Appendix F

Visual impact assessment

Hillston Sun Farm

Overland Sun Farming

Hillston Sun Farm

Environmental impact statement | Appendix F | Visual impact assessment

Prepared for OVERLAND Sun Farming Pty Ltd | 26 June 2017

Hillston Sun Farm

Environmental impact statement | Appendix F | Visual impact assessment

Prepared for OVERLAND Sun Farming Pty Ltd | 26 June 2017

Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065

T +61 2 9493 9500
F +61 2 9493 9599
E info@emmconsulting.com.au

www.emmconsulting.com.au

Hillston Sun Farm

Final

Report J16135RP1 | Prepared for OVERLAND Sun Farming Pty Ltd | 26 June 2017

Prepared by	**David Richards**	**Kate Cox**	Approved by	**Duncan Peake**
Position	Environmental Scientist	Associate Environmental Scientist	Position	Director
Signature			Signature	
Date	26 June 2017	26 June 2017	Date	26 June 2017

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

Document Control

Version	Date	Prepared by	Reviewed by
1	27 January 2017	K Cox D Richards	D Peake
2	28 April 2017	D Richards	K Cox
3	26 June 2017	D Richards	K Cox

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

www.emmconsulting.com.au

Executive Summary

OVERLAND Sun Farming Pty Ltd (OVERLAND) proposes to develop the Hillston Sun Farm, a large-scale solar photovoltaic (PV) generation facility and associated infrastructure in the Riverina bioregion of south-western NSW (the project). OVERLAND proposes to develop the project on a site within the Carrathool Shire local government area, approximately 3.5 kilometres south of the township of Hillston. The project includes the development, construction and operation of a solar PV electricity generation facility, which comprises the installation of PV solar panels and associated infrastructure on the site.

A visual assessment was completed for the project to assess impacts from nine representative viewpoints surrounding the site. The viewpoints were selected to represent views close to private residential properties and road corridors (ie Kidman Way, The Springs Road and Lachlan Valley Way) and infrastructure nearest to the site and the project's development footprint.

The assessment method adopted was based on methods outlined in the *Guidelines for Landscape and Visual Impact Assessment Third Edition* (2013) (the GLVIA) and the *Wind Energy: Visual Assessment Bulletin AB 01 For State significant wind energy development* (2016) (the VA Bulletin).

Due to existing mature vegetation in the landscape and the relatively low height of the dominant project infrastructure, namely the PV solar panels, the project's infrastructure will be relatively shielded from view at a number of the viewpoints assessed as part of this visual assessment, with the exception of views of the site from one rural residential property (R17) and parts of Kidman Way.

The project design, development footprint and placement of infrastructure have progressively evolved to minimise or avoid visual impacts. Nonetheless, the development of the project will result in some changes to the landscape. Visual impacts will occur during the construction and operational stages of the project. The visual landscape will be altered from its current state for the duration of the operational stage of the project.

This visual assessment determined that, of the viewpoints assessed, infrastructure may be visible to varying degrees from seven viewpoints; viewpoints 1, 2, 3, 6, 7, 8 and 9. The distance of the development footprint from these viewpoints ranges from 40 m to 3 km. Based on the presence of vegetation, combined with the relatively low height of the project's infrastructure, visual impacts will be minimal from the majority of these viewpoints.

While significant impacts are not expected from sensitive receptors, consultation with the property owner of receptor R17 (the only dwelling from which direct views of the project are likely) has determined that consideration of landscaping to minimise views of project infrastructure where possible, is required.

This visual assessment concludes that the project will not have any significant adverse visual impacts on the locality.

Table of contents

Table of contents *(Cont'd)*

Tables

Figures

Photographs

1 Introduction

1.1 Overview

OVERLAND Sun Farming Pty Ltd (OVERLAND) proposes to develop the Hillston Sun Farm, a large-scale solar photovoltaic (PV) generation facility and associated infrastructure in the Riverina region of south-western NSW (Figure 1.1) (the project). OVERLAND proposes to develop the project on a site within the Carrathool Shire local government area (LGA), approximately 3.5 kilometres (km) south of the township of Hillston.

The project is a State significant development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP). A development application (DA) for the project is required to be submitted under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The NSW Minister for Planning, or the Minister's delegate, is the consent authority.

An environmental impact statement (EIS) is a requirement of the approval process. This visual impact assessment (VIA) report forms part of the EIS. It documents the visual assessment methods and results and the initiatives built into the project design to avoid and minimise visual associated impacts.

1.2 Project description

The project includes the development, construction and operation of a solar PV electricity generation facility, which comprises the installation of PV solar panels and associated infrastructure on the site.

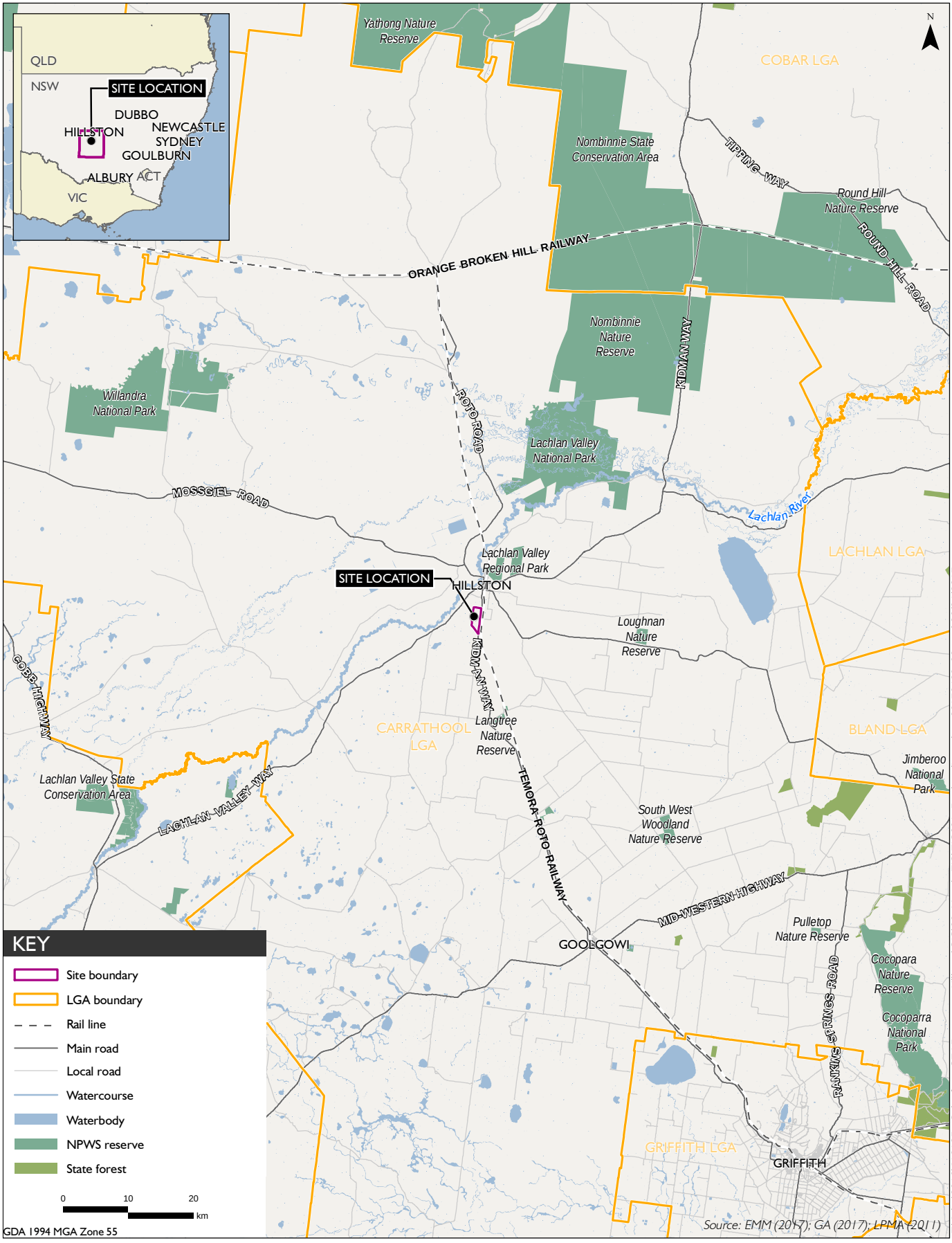
The project will connect to the Essential Energy 132 kV electricity distribution network that originates at the Hillston Substation (see Figure 3.1). The electricity and associated environmental products generated from the project will be sold to one or more of a registered energy retailing organisation, large energy users (governmental or private) or to the National Electricity Market that is managed by the Australian Energy Market Operator.

The project will have an estimated nominal capacity in the order of 85 megawatts (MW) and once operational will generate enough electricity to power up to 32,000 homes each year.

The project comprises the following key components:

- a network of PV solar panel arrays;
- electrical collection systems, switchyard and control room;
- a management hub, including demountable offices and amenities and equipment sheds;
- parking and internal access roads; and
- easement and connection infrastructure to the Hillston Substation.

The development footprint and conceptual infrastructure layout has been refined on the basis of grid connection studies, environmental constraints identification and design of project infrastructure with the objective of developing an efficient project that avoids and minimises environmental impacts. The development footprint and conceptual infrastructure layout are discussed in Chapter 4.



Regional project location

Hillston Sun Farm

Visual impact assessment

Figure 1.1

EMM

1.3 Assessment guidelines and requirements

This VIA has been prepared in accordance with the relevant governmental assessment requirements, guidelines and policies, and in consultation with the relevant government agencies.

There are no Commonwealth, NSW or local government planning policies, guidelines or standards directly applicable to this assessment. The VIA was prepared with reference to the methods outlined in:

- *Guidelines for Landscape and Visual Impact Assessment Third Edition* (2013) (the GLVIA), prepared by the Landscape Institute and Institute of Environmental Management and Assessment; and
- *Wind Energy: Visual Assessment Bulletin AB 01 For State significant wind energy development* (2016) prepared by the NSW Department of Planning and Environment (the VA Bulletin).

It is noted that the VA Bulletin specifically relates to assessment of visual impacts of wind farms in NSW, however a number of the methods for describing visual sensitivity and landscape character are considered to be relevant to this assessment. In the absence of other directly applicable guidelines/standards, the relevant elements from the VA Bulletin have been adopted for this assessment.

The VIA was prepared in accordance with the requirements of the NSW Department of Planning and Environment (DPE). These were set out in the Secretary's Environmental Assessment Requirements (SEARs) for the project, issued on 14 October 2016. The SEARs identify matters which must be addressed in the EIS. A copy of the SEARs is attached to the EIS as Appendix A, while Table 1.1 lists the individual requirements relevant to this VIA and where they are addressed in this report.

Table 1.1 Relevant SEARs

Requirement	Section addressed
Visual – including:	
• An assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.	Chapter 5

To inform preparation of the SEARs, DPE invited other government agencies to recommend matters to be addressed in the EIS. These matters were taken into account by the Secretary for DPE when preparing the SEARs. Copies of the government agencies' advice to DPE were attached to the SEARs.

One agency, the NSW Roads and Maritime Services (RMS), raised a matter relevant to the visual assessment. The matter raised is listed in Table 1.2.

Table 1.2 RMS's comments: assessment recommendations

Requirement	Section addressed
Issues relating to potential for distraction of, and for glare impacts on, passing motorists should be addressed in the development submission. As a minimum, consideration should be given to the establishment and maintenance of a visual buffer, such as a vegetated buffer, within the subject site along its frontage to any public road, particularly Kidman Way.	Chapter 5

1.4 Structure of the report

This report is structured as follows:

- Chapter 2 describes the visual impact methodology used in the preparation of this report;
- Chapter 3 describes the existing landscape within which the project will be sited;
- Chapter 4 describes the character of the visual components of the project and the staging of project development;
- Chapter 5 describes the impacts of the project from representative viewpoints in and around the site; and
- Chapter 6 provides conclusions.

2 Assessment methodology

2.1 Overview

The assessment method used in this report is that outlined in the GLVIA and VA Bulletin. The assessment involves information review, consultations, fieldwork observations and photography, computer-based data processing and analysis, and subjective professional judgement. The assessment involved seven key stages:

Stage 1: **View type and context** – the existing landscape baseline is described noting its character and complexity;

Stage 2: **Visibility baseline assessment** – the zone of visual influence of the project is established, where appropriate through the use of computer generated zones of theoretical visibility, based on topographical data, or through fieldwork analysis. This establishes the locations where views of the project may be possible. Fieldwork is undertaken to establish the types and locations of receptors within this theoretical zone;

Stage 3: **Viewpoint selection** – representative public and private viewpoints of the site are selected and the project's level of exposure to them is determined;

Stage 4: **Magnitude of change** - the magnitude of visual change and the changes arising from the project are assessed and the need for project modifications or other mitigation measures evaluated;

Stage 5: **Visual sensitivity** – the capacity of the landscape to absorb change without a loss of quality (its visual sensitivity) is determined;

Stage 6: **Evaluation of significance** – the significance of change in the landscape is a function of the magnitude of change when considered against the view type/context and the sensitivity of a receptor; and

Stage 7: **Mitigation** – the modified and mitigated project (if applicable) is assessed and final visual impacts are described and illustrated and their significance documented.

Details of each of the above stages are provided below.

2.2 Stages in the assessment methodology

2.2.1 Stage 1 - View type and context

This stage involves recording and analysis of existing landscape features, characteristics, the way in which the landscape is experienced and the value or importance of the landscape and visual resource in the site. The landscape character is determined by the number, size, type and contrast of elements present. Typically the key elements are topography, vegetation, water features and built elements. Other factors that are important are the consistency of these elements and whether they have developed progressively overtime and become well integrated into a harmonious landscape. In addition, the presence of change and whether the landscape is experiencing large scale development (such as residential growth on the urban fringe), needs to be considered.

The context is a primary factor in the visual sensitivity of the view. Generally sites within higher contrasting landscapes have greater ability to absorb change, whereas sites within a uniform or highly ordered landscape have higher sensitivity and less potential for absorption.

Reference has been made to the landscape characters defined in the VA Bulletin and descriptions provided in the *Interim Biogeographic Regionalisation for Australia* (IBRA). The GLVIA also sets out guidance in relation to landscape baseline at paragraph 5.3:

> Baseline studies for assessing landscape effects require a mix of desk study and field work to identify and record the character of the landscape and the elements, features and aesthetic and perceptual factors which contribute to it. They should also deal with the value attached to the landscape....The methods used should be appropriate to the context into which the development proposal will be introduced and in line with current guidance and terminology.

2.2.2 Stage 2 - Visibility baseline assessment

Baseline studies for visual effects establish the area in which the development may be visible, who will see the development, the viewpoints that will be affected and the nature of the views at those points. Viewshed analysis using GIS has been used to simulate visibility from viewpoints and the surrounding landscape.

2.2.3 Stage 3 - Viewpoint selection

Viewpoints are selected to provide a representative sample of the likely visual landscape changes on the different users of the areas surrounding the project and their visual exposure to various project elements. Viewpoints that are considered to have potential exposure to various project elements or areas available to public access, such as roads, and private viewpoints from residential properties surrounding the project, have been identified through GIS mapping, fieldwork and desktop analysis.

2.2.4 Stage 4 - Magnitude of change

The magnitude of change on the visual landscape is one factor in determining the significance of visual impacts of the project. In accordance with GLVIA, this visual assessment considered the following criteria in determining the magnitude of change on a receptor:

- whether the impact is temporary or permanent – impacts that are for a limited duration are considered less significant than those which occur for an extended period or are permanent;
- scale of change – the loss or addition of features in the view and changes in the proportion of the view affected by the project;
- degree of contrast – level of integration of new features with existing or remaining landscape elements, having regard to form, scale, height, colour, and texture;
- distance of the viewer from the altered elements in the landscape – close proximity to an altered landscape will increase the significance for private residences. In the case of motorists, mid ground changes can be greater than foreground elements as they can result in longer viewing times. Glare and reflection has also been considered in regards to motorists;
- viewing direction – whether the change is to the primary view from the receptor;

- extent of view affected – impacts that are visible over a greater portion of a view are more significant than those where only a part of the view is impacted. Intervening topography and vegetation will also affect the magnitude of change; and

- length of viewing time – views from a residence are constant whereas some views from roadways as experienced by motorists may be brief dependent upon speed and viewing direction.

2.2.5 Stage 5 - Visual sensitivity

Visual sensitivity is a measure of the landscape's ability to absorb development without a significant change in the character. It is a function of the view type and context. In this assessment, the major factor influencing visual sensitivity is the level of contrast between the project related infrastructure and the rural landscape setting in which it will be set.

The physical characteristics of the landscape, including existing development features, are integral components in determining the visual sensitivity. For example, a low visual sensitivity would enable a modification or addition to be made to the landscape which would only cause minimal contrast and result in a high level of integration with the surrounding landscape. Similarly, a high visual sensitivity would mean the same modification or addition to the surrounding landscape would cause high contrast to the surrounding landscape.

Visual sensitivity has been assessed based on the viewer sensitivity level classification given in the VA Bulletin, presented in Table 2.1.

Table 2.1 Viewer sensitivity level classification

Sensitivity	Description
High	Residential areas and rural villages (defined as land zoned R1, R2, R3, R4, R5 and RU5 in the Standard Instrument Local Environmental Plan [LEP]).
	Recreation, cultural or scenic sites and viewpoints of National or State significance.
	Any buildings, historic rural homesteads/residences on the State or local Government Heritage List.
Moderate	Rural dwelling.
	Tourist and visitor accommodation (definition in the Standard Instrument LEP).
	Recreation, cultural or scenic sites and viewpoints of regional significance.
Low	Interstate and state passenger rail lines with daily daylight services.
	State highways, freeways and classified main roads, classified tourist roads.
	Land management roads with occasional recreation traffic.
	Walking tracks of moderate local significance or infrequent recreation usage.
	Other low use and low concern viewpoints and travel routes.
	Navigable waterways.

The VA Bulletin establishes sensitive land use designations, including key National and State sensitive land use designations and potentially sensitive land use zones under the local environmental plans prepared under the EP&A Act. National and State sensitive land use designations and their land use zones are identified in Table 2.2.

Table 2.2 Sensitive land use designations

National and State sensitive land use designations	LEP zones as per the NSW Standard LEP	
World Heritage Areas	RU5 Village	RE2 Private Recreation
National Parks	R1 General Residential	E1 National Parks and Nature Reserves
National Reserve System reserves	R2 Low Density Residential	E2 Environmental Conservation
Coastal Zone (under the NSW *Coastal Protection Act 1979*)	R3 Medium Density Residential	E3 Environmental Management
Marine estate (under the NSW *Marine Estate Management Act 2014)*	R4 High Density Residential	E4 Environmental Living
Commonwealth Heritage List Sites	R5 Large Lot Residential	W1 Natural Waterways
State Heritage Register Sites	SP3 Tourist	W2 Recreational Waterways

Notes: Table 3 from VA Bulletin (DPE 2016).

The site is not within a sensitive land use zone; the nearest sensitive land use zone is approximately 2.2 km north-west of the site and is zoned R5 Large Lot Residential under the Carrathool LEP 2012 (Carrathool LEP). There are no dwellings within 3 km of the site located within this land use zoning.

2.2.6 Stage 6 - Evaluation of significance

The significance of a change in the landscape is a function of the magnitude of that change when considered against the view type/context and the sensitivity of a receptor. Typically, a noticeable change in the landscape in a rural or natural landscape, combined with a high visual sensitivity, would be considered to be significant, whereas a change in an already heavily modified landscape be considered slight or moderate.

Table 2.3 illustrates how the magnitude of a change in the landscape is assessed, and its significance rated, against the sensitivity of a viewpoint.

Table 2.3 Evaluation of significance matrix

Magnitude of change	Visual sensitivity		
	High	**Moderate**	**Low**
High	Substantial	Moderate/ Substantial	Moderate
Moderate	Moderate/ Substantial	Moderate	Slight/ Moderate
Low	Moderate	Slight/ Moderate	Slight
Negligible	Slight	Slight	Negligible
Key:	Significant	Not significant	

The primary assessment tools for determining the significance of impact of the project were the site inspection and photographs of the views from the selected viewpoints. This enabled an assessment of potential visual impact, taking into consideration the nature of the landscape, topography, the distance between the viewpoint and the proposed infrastructure, as well as the type of view experienced.

2.2.7 Stage 7 - Mitigation

The final step in the assessment process was to determine additional measures that could be incorporated into the design of the project to ameliorate, or, where possible, eliminate the visual impact of the proposed activity.

Mitigation measures can be in several forms including:

- design of project infrastructure to reduce the contrast with the surrounding environment;
- use of visual buffers and screening by planting vegetation; and
- designing infrastructure to screen operations and lighting.

Mitigation measures that have been incorporated into the design of the project are discussed in Section 4.7 of this report.

3 Site description

3.1 Description of the site

The site is within the Carrathool Shire LGA in the Riverina Interim Biogeographic Regionalisation for Australia (IBRA) bioregion of south-western NSW, approximately 3.5 km south of the township of Hillston (Figure 1.1). The site is west of Kidman Way and comprises approximately 296 hectares (ha). The development footprint is defined as the land area within the site where project infrastructure will be constructed and operate for the project life. The development footprint encompasses an area of 293 ha, which has been refined through the project design process informed by technical investigations to avoid environmental constraints.

The site is zoned RU1 Primary Production under the Carrathool LEP. It has been highly modified by past disturbances associated with land clearing, cropping, livestock grazing and weed invasion and is currently used for broad acre cropping. The site is largely devoid of vegetation in the areas which have been subject to cropping. Parts of the site are constrained due to the presence of native vegetation and potential floodwater pathways.

The site is immediately to the south of Essential Energy's Hillston 132 kilovolt (kV) Substation (Figure 3.1). It has direct access to Kidman Way, which provides access to the regional road network including the Cobb and Mid-Western highways (Figure 1.1 and Figure 3.1). The site is also adjacent to the Griffith to Hillston railway line, which runs parallel to Kidman Way and is currently used solely for grain-related train operations (Figure 3.1).

Elevation across the site is relatively uniform at approximately 117 to 120 m above sea level. Land around the site generally slopes from north-east to south-west. The Riverina IBRA bioregion's upper catchment landscape is comprised of a series of overlapping, low gradient alluvial fans on the eastern half of the Murray Basin, while the lower tract of the Murray River is a floodplain with overflow lakes (OEH 2016).

3.2 Surrounding land uses

The site is part of the Lachlan River catchment. Land use within this catchment is dominated by extensive agricultural operations, with grazing occupying 75.5% of the total catchment area (Office of Water 2011). Dryland cropping and horticulture (15.1%), conservation (4.1%), forestry (1.6%) and irrigation (1.4%) are also prevalent across the catchment area (Office of Water 2011).

The site is in a semi-rural setting, with the wider region characterised by grazing properties, small-scale farm businesses, natural areas, forestry, scattered rural dwellings, villages and towns and major transport infrastructure such as the Cobb and Mid-Western highways.

The majority of the land surrounding the site is zoned RU1 Primary Production under the Carrathool LEP (Figure 3.2). Land uses surrounding the site predominantly include dryland cropping (principally wheat) and irrigated horticulture (principally cotton). Agricultural production activities undertaken in the area are dominated by sheep and cattle grazing and cotton and rice production.

No notable scenic or significant vistas within proximity of the site have been identified.

Prominent features in the surrounding landscape are identified on Figure 3.1 and include:

- the Hillston Rest Area, managed by RMS, is a heavy and light vehicle rest area which provides basic amenities to motorists travelling along Kidman Way and is located approximately 1.4 km north of the site, with access provided on the south-bound side of Kidman Way;
- the Hillston Cemetery, approximately 2 km north of the site, with access from the north-bound side of Kidman Way; and
- the Hillston Showground, home to the annual Hillston Show, approximately 2.5 km north of the site with access from the southern side of The Springs Road.

The Hillston Cemetery is recognised as a place of local environmental heritage significance within the Carrathool LEP. One of the objectives of the Carrathool LEP is:

> to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views.

Views to the site from the Hillston Cemetery will be screened by existing tree planting within the landscape. Further, the distance to the site and relatively low height of the project's infrastructure would limit the potential for any views from this location.

3.3 Hillston Substation and other electricity transmission infrastructure

As noted in Section 3.1, the site is immediately to the south of Essential Energy's Hillston Substation (Figure 3.1). The electricity transmission lines connecting into the Hillston Substation are prominent features in the surrounding landscape (refer to Section 5.2.5). A 132 kV transmission line runs along the eastern boundary of the site, connecting to the Hillston Substation. Other lower voltage overhead wiring also runs into and out of the Hillston Substation with wires passing directly over Kidman Way close to the site.

3.4 Rural dwellings

An investigation of aerial imagery of the site and its surrounds identified 21 potential rural dwellings within an approximate 3 km radius of the site (Figure 3.1), excluding dwellings in the built-up area of Hillston township, approximately 2.8 km north of the site.

3.5 Settlements and townships

Hillston is the largest town in the Carrathool Shire LGA with a population of 1,430 and is the area's geographic and agricultural centre. The town is approximately 3.5 km north of the site.

Agriculture is the dominant industry of employment for Hillston's population, with school education and local government administration among the town's other major employers (ABS 2013). The town also hosts the majority of the area's largest social, cultural and recreational events, which make important contributions to its agriculturally dependent economy.

3.6 Traffic routes

The site has access to the regional road network from Kidman Way, which provides access to the Cobb and Mid-Western highways (Figure 1.1 and Figure 3.1). Kidman Way services the Murrumbidgee Irrigation Area and provides important transport connections for remote communities within the western Riverina region. At the site, Kidman Way is a single carriageway with a sealed surface. It is a designated B-double route and is also part of RMS Livestock Loading Scheme, which provides increased mass limits for livestock loads (RMS 2016). This designation permits the use of Kidman Way for heavy vehicle movements including 19 m, 23 m and 25 m B-double, B-triple and AB-triple vehicles. The height of the verge along the western side of Kidman Way is variable. In some areas, the verge is elevated above the level of the road, partially screening views of the site. Daily traffic estimates indicate that between 554 and 630 vehicles travel along Kidman Way per day, which corresponds to approximately 60 vehicles per hour during the peak hourly traffic periods (refer to Appendix H of the EIS).

Lachlan Valley Way and The Springs Road are also in close proximity of the site and at their closest points are located approximately 2 km west of the site's western boundary and 2.8 km east of the site's eastern boundary, respectively (Figure 3.1). These roads were considered as part of this visual assessment as motorists travelling along these road corridors may have partial, distant views of the project's infrastructure in some locations.

The site is adjacent to the Griffith to Hillston railway line, which runs parallel to Kidman Way (Figure 3.1). This line is owned by Transport for NSW (TfNSW) and is part of NSW's freight transport network. At present, the line is used solely for grain-related train operations, servicing one of GrainCorp's primary sites in southern NSW. A $3 million upgrade to the rail siding extension at Hillston was announced in 2016 to help service the region's major grain receival site (TfNSW 2016). Train operations along this line are likely to be seasonal and are more frequent during the grain harvesting period between November and January.

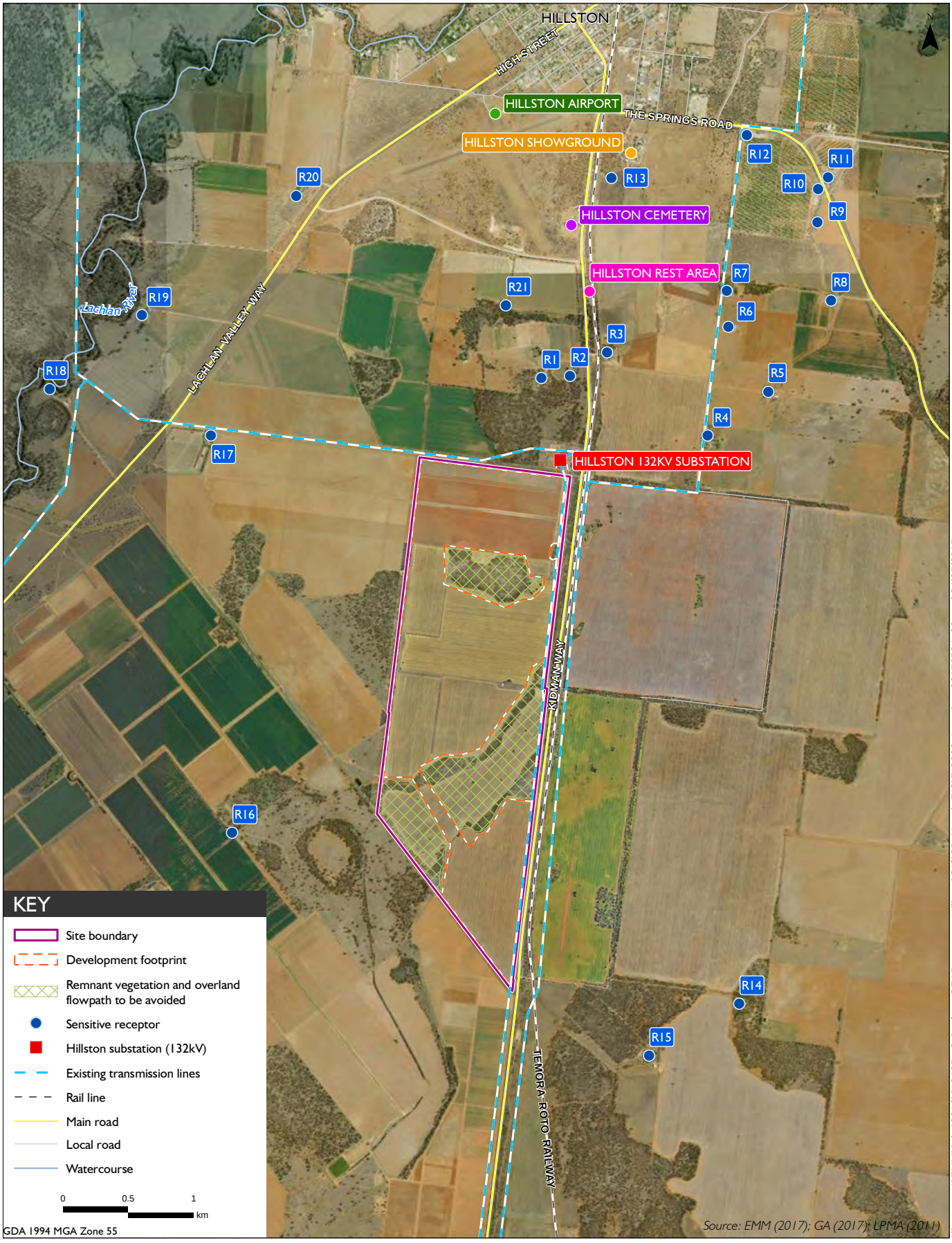
3.7 Air traffic

The Hillston Airport is approximately 2.7 km north of the site (Figure 3.1). There are no regularly scheduled services into or out of Hillston Airport.

3.8 Night lighting

Existing sources of night lighting in the immediate vicinity of the site are minimal due to its rural setting. The main sources of lighting would be from rural residential properties, farm machinery and vehicles on roads. The headlamps from vehicles travelling north-south along Kidman Way would provide a modest source of lighting in the evening and night time hours.

The project will not require permanent night lighting. Temporary, localised night lighting may be required during general maintenance activities conducted during the operation stage of the project. If required, lighting will be managed to minimise impacts on surrounding areas.

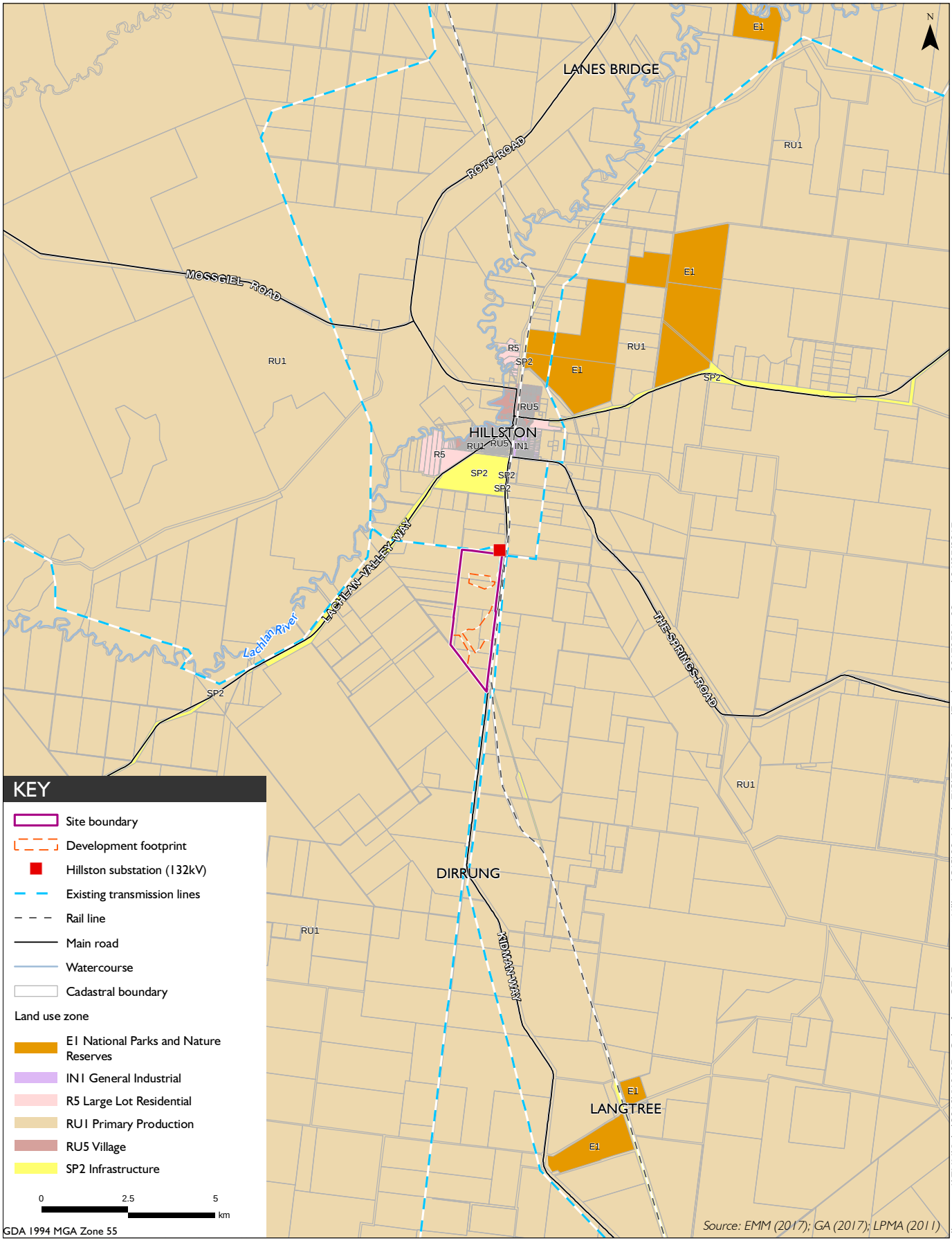


\\emmsvr1\EMM\Jobs\2016\J16135 - Solar farm SEARs request Hillston\GIS\02_Maps_EIS\EIS002_Location_20170524_02.mxd 24/05/2017

Location of the Hillston Sun Farm

Hillston Sun Farm
Visual impact assessment
Figure 3.1

EMM



\\emmsvr1\EMM\Jobs\2016\J16135 - Solar farm SEARs request Hillston\GIS\02_Maps_EIS\EIS003_LandZoning_20170524_03.mxd 24/05/2017

Land use zoning
Hillston Sun Farm
Visual impact assessment
Figure 3.2

EMM

4 Visual elements of the project

4.1 Development footprint

The development footprint within the site boundary (Figure 3.1) has been refined on the basis of grid connection studies, environmental constraints identification and design of project infrastructure.

OVERLAND has designed the project based on its experience leading benchmark renewable energy and infrastructure projects. The site location, capacity of the project, design and layout of infrastructure and connection to the electricity grid have been refined through an evaluation process both prior to and during preparation of this VIA and the associated EIS. The evaluation process has considered a range of factors, including:

- availability of solar radiation;
- proximity to, and capacity of the electricity grid;
- availability of sufficient land area with suitable physical characteristics;
- identification and avoidance of environmental constraints; and
- placement of infrastructure to minimise land use conflicts with landholders.

Specifically, the parcels of land which comprise the development footprint (as defined in Section 3.1), and the placement of infrastructure including solar panels, inverters, electrical collection system and switchyard and easement and connection infrastructure have been identified through detailed consultation with the landholder, to minimise visual impacts and land use conflicts and enable agricultural production and land management practices to continue on surrounding land.

4.2 Site preparation

Due to the development footprint's flat terrain and predominantly cleared landscape, limited site preparation and civil works will be required. Site establishment works and preparation for construction will include:

- the establishment of a temporary construction site compound in a fenced off area within the development footprint including:
  - a site office;
  - containers for storage; and
  - parking areas;
- construction of access tracks and boundary fencing;
- site survey to confirm infrastructure positioning and placement; and
- where necessary, additional geotechnical investigations to provide information specific to the selected tracking system, mountings, and foundation pile arrangement.

The site establishment works and preparation for construction outlined above are unlikely to result in significant visual impacts due to their temporary nature.

4.3 Construction

Upon completion of the site establishment and pre-construction activities described above, construction will typically be as follows:

- posts will be driven or screwed into the ground to provide support for the mounting framework required for the PV solar panels;
- foundations for the inverter blocks, switchyard and management hub structures will be prepared;
- underground cabling will be installed between the PV solar panels and the collection circuit (this cabling will carry power throughout the site, between the inverters and central electrical switchyard, which will be located in the management hub);
- PV solar panel frames will be assembled and mounted on top of the piles;
- PV solar panels, inverters, transformers and switchgear units will be installed;
- Transmission infrastructure will be constructed between the project electrical switchyard and the Hillston Substation;
- the management hub will be constructed;
- permanent fencing and security will be constructed; and
- the temporary construction site compound will be removed.

The construction stage of the project will take approximately 12 months from the commencement of site establishment works and will result in a number of physical changes to the landscape, namely through the installation of infrastructure, the components of which are described in detail below.

4.4 PV solar panels

The project involves the installation of PV solar panels, arranged in a series of rows positioned to maximise the use of the solar resource available at the site (refer to Photograph 4.1). Approximately 300,000 PV solar panels could be accommodated within the development footprint. The final number of PV solar panels within the development footprint will be dependent on detailed design, and availability and commercial considerations at the time of construction.

PV solar panels will be constructed in a single axis tracking configuration, and will be fixed to and supported by ground-mounted framing (refer to Photograph 4.2). This configuration will allow the PV solar panels to rotate from east to west during the day tracking the sun's movement. The average height of the PV solar panel rows will be approximately 1.2 m. During the early morning and late afternoon tracking periods, the maximum height of the PV solar panel rows will be approximately 2 m.

The NSW Department of Planning and Environment – Division of Resources and Energy (DPE-DRE) (2016) states that solar farms are not considered to be reflective. To maximise the efficiency of the electricity production process, PV solar panels are designed to absorb as much light as possible.

One of the primary goals of PV solar panel design, manufacture and installation is to minimise the amount of light reflected. PV solar panels will be constructed of solar glass with an anti-reflective surface treatment.

Photograph 4.1 **Example of the proposed PV solar panel array layout**

Photograph 4.2 **Example of the steel frame structures used to support PV solar panels**

4.5 Connection infrastructure

An overhead transmission line to the Hillston Substation will be constructed to export electricity produced at the site to the electricity grid. The Hillston Substation is immediately adjacent to the site's northern boundary (being approximately 150 m from the existing infrastructure). Within the site boundary, transmission infrastructure will originate from the main switchboard building and onsite substation adjacent to the site's northern boundary (see Figure 3.1). The overhead transmission line will be approximately 300 m in length and will require the installation of up to four supporting poles (constructed of either concrete or steel), which will be approximately 21 m high. The position of the overhead transmission line is illustrated in the detailed infrastructure layout plan (Figure 4.1).

4.6 Access, parking and security

Access to the site will be from Kidman Way, utilising two existing cleared access tracks (Figure 4.1). Two new intersections will be constructed. Further details on the intersection designs are provided in Appendix H of the EIS.

An average of 76 daily vehicle movements is expected to travel to and from the site during construction. During operation, daily vehicle movements will be significantly less and are expected to total approximately 12 daily vehicle movements. Further information about projected vehicle movements to and from the site throughout the project's construction and operation are available in Appendix H of the EIS.

Internal access roads of approximately 4-6 m width will be constructed to accommodate construction and operation traffic movements throughout the site. The indicative location of the access roads is illustrated in the detailed infrastructure layout plan (Figure 4.1).

During construction, a suitable number of parking spaces will be available within the temporary construction compound. The indicative location of the parking spaces is illustrated in the detailed infrastructure layout plan (Figure 4.1).

The site will be fenced off by a chain mesh fence, which will be approximately 1.8-2.4 m high. Fencing will restrict access to the site.

4.7 Mitigation of visual impacts

Development of the design has included general measures to reduce the degree of contrast between the project and the surrounding rural landscape, having regard to the form, scale, height, colour and texture of materials incorporated as part of the project's infrastructure. All of these amendments have reduced the overall visual impacts. This assessment has led to further refinement of the project to reduce visual impacts through consultation with surrounding landholders.

4.7.1 Landscaping

A conceptual landscaping plan is provided in Figure 4.2, which presents landscaping options either adjacent to the fenceline at receptor R17 (option A), or along the western boundary of the northern portion of the site (option B). Either of these options would reduce the visibility of project infrastructure from R17 (ie Viewpoint 8). The final location and extent of landscaping will be determined during detailed design and following subsequent discussions with the project landowner and the property owner of R17 as part of preparation of the environmental management plan. Landscaping would involve planting of native shrub species between 1-3 m in height. A suggested species list is provided in Table 4.1.

Table 4.1 Suggested native shrub species for landscaping

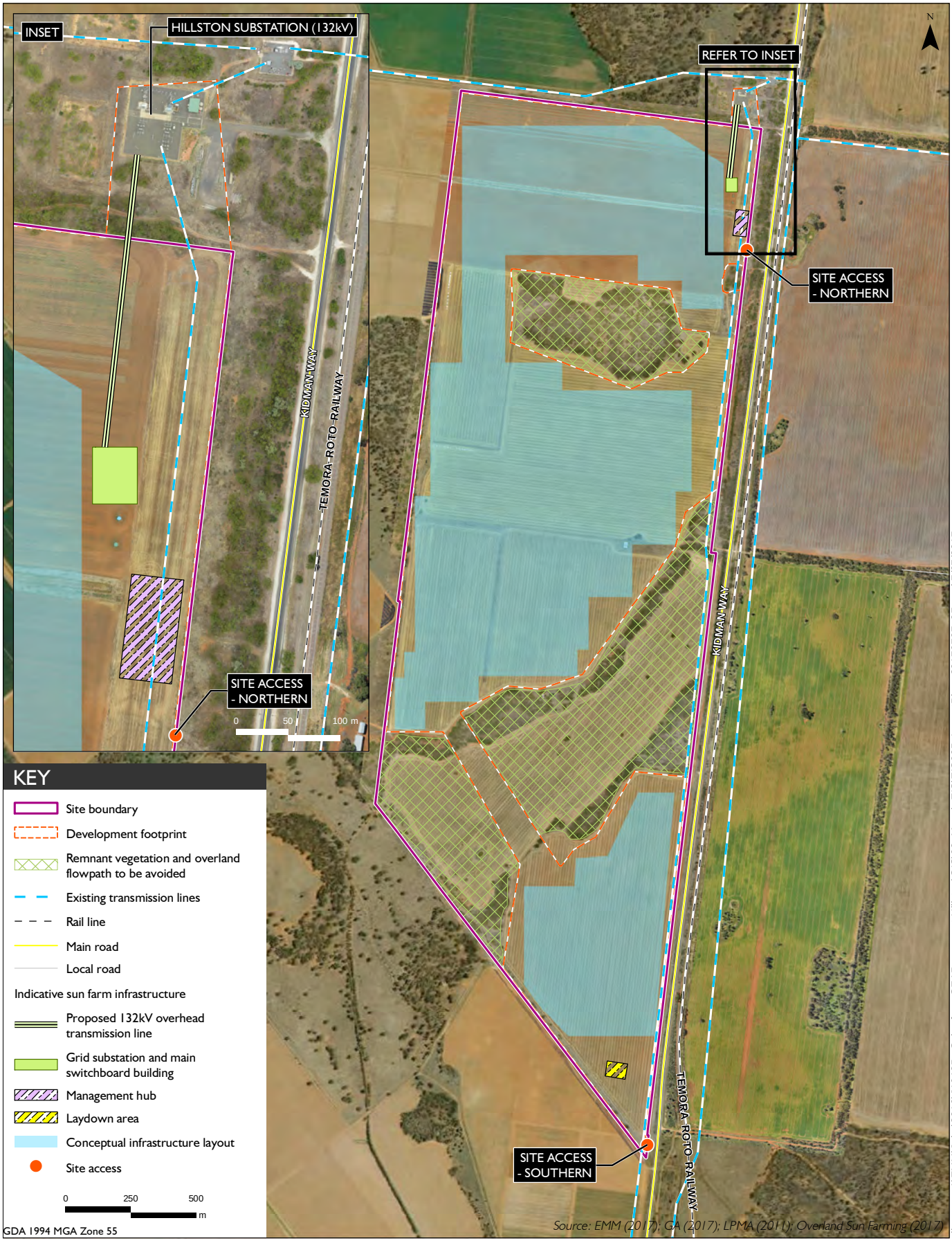
Scientific name	Common name	Height	Suggested planting spacing
Acacia oswaldii	Miljee	2-5 m	2-3 m apart
Apophyllum anomalum	Warrior Bush	2-3 m	2-3 m apart
Chenopodium nitrariaceum	Nitre Goosefoot	1-2 m	2-3 m apart
Dodonaea viscosa subsp. *angustissima*	Narrow-leaf Hop-bush	1-2 m	2-3 m apart
Eremophila longifolia	Emubush	1-2 m	2-3 m apart
Maireana aphylla	Cotton Bush	1 m	1-2 m apart
Maireana microphylla	Small-leaf Bluebush	1 m	1-2 m apart
Olearia pimeleoides	Pimelia Daisy-bush	1-2 m	2-3 m apart
Pittosporum angustifolium	Butterbush	2-3 m	2-3 m apart
Senna artemisioides	Desert Cassia	2 m	2-3 m apart

4.7.2 Colour of materials

Suitable colours will be chosen for project infrastructure to minimise visual impacts. Buildings and materials for site amenities will be made from colourbond or similar. These buildings and materials will be designed to blend in with the local farming landscape and will not be dissimilar to existing farm sheds located in the surrounding area.

4.7.3 Night lighting

As noted in Section 3.6, the project will not require permanent night lighting. Temporary, localised night lighting may be required during general maintenance activities conducted during the operation stage of the project. If required, lighting will be managed to minimise impacts on surrounding areas.

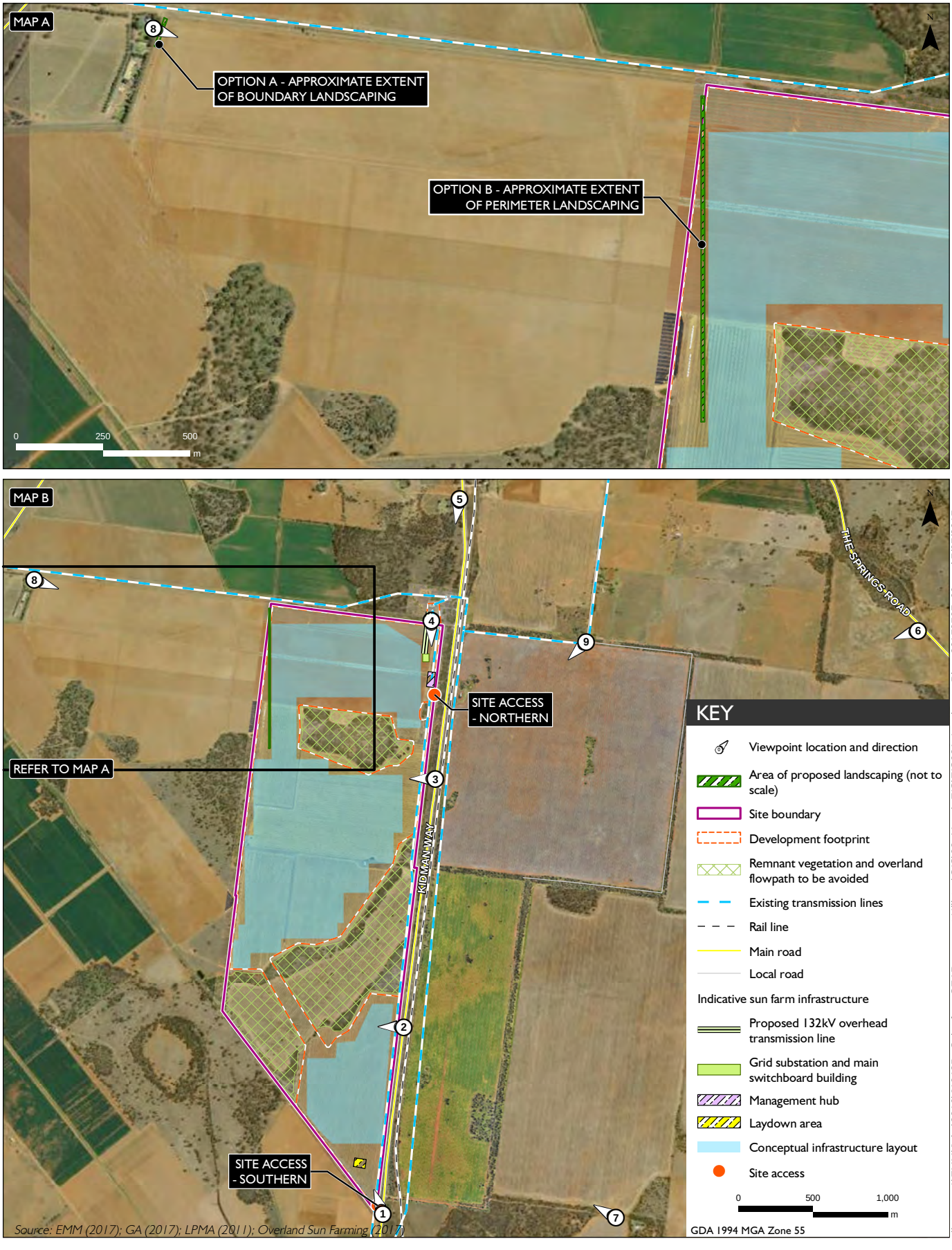


Infrastructure layout plan

Hillston Sun Farm

Visual impact assessment

Figure 4.1



\\emmsvr1\EMM\Jobs\2016\J16135 - Solar farm SEARs request Hillston\GIS\02_Maps_EIS\EIS021_LandscapePlan_20170707_06.mxd 7/07/2017

Conceptual landscaping plan

Hillston Sun Farm
Visual impact assessment
Figure 4.2

5 Visual assessment

5.1 Assessed viewpoints

Following the desktop analysis, a site inspection was undertaken on 8 December 2016 to ground-truth the identified representative viewpoints and photograph the site from these representative viewpoints. Viewpoints were selected based on:

- proximity to the site and, more specifically, the project's development footprint;
- the location of sensitive receptors (ie dwellings);
- the positioning of road corridors and potential impacts on passing motorists;
- local topography; and
- existing vegetation screening.

The locations of the nine viewpoints are illustrated in Figure 5.1. The rationale for the selection of each of the viewpoints analysed are summarised in Table 5.1.

Table 5.1 Assessed viewpoints and sensitive receptors

Assessment location	Viewpoint type	Rationale for selection
Viewpoint 1	Motorist	Views are representative of those experienced by motorists travelling along Kidman Way. Project infrastructure is likely to be visible for a distance of approximately 1.45 km travelling north from this viewpoint. Assuming that motorists are travelling at the prescribed speed limit of 100 km/h, this would mean a length of exposure of approximately 52 seconds. Daily traffic estimates indicate that between 554 and 630 vehicles travel along Kidman Way per day (refer to Appendix H of the EIS).
Viewpoint 2	Motorist	Views are representative of those experienced by motorists travelling along Kidman Way. Views of project infrastructure are likely for a distance of approximately 250 m travelling north and 1.2 km travelling south from this viewpoint. Assuming that motorists are travelling at the prescribed speed limit of 100 km/h, this would mean a length of exposure of approximately 9 seconds for motorists travelling north and 43 seconds for motorists travelling south. Daily traffic estimates indicate that between 554 and 630 vehicles travel along Kidman Way per day (refer to Appendix H of the EIS).
Viewpoint 3	Motorist	Views are representative of those experienced by motorists travelling along Kidman Way. Views of project infrastructure are likely for a distance of approximately 1 km travelling north and 400 m travelling south from this viewpoint. Assuming that motorists are travelling at the prescribed speed limit of 100 km/h, this would mean a length of exposure of approximately 36 seconds for motorists travelling north and 14 seconds for motorists travelling south. Daily traffic estimates indicate that between 554 and 630 vehicles travel along Kidman Way per day (refer to Appendix H of the EIS).
Viewpoint 4	Electricity workers at Hillston Substation	The view from this location is representative of the view of the existing Hillston Substation, the 132 kV transmission line and associated infrastructure as seen from Essential Energy's access point. This viewpoint was selected on the basis that the project may contribute to a cumulative visual impact for workers accessing the Hillston Substation and associated infrastructure and for motorists travelling south from this location.

Table 5.1 Assessed viewpoints and sensitive receptors

Assessment location	Viewpoint type	Rationale for selection
Viewpoint 5	Dwellings	Views are representative of sensitive receptors (ie dwellings) to the north of the site, including those closest to the site (R1, R2 and R3 – see Figure 5.2): R1 – 700 m; R2 – 950 m; R13 – 2.2 km; and R21 – 1.2 km..
Viewpoint 6	Motorist	Views are representative of those experienced by motorists travelling along The Springs Road, east of the site. This viewpoint was selected on the basis that motorists travelling along this road corridor may experience limited views of project infrastructure.
Viewpoint 7	Dwellings	Views are representative of sensitive receptors (ie dwellings) to the south-east of the site (Figure 5.2): R15 – 1.2 km; and R14 – 1.7 km.
Viewpoint 8	Dwellings Motorist	Views are representative of a sensitive receptor (ie dwelling) west of the site, R17, approximately 1.6 km from the site's western boundary (Figure 5.2). Views are also representative of sensitive receptors (ie dwellings) further west of the site (Figure 5.2): R18 – 2.8 km; and R19 – 2.4 km. Views are also considered representative of those experienced by motorists travelling along Lachlan Valley Way, west of the site. This viewpoint was selected on the basis that motorists travelling along this road corridor may experience limited views of project infrastructure.
Viewpoint 9	Dwellings	Views are representative of sensitive receptors (ie dwellings) to the north-east of the site (Figure 5.2): R4 – 1.1 km; R5 – 1.6 km; R6 – 1.6 km; R7 – 1.8 km; R8 – 2.3 km; R9 – 2.6 km; R10 – 2.7 km; R11 – 2.9 km; and R12 – 2.7 km.

For the viewpoints representative of motorists on Kidman Way, daily traffic estimates indicate that between 554 and 630 vehicles travel along this route daily (refer to Appendix H of the EIS).

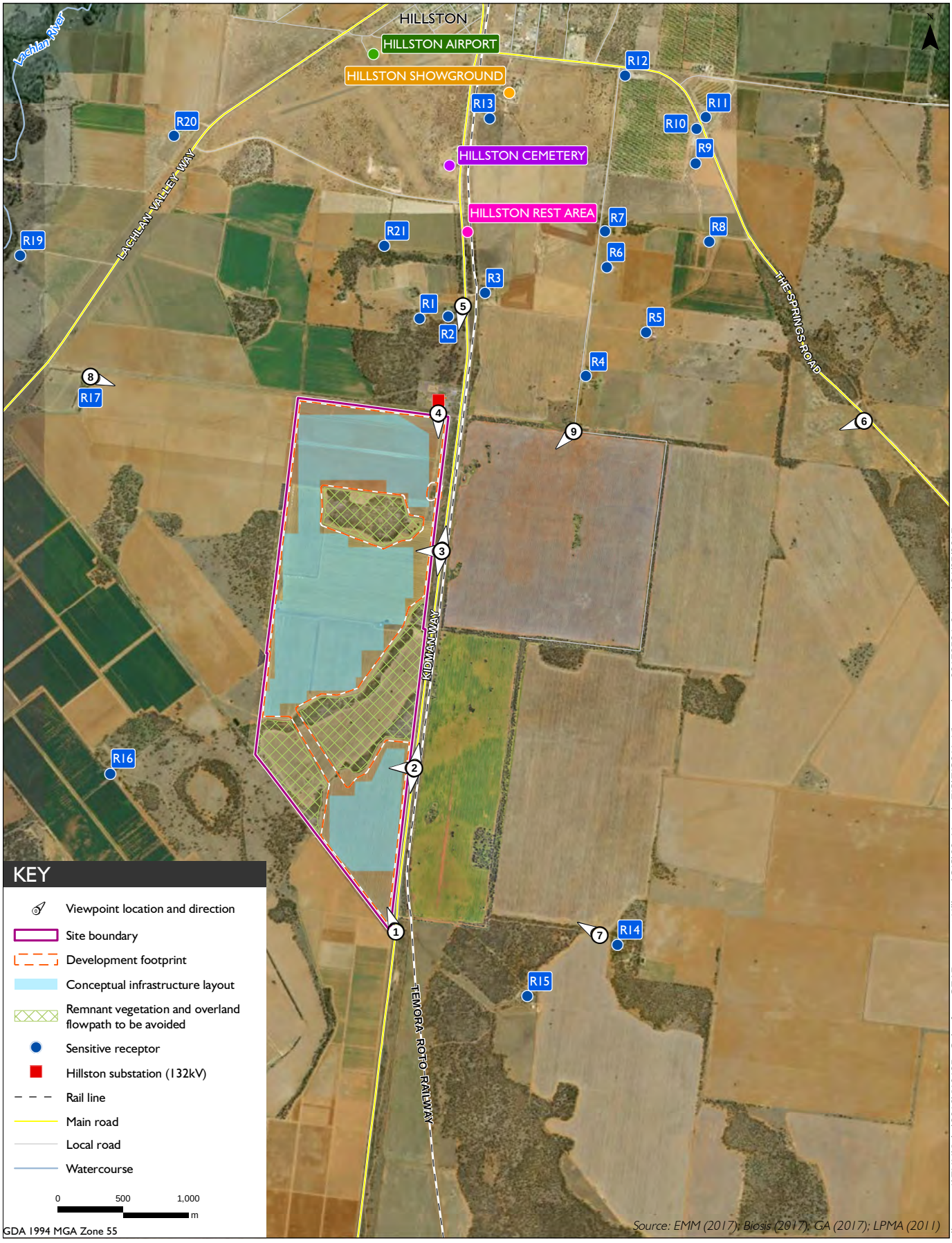
5.2 Construction impacts

A description of the site establishment and construction activities associated with the project is provided in Chapter 4.

As noted in Section 4.2, due to the site's flat terrain and predominantly cleared agricultural landscape, limited site preparation and civil works will be required. The site establishment works and construction activities will not have any significant visual impacts due to their temporary nature.

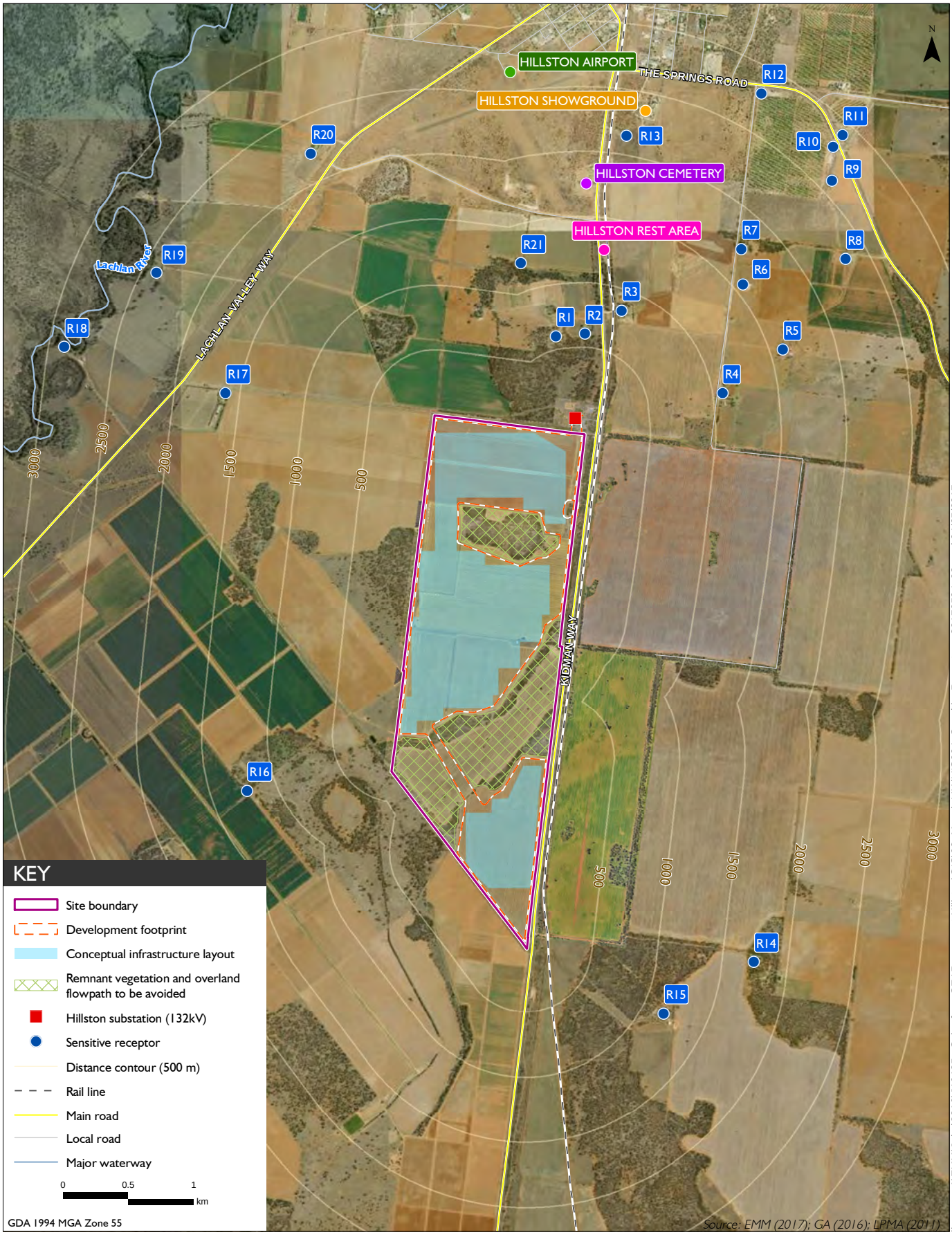
During construction, the landscape within the development footprint will undergo a number of physical changes, namely through the installation of project infrastructure, which will add new features to the site's visual landscape. Views of the site during construction will be predominantly from motorists travelling along Kidman Way. It is assumed the focus of these motorists will be in line with their direction of travel along Kidman Way. Any changes to the visual landscape during construction are not considered significant due to the low visual sensitivity of passing motorists and temporary nature of construction activities.

No additional mitigation measures during the site establishment and construction activities are warranted.



Viewpoint locations
Hillston Sun Farm
Visual impact assessment
Figure 5.1

EMM



\\emmsvr1\EMMJobs\2016\J16135 - Solar farm SEARs request Hillston\GIS\02_Maps_VIA\VIS004_SensitiveReceptors_20170524_03.mxd 24/05/2017

Sensitive receptors

Hillston Sun Farm

Visual impact assessment

Figure 5.2

5.3 Operation impacts

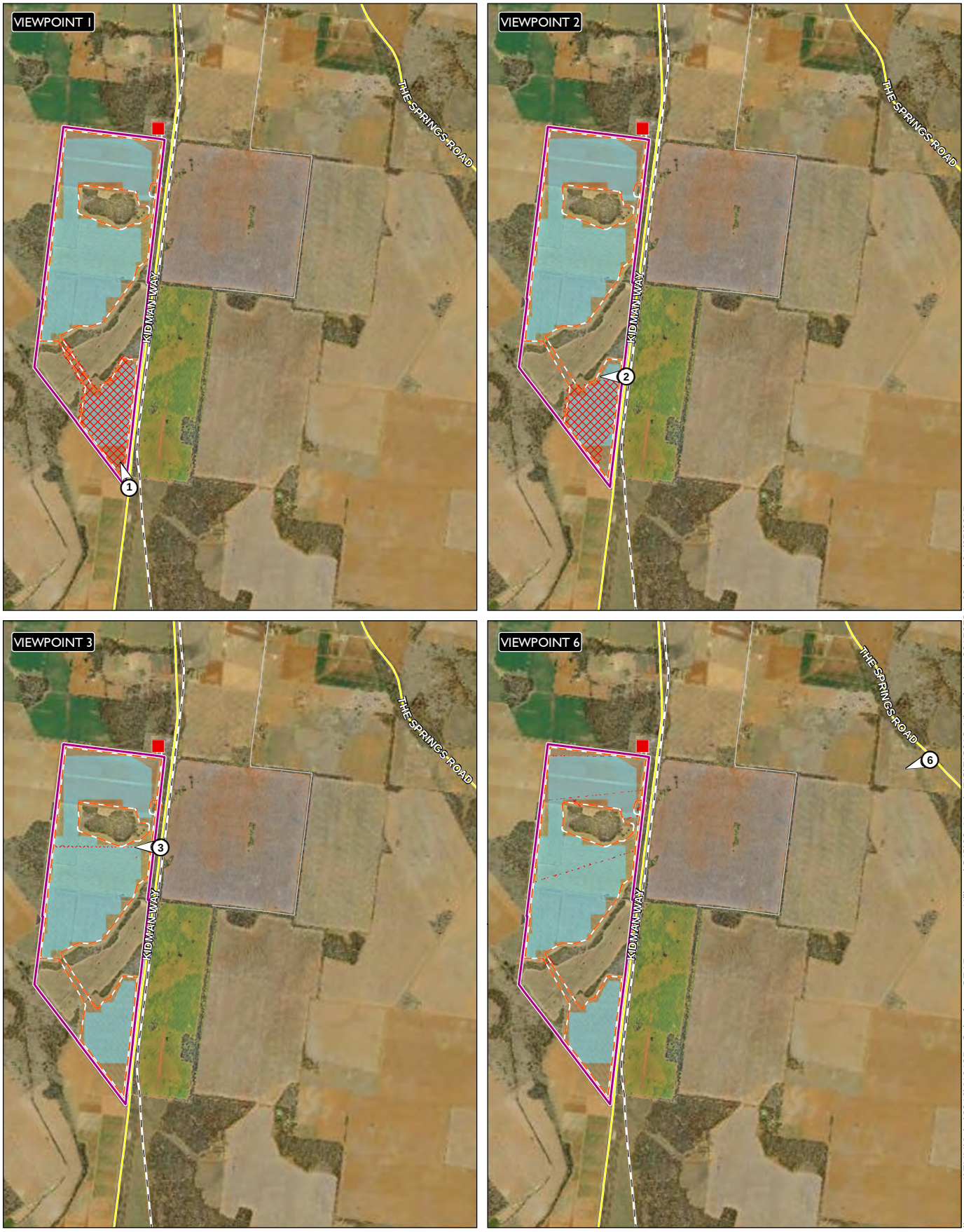
An assessment of the selected viewpoints in accordance with the methodology outlined in Chapter 2 of this report is presented in the following sections.

5.3.1 Viewshed analysis

To determine potential visibility of project infrastructure, a viewshed analysis was completed. The results of the viewshed analysis are presented in Figure 5.3. The viewshed analysis indicates that project infrastructure may be visible from seven of the nine viewpoints assessed, viewpoints 1, 2, 3, 6, 7, 8 and 9.

The viewshed analysis simulates the effects of existing vegetation (based on aerial imagery and ground-truthing) on screening views. A review of aerial imagery indicates that the majority of rural residential dwellings surrounding the site feature extensive vegetation screens on their boundaries. These screens would mitigate dust and noise impacts from existing intensive agriculture-related activities on land adjacent to these dwellings, such as, crop harvesting. A key observation made during the site survey conducted on 8 December 2016 was that the presence of vegetation screens, as well as stands of both scattered and more dense vegetation between the site and most dwellings means that views to the site are typically at least partially obstructed from most locations, with the exception of views of the site from R17 (Viewpoint 8) and parts of Kidman Way. The results of the viewshed analysis confirmed these observations.

With the exception of R17 (Viewpoint 8), all nearby sensitive receptors are shielded from views of the project infrastructure to some degree by vegetation immediately surrounding each of the dwellings and/or remnant vegetation between the site boundary and these dwellings.



KEY

Source: EMM (2017); GA (2016); LPMA (2011)

- Site boundary
- Development footprint
- Conceptual infrastructure layout
- Hillston substation (132kV)
- Rail line
- Main road
- Local road
- Modelled visible areas within the development footprint from viewpoint
- Viewpoint location and direction

N

0 1 2 km

GDA 1994 MGA Zone 55

Viewshed analysis within the development footprint from viewpoints 1, 2, 3 and 6

Limondale Sun Farm
Visual impact assessment
Figure 5.3

EMM

\\emmsvr1\EMMJobs\2016\U16135 - Solar farm SEARs request Hillston\GIS\02_Maps_EIS\EIS012_ViewshedsA_20170524_03.mxd 24/05/2017

KEY

Source: EMM (2017); GA (2016); LPMA (2011)

- Site boundary
- Development footprint
- Conceptual infrastructure layout
- Hillston substation (132kV)
- Rail line
- Main road
- Local road
- Modelled visible areas within the development footprint from viewpoint
- Viewpoint location and direction

N

0 1 2 km

GDA 1994 MGA Zone 55

EMM

Viewshed analysis within the development footprint from viewpoints 7, 8 and 9

Limondale Sun Farm
Visual impact assessment
Figure 5.4

\\emmsvr1\EMMJobs\2016\J16135 - Solar farm SEARs request Hillston\GIS\02_Maps_EIS\EIS013_ViewshedsB_20170524_04.mxd 24/05/2017

5.3.2 Viewpoint 1 – southern site boundary from Kidman Way

Table 5.2 Viewpoint 1 – southern site boundary from Kidman Way

Viewpoint details	This viewpoint, shown in Photograph 5.1, is on the western side of Kidman Way looking north-west towards the site. Photograph 5.1 was taken on the road shoulder approximately 40 m from the site's south-eastern boundary. The view direction in the photograph is to the north-west.
View type and context	Views from this location represent a typical rural setting with a predominantly flat expanse of cleared, agricultural land. The existing 132 kV transmission line is a prominent visual feature at this location, as seen in Photograph 5.1. A minimal amount of tree planting exists in the foreground with increased vegetation present in the background.
Visibility baseline assessment	The results of the viewshed analysis indicate that parts of the development footprint will be visible from this viewpoint (Figure 5.3). As part of this VIA, Viewpoint 1 was selected for preparation of a photomontage. Photomontages enable potential visual changes from a viewpoint to be illustrated on a photograph, with the objective of simulating the visual extent of project infrastructure, once constructed. Viewpoint 1 was selected as it is representative of viewers on Kidman Way and project infrastructure is predicted to be visible based on the results of the viewshed analysis (Figure 5.3). The existing view from Viewpoint 1 is shown in Photograph 5.1. The photomontage conservatively assumes the height of the perimeter fencing will be 2.4 m. The dominant project infrastructure, the PV solar panels, is shown at a height of 2.1 m in Photograph 5.2. As noted in Section 4.4, the PV solar panels will be constructed in a single axis tracking configuration, which will allow the PV solar panels to rotate from east to west during the day tracking the sun's movement. Therefore, the average height of the PV solar panels will be approximately 1.2 m. Consequently, it is assumed that the actual visible extent of project infrastructure from Viewpoint 1 will be less than the area highlighted in Photograph 5.2 for the majority of the daytime tracking period.
Magnitude of change	**Moderate** – While the project infrastructure will add new features to the visual landscape, views will be predominantly from motorists travelling along Kidman Way. Assuming that motorists are travelling at the prescribed speed limit of 100 km/h along Kidman Way, it is estimated that travelling motorists would be exposed to views of the project's infrastructure for no more than 52 seconds over a distance of 1.45 km. Project infrastructure will not be the primary view from this viewpoint, as it is assumed the focus of motorists will be in line with their direction of travel along Kidman Way. Roadside vegetation will not be impacted at this location.
Visual sensitivity	**Low** – due to its agricultural landscape character, absence of sensitive land use designations (RU1 Primary Production) and status as a Main Road.
Evaluation of significance	**Slight/moderate** – there would not be a significant impact from this viewpoint. Visual impacts from this viewpoint will continue throughout the life of the project.
Additional mitigation	No additional mitigation measures are warranted based on the evaluation of significance.

Photograph 5.1 **Viewpoint 1 – southern site boundary from Kidman Way**

\\emmsvr1\EMM\Jobs\2016\J16135 - Solar farm SEARs request Hillston\GIS\02_Maps_VIA\VIS005_PhotoVP1_20170706_01.mxd 6/07/2017

Viewpoint 1 – potential visible extent of project infrastructure

Hillston Sun Farm

Visual impact assessment

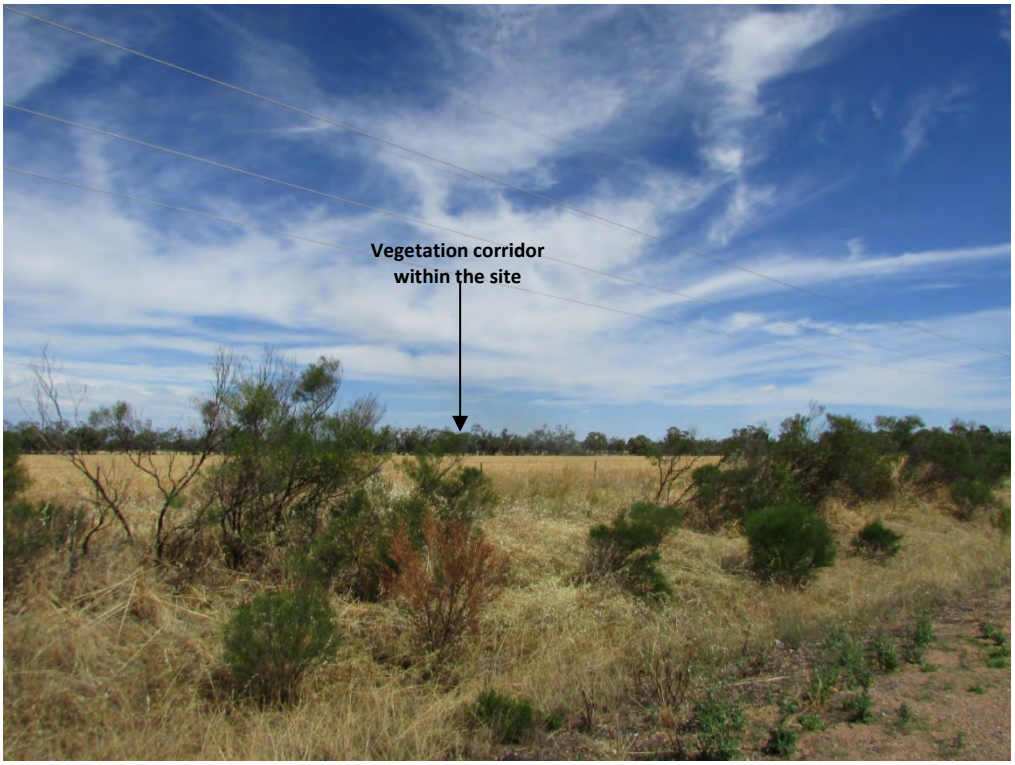
Photograph 5.2

EMM

5.3.3 Viewpoint 2 – Kidman Way

Table 5.3 Viewpoint 2 – Kidman Way

Viewpoint details	This viewpoint, shown in Photograph 5.3, is on Kidman Way. The site is visible to the west of Kidman Way. Photograph 5.3 was taken on the road shoulder approximately 40 m from the site boundary.
View type and context	Views from this location represent a typical rural setting with a predominantly flat expanse of cleared, agricultural land. The 132 kV transmission line is a prominent visual feature at this location. Roadside vegetation is present in the foreground of Photograph 5.3. Vegetation present in the background of Photograph 5.3 is part of the vegetation corridor on the site that would be retained. The level of tree planting in the foreground along this part of Kidman Way is variable with tree planting visibly increasing and becoming more dense to the north (Photograph 5.4) and visibly decreasing and becoming less dense to the south (Photograph 5.5).
Visibility baseline assessment	The results of the viewshed analysis indicate that parts of the development footprint will be visible from this viewpoint (Figure 5.3). As part of this VIA, Viewpoint 2 was selected for preparation of a photomontage. Viewpoint 2 was selected as it is representative of viewers on Kidman Way and project infrastructure is predicted to be visible based on the results of the viewshed analysis (Figure 5.3). The existing view from Viewpoint 2 looking south along Kidman Way is shown in Photograph 5.5. The photomontage conservatively assumes the height of the perimeter fencing will be 2.4 m. The dominant project infrastructure, the PV solar panels, is shown at a height of 2.1 m in Photograph 5.6. As noted in Section 4.4, the PV solar panels will be constructed in a single axis tracking configuration, which will allow the PV solar panels to rotate from east to west during the day tracking the sun's movement. Therefore, the average height of the PV solar panels will be approximately 1.2 m. Consequently, it is assumed that the actual visible extent of project infrastructure from Viewpoint 2 will be less than the area highlighted in Photograph 5.6 for the majority of the daytime tracking period.
Magnitude of change	**Moderate** – the extent of the visual landscape affected by project infrastructure will be mitigated by the presence of existing vegetation, although infrastructure will be visible through gaps in vegetation in the foreground. The degree of shielding from vegetation will increase in some areas where roadside vegetation is more dense. Roadside vegetation will not be impacted at this location. Views at this location will be from motorists. Assuming that motorists are travelling at the prescribed speed limit of 100 km/h along Kidman Way, it is estimated that travelling motorists would be exposed to views of the project's infrastructure for no more than 9 seconds if travelling north (over a distance of approximately 250 m), and 43 seconds if travelling south (over a distance of approximately 1.2 km). As evident in Photograph 5.4, the verges along the western side of Kidman Way north of this viewpoint increase in elevation compared to the level of the road. Given the low height of the project's infrastructure, it is likely that partial screening would also be provided by these elevated verges in some areas. Project infrastructure will not be the primary view from this viewpoint, as it is assumed the focus of motorists will be in line with their direction of travel along Kidman Way.
Visual sensitivity	**Low** – due to its agricultural landscape character, absence of sensitive land use designations (RU1 Primary Production) and status as a Main Road.
Evaluation of significance	**Slight/moderate** – there would not be a significant impact from this viewpoint. Visual impacts from this viewpoint will continue throughout the life of the project.
Additional mitigation	No additional mitigation measures are warranted based on the evaluation of significance.



Photograph 5.3 **Viewpoint 2 – looking west towards the development footprint**

Photograph 5.4 **View looking north along Kidman Way from Viewpoint 2**

Photograph 5.5 View looking south along Kidman Way from Viewpoint 2

\\emmsvr1\EMM\Jobs\2016\J16135 - Solar farm SEARs request Hillston\GIS\02_Maps_VIA\VIS006_PhotoVP2_20170706_01.mxd 6/07/2017

Viewpoint 2 – potential visible extent of project infrastructure

Hillston Sun Farm

Visual impact assessment

Photograph 5.6

EMM

5.3.4 Viewpoint 3 – Kidman Way looking west towards the development footprint

Table 5.4 Viewpoint 3 – Kidman Way looking west towards the development footprint

Viewpoint details	This viewpoint, shown in Photograph 5.7, is on the western side of Kidman Way, looking west. Photograph 5.7 was taken on the road shoulder approximately 40 m from the site's eastern boundary. The view direction of the photograph is to the west.
View type and context	Views from this location are dominated by tree planting in the foreground, which increases in height in the mid-ground.
Visibility baseline assessment	The results of the viewshed analysis indicate that parts of the development footprint will be visible from this viewpoint (Figure 5.3).
Magnitude of change	**Low** – the extent of the view affected will be limited by the density of tree plantings between the road surface edge and the site's eastern boundary and the low height of the project infrastructure. Viewers at this location will have intermittent views of the project infrastructure. Roadside vegetation which provides shielding of views will not be impacted. Views at this location will be from motorists. As evident in Photograph 5.8, the verges along the western side of Kidman Way north of this viewpoint are elevated from the level of Kidman Way. Given the relatively low height of the PV panels, it is likely that the existing elevated verges would provide further screening. Project infrastructure will not be the primary view from this viewpoint, as it is assumed the focus of motorists will be in line with their direction of travel along Kidman Way.
Visual sensitivity	**Low** – due to its agricultural landscape character, absence of sensitive land use designations (RU1 Primary Production) and status as a Main Road.
Evaluation of significance	**Slight –** there would not be a significant impact from this viewpoint. Visual impacts from this viewpoint will continue throughout the life of the project.
Additional mitigation	No additional mitigation measures are warranted based on the evaluation of significance.

Photograph 5.7 Viewpoint 3 – Kidman Way looking west towards the development footprint

Photograph 5.8 View looking north along Kidman Way from Viewpoint 3

5.3.5 Viewpoint 4 – access point for the Hillston Substation

Table 5.5 Viewpoint 4 – access point for the Hillston Substation

Viewpoint details	This viewpoint, shown in Photograph 5.9, is at Essential Energy's Hillston Substation, looking south towards the site. Photograph 5.10 illustrates the existing electricity infrastructure of the Hillston Substation.
View type and context	Views from this location are dominated by the Hillston Substation and associated transmission line infrastructure. The existing 132 kV transmission line is visible in Photograph 5.9. Due to the density of tree plantings between the road surface edge and the Hillston Substation, views of the Hillston Substation from motorists travelling along Kidman Way are limited. The location is publically accessible, but would typically only be accessed by electricity workers accessing the substation. It is noted that close to this location, a number of transmission lines pass directly over Kidman Way connecting to the substation, which are noticeable features within the proximity of this viewpoint.
Visibility baseline assessment	The results of the viewshed analysis indicate that infrastructure in the development footprint will not be visible from this viewpoint.

Table 5.5 Viewpoint 4 – access point for the Hillston Substation

Magnitude of change	**Low –** as evident in Photograph 5.9, mature vegetation between the site's northern boundary and the access point for the Hillston Substation will provide a significant level of screening to the project's infrastructure. The position of the overhead transmission line to connect the project to the Hillston Substation has not yet been finalised, but it is likely that this will be visible from this location. However, this transmission line will be designed to integrate with existing elements at this location, having regard to form, height and colour. Further, the project infrastructure will not be the primary view for receptors at this viewpoint as it is assumed that their focus will be on the Hillston Substation (Photograph 5.10) and associated infrastructure.
Visual sensitivity	**Low –** due to its industrial landscape character and the absence of sensitive land use designations (RU1 Primary Production). The access point is predominantly utilised by Essential Energy employees and contractors working on the Hillston Substation and associated infrastructure. Subsequently, any views of the project infrastructure would be experienced by a limited number of receptors and the length of view would be restricted to the amount of time spent working in the vicinity of this viewpoint. Views of the project infrastructure from motorists travelling south along Kidman Way close to the access point for the Hillston Substation will be obstructed by tree plantings along the western edge of Kidman Way.
Evaluation of significance	**Slight –** there would not be a significant impact from this viewpoint. Visual impacts from this viewpoint will continue throughout the life of the project.
Additional mitigation	No additional mitigation measures are warranted based on the evaluation of significance.

Photograph 5.9 Viewpoint 4 – looking south towards the site from the Hillston 132 kV Substation

Photograph 5.10 Existing infrastructure at the Hillston Substation

5.3.6 Viewpoint 5 – Kidman Way, north of the site

Table 5.6 Viewpoint 5 – Kidman Way, north of the site

Viewpoint details	This viewpoint is within proximity of the three closest private rural residential properties to the site and project infrastructure (R1, R2 and R3, see Figure 5.2). Photograph 5.11 was taken close to the driveway of R1 and R2 on the western side of Kidman Way, approximately 850 m from the site's north-eastern boundary. The view direction of the photograph is to the south-west.
View type and context	The landscape is dominated by flat grasslands and a rural character. There are two stands of dense, mature native vegetation in the vicinity of this viewpoint, one of which is between the dwellings and the site, and is visible in the background of Photograph 5.11, forming a screen between R1 and R2. A transmission line is also visible in the background. Views towards the project infrastructure at the northern end of the development footprint will be screened by existing vegetation.
Visibility baseline assessment	The results of the viewshed analysis indicate that infrastructure in the development footprint will not be visible from this viewpoint.
Magnitude of change	**Negligible –** viewers at this location will not have views of the project infrastructure due to the existing intermittent tree planting within the landscape.
Visual sensitivity	**Moderate –** due to the presence of rural dwellings.
Evaluation of significance	**Slight –** there would not be a significant impact from this viewpoint.
Additional mitigation	No additional mitigation measures are warranted based on the evaluation of significance.

Photograph 5.11 Viewpoint 5 – looking south-west from the Kidman Way towards R2

5.3.7 Viewpoint 6 – The Springs Road looking south-west toward the site

Table 5.7 Viewpoint 6 – The Springs Road looking south-west toward the development footprint

Viewpoint details	This viewpoint, shown in Photograph 5.12, is on The Springs Road looking south-west, and was taken on the road shoulder approximately 3 km from the site's north-eastern boundary. The view direction of the photograph is to the south-west.
View type and context	Immediate views from this location represent a typical rural setting with a large expanse of predominantly flat and cleared agricultural land. Mature paddock trees are visible in the mid-ground in the left side of the view, while a stand of mature vegetation along a paddock boundary approximately 600 m is visible on the left side of the view. The site is a further 2.5 km beyond these paddock boundary trees. The mature vegetation that exists between this viewpoint and the project, plus the considerable viewing distance of close to 3 km, will provide a significant level of screening of project infrastructure.
Visibility baseline assessment	The results of the viewshed analysis indicate that parts of the development footprint will be visible from this viewpoint (Figure 5.3).
Magnitude of change	**Negligible –** it is unlikely that viewers at this location will have views of the project infrastructure due to the distance from the site, existing intermittent tree planting within the landscape and the height of the project infrastructure. In addition, seasonal variability in cropping and crop height on the agricultural land between the site and this location will further reduce any potential views of the project infrastructure from this location.
Visual sensitivity	**Low –** due to its agricultural landscape character, absence of sensitive land use designations (RU1 Primary Production) and status as an unclassified road. Views at this location will be from motorists travelling on The Springs Road. Furthermore, it is assumed the focus of motorists will be in line with their direction of travel along The Springs Road rather than on project infrastructure.

Table 5.7 Viewpoint 6 – The Springs Road looking south-west toward the development footprint

Evaluation of significance	**Negligible** – there would not be a significant impact from this viewpoint.
Additional mitigation	No additional mitigation measures are warranted based on the evaluation of significance.

Photograph 5.12 Viewpoint 6 – view from The Springs Road looking south-west toward the site

5.3.8 Viewpoint 7 – dwelling east of Kidman Way looking north-west toward the development footprint

Table 5.8 Viewpoint 7 – dwelling east of Kidman Way looking north-west toward the development footprint

Viewpoint details	This viewpoint, shown in Photograph 5.13, is within proximity of the two closest private rural residential properties to the site's south-eastern boundary (R14 and R15 in Figure 5.2). Photograph 5.13 was taken from the private driveway of R14 approximately 1.6 km east of Kidman Way, and approximately 1.7 km from the site's south-eastern boundary. The view direction of the photograph is to the north-west.
View type and context	Immediate views from this location represent a typical rural setting with a large expanse of predominantly flat and cleared agricultural land. Mature tree plantings exist along the access road from Kidman Way in the foreground and in the background. An extensive screen of paddock boundary tree plantings (visible in the background of Photograph 5.13) exist between this viewpoint and Kidman Way. Views towards the project infrastructure at the southern end of the development footprint will be screened by existing tree planting within the landscape. Further, the relatively low height of the project infrastructure would limit the potential for any views from this location.
Visibility baseline assessment	The results of the viewshed analysis indicate that parts of the development footprint will be visible from this viewpoint (Figure 5.4).
Magnitude of change	**Negligible –** viewers at this location will not have views of the project infrastructure due to the existing intermittent tree planting within the landscape.

Table 5.8 Viewpoint 7 – dwelling east of Kidman Way looking north-west toward the development footprint

Visual sensitivity	**Moderate –** due to its agricultural landscape character, absence of sensitive land use designations (RU1 Primary Production) and presence of nearby rural dwellings.
Evaluation of significance	**Slight –** there would not be a significant impact from this viewpoint.
Additional mitigation	No additional mitigation measures are warranted based on the evaluation of significance.

Photograph 5.13 Viewpoint 7 – from driveway of dwelling R14, east of Kidman Way looking north-west toward the site

5.3.9 Viewpoint 8 – dwelling east of Lachlan Valley Way looking east toward the development footprint

Table 5.9 Viewpoint 8 – dwelling east of Lachlan Valley Way looking east toward the development footprint

Viewpoint details	This viewpoint, shown in Photograph 5.14, is within proximity of the closest private rural residential property to the site's western boundary (R17 in Figure 5.2). Photograph 5.14 was taken from R17, approximately 1.6 km from the site's western boundary. The view direction of the photograph is to the east.
View type and context	Immediate views from this location represent a typical rural setting with a large expanse of predominantly flat and cleared agricultural land (Photograph 5.14). Mature tree plantings exist in the background and during the site inspection on 3 May 2017, it was noted that vegetation becomes more prominent when looking south-east toward the development footprint close to this location. From this viewpoint, it is apparent that R17 has a significant level of vegetation along its western boundary, which would likely screen some views of the project infrastructure from this dwelling. Nonetheless, views directly east towards the project infrastructure at the northern end of the development footprint may be possible from this viewpoint.

Table 5.9 Viewpoint 8 – dwelling east of Lachlan Valley Way looking east toward the development footprint

Visibility baseline assessment	The results of the viewshed analysis indicate that parts of the development footprint will be visible from this viewpoint (Figure 5.4). As part of this VIA, Viewpoint 8 was selected for preparation of a photomontage. Viewpoint 8 was selected as it is representative of a sensitive receptor (ie dwelling) west of the site, R17, approximately 1.6 km from the site's western boundary. Based on the results of the viewshed analysis, project infrastructure is predicted to be visible from this viewpoint (Figure 5.4). The existing view from Viewpoint 8 is shown in Photograph 5.14. The dominant project infrastructure, the PV solar panels, is shown at a height of 2.1 m in Photograph 5.15. As noted in Section 4.4, the PV solar panels will be constructed in a single axis tracking configuration, which will allow the PV solar panels to rotate from east to west during the day tracking the sun's movement. Therefore, the average height of the PV solar panels will be approximately 1.2 m. Consequently, it is assumed that the actual visible extent of project infrastructure from Viewpoint 8 will be less than the area highlighted in Photograph 5.15 for the majority of the daytime tracking period.
Magnitude of change	**Moderate –** the relatively low height of the project infrastructure and distance to the site will limit the scale of change and degree of contrast for any views from this location. Further, seasonal variability in cropping and crop height on the agricultural land between the site and this location will also reduce the scale of change and degree of contrast experienced at this location. Motorists travelling along Lachlan Valley Way close to this viewpoint may experience views of the project infrastructure. However, project infrastructure will not be the primary view from this viewpoint due to the distance to the site (1.9 km), as well as the assumption that the focus of motorists will be in line with their direction of travel (south-west or north-east) along Lachlan Valley Way.
Visual sensitivity	**Moderate** – due to its agricultural landscape character, absence of sensitive land use designations (RU1 Primary Production), presence of a private rural residential property and the classification of Lachlan Valley Way as a main road.
Evaluation of significance	**Moderate** – there would not be a significant impact from this viewpoint. Visual impacts from this viewpoint will continue throughout the life of the project.
Additional mitigation	A conceptual landscaping plan is shown in Figure 4.2, which presents landscaping options either adjacent to the fenceline at receptor R17 (option A), or along the western boundary of the northern portion of the site (option B). Either of these options would reduce the visibility of project infrastructure from R17.

Photograph 5.14 **Viewpoint 8 – dwelling east of Lachlan Valley Way looking east toward the development footprint**

\\emmsvr1\EMM\Jobs\2016\J16135 - Solar farm SEARs request Hillston\GIS\02_Maps_VIA\VIS007_PhotoVP8_20170706_01.mxd 6/07/2017

Viewpoint 8 – potential visible extent of project infrastructure

Hillston Sun Farm

Visual impact assessment

Photograph 5.15

EMM

5.3.10 Viewpoint 9 – Norwood Lane looking south-west towards the site

Table 5.10 Viewpoint 9 – Norwood Lane looking south-west towards the site

Viewpoint details	This viewpoint, shown in Photograph 5.16, is approximately 1 km from the north-eastern corner of the site boundary. It is representative of views from up to nine dwellings to the north-east of the site, at distances from 1.1-2.9 km from the northern-eastern corner of the site boundary. Photograph 5.16 was taken from Norwood Lane (Figure 5.2) The view direction of the photograph is to the south-west.
View type and context	Immediate views from this location represent a typical rural setting with a large expanse of predominantly flat and cleared agricultural land. Vegetation is present in the foreground, with the vegetation corridor along Kidman Way visible in the background, approximately 1 km from the viewpoint (Photograph 5.16). From this viewpoint and associated dwellings, there are several stands of paddock boundary trees, as well as vegetation present around the dwellings, which would act to screen views of the site, together with increasing distance.
Visibility baseline assessment	The results of the viewshed analysis indicate that a very minimal extent of the development footprint will be visible from this viewpoint (Figure 5.4).
Magnitude of change	**Negligible** – the relatively low height of the project infrastructure and distance to the site, coupled with substantial roadside vegetation present along Kidman Way between the viewpoint and development footprint will limit the scale of change and degree of contrast for any views from this location. Further, seasonal variability in cropping and crop height on the agricultural land between the site and this location will also reduce the scale of change and degree of contrast experienced at this location.
Visual sensitivity	**Moderate** – due to its agricultural landscape character, absence of sensitive land use designations (RU1 Primary Production), and presence of rural dwellings.
Evaluation of significance	**Slight** – there would not be a significant impact from this viewpoint.
Additional mitigation	No additional mitigation measures are warranted based on the evaluation of significance.

Photograph 5.16 Viewpoint 9 – Norwood Lane looking south-west towards the site

5.4 Reflectivity and glare

A number of different sources indicate that, in general, as little as 2% of the light received is reflected by PV solar panels (NSW DoI DRE 2016; Solar Trade Association 2016; FAA 2010). As noted by both the Federal Aviation Administration of the United States (FAA 2010) and Spaven Consulting (2011), this degree of reflectivity is less than the reflectivity produced by a wide variety of different surfaces, including surfaces within the immediate vicinity of the project's development footprint, such as bare soil and vegetation, and is similar to the reflectivity of smooth bodies of water.

The potential impacts of reflectivity on sensitive receptors, primarily motorists travelling along Yanga Way, are glint and glare. Glint refers to shorter period and more intense levels of exposure, while glare refers to sustained or continuous periods of exposure to excessive brightness, but at a reduced level of intensity (Morelli 2014). The amount of glint and glare produced by a PV solar panel is variable and is dependent on the angle of the panels, with lower angles producing less glint and glare (Morelli 2014). As described above, the project's PV solar panels will be constructed in a single axis tracking configuration. This configuration will allow the PV solar panels to rotate from east to west during the day tracking the sun's movement. Consequently, the degree of glint and glare experienced by sensitive receptors will be variable depending on the time of day and viewing location.

Spaven Consulting (2011) prepared a report to assess the potential impact of solar photovoltaic energy facilities located in off-airfield situations. Within this report, the potential for glare to pilots caused by sunlight reflected by PV solar panels was identified as the only significant aviation issue likely to be raised by PV solar energy facilities (Spaven Consulting 2011). As noted within this report, PV solar energy facilities positioned away from airports and airfields are unlikely to present problems to pilots, with the only potential hazards likely to be encountered during the critical phases of flight, namely approach and landing (Spaven Consulting 2011). The report also concluded that there was no evidence at the time of publication of glare from any existing PV solar energy facilities affecting pilots and no cases of accidents in which glare caused by a PV solar energy facility was cited as a factor (Spaven Consulting 2011).

As noted in Section 3.5, the Hillston Airport is located approximately 2.7 km north of the site. The Hillston Airport runway is positioned in an approximate east-west orientation (refer to Figure 3.1).

Due to the distance between the Hillston Airport and the site, it is unlikely that aircraft using this facility will pass directly over the site during the critical phases of flight as identified in the report produced by Spaven Consulting (2011). OVERLAND consulted with the Civil Aviation Safety Authority (CASA) during the preparation of this VIA to discuss the potential impact of the project on flights to and from the Hillston Airport. As part of this consultation, CASA acknowledged that "*modern solar panels are designed to absorb and not reflect light. CASA's experience to date is that despite the large number of solar farms being developed around Australia – some on airports themselves – there have been no pilot reports of glare or of any safety issues or concerns related to these solar farms*". During consultation for a separate large-scale solar PV generation facility in NSW, CASA recommended that an anti-glare coating be applied to the PV solar panels to minimise any potential residual glare. As noted in Section 4.4, the panel designs considered for the project, feature anti-reflective surface treatment. In addition, consultation with Carrathool Shire Council's Town Overseer confirmed that it is unlikely the project will have any impact on aircraft landing at the Hillston Airport.

A scoping exercise was conducted by Solar Trade Association (2016) to help inform debates around development proposals for non-domestic solar PV developments in Scotland. The exercise identified a variety of examples of airports successfully operating with large installations of PV solar panels on airport-related infrastructure, adjacent to airport runways and/or under direct flight paths (Solar Trade Association 2016). REC PV solar panels are currently in use at the Giebelstadt Power Plant in Germany, which features 120,000 PV solar panels with a total capacity of 28 MW. This project is located adjacent to an airport currently used for general aviation purposes. Within the United States, four separate arrays of PV solar panels envelop the Denver International Airport, with a combined capacity of approximately 10 MW.

Within Australia, Adelaide Airport's Terminal One roof supports 760 PV solar panels with a capacity of 114 kW and Darwin Airport features a 4 MW solar farm, which includes 15,000 PV solar panels over 6 ha. In addition, the Ballarat Solar Park, which has an installed capacity of 300 kW, is positioned adjacent to the boundary of the Ballarat Airport.

The potential for low angled reflected sunlight to cause a distraction to drivers travelling along Kidman Way was considered as part of the traffic impact assessment for the project (Appendix H of the EIS). There is sufficient vegetative screening provided by existing roadside vegetation between the site boundary and Kidman Way along the northern portion of the site. In these areas, roadside vegetation is generally between 50-60 m deep. Along the southern portion of the site, the existing roadside vegetation is sparser and direct views of the site are possible. Notwithstanding, due to the anti-reflective properties of the PV solar panels, they are not expected to cause a distraction to motorists on Kidman Way due to glint and glare.

Based on the findings of previous assessments prepared for PV solar energy facilities, glint and glare from the project's PV solar panels are not expected to significantly impact the following:

- sensitive receptors within the vicinity of the site;
- people engaged in agricultural activities in the surrounding landscape;
- motorists travelling along the major road corridors of Kidman Way, Lachlan Valley Way or The Springs Road;
- motorists travelling along a number of minor unsealed rural property access roads and farm tracks; and
- aircraft arriving at or departing from the Hillston Airport.

5.5 Community perceptions of large-scale solar developments

Both Ipsos (2015) and NSW Office of Environment and Heritage (OEH) (2015) have conducted separate investigations in to the acceptability of large scale solar facilities in Australia and NSW, respectively. Ipsos (2015) noted that, in contrast to wind farms, large scale PV solar facilities do not trigger strong reactions from neighbouring members of the community. In a survey of approximately 1,200 Australians, a slightly higher proportion of participants agreed that large scale solar facilities have a negative visual impact on the local landscape when compared with participants who disagreed (Ipsos 2015). However, a higher proportion neither agreed nor disagreed, which indicates a lack of knowledge about the potential visual impact of such facilities.

As part of an investigation in to community attitudes to renewable energy, OEH surveyed 2,000 adults from across NSW, with the majority of survey participants supporting the use of solar farms (OEH 2015). Of the small proportion of participants who opposed solar farms being located near their place of residence, visual impacts were one of the key concerns raised. This finding provides further evidence of the need for effective community consultation to ensure that surrounding landholders are adequately informed of the impact of the project on the surrounding landscape.

Community consultation as part of the project has focused on informing surrounding landholders of the development footprint and the likely visual impact of the project infrastructure on the local landscape. This has included the provision of images of PV solar panels, inverters and other associated infrastructure. To assist with their interpretations of the scale of the project, the development footprint has been converted using easy-to-visualise descriptors, such as football fields, during community consultation activities.

The results of this VIA indicate that the project will have a negligible visual impact on the majority of the surrounding sensitive receptors. Landscaping is proposed to reduce the visibility of project infrastructure from R17 (refer to Section 4.7.1).

5.6 Summary of visual assessment

A summary of the results of the analysis of visual impacts for each of the eight viewpoints is provided in Table 5.11.

Table 5.11 Summary of results of visual impacts at each viewpoint

Viewpoint	Distance to site	Project infrastructure visible based on viewshed analysis	Magnitude of change	Visual sensitivity	Evaluation of significance	Significant impact?	Additional mitigation required?
Viewpoint 1	40 m	Yes	Moderate	Low	Slight/ moderate	No	No
Viewpoint 2	40 m	Yes	Moderate	Low	Slight/ moderate	No	No
Viewpoint 3	40 m	Yes	Low	Low	Slight	No	No
Viewpoint 4	150 m	No	Low	Low	Slight	No	No
Viewpoint 5	850 m	No	Negligible	Moderate	Slight	No	No
Viewpoint 6	3 km	Yes	Negligible	Low	Negligible	No	No
Viewpoint 7	1.7 km	Yes	Negligible	Moderate	Slight	No	No
Viewpoint 8	1.6 km	Yes	Moderate	Moderate	Moderate	No	Yes
Viewpoint 9	1 km	Yes	Negligible	Moderate	Slight	No	No

6 Conclusion

A visual assessment has been conducted from a number of representative viewpoints surrounding the site and the project's development footprint. The viewpoints were selected to represent views close to private residential properties, road corridors (ie Kidman Way, The Springs Road and Lachlan Valley Way) and infrastructure nearest to the site and the project's development footprint.

Nine viewpoints have been assessed to demonstrate the visual impacts of the project. Due to existing mature vegetation in the landscape and the relatively low height of the dominant project infrastructure, namely the PV solar panels, the project's infrastructure will be relatively shielded from view at a number of the viewpoints assessed as part of this VIA, with the exception of views of the site from one rural residential property (R17) and parts of Kidman Way.

The project design, development footprint and placement of infrastructure have progressively evolved to minimise or avoid visual impacts. Nonetheless, the development of the project will result in some changes to the landscape. Visual impacts will occur during the construction and operational stages of the project. The visual landscape will be altered from its current state for the duration of the operational stage of the project.

The visual assessment determined that, of the viewpoints assessed, infrastructure may be visible to varying degrees from seven viewpoints; viewpoints 1, 2, 3, 6, 7, 8 and 9. The distance of the development footprint from these viewpoints ranges from 40 m to 3 km. Based on the presence of vegetation, combined with the relatively low height of the project's infrastructure, visual impacts will be minimal from the majority of these viewpoints.

While significant impacts are not expected from sensitive receptors, consultation with the property owner of receptor R17 (the only dwelling from which direct views of the project are likely) has determined that consideration of landscaping to minimise views of project infrastructure where possible, is required.

This visual assessment concludes that the project will not have any significant adverse visual impacts on the locality.

Abbreviations

Carrathool LEP	Carrathool Local Environmental Plan 2012
CASA	Civil Aviation Safety Authority
DA	development application
DPE	NSW Department of Planning and Environment
EIS	environmental impact statement
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
GLVIA	Guidelines for Landscape and Visual Impact Assessment
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometres
kV	kilovolt
LEP	local environmental plan
LGA	local government area
mm	millimetre
MW	megawatt
OEH	NSW Office of Environment and Heritage
OVERLAND	OVERLAND Sun Farming Pty Ltd
PV	photovoltaic
RMS	NSW Roads and Maritime Services
SEARs	Secretary's Environmental Assessment Requirements
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SSD	State significant development
VA Bulletin	Wind Energy: Visual Assessment Bulletin AB 01 For State significant wind energy development
VIA	visual impact assessment

References

Australian Bureau of Statistics (ABS) 2013, 2011 Census Quick Stats: Carrathool (Local Government Area), viewed 29 August 2016, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/LGA11600?opendocument&navpos=220.

Federal Aviation Administration 2010, *Technical Guidance for Evaluating Selected Solar Technologies on Airports.*

Ipsos 2015, *Establishing the social licence to operate large scale solar facilities in Australia: Insights from social research for industry,* Australian Renewable Energy Agency.

Landscape Institute and Institute of Environmental Management and Assessment 2013, *Guidelines for Landscape and Visual Impact Assessment (GLVIA) Third Edition.*

Morelli, C 2014, *Glint and Glare Assessment for the proposed Mynthurst Farm Solar Park Photovoltaic Array*. Report prepared by AARDVaRC Ltd for Mynthurst Farms Ltd.

NSW Department of Industry - Division of Resources and Energy (DoI-DRE) 2016, *Fact Sheet – Solar Farms in NSW.*

NSW Department of Planning and Environment 2016, *Wind Energy: Visual Assessment Bulletin AB 01 For State significant wind energy development,* NSW Government.

NSW Office of Water 2011, *Water resources and management overview – Lachlan catchment.*

NSW Office of Environment and Heritage (OEH) 2015, *Community Attitudes to Renewable Energy in NSW*.

2016, Riverina – landform, viewed 31 March 2017, http://www.environment.nsw.gov.au/bioregions/Riverina-Landform.htm.

NSW Roads and Maritime Services (RMS) 2016, NSW Livestock Loading Scheme maps, viewed 21 December 2016, http://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/livestock/index html.

Solar Trade Association 2016, *Impact of Solar PV on Aviation and Airports.*

Spaven Consulting 2011, *Solar Photovoltaic Energy Facilities: Assessment of Potential for Impact on Aviation.*

Transport for NSW (TfNSW) 2016, $400 million Fixing Country Rail on track to delivery, viewed 1 September 2016, http://www.transport.nsw.gov.au/media-releases/400-million-fixing-country-rail-track-delivery.

SYDNEY
Ground floor, Suite 01, 20 Chandos Street
St Leonards, New South Wales, 2065
T 02 9493 9500 F 02 9493 9599

NEWCASTLE
Level 1, Suite 6, 146 Hunter Street
Newcastle, New South Wales, 2300
T 02 4907 4800 F 02 4907 4899

BRISBANE
Level 4, Suite 01, 87 Wickham Terrace
Spring Hill, Queensland, 4000
T 07 3839 1800 F 07 3839 1866