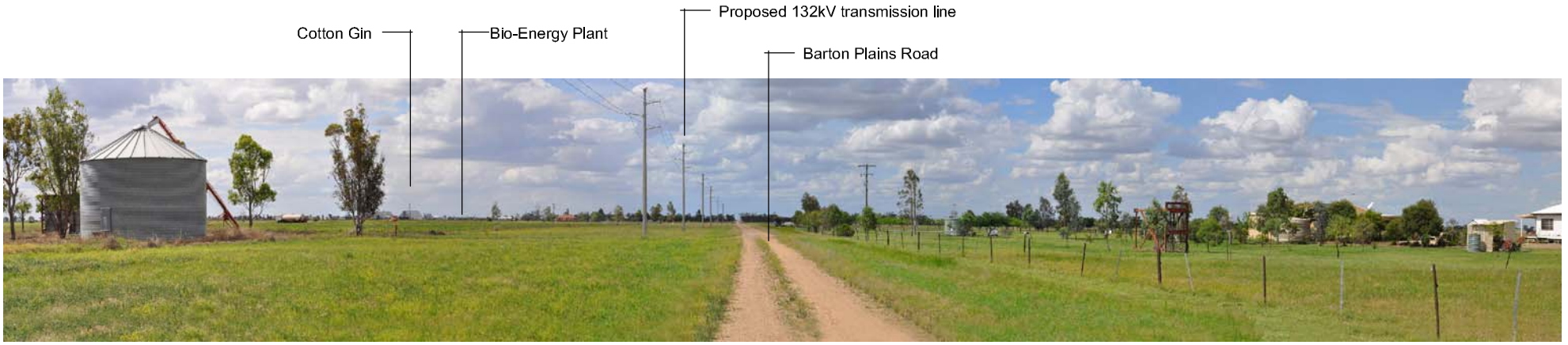
The photomontages were generated through the following steps:

- Photographs were taken from each of the view locations and recorded with GPS coordinate data.
- A digital SLR at 50mm focal length camera was used to take the photographs, as this is generally accepted as most closely representing the primary view cone of the human eye.
- Heights of existing and proposed structures were estimated by reference to surrounding features in the landscape.
- AutoCAD software was used for modelling visually significant components of the Project structures which were then pasted into panoramic images stitched from the individual site photographs.
- Finally the images were imported to Adobe Photoshop for final surface texturing to place the proposed structures within the context of the foreground and background elements of the photographs.

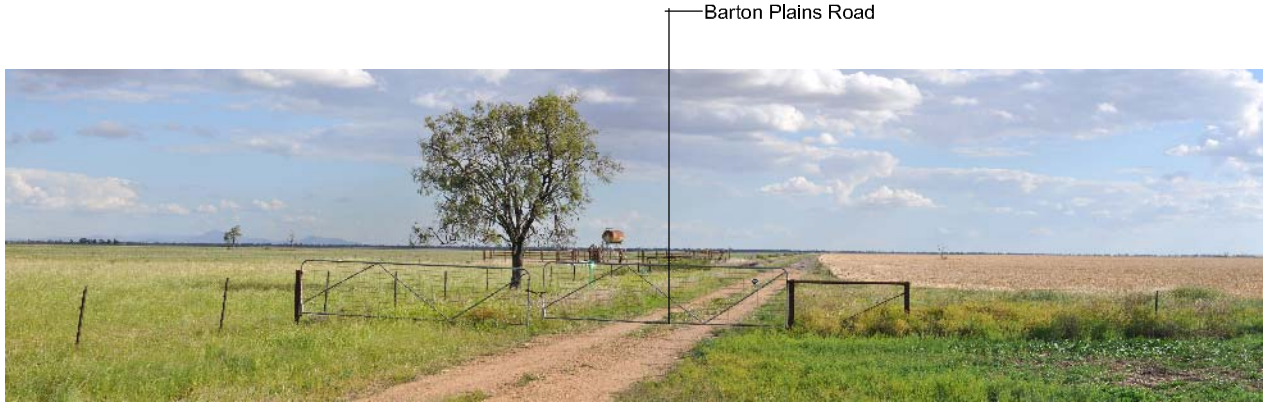
The photomontages are illustrated in **Figures 13** and **14** and are provided for illustrative purposes only. All structure locations and heights are indicative of the final arrangement which may vary depending on a range of detail design criteria.



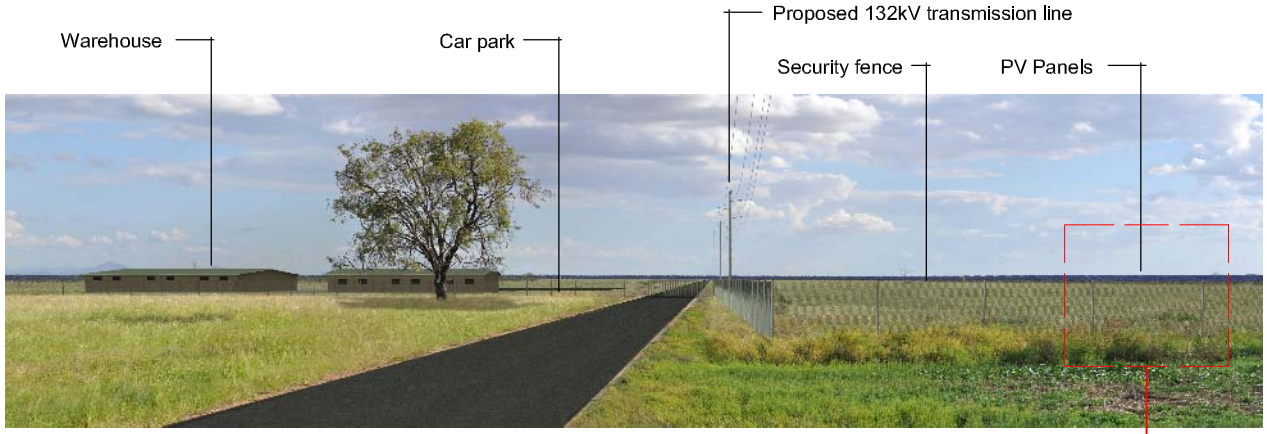
Photomontage Location PM1- Existing view north along Barton Plains Road



Photomontage Location PM1- Proposed view north along Barton Plains Road



Photomontage Location PM 2 - Existing view south along Barton Plains Road



Photomontage Location PM 2 - Proposed view south along Barton Plains Road

Detail View

Sunglint and Glare

SECTION 9

9.1 Introduction

This LVIA has considered a number of issues concerned with the potential for reflectivity of sunlight from the PV panels. Sunlight reflection is often perceived as a significant issue in relation to solar facilities; however, a primary function for the PV panels is to absorb sunlight energy rather than reflect it. The technical process in manufacturing PV panels includes an anti reflection coating to the solar cell wafers within each panel that minimises potential for sunlight reflection. The BP Solar PV panels also use high transmission, low iron glass, which absorbs greater amounts of light and produces less reflectance than standard glass.

Primarily sunlight reflection would be visible as either 'sunglint' or 'glare'.

9.2 Sunglint

Sunglint is a phenomenon that results from the direct reflection of sunlight (also known as specular reflection) from a reflective surface that would be visible when the sun reflects off the surface of the PV panels at the same angle that a person is viewing the PV panel surface.

9.3 Glare

Sunlight reflection from the polycrystalline structure of the individual PV panels may also result in glare (also known as diffuse reflection). Glare from a reflective surface occurs where sunlight is reflected at many angles rather than a single angle observed as sunglint.

There are a number of factors that determine both intensity and extent of sunglint and glare and include:

- the distance and orientation of the PV panels relative to surrounding view locations;
- the offset horizontal angle of the PV panels;
- time of day and seasonal variations defining position and angle of sunlight;
- the occurrence of cloud cover;
- the amount of particulate matter in the atmosphere (moisture, dust, smoke etc…) which may diffuse sunlight; and
- the presence of screening vegetation relative to view locations.

Moree airport is approximately 6.5km to the north of the Project, and sunglint or glare is unlikely to impact aircraft operations at the airport; however, the occurrence of sunglint or glare for aircraft passing over the Project would be dependent on the aircrafts altitude and directional bearing to the Project. Solar panels have been installed at airports in the United States of America and Europe. San Francisco International Airport is in the process of installing 2,800 solar panels on the roof of the Domestic Terminal 3 building in addition to an existing solar panel installation on the roof of the

airports engineering building. BP Solar installed a PV solar panel system on the roof of the Terminal 2 Check in Concourse at Munich International Airport, and neither this, or any solar panel installation at, or in proximity to an airport, has had any significant impact on aircraft operations including take off and landing.

The measure of how strongly various materials can reflect light from sources such as the sun (the 'albedo') has been measured (Power Engineers 2010 and Sunpower Corporation 200) and determined as a reflected energy percentage.

These studies have shown that common materials utilised within rural/agricultural environments, including steel, standard glass and plexiglass can have higher reflected energy percentages than materials employed for PV glass panels.

Based on the results of previous assessments for PV solar power projects and studies carried out in the United States of America and Europe, the potential for sunglint and glare would not be expected to have a significant impact on residential dwellings surrounding the Project area, or upon motorists or people travelling through or over the surrounding landscape.

Night Time Lighting

SECTION 10

10.1 Introduction

The Project would require lighting to be installed for night time illumination around the operation and maintenance facilities, car park and onsite substation. Lighting would be low level and directional within the site to minimise the potential for light spill onto adjoining areas.

In addition to the standard level of lighting required for normal security and safety, lighting may also be required for scheduled or emergency maintenance around the operations and maintenance buildings, substation and PV panel areas.

10.2 Existing light sources

A small number of existing night time light sources occur in the vicinity of the Project site, and includes residential and general lighting around agricultural and industrial installations.

Localised lighting is associated with a small number of residential dwellings located within the Project viewshed, but lighting is unlikely to be visually prominent and does not emit any significant illumination beyond immediate areas surrounding residential and agricultural buildings.

Lights from vehicles travelling along the local roads and the Newell Highway provide dynamic and temporary sources of light.

10.3 Potential visual impact

The categories of potential view locations that would be impacted by night time lighting include residents and motorists.

Irrespective of the total number of visible lights sources associated with the Project, lighting is more likely to be noticeable from exterior areas surrounding residences rather than from within residences where at night time room lights tend to reflect and mirror internal views in windows, or curtains and blinds tend to be drawn.

Night time lighting associated with the Project is unlikely to have a significant visual impact on the majority of motorists travelling along local roads; the duration of visibility would tend to be very short and partially screened by some landform elements and vegetation along some sections of local road corridors.

Pre-construction and construction

SECTION 11

11.1 Potential visual impacts

There are potential visual impacts that may occur during both pre-construction and construction phases of the Project. The construction phase is likely to occur over a four year period; however, construction activity is only likely to occur for nine months of each year. The extent and nature of pre-construction and construction activities would vary at different locations and at different times within the Project area.

The key pre-construction and construction activities that may be visible from areas surrounding the Project include:

- Ongoing detailed site assessment including sub surface geotechnical investigations;
- Various civil works to upgrade local roads and access point;
- Construction facilities, including portable structures and laydown areas;
- Various construction and directional signage;
- Excavation and earthworks; and
- Various construction activities including erection of buildings, solar panels and substation with associated electrical infrastructure works.

The majority of pre-construction and construction activities, some of which would result in physical changes to the landscape are generally temporary in nature and for the most restricted to various discrete areas within or beyond the immediate Project area. The majority of pre-construction and construction activities would be unlikely to result in an unacceptable level of visual impact for their duration and temporary nature.

Cumulative Impact Assessment

SECTION 12

12.1 Cumulative Impact Assessment

An assessment of cumulative environmental impacts considers the potential impact of a proposal in the context of existing development and future development to ensure that any potential environmental impacts are not considered in isolation.

'Direct' cumulative visual impacts may occur where two or more similar developments have been constructed within the same locality, and may overlap and are simultaneously viewed from the same view location.

'Indirect' cumulative visual impacts can also arise as a result of multiple developments being observed from the same view location, but do not overlap or occur within a single field of view.

'Sequential' cumulative visual impacts may also arise as a result of multiple developments being observed at different locations during the course of a journey (e.g. from a vehicle travelling along a highway or from a network of local roads), which may form an impression of greater magnitude within the construct of short term memory.

There are other solar power developments being considered in the landscape surrounding Moree which are competing for funding under the Federal Governments Clean Energy Initiative Solar Flagships Program. Irrespective of which projects may receive Government funding, it is possible that more than one solar power station facility could be constructed within the local area.

Given the relatively low level of visibility associated with the Project within the flat and large scale landscape surrounding Moree, it is unlikely that 'direct' or 'indirect' cumulative impacts would occur.

Multiple solar power station projects may result in 'sequential' cumulative visual impacts; however, a visual assessment for a proposed solar farm development to the east of Moree airport determined an overall low visual impact and, if visible on a journey that included views toward the BP Solar Power Station Project, would not result in an overall increased level of visual impact.

There are existing industrial/agricultural developments located within the landscape between the Project and Moree and include:

- Moree Industrial Park;
- Moree Airport;
- Bulk Wheat Storage Facility;
- Bio-Energy Plan;
- Duvanant's Cotton Gin;
- Saleyards; and
- Waste Management Facility.

The developments located in **Figure 15** (and illustrated in the panorama photographs **Figures 7** to **11**), significantly differ in shape and form to the Project and present potential for taller and more visible skyline views than the majority of the Projects components.

Approximately 7km of the 132kV transmission line would be visible against a backdrop of other electrical distribution and transmission lines, and would span an existing 66kV and 132kV transmission line south of the Moree Zone Substation.

Although existing transmission lines would occur within the viewshed of the proposed 132kV transmission line, they would tend to be visible within an increasingly industrialised landscape as the transmission lines approach the Substation. Given the relatively limited number of sensitive view locations from which all transmission lines would be visible, the overall cumulative visual impact has been determined as low.

Figure 15
Existing Development

Sources: Copyright Department of Lands
Panorama Avenue Bathurst 2795
(www.lands.nsw.gov.au)

N

0 0.5km 1km 2km

bp solar

MOREE SOLAR POWER STATION

GREEN BEAN DESIGN
landscape architects

Mitigation

SECTION 13

13.1 Mitigation

A number of mitigation measures have been developed where possible to avoid, reduce and offset the level of visual impact associated with the Project. Both primary measures, which comprise part of the development design through an iterative process, and secondary measures that specifically address residual effects, have been considered.

13.2 Avoidance

Solar Power Station

The siting, planning and design of the Project has considered the need to minimise the potential visual impact of the key elements of the Project.

The Project site has been located within an area of low population density and at a distance of over 8km from the denser populated urban areas of Moree.

Transmission Line

One of the key aims of the route selection process is to minimise potential visual impact wherever possible. A key consideration within the process has been to avoid residential dwellings and sensitive views wherever possible.

Wherever possible, angle positions have been selected and placed in strategic locations to minimise potential visual impact and to provide a maximum setback from residences and roads.

13.3 Reduction

Solar Power Station

The selection of construction materials and treatment of solar panel components would use low reflectivity material to reduce the potential for sunlight glint.

Transmission Line

The selection of construction materials would use low reflectivity material to reduce the potential for sunlight glint.

13.4 Offset

Solar Power Station and Transmission Line

Offset mitigation measures such as tree and shrub screen planting would be employed to reduce the visual impact of the Project's major components including transmission line and substation elements.

Screen planting strategies would be developed within the framework of a landscape management plan and consider areas that have been identified with a resultant high or moderate visual impact from the Project construction.

Strategic tree or large shrub planting may help to minimise the potential impact of the Project, and may be located between view locations and the Project, or located beyond the Project to form a backdrop against which the transmission line may be viewed.

Landscape treatments such as localised screen planting are a long term, but effective, mitigation measure, and would require individual site assessment to achieve maximum screening benefits. Appropriate plant species and specific planting locations would be identified in direct consultation with residents and landowners.

Table 6 provides a summary of the mitigation measures which have been adopted during the design phase of the project, and those that are recommended as the project progresses.

Table 6 – Mitigation Measures

Component	Potential Mitigation	Life Cycle Stage
General location and transmission line alignment	A careful and considered route selection process has been undertaken to avoid sensitive views and loss of existing vegetation where possible.	Planning, Construction and Operation.
Structure location	Wherever possible, angle positions have been selected and placed in strategic locations to minimise potential visual impact and to provide a maximum setback from residences and roads.	Planning and Construction.
Structure design	Selection of suitable component materials and selected treatment with low reflective properties.	Construction and Operation.
Conductors	Selection of materials with low reflective properties.	Construction and Operation.
Insulators	Selection of materials with low reflective properties.	Construction and Operation.
Erosion control	Appropriate control and removal of spoil from construction areas.	Construction.
Construction materials and equipment storage areas	Selection of suitable storage areas for materials or plant with minimum visibility from residences and roads with screening where necessary.	Construction.
Screen planting	Strategic tree or shrub planting between the view and the Project in consultation with affected residents and landowners.	Construction and Operation.

Conclusion

SECTION 14

14.1 Conclusion

Overall this LVIA concludes that the BP Solar Power Station Project would have a low visual impact on the majority of people travelling through and residing in areas surrounding the Project, and would not represent an unacceptable level of change to the existing landscape surrounding the Project. The key findings of this LVIA are summarised below.

The landscape surrounding the Project was determined to have a predominantly low sensitivity, primarily due to open and large scale nature of the landscape, simple landcover and landform patterns with sparse vegetation cover. The overall characteristics of the four LCA's identified in this LVIA are generally robust, and would not be greatly affected by the Project. The degree to which the existing landscape may accommodate the Project would not significantly alter existing landscape character.

A total of 34 residential view locations were identified, and included:

- 1 with a high visibility rating (assessed as Moderate to High);
- 2 with a moderate visibility rating (assessed as Low to Moderate);
- 28 with a low visibility rating; and
- 3 with a nil visibility rating.

It is important to note that a 'high' visual impact does not necessarily equate to a 'negative' visual impact. As is the case for other renewable energy projects (including wind farms), there are likely to be people in the local community who would find the Project an interesting and thought provoking development. This LVIA does not consider that the implementation of broad scale tree and shrub planting to the perimeter of the site a useful or desirable outcome. Mass tree planting would have the potential to create a visual impact in a landscape that is generally open.

This LVIA determined that the Project would have a potential moderate to high visual impact on 1 residential dwelling. The moderate to high visual impact rating results from the proximity of the residence to the Project and/or orientation of the dwelling to the layout of the Project. Implementing some of the proposed mitigation measures, including detailed and site specific landscape treatments would minimise the visual impact.

This LVIA determined that the Project would have a potential low to moderate visual impact on 2 residential view locations. The low to moderate visual impact results from the orientation and distance of the dwellings to the Project. Implementing the proposed mitigation measures, including the development and installation of suitable landscape treatments, would contribute to minimising the visual impact at a number of these locations.

This LVIA determined that the Project would have a potential low visual impact on 28 residential view locations. The low visibility rating results from a combination of factors, including the distance between residences and the Project, as well as the screening influence of localised tree cover.

This LVIA also determined that 21 of the residential view locations would have a low (nil) visual impact, and that the majority of these residential dwellings are likely to have very restricted, or no view toward the Project; however this would only be verified from an assessment within the property.

The potential cumulative impact for the 10km section of 132kV transmission line, where viewed in addition to sections of existing 66/132kV transmission lines has been determined as low (and more likely nil) for the majority of residential dwelling view locations located within the Project viewshed. The low visibility rating largely results from the distance between residential dwelling view locations and the proposed transmission line.

The type of 132kV transmission line structure (single pole) and arrangement of insulators and conductors is largely a function of engineering and safety requirements. The overall form is similar to existing structures and would not contrast or be significantly disparate from the visual quality of existing transmission lines within the Project view shed. Given the low level visibility of the Project and landscape sensitivity, there would be no overall advantage to warrant the significant cost to underground any portion or entire length of the 132kV transmission line.

A moderate to high number of people were identified on some of the roads in the vicinity of the Project, including the Newell Highway. The duration of views from vehicles travelling along these roads is likely to be very short and transitory in nature.

Indirect views from vehicles travelling north and south along the Newell Highway road corridor extend for approximately 800m toward the west portion of the Project site at its closest point to the Highway. The majority of the Project site, including some parts of the west section, would be partially screened by the low railway embankment between the Highway and the Project site.

This LVIA determined that the construction of the Project would generally not result in any significant visual impacts on the majority of views from roads and the rail corridor approaching the Project or passing beneath the 132kV transmission line.

It is unlikely that sunglint or glare reflection from components of the Project would have any significant impact on people residing in, or travelling through the landscape surrounding the Project. The potential for reflectivity of sunlight from the PV panels is less than a number of commonly established materials in the surrounding rural landscape including steel and standard window glass.

This LVIA recognises that the Project has the potential to impact people engaged in predominantly farming activities, where views toward components of the Project occur from surrounding agricultural areas. Ultimately the level of impact would depend on the type of activities engaged in as well as the location and duration of the activities together with the degree of screening provided by vegetation

and landform features within individual properties. Whilst views toward the Project may occur from some of these areas, the LVIA determined that the sensitivity of visual impacts is less for those employed or carrying out work in rural areas compared to potential views from within residential dwellings.

Overall the landscape along and surrounding the Project has a low population density, therefore the number of potential views is likely to be low. There would be a very small number of people working within agricultural areas surrounding the Project area.

A number of the residential dwellings identified within the viewshed are occasionally screened by tree planting around them, or combined with agricultural structures, sheds, workshops or silos which tend to screen immediate views toward the surrounding landscape.

The Project is unlikely to be visible from any public recreation areas, or from within the more densely inhabited residential areas of Moree.

Work associated with any necessary upgrade of the existing Moree Zone Substation would be unlikely to result in any significant additional visual impact on surrounding view locations.

References and Bibliography

Panoche Valley Solar Farm Project, Glint and Glare Study, Power Engineers May 2010.

Product Awareness Notification, Possible Glare and Reflectance in PV Systems, SunPower Corporation 2010.

Guidelines for Landscape and Visual Impact Assessment 2nd ed. The Landscape Institute & Institute of Environmental Management & Assessment, 2002.

Wind Prospect Boco Rock Wind Farm, Landscape and Visual Impact Assessment, Green Bean Design September 2009.

Visual Landscape Planning in Western Australia – a manual for evaluation, assessment, siting and design. Western Australian Planning Commission November 2007.

Bureau of Meteorology, Climate Statistics for Moree, 2010
http://www.bom.gov.au/climate/averages/tables/cw_053115.shtml

Limitations

Green Bean Design has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of BP Solar Pty Ltd/Walsh Consulting Pty Ltd and only those third parties who have been authorised in writing by Green Bean Design to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Green Bean Design Proposal dated 14th October 2010.

The methodology adopted and sources of information used are outlined in this report. Green Bean Design has made no independent verification of this information beyond the agreed scope of works and Green Bean Design assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to Green Bean Design was false.

This report was prepared between October 2010 and December 2010 and is based on the conditions encountered and information reviewed at the time of preparation. Green Bean Design disclaims responsibility for any changes that may have occurred after this time.

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