OVERLAND
SUN FARMING

Volume 1

Main Report
and Appendices A & B

Orange Grove Sun Farm
Environmental Impact Statement

Prepared for Orange Grove Sun Farm Pty Ltd
May 2018

Volume 1

Main Report

Appendices A & B

Appendix A	Secretary's Environmental Assessment Requirements
Appendix B	Consultation material

Certification

For submission of an environmental impact statement (EIS) under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979.*

EIS prepared by

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Applicant

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Proposed development

Orange Grove Sun Farm
Refer to Chapter 3 of this EIS for a description of the proposed development

Land to be developed

The legal property description of the land to be developed is given below.

Deposited plan (DP)	Lot number
945590	Lots 1 and 2
754928	Lots 27 and 30
1068520	Lots 1 and 2
1068518	Lot 3
126183	Lots 1, 2 and 3

Certification

We certify that we have prepared this EIS in accordance with the Schedule 2 of the Environmental Planning and Assessment Regulation 2000 and Secretary's environmental assessment requirements issued for the Orange Grove Sun Farm on 20 December 2017. To the best of our knowledge, it contains all available information that is relevant to the environmental assessment of the development to which the statement relates. The information contained in this EIS is neither false nor misleading.

David Richards
15/05/2018

Claire Burnes
15/05/2018

Orange Grove Sun Farm Environmental Impact Statement

Report J17210RP1 | Prepared for Orange Grove Sun Farm Pty Ltd | 15 May 2018

Prepared by	**David Richards**	**Approved by**	**Claire Burnes**
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Signature		**Signature**	
Date	15 May 2018	**Date**	15 May 2018

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Executive Summary

ES1 Project overview

OVERLAND Sun Farming Pty Ltd (OVERLAND) on behalf of Orange Grove Sun Farm Pty Ltd (the proponent) proposes to develop the Orange Grove Sun Farm, a large-scale solar photovoltaic (PV) generation facility and associated building and electrical infrastructure including grid connection works near the township of Gunnedah, in the Brigalow Belt South Bioregion of northern NSW (Figure 1.1) (the project). The project will have an estimated nominal capacity in the order of 110 MW and once operational will provide enough electricity to supply the equivalent of 30,000 homes each year (AEMC 2017).

The proponent proposes to develop the project on a site within the Gunnedah Shire local government area (LGA), approximately 12 kilometres (km) east of the township of Gunnedah. The site encompasses an area of approximately 817 hectares (ha), of which approximately 253 ha will be developed. The site has been modified by past disturbances associated with land clearing, irrigation development, cropping, livestock grazing and weed invasion, and is currently used for livestock grazing and cropping. The development footprint (253 ha) within the site boundary has been refined through the project design process to site project infrastructure to avoid environmental constraints as much as possible.

The project will connect to the TransGrid 132 kV electricity distribution network to the east of TransGrid's Gunnedah Substation (refer Figure 2.1). The development footprint has been designed to optimise the connection infrastructure required to connect the project to the electricity grid. The site's proximity to TransGrid's 132 kV transmission line avoids the need for major road crossings and minimises impacts on vegetation.

The project is a State significant development (SSD) which requires development consent under Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) from the Minister for Planning, or their delegate.

ES2 Project need

Under the guidance of the NSW Renewable Energy Action Plan (REAP), renewable energy is predicted to grow and make important contributions to the NSW economy. An important benefit of the project is its contribution to cleaner electricity generation in Australia and subsequent reductions in greenhouse gas emissions. The project is consistent with the objectives of the REAP. It will also contribute to achieving the Commonwealth Government's National Renewable Energy Target, which specifies targets for energy generated by renewable sources by 2020 (DoI-DRE 2016a).

The project will also contribute to continued growth in the total installed capacity of solar PV in both NSW and Australia. The NSW Department of Planning and Environment – Division of Resources and Energy (DPE-DRE) has identified potential for large-scale solar energy developments in the central, northern and western regions of NSW (NSW DoI-DRE 2016d). DPE-DRE (2016d) identifies ideal characteristics for large-scale solar energy as: low population densities; large, flat open spaces; and high average global solar exposure. The development footprint for the project is characterised by all of these features, which will allow the project to maximise the efficiency of electricity production, while minimising and avoiding disturbance of identified environmental constraints.

The project, in conjunction with similar large-scale investments in renewable energy, will also support two of the NSW Premier's priorities, namely creating jobs, and building infrastructure (Department of Premier and Cabinet 2017).

The project will create employment opportunities within the local region, including an average of 80 full-time equivalents (FTEs) during construction and three FTEs during the operational stage of the project.

ES3 Site selection

OVERLAND identified the site as a potential solar development in 2016, selecting land that provides an efficient electrical connection to TransGrid's 132 kV transmission line and minimises the potential for vegetation removal thereby minimising environmental impacts. The site location, capacity of the project, design and layout of infrastructure and connection to the electricity grid has been selected through consideration of key factors including:

- availability of high solar radiation;
- proximity to, and capacity of, the electricity grid. OVERLAND has been proactive in liaising with TransGrid regarding the grid connection and capacity of TransGrid's 132 kV transmission line, which has directly influenced the capacity of the project, and informed the project design and infrastructure layout;
- compatibility with the landholders' future agricultural and commercial objectives for the land;
- identification and avoidance of environmental constraints;
- availability of sufficient land area with suitable characteristics. The development footprint is predominantly cleared of native vegetation and requires limited site preparation and civil works. The proximity of the regional road network enables delivery of the infrastructure required for the project; and
- placement of infrastructure to minimise land use conflicts with other local projects and to facilitate the landholders' ongoing use of their land parcels outside of the development footprint.

ES4 Environmental assessment

ES4.1 Biodiversity

A biodiversity development assessment report has been completed in accordance with the NSW Biodiversity Assessment Method (BAM) (OEH 2017).

Measures to avoid and minimise impacts to vegetation were considered during the design and planning stage of the project, with the objective of significantly minimising impacts on native vegetation. Reductions and refinements to the development footprint within the site boundary have avoided impacts upon significant biodiversity features including a number of different plant community types (PCTs), riparian vegetation along the Namoi River, habitat for Koala and Squirrel Glider, as well as potential habitat and nest sites for a number of other threatened species.

The PCTs within the development footprint are heavily grazed and were identified to be in very low condition. Removal of vegetation has been limited to removal of 148.2 ha of low quality vegetation, which is characterised by isolated mature native trees with an understorey dominated by exotic (pasture) grasses and herbs and disturbance tolerant native species.

The vegetation integrity score of both vegetation zones within the development footprint is such that offsets are not required for impacts on native vegetation. Therefore, the project does not require any offsets and no biodiversity offset strategy is required.

ES4.2 Aboriginal heritage

An Aboriginal cultural heritage assessment report assessed the Aboriginal cultural heritage values of the site through field survey and consultation with registered Aboriginal parties identified during the consultation process. The field survey identified four previously unrecorded Aboriginal sites within the site boundary. There are no Aboriginal Heritage Information Management System registered sites within the development footprint nor site boundary.

The Aboriginal cultural heritage surveys identified four Aboriginal sites within the site boundary, however, the project design has avoided impacts to three of the four sites. One identified site is located within the development footprint, comprising an isolated artefact of low archaeological significance given its highly disturbed context, common material, and artefact type. As the artefact is of low archaeological significance and has been sufficiently recorded, salvage in the form of collection is not considered warranted.

Management measures have been identified and will be implemented in consultation with the relevant government agencies as well as the registered Aboriginal parties. These measures principally involve avoidance and management measures should unanticipated Aboriginal objects, relics, or suspected human remains be encountered during works associated with the project.

ES4.3 Historic heritage

A desktop assessment of the potential impact of the project on historic heritage was completed. The project will not impact any items of local, State, National or World heritage significance identified on the State Heritage Register, Gunnedah Local Environmental Plan 2012 or Australian Heritage Database.

ES4.4 Land

The project has been developed to avoid and minimise land disturbance and overall impacts on agricultural land.

The site is mapped within a broad, regional area of biophysical strategic agricultural land (BSAL) as defined by the Strategic Agricultural Land Map – New England North West regional mapping presented in State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (the Mining SEPP) (refer Figure 2.1). A total of 2.8 million ha of BSAL has been identified and mapped at a regional scale across NSW and includes land capable of sustaining high levels of productivity (NSW Government 2012).

The development footprint is defined as the land area within the site where project infrastructure will be constructed and operate for the project life, which encompasses an area of 253 ha, representing approximately 0.009% of the total land area mapped as BSAL within NSW, and 0.1% of the total land area mapped as BSAL within Gunnedah Shire LGA. The development footprint will be removed from agricultural production for the life of the project, which will be in the order of 30 years.

A soil erosion assessment report assessed the potential for erosion to occur within the development footprint. Soils within the development footprint were not found to be saline or sodic and would be considered relatively stable, therefore, soil erodibility was found to be low to moderate overall.

Nonetheless, it is recommended to minimise disturbance where possible. Where disturbance is required, installation of erosion and sediment control measures is recommended to minimise risk of dispersion.

Soil resources will be managed with consideration of the future viability of the site for agricultural production. Land management protocols and measures will be incorporated into an environmental management plan (EMP) that will be implemented to mitigate the potential impacts of the project on soil resources and land use.

Two mineral tenements which encompass the site have been identified, EL7241 and PEL0001. OVERLAND has engaged with the relevant license holders regarding potential interactions between the project and EL7241 and PEL0001, respectively (refer to Section 5.3). The project will not sterilise extractable resources in EL7241 or PEL0001. Exploration activities will be able to continue within areas of EL7241 and PEL0001 that are outside the site boundary.

ES4.5 Visual

A visual impact assessment was conducted from six viewpoints surrounding the development footprint. Representative views close to private residential properties (including six receptors within approximately 2 km of the development footprint) and Orange Grove Road were assessed.

The project design, development footprint and placement of infrastructure have progressively evolved to minimise or avoid visual impacts, where possible. 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 assessment determined that, of the viewpoints assessed, infrastructure may be visible to varying degrees from five viewpoints. Based on the presence of vegetation, combined with the relatively low height of the project's infrastructure, the impact assessment predicts:

- a negligible visual impact for Viewpoint 6;
- a slight/moderate visual impact for Viewpoints 3, 4 and 5;
- a moderate visual impact for Viewpoint 2 (representative of views from R2); and
- a potentially significant impact for Viewpoint 1 (representative of views from R1) for the unmitigated scenario.

As a result of its close proximity to the western boundary of the development footprint, without the implementation of appropriate mitigation measures, R1 will be exposed to views of project infrastructure. Although a significant level of vegetation was observed along the eastern boundary of this property, this vegetation is unlikely to provide a sufficient level of mitigation to reduce the visual impacts experienced from this viewpoint during the operation of the project. The proponent will provide landscape screening to mitigate the visual impacts from R1.

The relatively low height of the project infrastructure and distance to the development footprint will limit the scale of change and degree of contrast for any views from R2, which is approximately 760 m north-east of the northern portion of development footprint. The proponent will provide landscape screening to further reduce the visibility of project infrastructure from R2.

The final location and extent of landscaping at R1 and R2 will be determined during detailed design and following subsequent discussions with the project landholders and the property owners of R1 and R2 as part of preparation of the EMP.

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 receptors, surrounding land users, motorists or air traffic in the vicinity of the development footprint.

ES4.6 Noise and vibration

A noise and vibration impact assessment for the project predicted that potential construction and operational noise levels will be below relevant criteria at all assessment locations (ie. the 11 receptors that were identified within a radius of approximately 2 km from the development footprint). Road traffic noise levels inclusive of project-related traffic are predicted to achieve the relevant noise goals at the nearest receptors to the development footprint.

Vibration associated with the proposed construction works is unlikely to generate impacts at the nearest vibration-sensitive receivers. Additional noise management and mitigation measures are not considered to be required to achieve the relevant operational or construction noise criteria.

ES4.7 Traffic and transport

A traffic impact assessment predicted additional daily traffic usage of the surrounding roads during the peak stage of project construction will be approximately 116 daily vehicle trips, reducing to approximately 80 daily vehicle trips during the earlier and later (average) stages of project construction, and an average of 10 daily vehicle trips during operation.

To accommodate the peak construction stage traffic, which is anticipated to extend for a three month period, the unsealed portion of Orange Grove Road will be subject to a road maintenance program to maintain the safety and serviceability of the road for all road users. To minimise dust generation, the proponent will treat the road surface of the unsealed section of Orange Grove Road to reduce potential dust generation by project-related traffic during the construction period.

Two new intersections are proposed for access into the development footprint, both of which will be located on Orange Grove Road, serving the southern and northern portions of the development footprint, respectively. The designs of the new intersections will be developed in consultation with NSW Roads and Maritime Services and Gunnedah Shire Council and in accordance with the intersection design standards defined by the Austroads Guide to Road Design (Austroads 2010).

Internal access roads and car parking will be constructed to serve the project's access and car parking needs during construction and operation.

ES4.8 Water

An assessment of the potential impacts of the project on flooding, groundwater and surface water resources was completed. This included a surface water assessment to assess the flood risk across the development footprint, potential surface water impacts from the project and proposed mitigation measures to address these impacts.

The flooding characteristics of the development footprint have been described based on the findings presented as part of the SMEC (2003) assessment and with reference to the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016) (refer Chapter 5 of Appendix F) and in consideration of the topographical survey and cross-section information commissioned by the proponent for this project.

The assessment has identified that the land on which project infrastructure will be placed within the development footprint is situated above the level of the relevant large design flood considered in the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016) and therefore should not affect flood levels.

The project is not likely to impact groundwater during construction, operation and decommissioning due to the estimated depth to groundwater within the site boundary and the limited amount of subsurface disturbance activities required during the installation and decommissioning of project infrastructure. The project will not require access to groundwater resources outside of the site boundary and will not impact licensed water users within the vicinity of the site.

No interception of runoff is planned by project infrastructure and therefore there should be no net reduction in runoff from the development footprint.

An erosion and sediment control plan will be prepared in consultation with Gunnedah Shire Council and will be implemented during the life of the project to minimise potential impacts to water resources.

ES4.9 Hazards

All project infrastructure will be designed in accordance with relevant industry standards. Once operational, the project infrastructure will be capable of generating electric and magnetic fields (EMFs). The degree of exposure to EMFs within the development footprint during construction, operations and decommissioning will vary depending on proximity to specific components of project infrastructure. The combination of low exposure rates and the intermittent exposure of staff to elements of the project infrastructure capable of generating EMFs indicate that adverse impacts from EMFs are unlikely as a result of the project.

Public access to the development footprint will be restricted throughout the life of the project. Surrounding landholders accessing agricultural land in close proximity to project infrastructure are unlikely to be exposed to EMFs generated by the project infrastructure for extended periods of time.

Bushfire risks associated with the project have been assessed in accordance with Planning for Bushfire Protection (PBP) (RFS 2006). Measures to enable the project to comply with the objectives of PBP have been described within this EIS. The risk of the project initiating a bushfire will be minimised through the implementation of appropriate management measures throughout the life of the project.

ES4.10 Air quality

Emissions to the atmosphere from the project during construction will be temporary in nature and will be restricted to dust caused by soil and surface disturbances and vehicle, plant and equipment exhaust emissions.

Ongoing maintenance of project infrastructure and the land within the development footprint will be required during operation. Maintenance activities will result in minor, localised vehicle emissions, and generation of dust from vehicles travelling along internal, unsealed access roads.

The implementation of the recommended mitigation measures will minimise air quality impacts during construction, operation or decommissioning.

ES4.11 Socio-economic

The project will make important contributions to the production of renewable energy in NSW while creating employment opportunities, diversifying local revenue streams and generating direct and indirect benefits to the local economy throughout the life of the project. Through the provision of additional economic stimulus, employment opportunities and investment in community infrastructure and services, the net community benefit of the project is considered to be positive.

Based on the results of stakeholder engagement activities, overall there is a positive attitude and community support for the project.

During consultation with surrounding landholders and members of the local community, some specific topics have been raised in relation to potential impacts from the project (eg. flooding, visual and traffic). These topics have been addressed within this environmental impact statement (EIS) (refer to Section 5.4). The implementation of the proposed management measures will mitigate potential impacts from the project.

ES5 Justification and conclusion

OVERLAND has leveraged off its experience leading benchmark renewable energy and infrastructure projects to implement a robust site selection and design process to minimise potential impacts from the project.

There is a sound justification for the project, founded on the following:

- The site is suitably located:
  - in a region with ideal climatic conditions for large-scale solar energy generation, with ideal physical conditions;
  - within close proximity of infrastructure with adequate capacity to receive the energy proposed to be generated; and
  - proximate to land uses compatible with large-scale solar energy generation at a capacity which matches the availability of the network.
- The project will not result in significant adverse biophysical, social or economic impacts, and the project design has actively sought to avoid and minimise adverse impacts, in particular to biodiversity, heritage, land use, flooding and visual amenity, through the siting and design of project infrastructure.
- The project will generate direct and indirect economic benefits, through the creation of employment opportunities and benefits to the local economy through income and expenditure during the life of the project.
- The production of renewable energy directly aligns with the objectives of the State's renewable energy targets and the objectives of the NSW Government's REAP, and will contribute to increased energy security through valuable contributions to a more diverse energy mix.

A suite of design, mitigation and management measures are proposed in this EIS to avoid, minimise and manage impacts of the project. The project will enable the orderly and logical use of natural, physical and human resources existing in the area and region. There will be economic investment and employment benefits for the local region and a realised opportunity for renewable energy generation, while minimising potential environmental and social impacts. The overall benefits of the project are considered to be in the public interest.

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1 Introduction

1.1 Project overview

OVERLAND Sun Farming Pty Ltd (OVERLAND) on behalf of Orange Grove Sun Farm Pty Ltd (the proponent) proposes to develop the Orange Grove Sun Farm, a large-scale solar photovoltaic (PV) generation facility and associated building and electrical infrastructure including grid connection works near the township of Gunnedah, in the Brigalow Belt South Bioregion of northern NSW (Figure 1.1) (the project). The estimated capital investment for the project is $94 million.

The project is a State significant development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP). Therefore, 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.

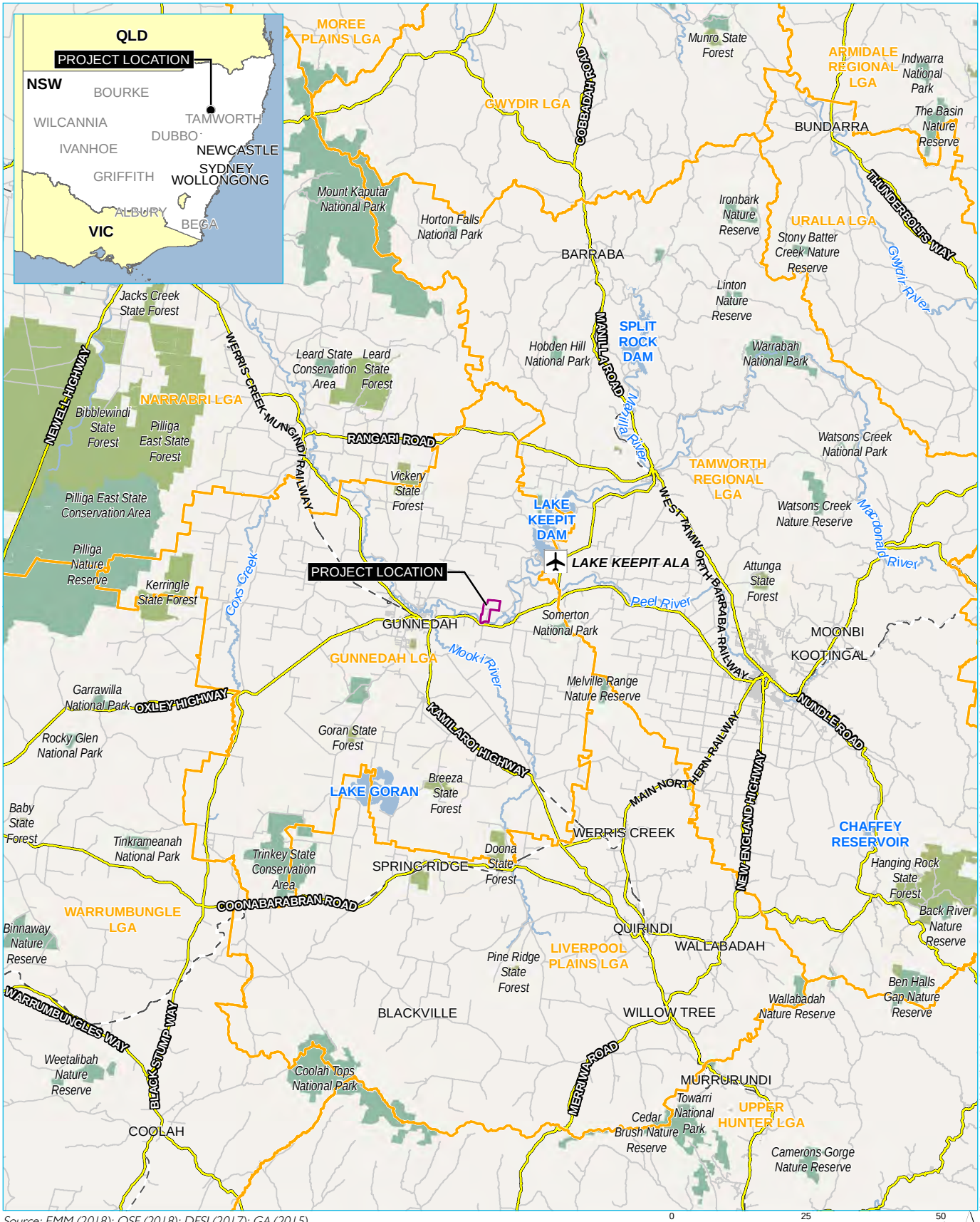
The project is intended to have benefits including:

- production of renewable energy, directly contributing to the State's renewable energy targets and the objectives of the NSW Government's Renewable Energy Action Plan (REAP);
- creation of employment opportunities, including an average of 80 full-time equivalents (FTEs) during construction, and three FTEs during operations;
- direct and indirect benefits to the local economy during the life of the project;
- diversification of local revenue streams; and
- increased energy security through valuable contributions to a more diverse energy mix.

The project is consistent with the objectives of the NSW Government's REAP and will contribute to achieving the Commonwealth Government's National Renewable Energy Target (RET) of 33,000 gigawatt hours (GWh) of energy generated by renewable sources by 2020 (DoI DRE 2016a), which the Australian Energy Regulator (2017) reports as requiring an additional 7,000 GWh of renewable energy to meet. Further discussion of the Commonwealth and NSW Government policy framework is provided as part of the strategic justification of the project in Section 1.3 and the conclusion and justification in Chapter 8.

1.2 The proponent

OVERLAND and EMM Consulting Pty Limited (EMM) have prepared this environmental impact statement (EIS) on behalf of the proponent for the project, Orange Grove Sun Farm Pty Ltd, an OVERLAND related company. OVERLAND is an Australian-owned and operated business engaged in the development of a portfolio of solar energy sun farms on land across regional Australia. Guided by direct experience in the development and commercial delivery of large-scale renewable projects, OVERLAND works closely with landowners, electricity supply companies, councils and governments to develop solar energy sun farms that bring both environmental and economic benefits to regional Australia consistent with the goals and objectives of both the Commonwealth and NSW governments.



Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

0 25 50 km

GDA 1994 MGA Zone 56

N

KEY

- Orange Grove Sun Farm site boundary
- Local government area (LGA) boundary
- Rail line
- Main road
- Local road
- Major waterway
- Waterbody
- NPWS reserve
- State forest

Regional project location

Orange Grove Sun Farm
Environmental impact statement
Figure 1.1

EMM

\\Emmsvr1\emmJobs\2017\J17210 - Orange Grove Sun Farm\GIS\02_Maps\G001_Regional_20180504_04.mxd 7/05/2018

OVERLAND's personnel have successfully led benchmark renewable energy and infrastructure projects from start to finish and have a sound record that traverses early stage site identification, working with landowners and communities, obtaining consents and licences from government to build and operate, securing energy and grid connection contracts, arranging financing and bringing projects into delivery. This experience includes responsibility for the development, financing and delivery of over 810 megawatts (MW) of large-scale, grid connected renewable energy generation projects in the National Electricity Market.

OVERLAND is continuing to develop a significant portfolio of solar energy sun farms throughout NSW and other National Electricity Market states. For example, the Limondale Sun Farm, a large-scale solar PV generation facility close to the township of Balranald in south-western NSW, which was approved by the Minister for Planning on 31 August 2017. In addition, OVERLAND has led the development of the proposed Hillston and Hay sun farms in south-western NSW that were approved by the Minister for Planning on 26 October 2017 and 20 December 2017, respectively.

1.3 Strategic justification

Throughout the site selection and design process and preparation of technical assessments supporting this EIS, OVERLAND has consulted with relevant government agencies, Gunnedah Shire Council (GSC) and local landholders to communicate the aims and objectives of the project and the likely benefits that it will bring to the region.

OVERLAND has engaged with the NSW Renewable Energy Advocate and a number of NSW Government agencies regarding the project and OVERLAND's ambitions to develop multiple solar farms in NSW. OVERLAND has had a continued dialogue with the NSW Department of Planning and Environment (DPE) with the objective of integrating appropriate standards and guidelines into the development, construction and operation of the project.

1.3.1 National context

The Commonwealth Government's RET scheme is designed to reduce emissions of greenhouse gases in the electricity sector and encourage the additional generation of electricity from sustainable and renewable sources. Since January 2011, the RET scheme has operated in two parts–the Small-scale Renewable Energy Scheme (SRES) and the Large-scale Renewable Energy Target (LRET). The LRET includes legislated annual targets, which requires significant investment in new renewable energy generation capacity in coming years, with a target of 33,000 GWh of renewable electricity generation by 2020 (DoI DRE 2016a). Within the Clean Energy Council's Clean Energy Australia Report 2016 (CEC 2016), it was reported that a total of approximately 17,500 GWh of renewable energy was generated in Australia in 2016, which is less than 55% of the 33,000 GWh target established under the LRET. Subsequently, significant growth is required to meet the LRET.

An important beneficial corollary of the project is its contribution to cleaner electricity generation in Australia and subsequent reductions in greenhouse gas emissions. On 10 November 2016, Australia ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol reinforcing its commitment to action on climate change and further reductions to greenhouse gas emissions. The Paris Agreement builds upon the United Nations Framework Convention on Climate Change and aims to strengthen the global response to the threat of climate change. Under the Paris Agreement, Australia has committed to reduce its emissions by 26–28% below 2005 levels by 2030 (DoEE 2016). This emissions reduction target builds upon the country's 2020 target of reducing emissions by 5% below 2000 levels (DoEE 2016). The target represents a 50–52% reduction in emissions per capita and a 64–65% reduction in the emissions intensity of the Australian economy between 2005 and 2030 (DoEE 2016).

In addition to the ratification of the Paris Agreement, the Commonwealth Government has demonstrated its ongoing commitment to greenhouse gas emission reductions through the implementation of a suite of national policies. These policies are already contributing to emissions reductions and encouraging both technological innovation and further expansions to the country's clean energy sector.

1.3.2 State context

The NSW Government's REAP was introduced to guide NSW's renewable energy development and to support the former national target of 20% renewable energy by 2020. Under the guidance of the NSW REAP, renewable energy is predicted to grow and make important contributions to the NSW economy.

This is supported by the NSW Climate Change Policy Framework (OEH 2016a), the aim of which is to maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change. The policy establishes long-term objectives to achieve net-zero emissions by 2050 and to make NSW more resilient to a changing climate.

Many of the State's large-scale renewable energy projects are in regional areas. At present, operational large-scale PV solar developments in NSW produce a combined capacity of more than 312 MW, which includes the Broken Hill Solar Plant, the Gullen Solar Farm, the Moree Solar Farm, the Royalla Solar Farm and the Nyngan Solar Plant (DoI-DRE 2018). Such projects are recognised by the NSW Department of Planning and Environment – Division of Resources and Energy (DPE-DRE) as providing ongoing economic benefits through both the diversification of regional income streams and provision of employment opportunities in regional NSW (DoI DRE 2016a).

The Orange Grove Sun Farm will make important contributions to these targets and to continued growth in the installed capacity of solar PV in NSW and Australia.

DPE-DRE identified potential for large-scale solar energy developments in the central, northern and western regions of NSW (DoI-DRE 2016c). Ideal characteristics for large-scale solar energy are identified by DPE-DRE (DoI-DRE 2016c) as: low population densities; large, flat open spaces; and high average global solar exposure. The development footprint for the Orange Grove Sun Farm is characterised by all of these features, which will allow the project to maximise the efficiency of electricity production, while minimising and avoiding disturbance of identified environmental constraints (refer to Section 3.2) such as remnant vegetation and identified Aboriginal heritage sites. The site selection and design process is described in Chapter 3.

The project, in conjunction with similar large-scale investments in renewable energy, will also support two of the NSW Premier's priorities, namely creating jobs, and building infrastructure (Department of Premier and Cabinet 2017). As noted in Section 1.1, the project will create employment opportunities within the Gunnedah Shire LGA, including an average of 80 FTEs during construction and three FTEs during the operational stage of the project. The project will have an estimated nominal capacity in the order of 110 MW and once operational will provide enough electricity to supply the equivalent of 30,000 homes each year (AEMC 2017). 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 (AEMO).

1.3.3 Local context

The key economic driver underpinning the local economy of the Gunnedah Shire LGA has traditionally been agriculture, however there has been recent strong growth in the mining and gas sectors, which is anticipated to continue into the near future. GSC's Economic Development Strategy (2014) identifies a need to diversify the economic base of the region to increase its resilience to the 'boom and bust' cycles that characterise both the agricultural and mining sectors, and identifies four priorities for economic development in the region, one of which is focussed at targeting new business and economic activities, with the aim to build and diversify the local economy by targeting new business and economic activities that will fill 'gaps' and strengthen and broaden existing sectors. The project supports these targets through provision of a supplementary income stream to ongoing agricultural activities for the project landholders, as well as providing construction and ongoing operational employment opportunities for the local community in the renewables sector, with associated flow-on effects for the regional economy.

In addition, the project also aligns with one of the key priorities for change for Northern Inland NSW identified within Regional Development Australia's (RDA's), Northern Inland Regional Plan 2016-2019, namely industry diversification, job creation, capacity building and resource efficiency (RDANI 2016). As noted within the plan, the region has several important pre-requisites to develop a renewable energy industry in the area, including land and sunshine. Subsequently, there is an identified opportunity to develop renewable energy industries with flow-on benefits for the region's economy. The project will contribute to industry diversification within the region and, as noted previously, will provide direct and indirect benefits to the local economy during the life of the project.

1.4 Purpose of report

This EIS accompanies a DA for the project under Part 4 of the EP&A Act and NSW Environmental Planning and Assessment Regulation 2000 (EP&A Regulation), and addresses the Secretary's environmental assessment requirements (SEARs) (Appendix A) and matters raised during consultation with stakeholders.

This EIS has been prepared by OVERLAND and EMM on behalf of the proponent, Orange Grove Sun Farm Pty Ltd.

1.5 Secretary's environmental assessment requirements

As required under Section 4.12 of the EP&A Act, this EIS has been prepared to address the SEARs for the project, which were issued on 20 December 2017 (reference SSD 8882) (Appendix A). The SEARs and where they are addressed in this EIS are summarised in Table 1.1.

Table 1.1 Secretary's environmental assessment requirements

Assessment requirements	Reference in EIS
General requirements	
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.	
• a stand-alone executive summary;	Executive summary
• a full description of the development, including:	Chapter 3
– details of construction, operation and decommissioning;	
– a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process); and	
– a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development.	
• a strategic justification of the development focusing on site selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential);	Section 3.2 Section 6.5
• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:	Chapter 6
– a description of the existing environment likely to be affected by the development;	
– an assessment of the likely impacts of all stages of the development (which is commensurate with the level of impact), including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice;	
– a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and	
– a description of the measures that would be implemented to monitor and report on the environmental performance of the development;	
• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS;	Chapter 7
• the reasons why the development should be approved having regard to:	Chapter 3
– relevant matters for consideration under the EP&A Act, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development;	Chapter 8
– the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and	
– feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.	
• a signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the development, including details of all the assumptions and components from which the capital investment value calculation is derived; and	Provided separate to the EIS
• the consent in writing of the owner/s of the land.	Provided separate to the EIS
Biodiversity	
• an assessment of the biodiversity values and the likely biodiversity impacts of the development, a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the NSW *Biodiversity Conservation Act 2016*.	Section 6.2 Appendix C

Table 1.1 Secretary's environmental assessment requirements

Assessment requirements	Reference in EIS
Heritage	
• an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community.	Section 6.3 Section 6.4 Appendix D
Land	
• including an assessment of the impact of the development on agricultural land (including impacts to Biophysical Strategic Agricultural Land) and flood prone land, a soil survey to consider the potential for erosion to occur (including impacts associated with sodic soils), and paying particular attention to cumulative impacts and compatibility of the development with the existing land uses on the site and adjacent land (eg. Gunnedah Solar Farm, operating mines, extractive industries, mineral or petroleum resources, exploration activities, aerial spraying, dust generation, and risk of weed and pest infestation) during operation and after decommissioning, with reference to the zoning provisions applying to the land.	Section 6.5 Section 6.9 Appendix E Appendix F
Visual	
• 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; and	Section 6.6 Appendix G
• a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.	Figure 6.6
Noise	
• an assessment of the construction noise impacts and cumulative impacts of the development in accordance with the Interim Construction Noise Guideline (ICNG) and operational noise impacts in accordance with the NSW Noise Policy for Industry (NPI); and	Section 6.7 Appendix H
• a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;	Not required
Transport	
• an assessment of the site access route (including Kamilaroi Highway, Oxley Highway, Orange Grove Road and Kelvin Road), site access point, any potential rail safety issues and likely transport impacts and cumulative transport impacts (including peak and average traffic generation, over-dimensional vehicles and construction worker transportation) of the development on the capacity and condition of roads (including on any Crown land);	Section 6.8 Appendix I
• a description of the measures that would be implemented to mitigate any impacts during construction;	Section 6.8 Appendix I
• a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); and	Section 6.8 Appendix I
• a demonstration about potential cost sharing with the Gunnedah Solar Farm project.	Section 5.3 Section 6.15
Water	
• an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including the Namoi River and its catchment, wetlands, riparian land, groundwater dependent ecosystems and acid sulphate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;	Section 6.9 Appendix F
• details of water requirements and supply arrangements for construction and operation; and	Section 6.9
• a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004).	Section 6.9 Section 6.5 Appendix E

Table 1.1 Secretary's environmental assessment requirements

Assessment requirements	Reference in EIS
Hazards and Risks	
• a preliminary risk screening in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and *Applying SEPP 33* (DoP 2011), and if the preliminary risk screening indicates the development is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with *Hazard Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (DoP 2011) and *Multi-Level Risk Assessment* (DoP 2011); and	Section 4.1.4
• an assessment of potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure (including the proposed transmission line and substation), including against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields*.	Section 6.10 (Electromagnetic interference) Section 6.11 (Bushfire)
Socio-Economic	
• an assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation including assessment of cumulative impacts.	Section 6.13 Section 6.15
Consultation	
• During the preparation of the EIS, consultation is required with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, nearby airport or aerodrome operators, exploration licence holders, quarry operators and mineral title holders (including the Australian Coalbed Methane Pty Ltd and Santos QNT Pty Ltd); • In particular, detailed consultation with Gunnedah Solar Farm and affected landowners surrounding the development must be undertaken; and • The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	Chapter 5

1.6 Report structure

This EIS consists of the main EIS document and supporting appendices and is structured as follows:

- Chapter 1 – Introduction

  Provides an introduction to the project, including an overview of the project, information about the proponent, the purpose of this EIS, and the SEARs.

- Chapter 2 – Site and surrounds

  Provides a description of the site and surrounds, including the project location, the biophysical environment, socio-economic factors, and other surrounding developments.

- Chapter 3 – Project description

  Provides a detailed outline of the project, including project details and objectives and alternatives considered during the site selection and project design process.

- Chapter 4 – Legislative framework

  Provides information on the legislative framework and approval process for the project under relevant Commonwealth and NSW legislation and environmental planning instruments.

- Chapter 5 – Stakeholder consultation

  Provides an overview of stakeholder consultation and engagement activities undertaken for the project and a summary of the consultation results.

- Chapter 6 – Impact assessment

  Provides an assessment of the likely impacts of the project, including consideration of management measures to be implemented.

- Chapter 7 – Summary of mitigation and management

  Provides a summary of the management and mitigation measures.

- Chapter 8 – Conclusion and justification

  Provides a justification for the project, including discussion of the suitability of the site.

- Appendices

  The appendices to the EIS which support the main document, including copies of all technical assessments.

- Appendix A – SEARs;
- Appendix B – Consultation material;
- Appendix C – Biodiversity development assessment report (BDAR);
- Appendix D – Aboriginal cultural heritage assessment report (ACHAR);
- Appendix E – Soil erosion assessment;
- Appendix F – Surface water assessment;
- Appendix G – Visual impact assessment;
- Appendix H – Noise and vibration impact assessment; and
- Appendix I – Traffic impact assessment.

It should be noted that this main EIS document provides a summary of all the technical assessments prepared to support the EIS. The technical studies provide a full and comprehensive assessment of the project relating to their respective technical area.

2 Site and surrounds

2.1 Site description

The proponent proposes to develop the project on a site within the Gunnedah Shire LGA, approximately 12 km east of the township of Gunnedah. The site is divided by Orange Grove Road in to two portions, northern and southern, and encompasses an area of approximately 817 hectares (ha) (Figure 2.1). The legal property description is given in Table 2.1. Cadastral details for the site and development footprint are provided in Figure 2.2.

Table 2.1 Property description

Portion	Site		Development footprint	
	Lot description	Area (ha)	Lot description	Area (ha)
Northern	DP 945590 (Lots 1 and 2) DP 754928 (Lots 27 and 30) DP 1068520 (Lots 1 and 2) DP 1068518 (Lot 3)	463	DP 945590 (Lot 1 and part Lot 2) DP 754928 (Lot 30) DP 1068520 (part lot 1) DP 1068518 (Lot 3)	239
Southern	DP 945590 (Lot 2) DP 126183 (Lots 1, 2 and 3)	354	DP 945590 (part Lot 2) DP 126183 (part Lot 1)	14
Total area (ha)		**817**		**253**

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 253 ha, which has been refined through the project design process to avoid identified environmental constraints. The conceptual infrastructure layout within the development footprint is discussed further in Chapter 3.

The site is zoned RU1 Primary Production under the Gunnedah Local Environmental Plan 2012 (Gunnedah LEP). The site has been highly modified by past disturbances associated with land clearing, irrigation development, cropping, livestock grazing and weed invasion. It is currently used for livestock grazing and cropping.

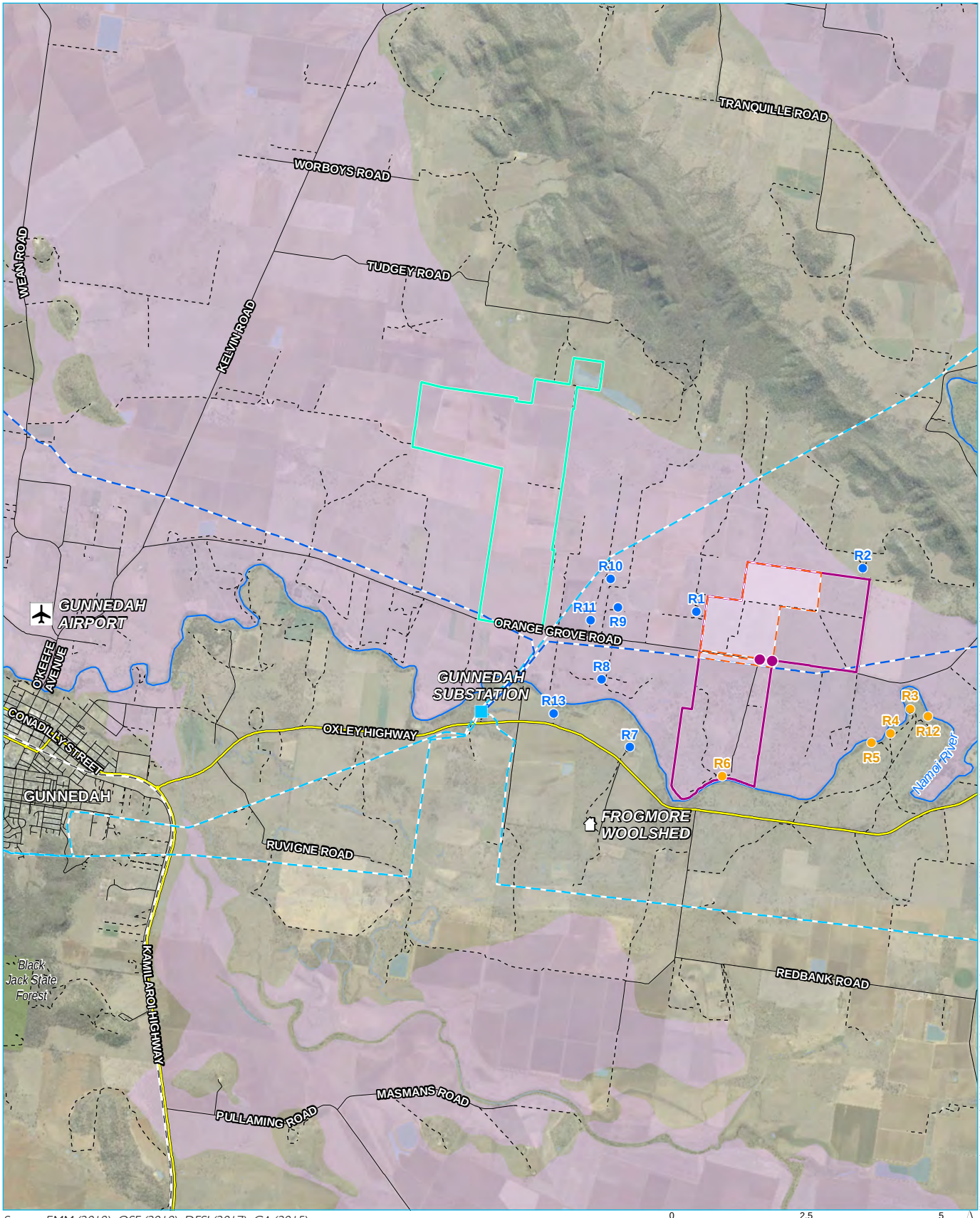
At its closest point, the development footprint is approximately 4.2 km north-east of TransGrid's Gunnedah Substation (refer Figure 1.1). TransGrid's 132 kilovolt (kV) transmission line runs parallel to the southern boundary of the southern portion of the development footprint (refer Figure 2.1). The site has suitable access to the local and regional road network including the Kamilaroi and Oxley Highways, Orange Grove Road and Kelvin Road (refer Figure 1.1).

The site is mapped as biophysical strategic agricultural land (BSAL) as defined by the Strategic Agricultural Land Map – New England North West regional mapping presented in State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (the Mining SEPP) (refer Figure 2.1). A total of 2.8 million ha of BSAL has been identified and mapped at a regional scale across NSW and includes land capable of sustaining high levels of productivity (NSW Government 2012). This is described further in Section 6.5.

Photographs 2.1 and 2.2 illustrate the general condition of the site.

Photograph 2.1 **General condition of the northern portion of the development footprint looking north from the south-western corner (photograph taken in January 2018)**

Photograph 2.2 **General condition of the southern portion of the development footprint looking south-east from the north-western corner (photograph taken in January 2018)**



Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

0 2.5 5 km

GDA 1994 MGA Zone 56

N

KEY

- Orange Grove Sun Farm site boundary
- Development footprint
- Indicative site access point
- Gunnedah Solar Farm (SSD 8658 - proposed by Photon Energy Generation Pty Ltd)*

Receptors

- Non project-related receptor
- Project-related receptor
- 132 kV transmission line
- 66 kV transmission line
- Rail line
- Main road
- Local road
- Vehicular track
- Namoi River
- Biophysical Strategic Agricultural Land
- Waterbody
- State forest

** DPE 2017, Gunnedah Solar Farm, viewed 11 October 2017, http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8658*

Location of the Orange Grove Sun Farm

Orange Grove Sun Farm
Environmental impact statement
Figure 2.1

EMM

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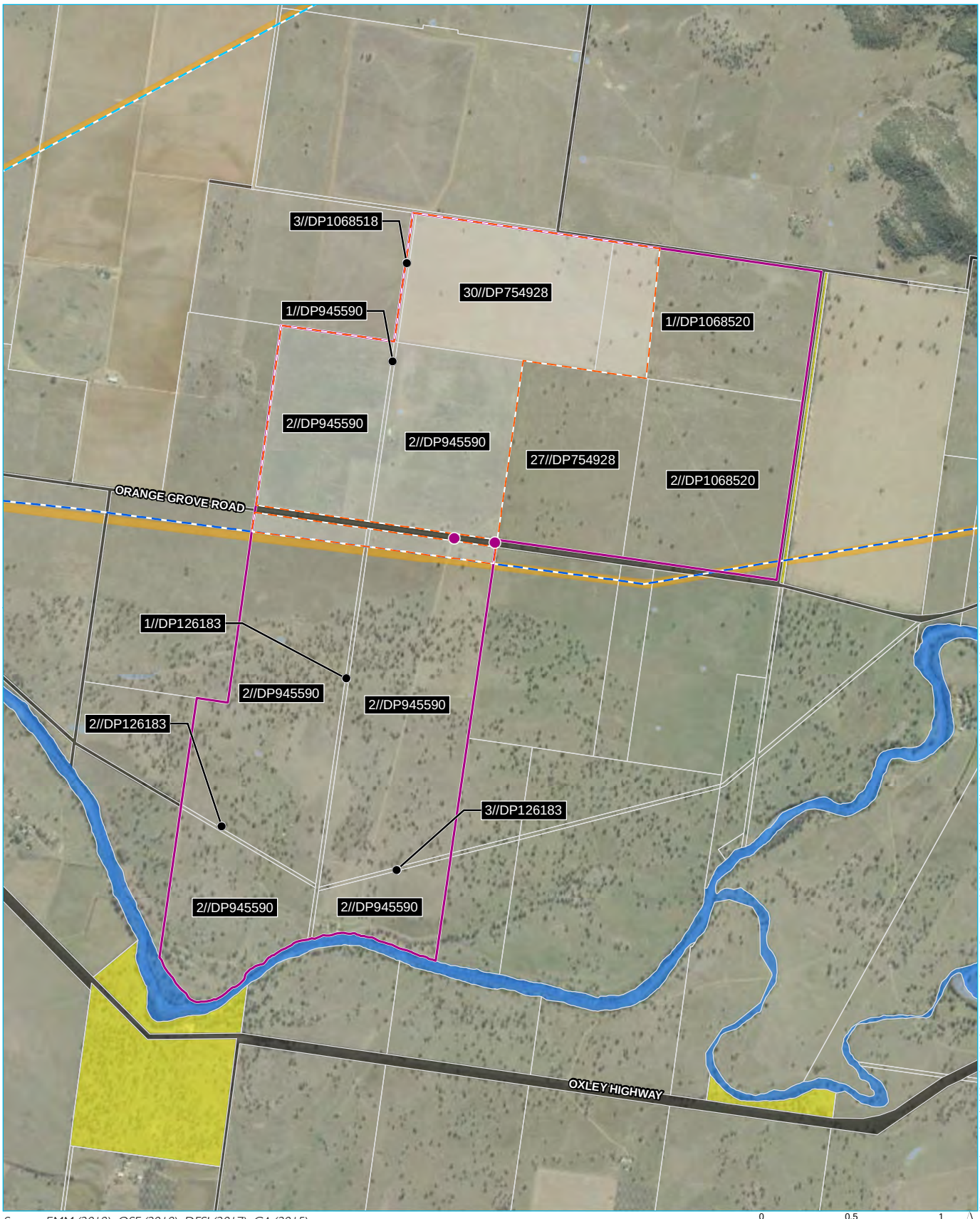

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Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Orange Grove Sun Farm site boundary
- Development footprint
- Indicative site access point
- 132 kV transmission line
- 66 kV transmission line
- Waterbody
- Cadastral boundary
- Crown land
- Water feature corridor
- Easement
- Road corridor (public road in use)

Cadastral details

Orange Grove Sun Farm
Environmental impact statement
Figure 2.2

EMM

2.2 Surrounding land uses

The site is within the Gunnedah Shire LGA, which covers an area of 4,994 km^2 in north-western NSW. The site is part of the Namoi River catchment. Land use within this catchment is dominated by extensive agricultural operations with grazing occupying 61.2% of the total catchment area (Office of Water 2011). Dryland cropping and horticulture (16.2%), forestry (10.3%), native landscapes (5.1%), conservation (3.2%) and irrigation (3.0%) are also prevalent across the catchment area (Office of Water 2011).

The majority of land surrounding the site is zoned RU1 primary production under the Gunnedah LEP (Figure 2.3). Land uses surrounding the site are predominantly agricultural and include both dryland and irrigated broad acre crop production and livestock grazing. The geography, climate, and environment within the Gunnedah Shire LGA are favourable for a variety of agricultural activities including the production of a variety of summer and winter crops (GSC 2014).

Two mineral tenements that encompass the site were identified in a search of the NSW Department of Industry – Resources and Energy DIGS database; a coal exploration licence (EL) issued under the NSW *Mining Act 1992* (EL7241) held by the Secretary of DPE; and a petroleum exploration license (PEL) issued under the NSW *Petroleum (Onshore) Act 19*91 (PEL0001) held by Australian Coalbed Methane Pty Ltd and Santos QNT Pty Ltd. EL7241 and PEL0001 cover an area of 2,575 square kilometres (km^2) and 5,246 km^2, respectively, in north-western NSW (refer Figure 2.4).

The closest receptors are dwellings. The nearest receptors, R1 and R2, are approximately 150 m west of the western boundary and 760 m north-east of the north-eastern boundary of the northern portion of the development footprint, respectively (Figure 2.1). In addition, a further 11 dwellings are between approximately 1.6 km and 3 km from the development footprint (Figure 2.1).

The Namoi Pistol Club is approximately 1.6 km from the north-eastern corner of the development footprint.

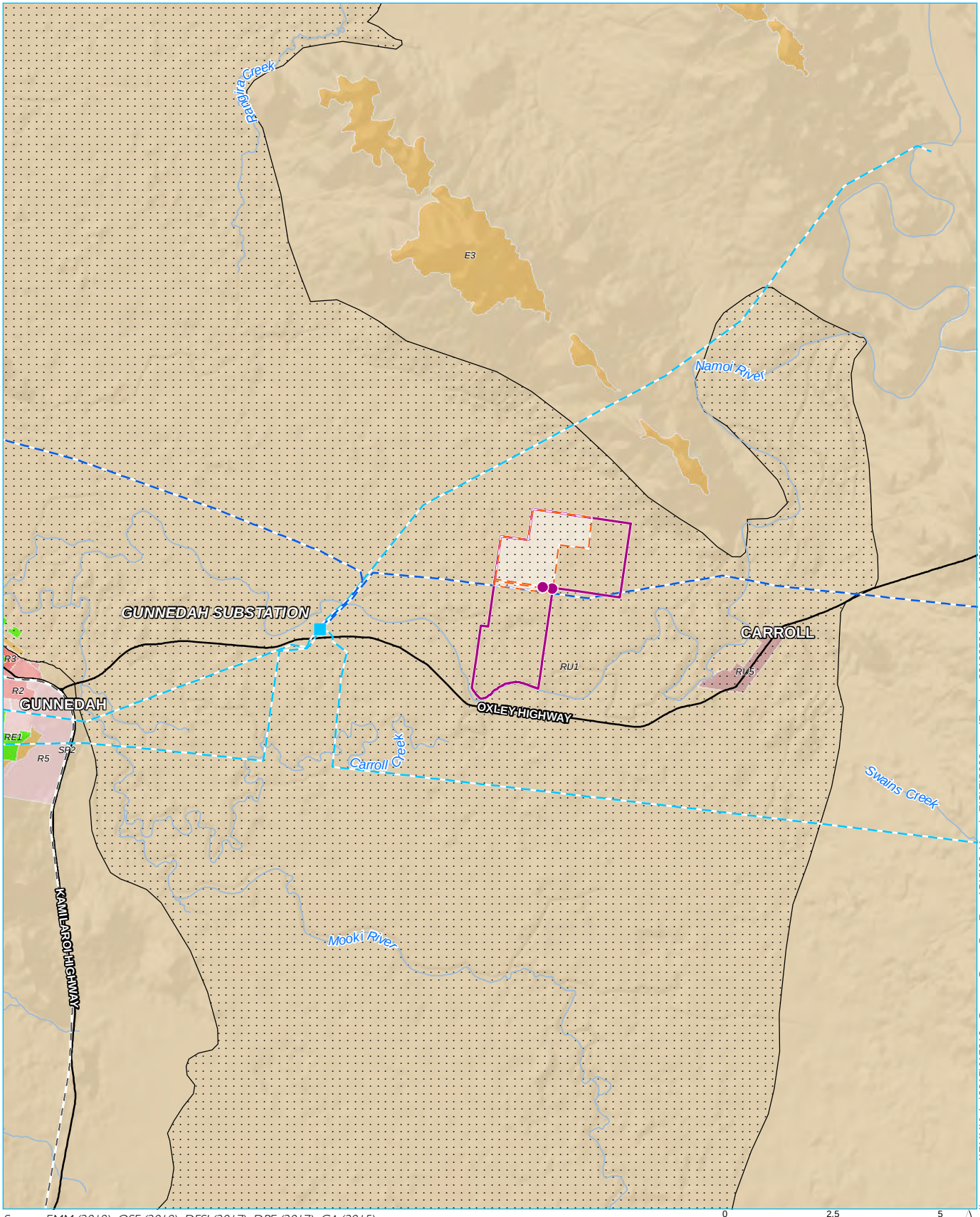
Somerton National Park is approximately 11 km south-east of the site and covers an area of 759 ha. Melville Range Nature Reserve is approximately 22.5 km south-east of the site and covers an area of 843 ha (Figure 1.1).

2.3 Transport infrastructure

The primary road transport route in the vicinity of the site is Orange Grove Road (Figure 2.1). Orange Grove Road is a GSC rural road that traverses the landscape between Kelvin Road in the west and Keepit Dam Road in the east. Orange Grove Road primarily services local traffic and agricultural operations. At the site, Orange Grove Road is a single carriageway with an unsealed surface. Kelvin Road, which connects to O'Keefe Avenue, will provide access for light vehicles from the site to the township of Gunnedah and the Kamilaroi and Oxley Highways.

The Kamilaroi Highway, approximately 10.5 km south-west of the site, is 605 km in length and is a NSW State highway extending from Willow Tree to Bourke. The highway is a significant freight corridor and connects a number of north-western NSW's major settlements including Brewarrina, Walgett, Narrabri, Gunnedah and Quirindi. The majority of the Kamilaroi Highway is a sealed single carriageway and it is a designated B-Double route connecting the Mitchell and New England Highways.

The Oxley Highway, south of the Namoi River, is 656 km in length and is a State-owned rural highway extending from the Mitchell Highway at Nevertire to the Pacific Highway at Port Macquarie.



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Source: EMM (2018); OSF (2018); DFSI (2017); DPE (2017); GA (2015)

KEY

- Orange Grove Sun Farm site boundary
- Development footprint
- Indicative site access point
- 132 kV transmission line
- 66 kV transmission line
- Rail line
- Main road
- Watercourse / drainage line
- Flood planning area

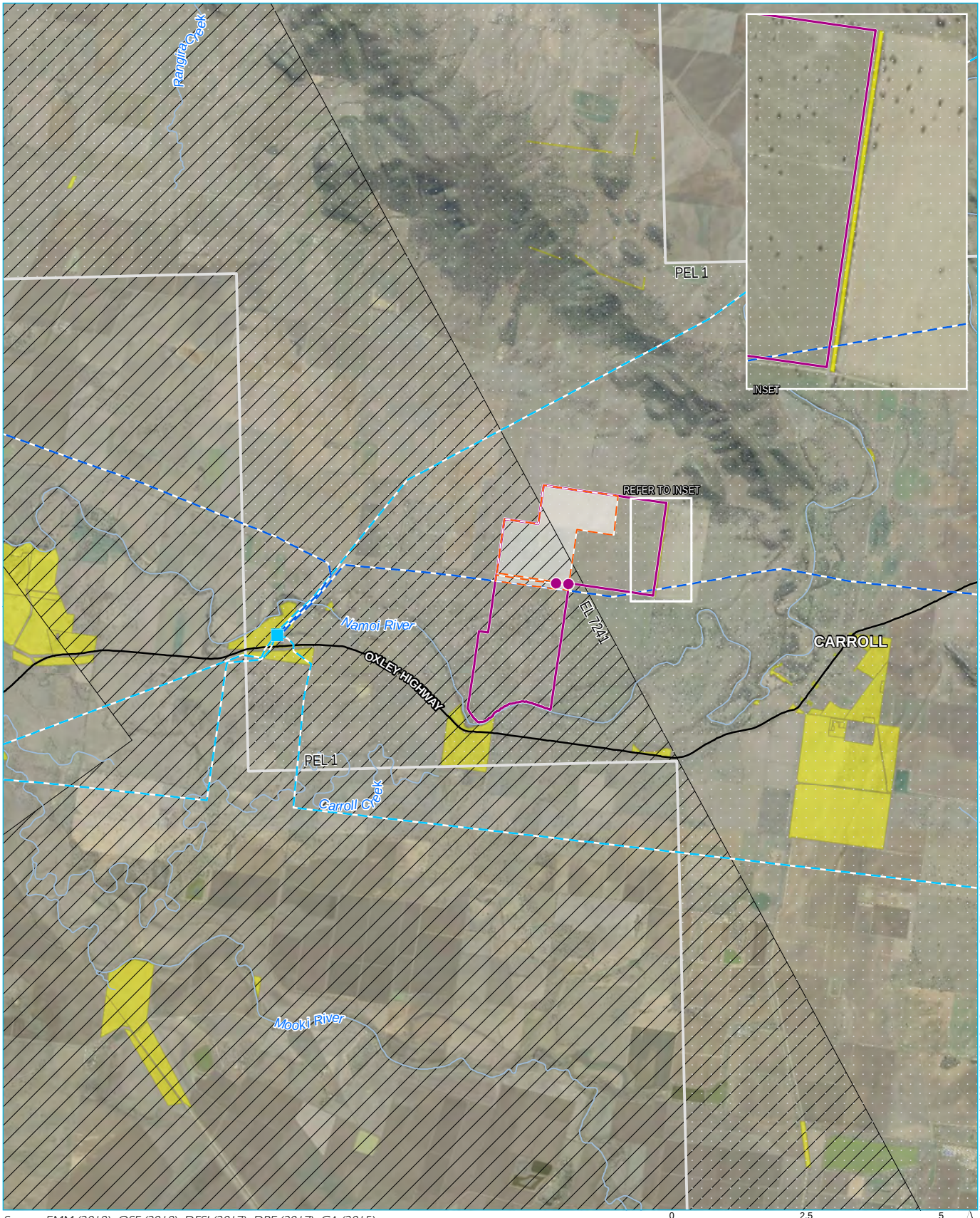
Land use zone

- E3 Environmental Management
- R2 Low Density Residential
- R3 Medium Density Residential
- R5 Large Lot Residential
- RE1 Public Recreation
- RU1 Primary Production
- RU5 Village
- SP2 Infrastructure

Land use zoning

Orange Grove Sun Farm
Environmental impact statement
Figure 2.3

EMM



Source: EMM (2018); OSF (2018); DFSI (2017); DPE (2017); GA (2015)

0 2.5 5 km

GDA 1994 MGA Zone 56

N

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KEY

- Orange Grove Sun Farm site boundary
- Development footprint
- Indicative site access point
- Gunnedah Substation
- 132 kV transmission line
- 66 kV transmission line
- Main road
- Watercourse / drainage line
- Crown land

Exploration licence boundary

- PEL0001
- EL7241

Crown land and mineral tenements

Orange Grove Sun Farm
Environmental impact statement
Figure 2.4

EMM

The highway connects a number of western and northern NSW's major settlements including Gilgandra, Coonabarabran, Gunnedah, Tamworth, Wauchope and Port Macquarie. The majority of the Oxley Highway is a sealed single carriageway and it is a designated B-Double route.

Gunnedah Airport is approximately 12 km west of the site (Figure 2.1). In addition, Lake Keepit Aircraft Landing Area (ALA) is approximately 13 km north-east of the site (Figure 1.1).

2.4 Biophysical environment

2.4.1 Climate

The site is within the Brigalow Belt South Interim Biogeographic Regionalisation of Australia (IBRA) bioregion, which is characterised by a subhumid climate, with no dry season and a hot summer. Climate data for the site has been obtained from the Australian Bureau of Meteorology's (BoM) station at Gunnedah Airport (station number 055202), approximately 12 km west of the site. Mean monthly minimum and maximum temperatures range between 16.4°C to 34.3°C in summer and 1.9°C to 19.3°C in winter (BoM 2018a). The area experiences a mean annual rainfall of 557 millimetres (mm) (BoM 2017a).

Climate data from the BoM indicates that the site's daily solar exposure ranges between 10.3-26.5 megajoules/m^2 (MJ/m^2), with an annual average of 16.8 MJ/m^2, which equates to approximately 4.7 kWh/m^2 with an average of 8-9 hours of sunshine per day (BoM 2017a; BoM 2017b). Annual cloud cover statistics over a 63 year period indicate that the site receives an average of 68.8 cloudy days per annum (BoM 2018b). The Gunnedah Shire LGA experiences a consistently high availability of solar radiation, and is therefore ideal for large-scale solar development.

2.4.2 Topography and landform

The site is within the Brigalow Belt South bioregion, which extends from south of Dubbo in central-western NSW to the central Queensland coast. On a landscape scale, the site is part of an extensive floodplain of the Namoi River. Locally, the site is characterised by a landform pattern of mixed stagnant alluvial plains and features a single and continuous plain landform element. Elevation across the site is relatively uniform at approximately 272–276 m Australian Height Datum (AHD).

2.4.3 Geology and soils

The site is on complex alluvium derived from the range of geological formations in the Liverpool Plains catchment. Sorting of material by floodwaters has led to surface lithologies ranging from fine sands to clays and gravels. The depth of alluvium to basement material varies from 5 m to >50 m.

The site is part of the Burburgate soil landscape, described as mixed stagnant alluvial plains and floodplains of the Namoi River on the Liverpool Plains, characterised by a complex distribution of soils, consisting of moderately drained brown clays, and poorly drained red-brown earths, with smaller areas of high floodplain often consisting of solodic soils (OEH 2011).

2.4.4 Water resources

The development footprint is within the Namoi River catchment and is approximately 2.3 km north of the Namoi River at its closest point (see Figure 2.1). The site slopes gently from east to west at a gradient of approximately 0.15%, with the lowest point in the south-west.

Median elevation across the site is approximately 9 m above the surveyed Namoi River channel. A broad swale in the north-east of the development footprint, with a maximum depth of 1 m, is mapped as a first-order stream on NSW topographic maps.

The Namoi catchment covers an area of 42,000 km^2 and supports a population of approximately 100,000 people, which includes a number of rural townships, such as Tamworth, Gunnedah and Narrabri (Office of Water 2011). Within the catchment, the Namoi River stretches over 700 km, beginning in the Great Dividing Range and flowing across much of north-western NSW through to its junction with the Barwon River near Walgett. The highest daily mean flow of the Namoi River is experienced at Gunnedah, close to the site, with a flow of 1,922 ML (Office of Water 2011). Streamflow declines downstream due to significant irrigation extractions and diversions into effluent channels (Office of Water 2011).

The site is within the floodplain of the Namoi River and lies within GSC's flood planning area as mapped under the Gunnedah LEP (refer Figure 2.3). The *Carroll-Boggabri Floodplain Management Plan* (the FMP) (Department of Natural Resources (DNR) 2006) commences at the village of Carroll, downstream of the confluence of the Peel and Namoi Rivers, and extends north and west, past Gunnedah, to the town of Boggabri. This floodplain supports successful grazing, irrigation and dryland agricultural industries. The FMP primarily applies to land within the Gunnedah Shire LGA, including the site.

The site is identified as part of the proposed Upper Namoi Valley Floodplain within the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016). Under the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016), the site is mapped as part of the Upper Management Zone BL, which covers a significant portion of the catchment. This management zone is described as 'flood storage and secondary flood discharge areas', with proposed controls and rules associated with this zone supporting the maintenance of flow paths and temporary storage of floodwaters while allowing for appropriate development.

The Namoi catchment does not contain any extensive wetland complexes.

The site is within the Upper Namoi Alluvium groundwater management area which is characterised by an inland alluvial aquifer. Groundwater at the site is of fresh to moderate quality (0-1,500 total dissolved solids (TDS) mg/L) and is suitable for domestic, stock and some irrigation purposes (Office of Water 2011).

2.4.5 Biodiversity

The site is within the Brigalow Belt South IBRA bioregion and the Liverpool Plains subregion. As noted by Morgan and Terrey (1992), vegetation within the Liverpool Plains subregion is characterised by:

- plains grass, panic, windmill grass and blue grass on black earths with occasional white box, yellow box, poplar box and wilga; and
- white box and white cypress pine with rough-barked apple, hill red gum, occasional belah and mulga on texture contrast hillslope soils.

The quality of native vegetation within the site boundary is heavily impacted by past land use. All areas have been subject to extensive clearing, with scattered trees or small clumps of timber interspersed through native and exotic grasslands.

The quality of the underlying groundcover within the site boundary is dependent on grazing pressure, with areas subject to heavy grazing pressure dominated by exotic grasses, while areas subject to low to moderate grazing pressure retain a much higher cover of native species.

Roadside vegetation along Orange Grove Road is similar to that found on-site, with scattered trees over a largely exotic grassy groundcover. Land in the north of the northern portion of the development footprint is cropped and supports minimal biodiversity value.

Threatened species assessments, including targeted surveys, have been undertaken in accordance with NSW and Commonwealth survey guidelines. These surveys identified a number of threatened fauna species in areas to the south of Orange Grove Road, however, these areas have since been excluded from the development footprint to avoid potential impacts.

2.5 Socio-economic factors

The population of the Gunnedah Shire LGA in 2016 was 12,215 compared to 12,066 in 2011, which reflects an increase of 149 people (or 1.2%) residing in the area (ABS 2013a; ABS 2017a). Similarly, the township of Gunnedah and the village of Carroll both experienced increases in population over this period from 9,340 and 176 in 2011 to 9,726 and 337 in 2016, respectively (ABS 2013b; ABS 2013c; ABS 2017b; ABS 2017c). The percentage of the population who identify themselves as Aboriginal and Torres Strait Islander people within the Gunnedah Shire LGA (12.8% in 2016) is significantly higher than the State and national average (ABS 2017a).

The economy within the Gunnedah Shire LGA is relatively diverse with the primary economic activities being agriculture and coal mining (GSC 2014). Agriculture is the predominant employing industry within the Gunnedah Shire LGA, with sheep, beef cattle and grain farming the area's primary employer (12.2%) (ABS 2013a).

Coal mining is the area's second largest employer, accounting for 6.3% of the region's employment in 2011 (ABS 2013a). The Gunnedah Shire LGA is within the Gunnedah Basin, which contains more than 11% of the estimated recoverable coal reserves in NSW (GSC 2014). Within the township of Gunnedah, coal mining accounts for more than 7% of the town's employment and is the town's predominant employing industry (ABS 2013b). Other mining activities within the Gunnedah Shire LGA include coal seam gas exploration and hard rock quarrying. Within the Gunnedah Shire LGA, the unemployment rate is 6.3%, which is higher than both the NSW (4.9%) and Australian (5.7%) unemployment rates (DoE 2017).

Gunnedah is the largest town in the Gunnedah Shire LGA with a population of 9,726 and is the area's commercial and administrative centre (GSC 2014). There are a range of retail, commercial, professional and personal services available within the town, as well as a number of accommodation options, which support the Gunnedah Shire LGA's strong visitor economy. As noted above, coal mining is the dominant industry of employment for the town of Gunnedah's population.

2.6 Other local developments

Photon Energy Generation Pty Ltd (Photon Energy) propose to construct the Gunnedah Solar Farm, a 155 MW PV solar farm approximately 3 km west of the site (refer Figure 2.1), SEARs for which were issued by DPE on 25 August 2017. Publically available information indicates that the solar farm proposed by Photon Energy will be located on Lot 1 of DP 1202625, Lots 151, 153 and 264 of DP 754954, Lot 2 of DP 801762 and Lot 1 of DP 186590 and that the project infrastructure will cover a total area of approximately 205 ha within the 692 ha site (refer Figure 2.1). OVERLAND has engaged with Photon Energy as part of the consultation process for the project (refer to Section 5.4).

The SEARs require an assessment of the potential cumulative impacts of the project with the Gunnedah Solar Farm (refer to Section 6.15). This includes consideration of visual amenity, compatibility of land use, traffic and construction noise impacts.

As noted in Section 2.1, two mineral tenements that encompass the site were identified in a search of the NSW Department of Industry – Resources and Energy DIGS database, EL7241 and PEL0001. EL7241 and PEL0001 cover an area of 2,575 km^2 and 5,246 km^2, respectively, in north-west NSW (refer Figure 2.4). OVERLAND has engaged with the relevant license holders as part of the consultation process for the project (refer to Section 5.3).

During consultation with GSC, it was noted that WaterNSW and the NSW Government are currently in the process of upgrading infrastructure at Keepit Dam, approximately 13 km north-east of the site (refer Figure 1.1). The purpose of these upgrades is to strengthen the dam wall and it is anticipated that these upgrades will continue in to 2019.

3 Project description

3.1 Overview

The project includes the development, construction and operation of a solar PV electricity generation facility, which comprises the installation of PV solar panels, electrical cabling, electrical switchyard / substation, electrical connection to the TransGrid network and other associated infrastructure within the development footprint.

The objectives of the Orange Grove Sun Farm are to:

- develop a large-scale PV solar development that avoids and minimises environmental, community and landholder impacts;
- contribute to the strategic objectives and targets of the NSW and Commonwealth governments for renewable energy generation;
- contribute to increased energy security through valuable contributions to a more diverse energy mix for NSW and Australia; and
- provide ongoing economic benefits for regional NSW through both the diversification of regional income streams and provision of employment opportunities during construction and throughout the operational stage of the project.

The project will connect to the TransGrid 132 kV electricity distribution network that feeds TransGrid's Narrabri to Gunnedah and Gunnedah to Tamworth network system (see Figure 2.1). The electricity generated from the project will be sold to one or more of a registered energy retailing organisation, large energy user (governmental or private) or to the National Electricity Market that is managed by the Australian Energy Market Operator.

As an indication of scale, based on current technologies, the estimated total installed capacity will be in the order of 110 MW, which would be generated by approximately 330,000 PV solar panels.

The project comprises the following key components:

- a network of PV solar panel arrays including supporting structures and tracker system;
- an internal network of electrical collection and distribution systems including electrical inverters;
- an internal network of communications and control cabling and systems;
- switchyard including electrical switching, control and monitoring equipment, electrical transformation system and operational and control room;
- electrical connection and communications cabling from the on-site switchyard and transformation area to the TransGrid 132 kV electrical network;
- a management hub, including material storage areas, demountable offices, amenities and equipment sheds;
- provision of land area within the development footprint for possible future energy storage and network support devices; and
- fencing, access roads from adjacent public roadways, on-site parking and internal access roads.

The project may include the installation of battery and energy storage devices within a secure compound within the development footprint. The rated capacity of future battery and energy storage devices has not been determined at this stage of project development. The inclusion of such energy storage devices will be determined during the detailed design stage of the project and will be dependent on network integration and commercial considerations at such time. A modification to the consent would be sought to permit the installation of this infrastructure within the development footprint if required.

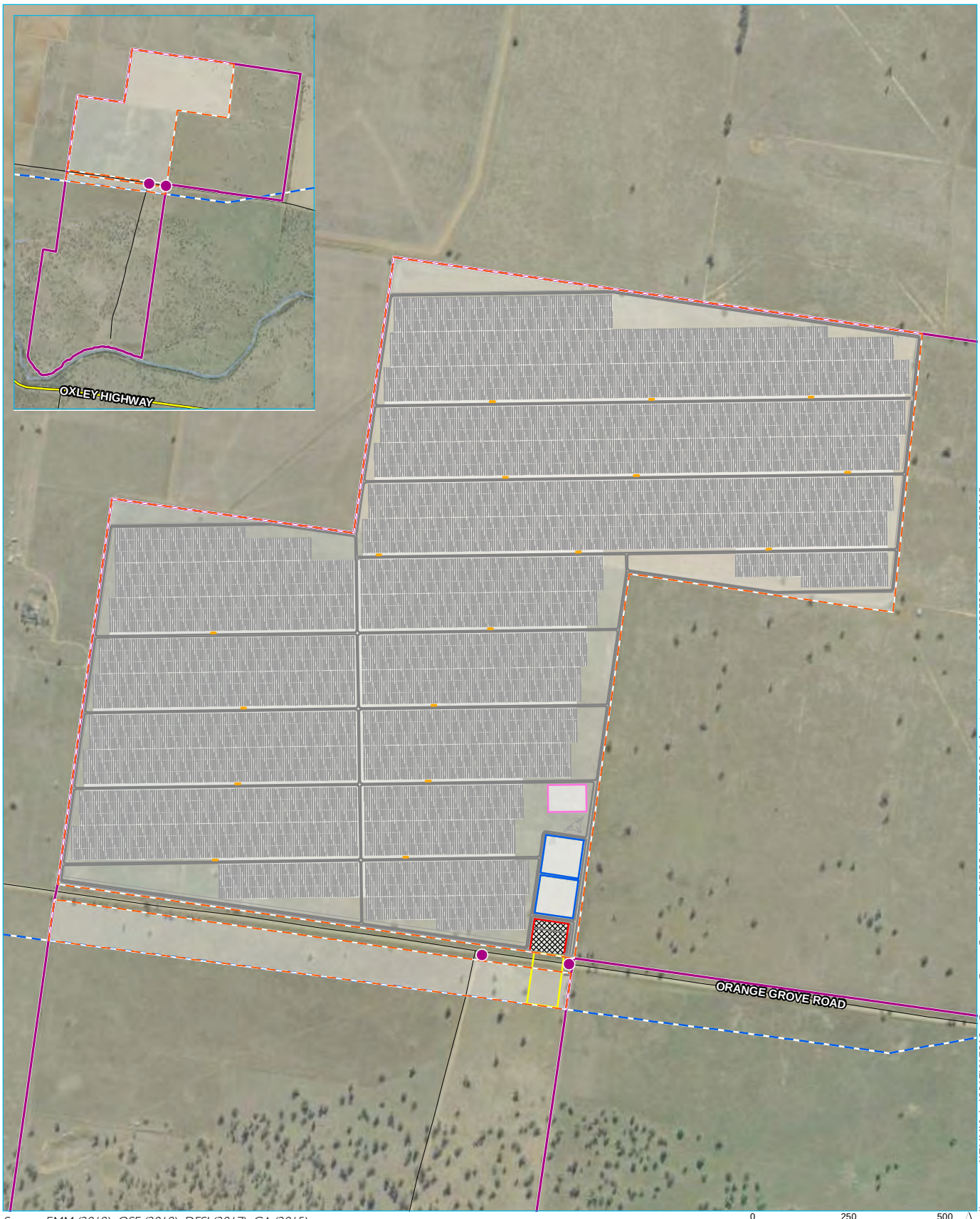
The purpose of the battery and energy storage devices would be to store energy on-site, which will allow energy to be released at specific times. The battery and energy storage devices would also provide a number of network services, including frequency control integration and energy arbitrage, as well as improved reliability of electricity provision from the project.

Energy arbitrage allows energy to be stored on-site during periods of low demand and then be discharged into the network during periods of greater demand.

The conceptual infrastructure layout is illustrated in Figure 3.1. The infrastructure associated with the project will cover an area within the development footprint. During the preparation of the EIS, the development footprint within the site boundary 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.

Approximately 1 ha of land is proposed to be subdivided within Lot 2 of DP 945590 to enable the construction of the on-site switchyard and transformation area (Figure 3.1). At the end of the operational life of the electrical infrastructure, the infrastructure on the subdivided lot will be decommissioned and the lot will be reconsolidated back into the residual lot.

All land surrounding the site is zoned RU1 Primary Production under the Gunnedah LEP, with associated minimum lot sizes of 200 ha. The proposed subdivision will result in a lot size that is less than the minimum lot size under the Gunnedah LEP. Notwithstanding, in accordance with the provisions of Section 4.38 of the EP&A Act, the proposed subdivision is permissible subject to the approval of the Minister for Planning or their delegate. The proposed subdivision will be the subject of ongoing discussions with GSC.



Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

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KEY

- Orange Grove Sun Farm site boundary
- Development footprint
- Area to be subdivided
- Indicative site access point
- 132 kV transmission line
- Local road

Project infrastructure

- Solar panel layout
- Internal road
- Management hub and potential future battery storage
- On-site switchyard and transformation area
- Inverter
- Temporary laydown area
- Transmission corridor

Infrastructure layout plan

Orange Grove Sun Farm
Environmental impact statement
Figure 3.1

EMM

3.2 Site selection and project design

OVERLAND has leveraged off its experience leading benchmark renewable energy and infrastructure projects to implement a robust site selection and design process to minimise potential environmental impacts. This experience includes the development and financing of 810 MW of large-scale solar installations. In addition, OVERLAND is continuing to develop a significant portfolio of solar energy sun farms throughout NSW and other National Electricity Market states.

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 the EIS. The evaluation process has considered a range of factors relating to a broader study area (ie. the site boundary) comprising the site's northern and southern portions. Key factors include:

- Availability of solar radiation – the Gunnedah Shire LGA experiences a consistently high availability of solar radiation. As noted in Section 2.4.1, climate data from the BoM indicates that the site's daily solar exposure, average hours of sunshine per day and number of cloudy days per annum make it ideal for a large scale solar development (BoM 2018a; BoM 2018b; BoM 2017a; and BoM 2017b).
- Proximity to, and capacity of the electricity grid – the southern boundary of the southern portion of the development footprint is adjacent to TransGrid's 132 kV transmission line, which feeds TransGrid's Gunnedah Substation (Figure 2.1). The site's proximity to TransGrid's 132 kV transmission line is beneficial and has been an important element of site selection, minimising the length of connection infrastructure required to connect the project to the electricity grid. The site's proximity to TransGrid's 132 kV transmission line means that the connection infrastructure will avoid major road crossings and also minimises impacts on vegetation. OVERLAND has been proactive in completing vegetation and heritage feasibility assessments and liaising with TransGrid regarding the grid connection and capacity of the network at this location, which has directly influenced the capacity of the project, and informed the project design and infrastructure layout.
- Availability of sufficient land area with suitable physical characteristics – the development footprint is predominantly cleared of native vegetation, would require minimal ground preparatory works and has good access to the regional road network and regional centres. The relatively flat terrain within the development footprint and predominantly cleared landscape mean that limited site preparation and civil works will be required. The development footprint has a relatively homogenous soil type, constant grade and is also well drained, which would limit runoff water velocity during heavy rainfall events and thus mitigate erosion potential. The project should not impact on the relevant large design flood, and the proximity of the regional road network enables efficient delivery of the infrastructure required for the project.
- Identification and avoidance of environmental constraints – OVERLAND has actively sought to identify and avoid environmental constraints as part of the project development, which has resulted in continual refinement of the site boundary, development footprint and infrastructure layout (Figure 3.1). This process has involved OVERLAND's team working with environmental specialists and landholders to:
    - Complete site inspections, surveys and desktop review to map potential environmental and land use constraints;
    - assess the significance of potential constraints; and
    - identify opportunities to avoid constraints where required.

- Detailed technical environmental investigations have identified environmental and land use constraints that have informed the site selection process, development footprint and infrastructure layout. Identified site features are provided in Figure 3.2 with further detail presented in Table 3.1. The location of a number of these features with respect to project infrastructure is provided in Figure 3.3. The development footprint's predominantly cleared and disturbed nature will minimise potential impacts on biodiversity.

- Placement of infrastructure to minimise land use conflicts with landholders – the parcels of land that comprise the development footprint, the placement of infrastructure including solar panels, inverters and electrical collection system, switchyard and connection infrastructure have been identified through detailed consultation with the landholders, to minimise land use conflicts and enable agricultural production and land management practices to continue on surrounding land. As discussed in Table 3.1, a number of identified site features within the site boundary have been avoided through careful consideration of the placement of infrastructure for the project, in particular the PV solar panel layout.

A summary of some of the key environmental constraints and site features considered during the site selection and preliminary project design process is provided in Table 3.1.

Table 3.1 Matters considered during the site selection and project design process

Aspect	Matters considered
Biodiversity	Measures to avoid and minimise impacts to vegetation were considered during the planning and detailed design stages of the project, resulting in avoidance of all significant biodiversity values, and minimisation of impacts on other areas of native vegetation. This iterative process has resulted in the project impacting upon native vegetation of low quality only. Refinements to the development footprint have avoided impacts upon the following significant biodiversity features: • 0.58 ha of PCT 438 - *River Red Gum riparian tall woodland wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion*; and • 19.13 ha of habitat for Koala and Squirrel Glider, potential nest sites for the Black-breasted Buzzard and Square-tailed Kite, potential habitat for Murray Cod, Silver Perch and Flat-headed Galaxias in the Namoi River and riparian vegetation along the Namoi River, south of the development footprint; Refinements to the development footprint have also significantly reduced impacts upon the following vegetation communities: • reduced impact upon PCT 101 - *Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion* from removal of approximately 342.9 ha to 145.8 ha in the current development footprint; and • reduced impact upon PCT 281 - *Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* from removal of approximately 14.9 ha down to 2.4 ha in the current development footprint. Through an iterative design process, which considered the above biodiversity values, the residual impact of the project will be limited to removal of 148.2 ha of low quality native vegetation.
Heritage	Aboriginal and historic heritage sites. Mapping of potential constraints and their likely significance early in the site selection and project design stage has enabled the identification and avoidance of heritage items, including two potential scar trees, OG_PST1 and OG_PST2, and one isolated artefact, OG_ISF1. The project is unable to avoid impacts to OG_ISF2, an isolated artefact in the northern portion of the development footprint. As the artefact is of low archaeological significance and has been sufficiently recorded, salvage in the form of collection is not considered warranted.

Table 3.1 Matters considered during the site selection and project design process

Aspect	Matters considered
Land use	Engagement with the landholders has enabled consideration of a range of potential land uses over the life of the project, and consideration of the value of agricultural production on the land to the landholders, compared to utilising the land for solar power generation. The project will provide the landholders with an alternative source of income during prolonged drought periods. In addition, where possible, a preference was made for grazing land to limit the use of cropping land which is of higher agricultural production value within the Gunnedah Shire LGA. The site is in close proximity to TransGrid's 132 kV transmission line. The development footprint has been designed to minimise the length of connection infrastructure required to connect the project infrastructure to the electricity grid. The site's proximity to TransGrid's 132 kV transmission line means that the connection infrastructure will avoid major road crossings. Consultation with mineral tenement holders has ensured that the project will have minimal impacts on existing resources and will not sterilise extractable resources in EL7241 or PEL0001.
Visual	Proximity to surrounding residences and passing motorists and potential impacts from glint and glare.
Noise	Potential noise impacts during construction and operation and proximity to surrounding residences. During the detailed design stage of the project, potential noise-generating infrastructure (including inverters and the switchyard / on-site substation), which will be required throughout the project's operations has been positioned as far from the closest sensitive residences as possible.
Transport	Proximity to, and capacity of, the local and regional road network and ability to transport the necessary infrastructure to the site and resource the workforce demand during construction.
Water	Proximity to, and interaction with, surface water and groundwater resources and overland flow paths within the development footprint. No interception of runoff is planned by project infrastructure and therefore there should be no net reduction in runoff from the development footprint. The project should not impact on the relevant large design flood.
Electromagnetic interference and hazards	The *Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields* (ICNIRP 1998) were considered in the placement of electrical infrastructure, including the inverters, electrical collection system and switchyard and connection infrastructure. The location of potentially hazardous infrastructure within the development footprint, including the switchyard / on-site substation and transmission line connection infrastructure, has been informed by proximity to the closest receptors.
Socio-economic	Proximity to one of the New England North West region's strategic centres (ie. Gunnedah) and availability of local businesses, services, temporary accommodation options and a local labour force.

In addition to the environmental aspects described above, the selection process has also been informed by the technical requirements of the PV solar panels (ie. spacing requirements between panels and shading limitations) and the economic feasibility of the project.

The legal property description for the development footprint for the project is provided in Table 3.2.

Table 3.2 Property description

Portion	Development footprint	
	Lot description	Area (ha)
Northern	DP 945590 (Lot 1 and part Lot 2) DP 754928 (Lot 30) DP 1068520 (part lot 1) DP 1068518 (Lot 3)	239
Southern	DP 945590 (part Lot 2) DP 126183 (part Lot 1)	14
Total area (ha)		253

3.2.1 Project alternatives

i 'Do nothing' option

The site is currently used for livestock grazing and cropping. The 'do nothing' scenario would allow for the continued use of the site for agricultural production. There are no additional agricultural services dependent on agricultural production within the site boundary.

Although the 'do nothing' scenario would allow the site's continued use for agricultural production, it would also forego the benefits of the project listed in Section 1.1, namely:

- production of renewable energy;
- creation of employment opportunities;
- direct and indirect benefits to the local economy;
- diversification of local revenue streams; and
- increased energy security.

The 'do nothing' scenario would result in a lost opportunity for the development of a large-scale renewable energy project on an ideally located site (close to TransGrid's 132 kV transmission line) with limited significant environmental constraints. Further, the 'do nothing' scenario would also result in a lost opportunity for the landholders to diversify their revenue streams.

The 'do nothing' scenario would avoid the potential environmental impacts associated with the construction, operation and decommissioning of the project, which include construction noise, traffic and visual impacts, as well as impacts to biodiversity and heritage. However, through the implementation of the management and mitigation measures described in Chapter 7, these potential impacts would not result in any significant impacts to the environment.

The project satisfies the principles of ecologically sustainable development (ESD) (refer to Chapter 8) and given its limited impact on the environment and considerable benefits, the 'do nothing' scenario is considered inappropriate.

ii Alternative solar technology

Under the guidance of the NSW REAP, renewable energy is predicted to grow and make important contributions to the NSW economy. As noted within the REAP, NSW has excellent renewable energy resources and is suitable for a number of different renewable energy technologies, including, hydroelectricity, wind, PV solar, solar thermal, bioenergy, geothermal and wave and tidal energy projects (NSW Government 2013).

OVERLAND's experience in the development of a portfolio of solar energy sun farms on land across regional Australia, supports the decision to develop the site into a large-scale solar PV energy development. Solar PV technology is considered to be more economically viable and also requires less supporting infrastructure than a similar scale solar thermal energy development.

iii Alternative site locations and configuration

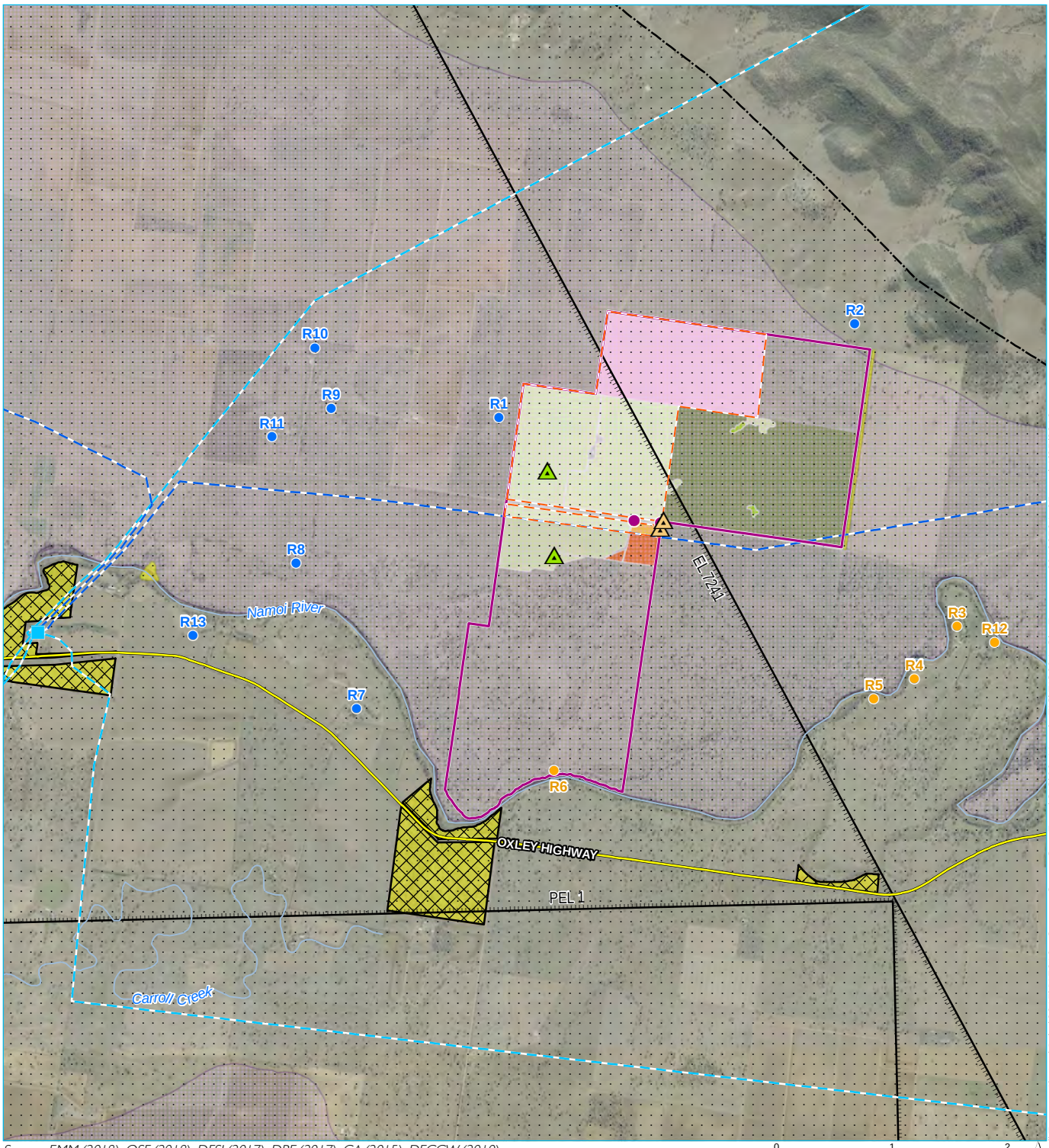
As noted in Section 1.3, DPE-DRE has identified potential for large-scale solar energy developments in the central, northern and western regions of NSW (DoI DRE 2016c). DPE-DRE (DoI DRE 2016c) identifies ideal characteristics for large-scale solar energy as: low population densities; large, flat open spaces; and high average global solar exposure.

Throughout the site selection and design process, OVERLAND considered a number of different site locations. This included land parcels south of the township of Carroll, as well as south of the Namoi River on a parcel of land with easement access to the Gunnedah Substation. OVERLAND completed a critical constraints assessment with a focus on avoiding land subject to adverse flooding events in the past, land that may impact on natural flood flows and impacts to prime agricultural land (currently used for irrigated cropping). OVERLAND ruled out a number of sites in the surrounding area as a result of these constraints. In addition, site selection also considered sites with limited dwellings within close proximity of the site and where natural screening to reduce potential visual impacts was also present.

As noted in Section 3.2, the site location, capacity of the project, design and layout of project infrastructure and connection to the electricity grid have been refined through an evaluation process both prior to and during preparation of the EIS. The development footprint and infrastructure layout within the site boundary have been refined on the basis of environmental constraints identification with the objective of developing an efficient project that avoids and minimises environmental impacts.

As noted in Section 3.2, the site's proximity to TransGrid's 132 kV transmission line avoids the need for major road crossings and minimises impacts on vegetation.

The site has also been selected to avoid and minimise land disturbance and overall impacts on agricultural production in the Gunnedah Shire LGA, where possible. As noted in Section 6.5.4, access tracks to and from the site will remain accessible to the landholders to avoid any impacts to the operation and sustainability of agricultural production on land adjacent to the development footprint. Further, relevant agencies have been consulted in respect of the proposed access intersections (refer to Section 5.3).



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Source: EMM (2018); OSF (2018); DFSI (2017); DPE (2017); GA (2015); DECCW (2010)

KEY

- Orange Grove Sun Farm site boundary
- Development footprint
- Indicative site access point
- Gunnedah Substation
- 132 kV transmission line
- 66 kV transmission line
- Main road
- Watercourse / drainage line
- Exploration lease boundary
- Travelling stock reserve
- Biophysical Strategic Agricultural Land
- Crown land
- Flood planning area

Receptors

- Non project-related receptors
- Project-related receptor

Aboriginal heritage site

- Isolated find
- Tree with scar
- Cropped/disturbed land

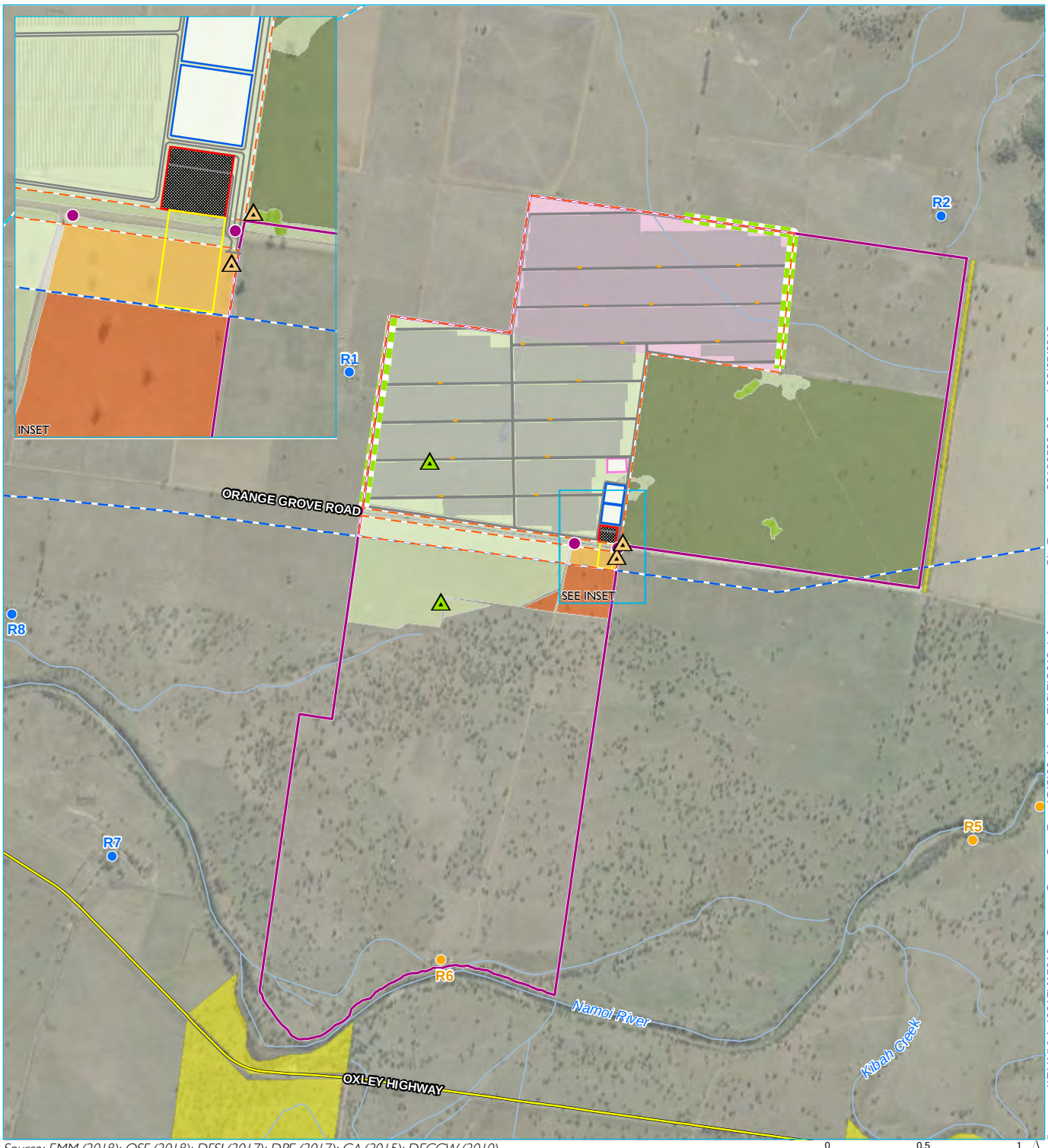
Plant community type

- PCT101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion - Low (grazed)
- PCT101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion - Moderate/good (derived grassland)
- PCT101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion - Moderate/good (poor)
- PCT281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion - Low (grazed)
- PCT281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion - Moderate/good

Site features

Orange Grove Sun Farm
Environmental impact statement
Figure 3.2

EMM



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Source: EMM (2018); OSF (2018); DFSI (2017); DPE (2017); GA (2015); DECCW (2010)

KEY

- Orange Grove Sun Farm site boundary
- Development footprint
- Indicative site access point
- 132 kV transmission line
- 66 kV transmission line
- Main road
- Area of proposed landscaping (not to scale)
- Watercourse / drainage line

Project infrastructure

- Solar panel layout
- Internal road
- Management hub and potential future battery storage
- On-site switchyard and transformation area
- Inverter
- Temporary laydown area
- Transmission corridor
- Crown land
- Area to be subdivided

Receptors

- Non project-related receptors
- Project-related receptor

Aboriginal heritage site

- Isolated find
- Tree with scar
- Cropped/disturbed land

Plant community type

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- PCT101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion - Moderate/good (poor)
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- PCT281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion - Moderate/good (an EEC listed under the BC Act)

Infrastructure layout and site features

Orange Grove Sun Farm
Environmental impact statement
Figure 3.3

EMM

3.3 Project components

3.3.1 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 3.1). PV solar panels will be constructed in a single axis tracking array, which will allow the PV solar panels to pivot from east to west during the day tracking the sun's movement. Panels will be fixed to, and supported by, ground-mounted framing (refer to Photograph 3.2). 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 2.4 m.

The typical dimensions of the PV solar panels are 1.7 m by 1 m, which provides a surface area of approximately 1.65 square metres (m^2) per PV solar panel. PV solar panels will be constructed of solar glass and have an anti-reflective coating.

Approximately 330,000 PV solar panels could be accommodated within the development footprint, providing an estimated nominal capacity in the order of 110 MW. The final number of PV solar panels within the development footprint will be dependent on detailed design and network requirements, availability and commercial considerations at the time of construction.

Photograph 3.1 **Example of the proposed PV solar panel array layout with inverters**

Photograph 3.2 **Example of the steel frame structures with a single axis tracking system used to support PV solar panels**

3.3.2 Electrical collection system, inverters and switchyard

The PV solar panels will be connected in series and the electricity generated by the project will be directed via electrical collection systems to the inverters (refer to Photograph 3.1). The number of inverters required will be dependent on the final detailed design, however, it is anticipated that up to 40 inverters will be required. The dimensions for each inverter will be approximately 6 m wide by 2.6 m high by 2.5 m deep. The inverters will connect to a project electrical switchyard and on-site substation, which will use the connection infrastructure to export electricity to the grid network. The dimensions of the electrical switchyard and on-site substation will be determined during detailed design.

3.3.3 Management hub

The project includes the development of a management hub, from which operation of the infrastructure will be managed. Structures will include a demountable office control building, including staff amenities, and equipment storage sheds. This will be the receival point for all equipment delivery during construction and all management activities during the project's operational period.

3.3.4 Battery and energy storage

The project may include the installation of battery and energy storage devices within a secure compound within the development footprint. The rated capacity of future battery and energy storage devices has not been determined at this stage of project development. The inclusion of such energy storage devices will be determined during the detailed design stage of the project and will be dependent on network integration and commercial considerations. A modification to the consent would be sought to permit the installation of this infrastructure within the development footprint if required.

3.3.5 Access, parking and security

Access to the development footprint's northern and southern portions will be via Orange Grove Road (Figure 3.1). The proposed access will utilise two access roads located off Orange Grove Road, one each for the northern and southern portions of the development footprint. Both of the proposed access intersections will consist of a three-way intersection with Orange Grove Road, with a connecting access road extending into the respective northern or southern portions of the development footprint. The proposed intersections would require some gravel shoulder widening on the approaches to and from Orange Grove Road, generally within the Orange Grove Road reserve, to accommodate the swept path turning movement by the largest types of trucks requiring access to the development footprint.

The predicted additional daily traffic generated at the peak stage of project construction (approximately three months) will be approximately 116 daily vehicle movements, reducing to approximately 80 daily vehicle movements during the earlier and later (average) stages of project construction, and approximately 10 daily vehicle trips during the operational stage of the project.

Oversized vehicle movements may be required for the delivery of the 33 kV/132 kV transformer that will be located at the project electrical switchyard.

Internal access roads to material storage compounds and the switchyard / on-site substation will be approximately 4–6 m width, whilst general internal roads will be approximately 3.5–5 m width. Roads will be constructed to accommodate construction and operational traffic movements throughout the development footprint's northern portion. The indicative location of the access roads is illustrated in the infrastructure layout plan (Figure 3.1).

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 infrastructure layout plan (Figure 3.1).

The northern portion of the development footprint will be fenced off by a chain mesh fence, which will be approximately 1.8–2.4 m high. Fencing will restrict public access to the northern portion of the development footprint. No additional fencing is proposed for the southern portion of the development footprint.

3.3.6 Connection infrastructure

The project will include connection of an electricity line and associated infrastructure from the project's electrical system and on-site switchyard / substation to TransGrid's 132 kV transmission line, which runs parallel to the southern boundary of the southern portion of the development footprint (Figure 3.1).

The connection infrastructure between the on-site switchyard / substation and the existing TransGrid transmission line will include a 132 kV overhead transmission line consisting of three electrical conductors, optical fibre communication cables and overhead earth wire. The overhead transmission line will be approximately 200 m in length and will require the installation of approximately four supporting poles (constructed of timber, concrete or steel) and an access track, all of which will be contained within the transmission corridor (Figure 3.1).

3.4 Construction

3.4.1 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;
  - construction material laydown areas; and
  - parking areas;
- removal of above and below ground irrigation structures;
- site works where required for stormwater and erosion management and preparation for infrastructure foundations;
- construction of access tracks and boundary fencing;
- site survey to confirm infrastructure positioning and placement; and
- geotechnical investigations to confirm the ground condition.

3.4.2 Construction stages

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

- installation of posts to provide support for the mounting framework required for the PV solar panels;
- foundations for the inverter blocks, buildings, switchgear and on-site substation will be prepared;
- cabling will be installed between the PV solar panels and the collection circuit (this cabling will carry power throughout the development footprint, between the inverters and central electrical switchyard);
- PV solar panel frames will be assembled and mounted on top of the posts;
- PV solar panels, inverters, transformers and switchgear units will be installed;
- connection infrastructure between the project electrical switchyard and TransGrid's 132 kV transmission line will be constructed;
- the management hub will be constructed;
- permanent fencing and security will be constructed; and
- the temporary construction site compound will be removed.

As noted previously, the project may include the installation of battery and energy storage devices within the development footprint. The proposed battery and energy storage devices would be housed in a secure compound within the development footprint and, if required, would be installed concurrently with other key project infrastructure including the PV solar panels, inverters, transformers and switchgear units. A modification to the consent would be sought to permit installation of this infrastructure within the development footprint in the future if required.

3.4.3 Construction plant and equipment

The plant and equipment required for the construction of the project will include:

- earthmoving machinery and equipment for site preparation;
- cable trenching and laying equipment;
- post-driving equipment;
- assisted material handling equipment (forklifts and cranes);
- machinery and equipment for connection infrastructure establishment; and
- water trucks for dust suppression.

3.4.4 Delivery of construction materials and infrastructure

Construction materials and infrastructure will be transported to the development footprint via road. Heavy vehicles up to 19 m in length will require access to the development footprint. Construction materials and infrastructure delivered to the development footprint will include:

- PV solar panels;
- posts and frameworks;
- electrical infrastructure including cabling, inverters, switchgear, transformer and electrical equipment associated with the switchyard and connection infrastructure;
- construction and permanent buildings and associated infrastructure;
- earthworks and lifting machinery and equipment; and
- water for dust suppression.

Oversized vehicle movements may be required for the delivery of the 33 kV/132 kV transformer that will be located at the project electrical switchyard.

The proposed heavy vehicle route for access to the development footprint is identified on Figure 6.8.

3.4.5 Construction duration and hours

Construction of the project will take approximately nine months from the commencement of site establishment works to commissioning. This will include a peak construction period of approximately three months. Construction activities will be undertaken during the standard daytime construction hours of:

- 7 am–6 pm Monday to Friday; and

- 8 am–1 pm Saturday.

In general, no construction activities will occur on Sundays or public holidays. Exceptions to these hours may be required on limited occasions. The local council and surrounding landholders will be notified of any exceptions.

3.4.6 Construction workforce

During the peak construction period, it is expected that a workforce of approximately 100 people will be required on-site. The final workforce will depend on project delivery timelines, including those for connection to the TransGrid network, and the generation requirements of the energy market. It is anticipated that the average construction workforce throughout the nine month construction period will be approximately 80 people.

3.5 Operation

Following construction, the project will begin operating, with the production of electricity for contribution to the grid network. The PV solar panels will operate during daylight hours, 7 days per week, 365 days per year. The operational lifespan of the project may be in the order of 30 years, depending on the nature of solar PV technology and energy markets.

The maximum height of the project buildings and infrastructure components, excluding the switchyard / on-site substation will be approximately 3 m.

An operational workforce in the order of three FTEs will be required to maintain the project once construction has been completed and operations commence.

Throughout operations, ongoing maintenance of the development footprint and project infrastructure will be required. This will include the following ongoing tasks:

- monitoring and control of the generation plant and connection to the TransGrid network system;
- site maintenance including:
  - vegetation maintenance;
  - weed and pest management;
  - fence and access road management; and
  - landscaping;
- infrastructure maintenance including:
  - panel cleaning;
  - panel repair (if required); and
  - equipment, cabling, substation and communications system inspection and maintenance.

To ensure the optimal electricity production output for the project is maintained, the PV solar panels may need to be washed periodically to remove dirt, dust and other matter. Water for panel cleaning will be transported to the development footprint via water trucks or via access to an appropriately licensed groundwater bore within close proximity of the development footprint. Washing will not require any detergent or cleaning agents.

The operational workforce will also be responsible for ongoing security monitoring of the development footprint and project infrastructure.

3.6 Decommissioning

Once the project reaches the end of its investment and operational life, the project infrastructure will be decommissioned and the development footprint returned to its pre-existing land use, or other land use in consultation with the landholders, as far as practicable.

Decommissioning of the development footprint will involve the removal and recycling of the materials on site including:

- PV solar panels and mounting frames;
- metals from posts and cabling; and
- all other equipment including inverters and transformers.

During decommissioning, all above ground facilities will be removed from the development footprint.

3.7 Environmental management

An environmental management strategy will be implemented to provide the strategic framework for environmental management of the project. The strategy will:

- incorporate a project environmental management plan (EMP), all other required plans, protocols, management and mitigation measures proposed in this EIS;
- identify all relevant statutory approvals;
- establish roles, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
- establish procedures for consulting with the local community and relevant agencies about the operation and environmental performance of the development; and
- establish procedures for handling of complaints, disputes, non-compliances and emergency response.

Chapter 7 provides a consolidated summary of the management measures that will be implemented during the construction and operation of the project to manage, mitigate and/or monitor potential impacts identified within this EIS.

4 Regulatory framework

4.1 NSW Environmental Planning and Assessment Act 1979

4.1.1 Approval process

The EP&A Act and the EP&A Regulation provide the framework for environmental planning and assessment in NSW. Part 4 of the EP&A Act relates to development assessment; Part 4, Division 4.1 relates to the assessment of development deemed to be significant to the State (or SSD).

Section 4.36 (2) of the EP&A Act states that a:

> ...State environmental planning policy may declare any development, or any class or description of development, to be State significant development.

The project is declared to be SSD by the provisions of the SRD SEPP (see Section 4.1.4.i for further details).

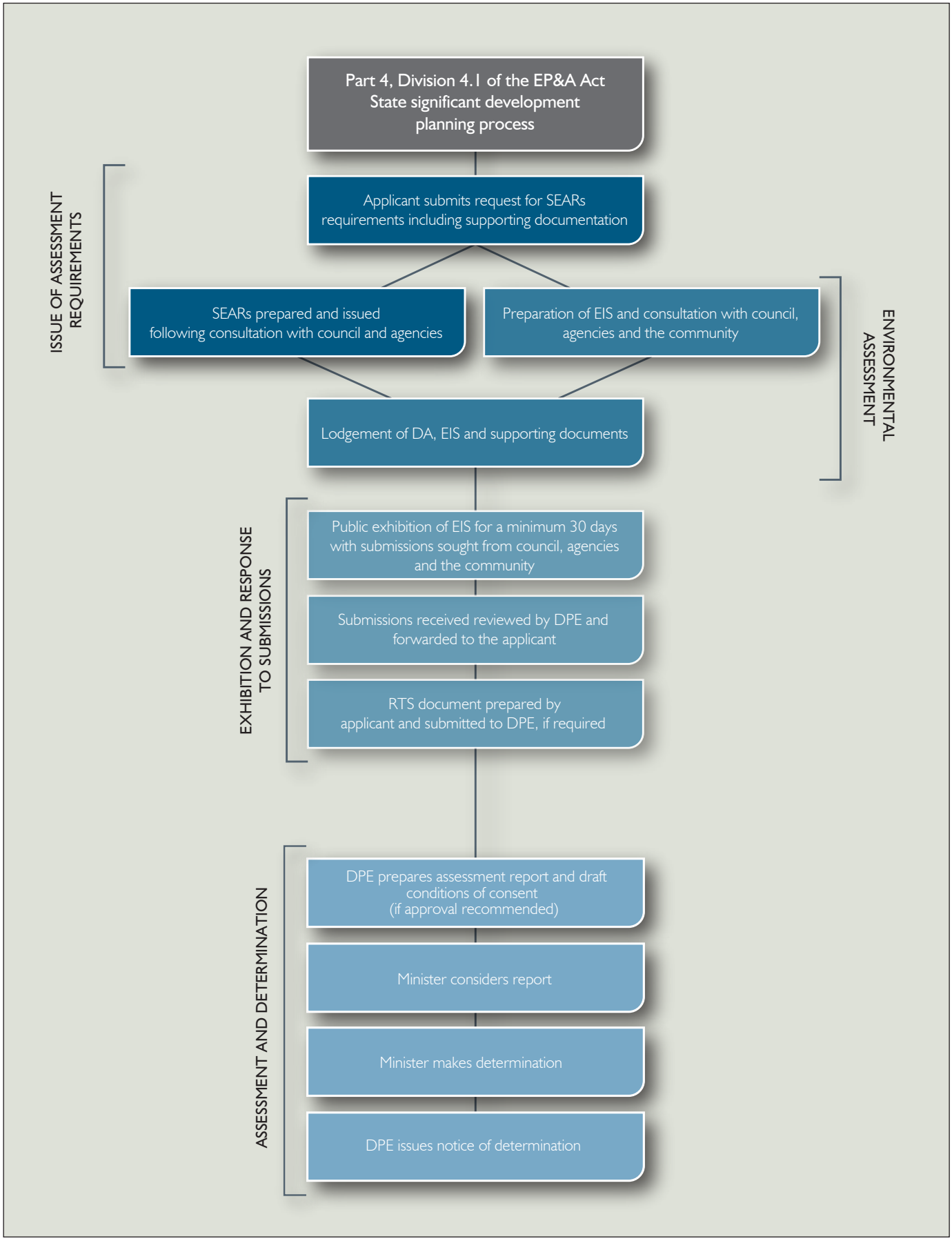
Under 4.38 of the EP&A Act, the NSW Minister for Planning is the consent authority for SSD. However, pursuant to Section 2.4 of the EP&A Act, the Minister may delegate the consent authority function to the Independent Planning Commission, the Secretary or to any other public authority.

A DA for SSD must be accompanied by an EIS, prepared in accordance with the EP&A Regulation. Before preparing an EIS, an applicant must request SEARs which specify what must be addressed in an EIS. The SEARs for the project, issued on 20 December 2017, are included with this EIS in Appendix A.

The EIS will be placed on public exhibition for a minimum of 30 days by DPE and submissions will be sought from local and State government agencies and the community. Any submissions received by DPE will be reviewed and forwarded to the applicant to consider and respond to (via a response to submissions (RTS) report).

Following receipt of the RTS report, DPE will prepare its assessment report considering this EIS, all submissions received during the exhibition process and the RTS report. This report is forwarded to the consent authority for consideration before determining the DA.

The planning approval process for SSD (under Division 4.1 of Part 4 of the EP&A Act) can be seen in Figure 4.1.



Planning approval process for SSD
Orange Grove Sun Farm
Environmental impact statement
Figure 4.1

4.1.2 Matters for consideration

When assessing a DA for SSD, the consent authority is required to take into consideration the matters outlined in Section 4.15 of the EP&A Act. These matters are addressed in Table 4.1.

Table 4.1 Matters for consideration – Section 4.15 of the EP&A Act

Provision	Consideration
Any environmental planning instrument	Relevant planning instruments are addressed in Section 4.1.4.
Any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority	There are no proposed instruments relevant to the project.
Any development control plan	Clause 11 of the SRD SEPP states that development control plans do not apply to SSD.
Any planning agreement that has been entered into under Section 7.4, or any draft planning agreement that a developer has offered to enter into under Section 7.4	There are no planning agreements relevant to the project.
The regulations (to the extent that they prescribe matters for the purposes of this paragraph)	The requirements of the EP&A Regulation are addressed in Section 4.1.5.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	This EIS comprehensively describes the likely impacts of the project based on the SEARs, including environmental impacts on both the natural and built environments, and social and economic impacts in the local area, region and State. It also describes commitments proposed by the proponent to mitigate and manage these impacts. These descriptions are based on technical studies prepared by specialists, which are appended to this EIS and summarised in Chapter 6. The technical studies were prepared using the most recent and accurate scientific data relevant to the project in consideration of current policies and legislation. In addition, the technical studies adopted conservative assumptions to enable the upper limit of likely impacts to be assessed.
The suitability of the site for the development	It is considered that the site of the project is suitable for a solar farm for a number of reasons, which are detailed in Chapter 3.
Any submissions made in accordance with this Act or the regulations	This EIS will be placed on public exhibition for a minimum of 30 days by DPE and submissions will be sought from local and State government agencies and the community. Any submissions received by DPE will be reviewed and forwarded to Orange Grove Sun Farm Pty Ltd to consider and respond to (via a RTS report). Following receipt of the RTS report, DPE will prepare its assessment report considering this EIS, all submissions received during the exhibition process and the RTS report.
The public interest	To assist the consent authority in determining whether the project is in the public interest, this EIS provides a justification for the project (refer to Section 1.3 and Chapter 8), taking into consideration its potential environmental impacts, and the suitability of the site. It also considers the project against the principles of ESD. The consent authority will also be required to consider all submissions received during the public exhibition of the EIS.

4.1.3 Approvals not required or which cannot be refused

Under Section 4.41 of the EP&A Act, the following authorisations are not required for SSD:

(a) (repealed);

(b) a permit under Section 201, 205 or 219 of the NSW *Fisheries Management Act 1994*;

(c) an approval under Part 4, or an excavation permit under Section 139, of the NSW *Heritage Act 1977*;

(d) an Aboriginal heritage impact permit under Section 90 of the NSW *National Parks and Wildlife Act 1974;*

(e) (repealed);

(f) a bush fire safety authority under Section 100B of the NSW *Rural Fires Act 1997*; and

(g) a water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the NSW *Water Management Act 2000*.

Further, Section 4.42 of the EP&A Act lists authorisations which cannot be refused and are to be substantially consistent with a development consent for SSD. Relevant to the project, consent under Section 138 of the NSW *Roads Act 1993* (Roads Act) may be required for the proposed access intersections to connect the project to Orange Grove Road. Should the project obtain development consent, approval under the Roads Act cannot be refused and will be consistent with conditions of approval.

4.1.4 Environmental planning instruments

The following environmental planning instruments are relevant to the project:

- SRD SEPP;
- State Environmental Planning Policy (Infrastructure) 2007 (the Infrastructure SEPP);
- State Environmental Planning Policy No 33–Hazardous and Offensive Development (SEPP 33);
- State Environmental Planning Policy No 55 – Remediation of Land (SEPP 55);
- State Environmental Planning Policy (Rural Lands) 2008 (Rural Lands SEPP);
- State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44); and
- Gunnedah LEP.

The relevant provisions of the above instruments to the project are discussed in the following sections.

i State Environmental Planning Policy (State and Regional Development) 2011

The SRD SEPP identifies development that is SSD. Clause 8 of the SRD SEPP states:

> (1) Development is declared to be State significant development for the purposes of the Act if:
>
> (a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and
>
> (b) the development is specified in Schedule 1 or 2.

Schedule 1 of the SRD SEPP defines the following as SSD:

> Electricity generating works and heat or co-generation
>
> Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:
>
> (a) has a capital investment value of more than $30 million.

The project is a development for the purpose of electricity generation using a solar energy source, and will have a capital investment value of more than $30 million.

Permissibility of the project is given under clause 34 (7) of the Infrastructure SEPP as detailed further below.

The project meets both the requirements of clause 8 of the SRD SEPP as it is not permissible without development consent and is development specified in Schedule 1. Therefore, the project is SSD for the purposes of the EP&A Act.

ii State Environmental Planning Policy (Infrastructure) 2007

The Infrastructure SEPP provides development controls for infrastructure and services. Clause 34 (7) of the SEPP provides provisions for development that is permitted with consent. It states:

> (7) Solar energy systems
>
> Except as provided by subclause (8), development for the purpose of a solar energy system may be carried out by any person with consent on any land.
>
> Subclause (8) limits the use of photovoltaic electricity generating systems with a capacity to generate more than 100 kW in residential zones. The site is not within a residential zone and, therefore, is not affected by this subclause.

Therefore, the project is permissible with development consent.

iii State Environmental Planning Policy No 33 – Hazardous and Offensive Development

Under SEPP 33 a preliminary hazard assessment (PHA) prepared in accordance with the current circulars or guidelines must be submitted for potentially hazardous or offensive development. The guideline *Applying SEPP 33* (DoP 2011) includes a checklist and a risk screening procedure to determine whether a development is potentially hazardous or offensive.

A review of *Applying SEPP 33* has identified that the project is not potentially hazardous, as it will not exceed the screening threshold for any of the hazardous material identified in *Applying SEPP 33*. Further, the project will not pose a significant risk to or have a significant adverse impact on human health, life, property or the biophysical environment (see Chapter 6). The project is not a potentially hazardous or offensive industry and therefore, a PHA is not required.

iv State Environmental Planning Policy No 55 – Remediation of Land

SEPP 55 was enacted to provide a state wide planning approach to the remediation of contaminated land, and aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human and environmental health.

Clause 7 of SEPP 55 requires that a consent authority take into consideration whether the land is contaminated. The contaminated land planning guidelines *Managing Land Contamination Planning Guidelines: SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning 1998) identifies activities with the potential to cause contamination. These guidelines list 'agricultural/horticultural activities' as an activity which potentially causes contamination.

A search of the EPA's contaminated land record, public register and list of sites notified to the EPA under Section 60 of the NSW Contaminated Land Management Act 1997 did not return any information on reported contamination or any regulatory notices issued for the site (EPA 2018a; EPA 2018b).

v State Environmental Planning Policy (Rural Lands) 2008

The rural lands SEPP aims to, among other objectives, facilitate the orderly and economic use and development of rural lands for rural and related purposes, to identify rural planning principles so as to assist the proper management of rural lands, reduce land use conflicts and identify State significant agricultural land to ensure its ongoing viability.

Clause 7 of the rural lands SEPP identifies rural planning principles as follows:

(a) the promotion and protection of opportunities for current and potential productive and sustainable economic activities in rural areas,

(b) recognition of the importance of rural lands and agriculture and the changing nature of agriculture and of trends, demands and issues in agriculture in the area, region or State,

(c) recognition of the significance of rural land uses to the State and rural communities, including the social and economic benefits of rural land use and development,

(d) in planning for rural lands, to balance the social, economic and environmental interests of the community,

(e) the identification and protection of natural resources, having regard to maintaining biodiversity, the protection of native vegetation, the importance of water resources and avoiding constrained land,

(f) the provision of opportunities for rural lifestyle, settlement and housing that contribute to the social and economic welfare of rural communities,

(g) the consideration of impacts on services and infrastructure and appropriate location when providing for rural housing,

(h) ensuring consistency with any applicable regional strategy of the Department of Planning or any applicable local strategy endorsed by the Director-General.

The project is considered to be an orderly use of the rural lands encompassed by the site, for the reasons outlined in Section 3.2. Potential impacts to biodiversity, heritage, land use and water resources are considered in Chapter 6.

Clause 13 of the rural lands SEPP identifies land as being State significant agricultural land if it is listed in Schedule 2, however, Schedule 2 does not identify any land as State significant agricultural land. As noted in Section 2.1, the site is mapped as BSAL.

During consultation with one of the project landholders, it was noted that irrigated crop production ceased on a large part of the development footprint during the 1990's due to significant reductions in the availability of a reliable supply of irrigation water from the Namoi River. Subsequently, irrigated crop production became uneconomic on this land parcel and the landholder reverted to grazing.

As noted in Section 2.1, the development footprint has been refined throughout the project design process to avoid identified environmental constraints. In addition to avoiding environmental constraints, revisions to the development footprint have also reduced the project's impacts on BSAL and agricultural production operations on additional parcels of land within the site boundary.

On balance, the project is considered to be an acceptable use of rural lands, in consideration of the social, economic and environmental interests of the community.

vi State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44)

SEPP 44 encourages the proper conservation and management of areas of natural vegetation that provide habitat for koalas. It applies to areas of native vegetation greater than 1 ha and in LGAs listed in Schedule 1 of SEPP 44. The development footprint is in the Gunnedah Shire LGA, which is listed in Schedule 1, therefore Koala habitat was considered within the BDAR.

One Koala feed tree species (Bimble Box), as defined within Schedule 1 of SEPP 44, was identified within the development footprint. Bimble Box makes up greater than 15% of the tree species within the development footprint, therefore the vegetation within the development footprint is considered potential Koala habitat as defined under SEPP 44.

Most of the trees within the development footprint are likely to provide foraging or sheltering resources for Koala. Koala scats were recorded on the southern banks of the Namoi River, in more timbered habitat south of the development footprint (Biosis 2017), however, no scats were found in the development footprint. The development footprint is therefore not considered core Koala habitat under SEPP 44.

Further discussion of the potential impacts of the project on koala habitat is provided in Appendix C.

vii Gunnedah Local Environmental Plan 2012

The site is zoned RU1 Primary Production pursuant to the Gunnedah LEP. The objectives of the RU1 zone are:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- to encourage diversity in primary industry enterprises and systems appropriate for the area;
- to minimise the fragmentation and alienation of resource lands;
- to minimise conflict between land uses within this zone and land uses within adjoining zones;
- to provide for a range of ecologically sustainable agricultural and rural land uses and development on broad acre rural lands;
- to protect significant agricultural resources (soil, water and vegetation) in recognition of their value to Gunnedah's longer term economic sustainability; and
- to conserve and enhance the quality of valuable environmental assets, including waterways, riparian land, wetlands and other surface and groundwater resources, remnant native vegetation and fauna movement corridors as part of all new development and land use.

The project will harness a natural resource, namely solar energy. Whilst the development of this project will impact the availability of land for other primary production, it will allow for and encourage diversity in the area's land use, and will provide economic stimulus and support to rural communities.

Development for the purpose of electricity generation is prohibited in the RU1 Zone as it is not specified in item 2 or 3 of the Gunnedah LEP. Notwithstanding, clause 34 (7) of the Infrastructure SEPP states that:

> ...development for the purpose of a solar energy system may be carried out by any person with consent on any land.

Therefore, development for the purpose of a solar energy system may be carried out on the site with development consent.

4.1.5 Environmental Planning and Assessment Regulation 2000

As previously stated, a DA for SSD must be accompanied by an EIS, prepared in accordance with the EP&A Regulation. Schedule 2 of the EP&A Regulation stipulates:

- requirements of the Director-General and approval bodies in relation to EISs (ie. the SEARs); and
- general provisions relating to EISs.

The general provisions specify the form (clause 6) and the content (clause 7) of an EIS. The clause 6 and 7 requirements and where they are addressed in the EIS are set out in Table 4.2.

Table 4.2 Schedule 2 requirements for an EIS

Requirement	Where contained in the EIS
Name, address and professional qualifications of the person(s) who prepared the EIS.	Certification page at the front of this EIS
Name and address of the responsible person (the applicant).	Certification page at the front of this EIS
Address of land.	Table 2.1
Description of development.	Chapter 3
Assessment of the environmental impact.	Chapter 6
Declaration that the EIS has been prepared in accordance with this Schedule, contains all available information that is relevant to the environmental assessment of the development and that the information contained in the statement is neither false nor misleading.	Certification page at the front of this EIS
Summary of the EIS.	Executive summary
A statement of the objectives of the development.	Section 3.1
An analysis of feasible alternatives, having regard to its objectives, including the consequences of not carrying out the development.	Section 3.3
A full description of the development.	Chapter 3
A general description of the environment likely to be affected by the development.	Chapter 2
The likely impact on the environment of the development.	Chapter 6
A full description of the measures proposed to mitigate any adverse effects of the development.	Chapter 6 Chapter 7
A list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out.	Table 4.3
A compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv) (a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment).	Chapter 7
The reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development.	Section 1.3 Section 8.3.7

4.2 Other State legislation

4.2.1 NSW Crown Lands Act 1989

The NSW *Crown Lands Act 1989* (CL Act) sets out how Crown land is to be managed. In particular, specific use of Crown land generally needs to be authorised by a lease, licence or permit. The NSW Department of Industry Crown Lands & Water Division (CLAWD) is responsible for administering the CL Act.

There is a small parcel of Crown land adjacent to the eastern boundary of the site (Lot 1 of DP 245982). This parcel of Crown land is identified on Figure 2.4. The project will not impact this parcel of Crown land.

4.2.2 NSW Protection of the Environment Operations Act 1997

The NSW Protection of the Environment Operations Act 1997 (POEO Act) is the principal NSW environmental protection legislation and is administered by the NSW Environment Protection Authority (EPA). Section 48 of the POEO Act requires an environment protection licence (EPL) to undertake scheduled activities at a premise. Scheduled activities are defined in Schedule 1 of the POEO Act and include the following premise-based activities that apply to the project:

> 17 Electricity generation
>
> (1) ...general electricity works, meaning the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power.
>
> (2) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.

The project involves the generation of electricity from solar energy. Therefore, it is not a scheduled activity and an EPL is not required.

4.2.3 NSW Water Management Act 2000

The NSW *Water Management Act 2000* (WM Act) regulates the use and interference with surface and groundwater in NSW where a water sharing plan has been implemented. A number of water sharing plans apply to the region in which the site is located, namely the Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources and the Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources.

The WM Act provides for basic landholder rights, which enable landholders to extract water from an aquifer underlying their properties for domestic and stock purposes without the need for a licence. A water use approval under Section 89 of the WM Act is not required for the project by virtue of Section 89J of the EP&A Act. Should water be extracted under these provisions for stock watering purposes, the relevant water supply work approvals would be sought under the WM Act.

The WM Act also contains provisions relating to harvestable rights. Harvestable rights allow landholders to collect a proportion of the runoff from their property. Any runoff harvested from the development footprint would be within the volume permitted under harvestable rights.

As described in Section 6.9.3, water demands for the project will be met via potable water trucked to the site and/or extraction from the Upper Namoi Zone 4 Namoi Valley (Keepit Dam To Gin's Leap) Groundwater Source. As noted, during operations, the project may require access to GW902401, which has a current water access licence. This will be the subject of ongoing consultation with the project landholder. In addition, during consultation about the project, a neighbouring landholder has offered to sell water to the project, should it be required.

4.2.4 NSW Rural Fires Act 1997

The NSW *Rural Fires Act 1997* (RF Act) aims to prevent, mitigate, and suppress bush and other fires in local government areas of the State. Section 63(2) of the RF Act requires the owners of land to prevent the ignition and spread of bushfires on their land. Under Section 4.41 of the EP&A Act, a bush fire safety authority under Section 100B of the RF Act is not required for SSD that is authorised by a development consent.

The RFS Bush Fire Prone Land online mapping tool and GSC bushfire prone mapping indicate that the site is not bush fire prone, however, a brief assessment and recommendations have been made to address how a grass fire impacting on and structural fire emanating from the project will be managed (refer to Section 6.11).

4.2.5 NSW Roads Act 1993

The NSW *Roads Act 1993* (Roads Act) is administered by either RMS, local government or New South Wales Land and Property Information (NSW LPI). The RMS has jurisdiction over major roads, local government over minor roads and NSW LPI over Crown roads. The Roads Act sets out the rights of the public in regard to access to public roads.

Under section 138 or Part 9, Division 3 of the Roads Act, a person must not undertake any works that impact on a road, including connecting a road (whether public or private) to a classified road, without approval of the relevant authority, being either RMS or local council, depending upon classification of the road.

The project will require the construction of at least one new intersection to connect the project to Orange Grove Road. Under the provisions of the EP&A Act, an approval under Section 138 or Part 9, Division 3 of the Roads Act cannot be refused if it is necessary for carrying out a SSD authorised by a development consent (refer to Section 4.1.3).

4.2.6 NSW National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act 1974* (NPW Act) provides for nature conservation in NSW including the conservation of places, objects and features of significance to Aboriginal people and protection of native flora and fauna. A person must not harm or desecrate an Aboriginal object or place without an Aboriginal heritage impact assessment under Section 90 of the NPW Act. However, a Section 90 permit is not required for SSD approvals by virtue of Section 4.41 of the EP&A Act.

The project design has avoided impacts to Aboriginal heritage sites as far as practicable. The project will avoid harm to three of the four Aboriginal heritage sites identified within the study area adopted as part of the ACHAR (refer to Section 6.3.3). The project is unable to avoid impacts to OG_ISF2, an isolated artefact in the northern portion of the development footprint. As the artefact is of low archaeological significance and has been sufficiently recorded, salvage in the form of collection is not considered warranted.

Further discussion of the potential impacts to Aboriginal heritage sites resulting from the project are detailed in Section 6.3 and Appendix D.

4.2.7 NSW Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act) commenced on 25 August 2017, which repealed the following:

- NSW Threatened Species Conservation Act 1995;
- sections of the NPW Act; and
- NSW Native Vegetation Act 2003.

The BC Act establishes a new regulatory framework for assessing and offsetting biodiversity impacts for proposed developments. Where development consent is granted, the consent authority may impose as a condition of consent, an obligation to retire a number and type of biodiversity credits determined under the new Biodiversity Assessment Method (BAM).

The BC Act is also supported by the Biodiversity Conservation Regulation 2017 and the Biodiversity Conservation (Savings and Transitional) Regulation 2017, which outline the methods to be used in applying the BAM, and specific considerations for transitional projects immediately following commencement of the new framework.

Detailed ecological assessments have been undertaken by Biosis Pty Ltd (Biosis) and EMM between March 2017 and February 2018 in accordance with the Biodiversity Assessment Method (BAM) (OEH 2017a). Assessments have included mapping of native vegetation, collection of plot/transect data and targeted threatened species surveys. This data has been used to refine the development footprint to avoid and minimise impacts to biodiversity.

The PCTs within the development footprint are heavily grazed and were identified to be in very low condition. Removal of vegetation has been limited to removal of 148.2 ha of low quality vegetation. The vegetation integrity score of both vegetation zones within the development footprint is such that offsets are not required for impacts on native vegetation. Therefore, the project does not require any offsets and no biodiversity offset strategy is required.

Further discussion of the potential impacts of the project on native vegetation and threatened species listed under the BC Act is provided in Section 6.2 and Appendix C.

4.2.8 NSW Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) aims to protect and conserve the natural and cultural history of NSW, including scheduled heritage items, sites and relics. Approvals under Part 4 or an excavation permit under section 139 of the Heritage Act are not required for SSD by virtue of Section 4.41 of the EP&A Act.

The project will not impact any items of local, State, National or World heritage significance identified on the SHR, Gunnedah LEP or Australian Heritage Database.

Further discussion of the potential heritage impacts of the project are detailed in Section 6.4.

4.2.9 NSW Biosecurity Act 2015

The NSW *Biosecurity Act 2015* (BS Act) was developed in consultation with industry; community and State government regulators to ensure the development of a regulatory framework that will effectively respond to and manage biosecurity risks.

The broad objectives of the BS Act are to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants by preventing their entry into NSW, quickly finding, containing and eradicating any new entries and effectively minimising the impacts of those pests, diseases, weeds and contaminants that cannot be eradicated through robust management arrangements.

The *North West Strategic Weed Management Plan* (LLS North West 2017) outlines how government, industry, and the community will share responsibility and work together to identify, minimise, respond to and manage weeds. The plan also supports regional implementation of the BS Act. No State or regional level priority weeds, as identified within the plan, were recorded within the development footprint.

The project may lead to a reduction in biosecurity (ie. reduced pest and weed control) due to the temporary significant increase in vehicle movements to and from the development footprint during construction. In addition, pest animals may also be encouraged by food sources from construction works and general disturbance.

During the construction and operational stages of the project, a number of land management and mitigation measures will be implemented to reduce the impact of the project on regional biosecurity. For example, vehicle movements will be restricted to the formed access tracks. In addition, if implemented, sheep grazing would put pressure on any increases to weed levels while maintaining a multi-purpose land use throughout the life of the project.

Further discussion of the potential biosecurity impacts of the project are detailed in Section 6.5 and Appendix C.

4.2.10 NSW Local Land Services Act 2013

The NSW *Local Land Services Act 2013* (LLS Act) established Local Land Services (LLS) who are responsible for the management and delivery of local land services in the social, economic and environmental interests of the State in accordance with any State priorities for local land services.

One of the objects of the LLS Act is to ensure the proper management of natural resources in the social, economic and environmental interests of the State, consistently with the principles of ESD. The four principles of ESD and the project's compatibility with each are considered Section 8.2.11. Resources within the development footprint include land that is being used for agricultural production, and land which has biodiversity and cultural heritage values. This constitutes the 'natural resources', which must be properly managed, developed or conserved.

The development footprint will be removed from agricultural use, however land management practises will avoid or minimise impacts with adjoining land uses, and ensure that land is not precluded from being returned to a productive agricultural use at the end of the operational stage of the project (refer to Section 6.5).

The site is part of the North West LLS region. As part of the consultation process for the project, OVERLAND has engaged with LLS North West. Details of this consultation are provided in Section 5.3. In addition, reference to the *North West Local Strategic Plan 2016-2021*, which was prepared by LLS North West, is provided in Section 4.4.2.

4.3 Commonwealth legislation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to protect matters of national environmental significance (MNES) including:

- world heritage properties;
- national heritage places;
- Ramsar wetlands of international importance;
- nationally threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- a water resource, in relation to coal seam gas development and large coal mining development.

If an action would, or is likely to, have a significant impact on any MNES, it is deemed to be a 'controlled action' and requires approval from the Commonwealth Minister for the Environment and Energy or the Minister's delegate. To determine whether a proposed action will or is likely to be a controlled action, a Referral or Proposed Action is submitted to the Commonwealth Department of the Environment and Energy (DoEE).

A search of the Commonwealth Protected Matters Search Tool indicates that there are no World Heritage Properties or National Heritage Places within the vicinity of the site. The Commonwealth Protected Matters Search Tool and detailed ecological investigations undertaken to date indicate that there is limited potential for listed threatened species and listed migratory species to occur within the vicinity of the site.

4.4 Strategic policies

4.4.1 New England North West Regional Plan 2036

The New England North West region encompasses a total of 12 LGAs in regional NSW including the Gunnedah Shire LGA. The *New England North West Regional Plan 2036* (NSW Government 2017) will guide the NSW Government's land use planning priorities and decisions in the New England North West region to 2036.

One of the primary goals of the *New England North West Regional Plan 2036* is to develop a strong and dynamic regional economy within the region. The region's economy has historically been dependent on agricultural productivity (NSW Government 2017). In the short term, the focus of the plan is on supporting cities, important farmland, renewable energy projects and tourism opportunities to help diversify the region's economy. To achieve this goal, the plan defines nine directions, one of which is to grow New England North West as the renewable energy hub of NSW. Large-scale renewable energy projects have potential to generate new employment opportunities and investment from construction, operations and connection to the State's electricity grid.

As noted within the *New England North West Regional Plan 2036,* the NSW Government is to work with local councils to deliver the directions and actions set out within this plan to grow the New England North West region as a renewable energy hub of NSW. The plan also establishes priorities for each council to guide further investigations and implementation. One of the priorities identified for GSC is to identify and promote wind, solar and other renewable energy production.

The region has potential sources of solar energy, receiving 1920 megajoules daily of solar exposure, making it the second highest solar penetration region in NSW (NSW Government 2017).

As noted in Section 3.2, the site and, more generally, Gunnedah Shire LGA, experience a consistently high availability of solar radiation making them ideal for large scale solar developments.

The project will create employment opportunities and have direct and indirect benefits to the local and regional economy during the life of the project. In addition, the site's proximity to TransGrid's 132 kV transmission line is beneficial and has been an important element of site selection, minimising the length of connection infrastructure required to connect the project to the electricity network. The project will contribute to the diversification of the energy sector while strengthening the New England North West region's economy.

4.4.2 North West Local Strategic Plan 2016-2021

The *North West Local Strategic Plan 2016-2021* was prepared in 2016 by LLS North West. The plan details actions and strategies that will be implemented to achieve the vision of strong communities, resilient landscapes and competitive agriculture over the five year period 2016-2021. The plan focuses its strategies for land management in the North West region on four long term goals for LLS, which include:

- Goal 1 – resilient, self-reliant and prepared local communities;
- Goal 2 – Biosecure, profitable, productive and sustainable primary industries;
- Goal 3 – Healthy, diverse and connected natural environments; and
- Goal 4 – Board members and staff who are collaborative, innovative and commercially focused.

The project is consistent with a number of the goals of the *North West Local Strategic Plan 2016-2021* and will contribute to the state-wide strategies identified by LLS to achieve these goals.

The development of a large-scale solar energy facility will improve the innovation, productivity and sustainability of land management in the North West region, which will contribute to strategies and key performance indicators targeting self-reliant, resilient and prepared communities. The project will also deliver positive economic outcomes and employment opportunities in the region with low environmental impact. This will contribute to the strategies for productive, biosecure and sustainable primary industries, including supporting land manager capacity to increase enterprise productivity and sustainability.

4.4.3 New England North West Strategic Regional Land Use Plan

The *New England North West Strategic Regional Land Use Plan* (NSW Government 2012) is an important component of the State government's Strategic Regional Land Use Policy (SRLUP), which comprises multiple initiatives to address land use conflict in regional areas, particularly focused on managing coal and coal seam gas issues. The plan identifies areas of strategic agricultural land, which includes both land with unique natural resource characteristics, known as BSAL, and clusters of significant agricultural industries that are potentially impacted by coal seam gas or mining development, known as critical industry clusters (NSW Government 2012).

There are no critical industry clusters in the New England North West Region, which includes the site and the wider Gunnedah Shire LGA. As noted in Section 2.1, the site is mapped as BSAL. Further discussion of the potential impacts of the project on BSAL is detailed in Section 6.5.

4.4.4 NSW Renewable Energy Action Plan

The REAP, prepared by the NSW Government in 2013 guides NSW's renewable energy development and supports the achievement of national renewable energy targets. The NSW Government's vision is for a secure, reliable, affordable and clean energy future for the State. The REAP positions NSW to increase the use of energy from renewable sources.

The REAP sets out a number of actions to achieve its vision, under the following three goals:

- Goal 1 – attract renewable energy investment;
- Goal 2 – build community support; and
- Goal 3 – attract and grow renewable energy expertise.

The project will assist in achieving the NSW Government's goals of increasing renewable energy generation in NSW to help achieve renewable energy targets. Through creating new solar employment opportunities, the project will contribute to growing expertise in renewable energy technologies.

4.5 Summary of licences, approvals and permits

Table 4.3 contains a summary of the licences, approvals and permits that are likely to be required for the project.

Table 4.3 Summary of required licenses, approvals and permits

Legislation	Authorisation	Consent or approval authority
EP&A Act	Development consent	Minister for Planning or delegate
	Construction certificate required prior to construction of certain structures	GSC or private certifier
	Occupation certificate required prior to use of certain buildings	GSC or private certifier
Roads Act	Section 138 permit for road and intersection improvements for the intersection to connect the project to Orange Grove Road	GSC

5 Stakeholder consultation

5.1 Overview

During the project design, development process and preparation of this EIS, consultation was undertaken with a range of stakeholders including various local and NSW Government agencies and the local community. This chapter describes the consultation undertaken for the project, including information on stakeholder identification, methods of communication, and outcomes of the consultation process.

5.2 Stakeholder identification

Three stakeholder groups were identified who may have a direct or indirect interest in the project, and hence were included in the consultation for the project. These broad groups were:

1. Regulatory – local, State and Commonwealth government agencies.
2. Community – neighbouring landholders, the communities of Gunnedah and Carroll and Aboriginal stakeholders.
3. Other stakeholders with local interests.

Table 5.1 provides a summary of the stakeholder and consultation objectives for the project.

Table 5.1 Stakeholders and consultation objectives

	Stakeholder	Consultation objectives
Regulatory	DPE GSC DPE-DRE DPE – Division of Resources and Geoscience (DRG) Office of Environment and Heritage (OEH) Roads and Maritime Services (RMS) Local Land Services (LLS) North West Department of Industry (DoI) – Crown Lands and Water Division (CLAWD) NSW Environment Protection Agency (EPA) NSW RFS Local Aboriginal Land Council (LALC) SafeWork NSW Fire & Rescue NSW	Introduce the project, including the project infrastructure layout and project timeline. Address matters raised by each of the listed agencies in correspondence provided with the SEARs, as well as any other matters that arise during consultation.

Table 5.1 Stakeholders and consultation objectives

	Stakeholder	Consultation objectives
Community	Adjoining landholders (including the Namoi Pistol Club)	Introduce the project, including the project infrastructure layout and project timeline. Where relevant, request information about on-site agricultural operations, aerial spraying, weed and pest management practices and bushfire protection management measures implemented on adjoining land. Listen to and document any concerns raised about the project. Seek to address concerns with the project design consistent with planning, economic and environmental considerations. Discuss the approval process. Present the findings of the visual impact assessment and discuss potential mitigation/management measures to address impacts (if required). Provide an opportunity for stakeholders to raise any concerns about the visual impact of the project.
	Local community (including Gunnedah and Carroll)	Introduce the project, including the project infrastructure layout and project timeline. Present information on the approval process. Inform the general public about the appropriate avenues for input into the project. Determine whether there are any concerns about the project to be addressed in the EIS.
	Aboriginal stakeholders	Introduce the project, including the project infrastructure layout and project timeline. Consultation regarding the Aboriginal cultural heritage values of the site.
Other stakeholders	Civil Aviation Safety Authority (CASA)	Introduce the project, including the project infrastructure layout and project timeline. Clarify whether there is potential for the Orange Grove Sun Farm to present a hazard to aviation.
	TransGrid	Discuss the proposed connection infrastructure to Transgrid's 132 kV transmission line.
	Photon Energy	Introduce the project, including the project infrastructure layout and project timeline.
	Australian Coalbed Methane Pty Ltd	Interactions with PEL 0001
	Santos QNT Pty Ltd	Interactions with PEL 0001

5.3 Regulatory and industry stakeholders

The methods of engagement with regulatory and industry stakeholders, the purpose of engagement, and outcomes of the consultation, is provided in Table 5.2. Detailed records of consultation are provided in Appendix B.

Table 5.2 **Consultation record and outcomes – regulators and industry stakeholders**

Stakeholder	Method of engagement	Date	Purpose	Outcome/comments
GSC	Phone call	13-Oct-17	Arrange meeting	To introduce OVERLAND to GSC and arrange a formal meeting of introduction.
	Email	16-Oct-17	Arrange meeting	Introduction email to the General Manager at GSC.
	Email	18-Oct-17	Arrange meeting	Meeting confirmation with the General Manager and Director Planning and Environmental Services.
	Meeting	24-Oct-17	General project briefing	Introduced OVERLAND to GSC.
	Phone call	25-Oct-17	Amend GSC letter of support	Request to update letter of support from GSC to provide additional project related detail.
	Email	08-Dec-17	Notify GSC of SEAR's	Email re SEARs application being uploaded to the DPE website distributed to the General Manager and Director Planning and Environmental Services.
	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Meeting	22-Feb-18	General project briefing	Met with Manager Planning and Development to provide an overview of the Orange Grove Sun Farm Project. Meeting to discuss the project with council with particular reference to council's SEAR's response namely: 1. Traffic volumes during construction, referencing whether bussing workers to site would be required; 2. Dust suppression; 3. Accommodation of the construction workforce; and 4. Use of Old Blue Vale Road during construction.
	Phone call	01-Mar-18	Notified GSC of Kibah quarry	Call to Manager Planning and Development regarding the gravel pit on Kibah property to confirm that discussions with the landholder confirmed it is managed by GSC.
	Email	04-Mar-18	Request	Request regarding clarification of GSC's requirement for consideration of dust suppression treatments.
	Email	05-Mar-18	Reply from GSC	GSC clarified that alternative road treatments would need to be submitted to GSC for consideration.
	Delivery	13-Mar-18	Deliver Factsheets	Orange Grove Sun Farm factsheets dropped off for display at GSC reception.

Table 5.2 **Consultation record and outcomes – regulators and industry stakeholders**

Stakeholder	Method of engagement	Date	Purpose	Outcome/comments
LLS North West	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Phone call and email	Multiple	Arrange meeting	Arranged a meeting at the LLS North West office in Gunnedah.
	Meeting	09-Mar-18	General project briefing	Introduced OVERLAND to six people from LLS and provided an overview of the Orange Grove Sun Farm project. Fielded questions in relation to the project. Of particular concern to the group is Koala habitat and limiting any potential impact upon the local Koala population.
OEH	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Phone call and email	Multiple	Arrange meeting	Arranged a meeting at the OEH office in Dubbo.
	Meeting	28-Feb-18	General project briefing	Introduced OVERLAND to OEH and provided an overview of the Orange Grove Sun Farm project. Discussed biodiversity matters.
DPE – DRG	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Phone call and email	Multiple	Arrange meeting	Arranged a meeting at DRG's offices in Maitland.
	Meeting	21-Feb-18	General project briefing	Provided an overview of the Orange Grove Sun Farm project. Fielded questions. Reviewed the tenements overlaying the site and had general discussion regarding the tenements. DRG advised it is unlikely the tenement they manage will be put to the market in the near future. Further, it is unlikely the project would impact the tenement.
	Email	20-Mar-18	Acknowledgement	DRG acknowledged OVERLAND's advice re the Kibah gravel pit, officially known as Gunnan Ridge South.

Table 5.2 **Consultation record and outcomes – regulators and industry stakeholders**

Stakeholder	Method of engagement	Date	Purpose	Outcome/comments
RMS	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Phone call and email	Multiple	Arrange meeting	Arranged a meeting at the RMS offices in Grafton.
	Meeting	16-Feb-18	General project briefing	Provided an overview of the Orange Grove Sun Farm project. Fielded questions. Discussed the broader outline of the TIA being undertaken. No major issues assuming the TIA is thorough.
RFS	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Phone call and email	Multiple	Arrange meeting	Attempted to arrange meeting in Coffs Harbour after RFS's invitation.
EPA	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Email	06-Feb-18	Reply to meeting request	EPA replied that as the proposed activity isn't a scheduled activity in the POEO Act it won't require an EPL with the EPA. GSC will be the appropriate regulatory authority for the purposes of the POEO Act.
DPI	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Phone call	06-Mar-18	Arrange meeting	DPI had tried to contact OVERLAND but did not leave a message and phone ID was blocked. OVERLAND were advised that DPI don't do face to face meetings. DPI's main issue is ability to rehab land at the end of the projects life.
Fire & Rescue NSW	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
Safe Work NSW	Email	05-Feb-18	Arrange meeting	Acknowledgement of SEAR's input and request for meeting.
	Phone call	06-Mar-18	Arrange meeting	Left message requesting a meeting or otherwise.
CASA	Email	02-Feb-18	General project briefing	Provided a copy of the preliminary site boundary and requested details of CASA registered aerodromes in the vicinity of the site and whether there were any concerns with the project's location.
	Email	02-Feb-18	Response from CASA	CASA noted that the project is sufficient distance from Gunnedah Airport and Lake Keepit Aircraft Landing Area (ALA) to not be of any concern to air navigation. CASA also noted that modern solar panels are designed to absorb light and not to reflect it.

Table 5.2 **Consultation record and outcomes – regulators and industry stakeholders**

Stakeholder	Method of engagement	Date	Purpose	Outcome/comments
Santos	Phone call and email	Multiple	Arrange meeting	Arranged a meeting at the Santos office in Narrabri.
	Meeting	06-Mar-18	General project briefing	Introduced OVERLAND to Santos Narrabri and provided an overview of the project. Santos manages the overlaying PEL tenement on behalf of the owner and doesn't have any issues with the project.
	Letter	12-Apr-18	Confirmation of no conflict	Santos, as operator of PEL 001, advised it is unlikely that the project as described in the PEA would conflict with prospecting activities that Santos may undertake in PEL 001.
Gunnedah Chamber of Commerce	Phone call and email	Multiple	Arrange meeting	Spoke with the Chamber President to arrange a meeting.
	Meeting	27-Mar-18	General project briefing	Met with the Chamber Vice President to provide project overview.
State Member for Tamworth	Phone call and email	Multiple	Arrange meeting	Arranged a meeting at Parliament House (Sydney).
	Meeting	03-May-18	General project briefing	Met with the incumbent member to discuss the project.

5.4 Community consultation

5.4.1 Surrounding landholders and other stakeholders

The outcomes of consultation with surrounding landholders and other stakeholders is summarised in Table 5.3. Copies of correspondence are provided in Appendix B.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
R1	Phone call	01-Aug-16	Initial contact	Contacted landholder about providing land for the sun farm.
	Meeting	15-Feb-18	Project briefing	Met with landholder on-farm to provide a project overview. OVERLAND requested that the meeting be rescheduled until a third party representing the landholder's interests could be present.
	Phone call	18-Feb-18	Follow-up	Contacted landholder regarding meeting.
	Phone call	22-Feb-18	Follow-up	Left voicemail regarding meeting.
	Phone call	27-Feb-18	Follow-up	Contacted landholder regarding meeting.
	Phone call	13-Mar-18	Follow-up	Left voicemail regarding further meeting, upcoming community information session, and to advise a factsheet left in mailbox.
	Phone call	13-Mar-18	Project briefing	A relative of the landholder responded to voicemail. The relative advised they are the Power of Attorney for the landholder and contact person. OVERLAND provided a brief on the project to the landholder's relative. The relative declined OVERLAND's offer to meet.
	Community information session	15-Mar-18	General project briefing	Landholder and their relative attended the community information session. Landholder and their relative had questions about visual, fire management, runoff and erosion, EMF, glare, flooding, noise, EIS submission date, land values, animal control/habitat, temperatures, ground water, weed control, project life span and decommissioning.
	Phone call	3-Apr-18	Follow-up	Attempted to contact the landholder's relative in follow-up to conversations during the community information session. Left message to contact.
	Phone call	10-Apr-18	Follow-up	Attempted to contact the landholder's relative in follow-up to conversations during the community information session. Left message to contact.
	Email	12-Apr-18	Email	Landholder's relative emailed a list of questions about the project and requested a copy of the draft EIS.
R2	Phone call	07-Feb-18	Project briefing	Introduced OVERLAND and arranged a meeting either at their home in Sydney or at their property. Landholders advised they will travel to their property.
	Meeting	13-Feb-18	Project briefing	Met with the landholders to provide a project overview, details about the site selection process and outline of the planning process. Landholders raised questions over glare from the solar panels. Drove across property with the landholders to the site boundary.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
	Phone call	14-Feb-18	Project briefing	Clarified the proposed development footprint with the landholders. Discussed EIS submission and assessment process.
	Phone call	14-Feb-18	Project briefing	Discussed the proposed solar panel and tracking technology.
	Phone call	22-Feb-18	Request from landholder	Landholders requested information on the solar panel and tracking technology and a map of the development footprint. Discussed project layout and landscape management plans. Advised landholders about the community information session.
	Phone call	27-Feb-18	Project update	Landholder called to check on arrival of information requested. Advised parcel express posted to their principal place of residence in Sydney as requested. OVERLAND asked for a follow up meeting.
	Phone call	28-Feb-18	Project update	Landholder called to confirm receipt of the parcel in Sydney. Landholder requested a copy of the infrastructure layout. OVERLAND advised that a layout was in preparation and would be available in the public EIS document.
	Phone call	01-Mar-18	Request from landholder	Landholder requested a copy of the infrastructure layout. OVERLAND advised that a layout was in preparation and would be available in the public EIS document.
	Phone call	05-Mar-18	Arrange a further meeting	Call to landholder and requested a further meeting.
	Phone call	07-Mar-18	From landowner	Landholder returned call and established a meeting time with OVERLAND.
	Meeting	14-Mar-18	Project update	OVERLAND tabled a draft indicative infrastructure layout of the sun farm to discuss visual impacts and landscape management. OVERLAND permitted to take photos from the landholder's veranda, which were used to inform the assessment of visual impacts and preparation of a photomontage (refer to Photograph 5.5 in Appendix G).
	Community information session	15-Mar-18	General project briefing	Landholders attended the community information session. Landholder had questions about visual, fire management, runoff and erosion, electromagnetic fields, glare, flooding, noise, EIS submission date, land values, animal control/habitat, temperatures, ground water, weed control, project lifespan and decommissioning.
	Phone call	9-Apr-18	Meeting request	Contacted landholders to request a meeting in Sydney at their home on the property to table the draft photomontage.
	Email	10-Apr-18	Request from landholder	Request to provide written response to queries previously discussed.
	Email	12-Apr-18	Landholder follow-up	Follow-up to email of 10-Apr-18.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
	Email	17-Apr-18	Landholder follow-up	Follow-up to email of 10-Apr-18.
	Email	17-Apr-18	Reply to landholder	Provided a reply to the landholders and again requested a meeting.
	Email	18-Apr-18	Reply to landholder	Provided further reply to the landholders advising the requested EIS documents are draft and will be available once the EIS is lodged. OVERLAND again requested a meeting.
	Email	19-Apr-18	Landholder request	Request for EIS documents prior to EIS lodgement.
	Email	30-Apr-18	Landholder request	Follow-up of request for EIS documents prior to EIS lodgement.
	Email	8-May-2018	Landholder request	Follow-up of request for EIS documents prior to EIS lodgement.
R7	Phone call	March 2017	Request for easement	Provided a project brief and enquired if they would be interested in allowing an easement through their land for exporting power from the project. Landholder declined.
	Phone call	13-Mar-18	General project briefing	Provided the landholder with an overview of the Orange Grove Sun Farm project and advised a factsheet had been placed in their letter box. The landholder has read the factsheet and had questions about whether an embankment was being placed around the sun farm. Advised the landholder there's no plan for an embankment around the sun farm site.
	Community Information Session	15-Mar-18	General project briefing	Landholders attended the community information session.
	Phone call	16-Apr-18	Enquiry regarding R13	Contacted the landholder regarding R13 (refer below) as the house is on their property. Advised that their relative lives in the house. Answered questions about flood studies and reaffirmed no embankment is planned around the perimeter of the sun farm.
R8	Property visit	15-Mar-17	Contact landholder	OVERLAND visited the property during mid-afternoon and left a business card plus note to please contact OVERLAND regarding providing land for the sun farm.
	Phone call	13-Mar-18	Arrange meeting	Obtained contact details for the new title owner of the property (resides in Sydney) to introduce OVERLAND and arrange a meeting to provide a project brief. Advised community information sessions on 15 and 16 March in Gunnedah and that a factsheet was delivered to the property.
	Text message	13-Mar-18	Request for information	Landholder requested that a map showing the project area be emailed to them.
	Email	13-Mar-18	Provision of information	OVERLAND emailed a PDF copy of the factsheet that included a project map.
	Email	14-Mar-18	Landholder query	Landholder had a question regarding the project area. OVERLAND sent a reply via email.
	Text message	14-Mar-18	Landholder request	Request from landholder to change Thursday 15 March meeting time. OVERLAND agreed.
	Phone call	15-Mar-18	Landholder advice	Request from landholder to change meeting time / day.
	Phone call	15-Mar-18	Landholder advice	Landholder called to advise they were at the Gunnedah Saleyards and could meet. OVERLAND agreed to meet in park adjacent to main street.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
	Meeting	15-Mar-18	General project briefing	Met with landholder and another party at Wolseley Park, Conadilly Street, Gunnedah. Provided a project overview, confirmed the infrastructure footprint and landholders working with OVERLAND, discussed EIS studies. Landholder had questions about visual, fire management, runoff and erosion, electromagnetic fields, glare, flooding, noise, EIS submission date, land values, animal control/habitat, temperatures, ground water, weed control, project life span and decommissioning.
	Community information session	15-Mar-18	General project briefing	Landholder and another party attended the community information session. Landholder had questions about visual, fire management, runoff and erosion, EMF, glare, flooding, noise, EIS submission date, land values, animal control/habitat, temperatures, ground water, weed control, project life span and decommissioning.
	Community information session	16-Mar-18	General project briefing	Landholder attended the community information session and was the only non-project related attendee. Landholder had questions mainly relating to site selection from an electricity grid perspective.
	Phone call and text message	16-Mar-18	Obtain photo from residence	OVERLAND left voice and text messages with landholder requesting access to allow for a photo to be taken from their house on the Orange Grove property. No response.
	Email	17-Mar-18	Notification and request for information	Landholder requested all correspondence be via email as the property's letter box is only occasionally checked as the landholder resides permanently in the Sydney area. Landholder enquired how the general community would be notified of the 30-day EIS public exhibition period.
	Email	19-Mar-18	Reply to email	OVERLAND acknowledged landholder's request for all correspondence to be via email. Provided a reply regarding DPE's process of notification and advised OVERLAND would also make contact advising the 30-day period had commenced. Provided (as verbally offered) the following: 1. A copy of the preliminary environmental assessment; and 2. A copy of the SEARs. Closed by offering to meet again in person to provide further information on issues of concern.
	Email	23-Mar-18	Request for information and offer to meet	Landholder asked when a response to queries raised would be provided along with those raised at the community information session. Requested: 1. A map showing the distance of the project to the residence; and 2. A copy of the surface water assessment. Offered to meet in Sydney on 29 or 30 March.
	Email	23-Mar-18	Reply to email	OVERLAND advised that no preliminary or draft documents can be emailed to the landholder. Offered to meet in person in Sydney if the landholder is available.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
	Email	27-Mar-18	Outline of landholder's situation and expectations.	Landholder provided an outline of their situation and expectations.
	Email	28-Mar-18	Request to provide further information	OVERLAND requested clarification on landholder's expectations.
	Email	29-Mar-18	Reply to OVERLAND's request	Landholder outlined expectations.
	Phone call	05-Apr-18	Follow-up	OVERLAND contacted landholder and offered to meet at residence in Sydney on 11 or 12 April 2018. Landholder did not want to meet in person and would only like to communicate via email.
	Email	05-Apr-18	Follow-up	Landholder sent email requesting all contact with OVERLAND be handled through email.
	Email	05-Apr-18	Follow-up	OVERLAND reiterated offer to meet in Sydney and informed landholder that there was no set date for the EIS submission, but that Landholder would be made aware once it becomes publically available.
	Email	06-Apr-18	Follow-up	Landholder outlined a series of financial and other commercial terms, that if OVERLAND agreed to enter into, the landholder would be willing to accept the project.
	Email	09-Apr-18	Follow-up	OVERLAND acknowledged receipt of the landholder's email.
	Email	09-Apr-18	Follow-up	Landholder emailed requesting an update on their request for OVERLAND to enter into an agreement with them.
	Email	19-Apr-18	Follow-up	Landholder emailed requesting an update on their request for OVERLAND to enter into an agreement with them.
	Email	20-Apr-18	Follow-up	Landholder emailed requesting an update on their request for OVERLAND to enter into an agreement with them.
	Phone Call	23-Apr-18	Follow-up	Landholder called OVERLAND requesting an update on their request for OVERLAND to enter into an agreement with them. OVERLAND explained that no decision around their request had been made. Landholder set a deadline for OVERLAND to respond.
	Phone Call	24-Apr-18	Follow-up	OVERLAND contacted landholder to advise the landholder that no decision had been made about the financial arrangement the landholder had request.
	Phone Call	27-Apr-18	Follow-up	OVERLAND contacted the landholder requesting permission to access their property to take photos to assess potential impact of the project. Landholder granted access to property.
	Email	01-May-18	Follow-up	Landholder emailed OVERLAND requesting an update on their request for OVERLAND to enter into an agreement with them.
	Phone Call	10-May-18	Follow-up	Landholder phoned OVERLAND requesting an update on their request for OVERLAND to enter into an agreement with them.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
R9	Phone call	Multiple	Arrange meeting	Introduce OVERLAND and to arrange a meeting.
	Meeting	12-Mar-18	General project briefing	OVERLAND provided the landholders with an overview of the project. Main issues raised were in relation to construction period traffic during school bus and local peak periods.
	Meeting	15-Mar-18	General project briefing	Landholder attended the community information session.
R10	Phone call	01-Mar-18	Arrange meeting	Requested a meeting to introduce OVERLAND and provide a project overview. Landholder advised they were unwell and would contact again in a week's time.
	Phone call	06-Mar-18	Arrange meeting	Landholder still unwell and unable to meet. Requested a call back in another week or so.
	Phone call	13-Mar-18	General project briefing	Landholder still unwell and unable to meet. Landholder had read the Orange Grove Sun Farm factsheet and did not have any questions.
	Phone call	13-Mar-18	Request	Contacted landholder to request contact information for surrounding landholder.
R11	Phone call	01-Mar-18	Arrange meeting	Introduced OVERLAND and arranged meeting.
	Meeting	06-Mar-18	General project briefing	Met with landholder and provided project briefing. Landholder asked questions about dust suppression and possible road degradation of Orange Grove Road during construction.
R13	Meeting	15-Mar-18	General project briefing	Occupant of residence (who is a relation of R7) attended the community information session.
	Phone call	17-Apr-18	Follow up with resident	Landholder asked questions about flood water impacts.
Namoi Pistol Club	Phone call	14-Feb-18	General project briefing	Contacted club founder and secretary to introduce OVERLAND and provide a project overview. Issues raised were in relation to glare and flooding. Advised community information session is being arranged.
	Phone call	23-Mar-18	General project briefing	Call to obtain the frequency of club meets. Further discussion in relation to glare and flooding. Overall no issue with the project. Secretary was aware the community information session was on but chose not to attend.
Gunnedah Services and Bowling Club	Delivery	13-Mar-18	Deliver factsheets	Orange Grove Sun Farm factsheets dropped off at the Gunnedah Services and Bowling Club for display in the foyer.
Carroll Store	Delivery	13-Mar-18	Deliver factsheets	Orange Grove Sun Farm factsheets pinned to the community notice board at the Carroll Store.
Gunnedah Solar Farm	Phone call	23-Apr-18	General project briefing	OVERLAND contacted Gunnedah Solar Farm to discuss their respective projects and the ongoing consultation with the local community.
	Phone call	24-Apr-18	General project briefing	Project manager from Gunnedah Solar Farm called OVERLAND to discuss their community consultation progress and provide a general project overview.

5.5 Community consultation

5.5.1 Surrounding landholders and other stakeholders

The outcomes of consultation with surrounding landholders and other stakeholders is summarised in Table 5.3. Copies of correspondence are provided in Appendix B.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
R1	Phone call	01-Aug-16	Initial contact	Contacted landholder about providing land for the sun farm.
	Meeting	15-Feb-18	Project briefing	Met with landholder on-farm to provide a project overview. OVERLAND requested that the meeting be rescheduled until a third party representing the landholder's interests could be present.
	Phone call	18-Feb-18	Follow-up	Contacted landholder regarding meeting.
	Phone call	22-Feb-18	Follow-up	Left voicemail regarding meeting.
	Phone call	27-Feb-18	Follow-up	Contacted landholder regarding meeting.
	Phone call	13-Mar-18	Follow-up	Left voicemail regarding further meeting, upcoming community information session, and to advise a factsheet left in mailbox.
	Phone call	13-Mar-18	Project briefing	A relative of the landholder responded to voicemail. The relative advised they are the Power of Attorney for the landholder and contact person. OVERLAND provided a brief on the project to the landholder's relative. The relative declined OVERLAND's offer to meet.
	Community information session	15-Mar-18	General project briefing	Landholder and their relative attended the community information session. Landholder and their relative had questions about visual, fire management, runoff and erosion, EMF, glare, flooding, noise, EIS submission date, land values, animal control/habitat, temperatures, ground water, weed control, project life span and decommissioning.
	Phone call	3-Apr-18	Follow-up	Attempted to contact the landholder's relative in follow-up to conversations during the community information session. Left message to contact.
	Phone call	10-Apr-18	Follow-up	Attempted to contact the landholder's relative in follow-up to conversations during the community information session. Left message to contact.
	Email	12-Apr-18	Email	Landholder's relative emailed a list of questions about the project and requested a copy of the draft EIS.
R2	Phone call	07-Feb-18	Project briefing	Introduced OVERLAND and arranged a meeting either at their home in Sydney or at their property. Landholders advised they will travel to their property.
	Meeting	13-Feb-18	Project briefing	Met with the landholders to provide a project overview, details about the site selection process and outline of the planning process. Landholders raised questions over glare from the solar panels. Drove across property with the landholders to the site boundary.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
	Phone call	14-Feb-18	Project briefing	Clarified the proposed development footprint with the landholders. Discussed EIS submission and assessment process.
	Phone call	14-Feb-18	Project briefing	Discussed the proposed solar panel and tracking technology.
	Phone call	22-Feb-18	Request from landholder	Landholders requested information on the solar panel and tracking technology and a map of the development footprint. Discussed project layout and landscape management plans. Advised landholders about the community information session.
	Phone call	27-Feb-18	Project update	Landholder called to check on arrival of information requested. Advised parcel express posted to their principal place of residence in Sydney as requested. OVERLAND asked for a follow up meeting.
	Phone call	28-Feb-18	Project update	Landholder called to confirm receipt of the parcel in Sydney. Landholder requested a copy of the infrastructure layout. OVERLAND advised that a layout was in preparation and would be available in the public EIS document.
	Phone call	01-Mar-18	Request from landholder	Landholder requested a copy of the infrastructure layout. OVERLAND advised that a layout was in preparation and would be available in the public EIS document.
	Phone call	05-Mar-18	Arrange a further meeting	Call to landholder and requested a further meeting.
	Phone call	07-Mar-18	From landowner	Landholder returned call and established a meeting time with OVERLAND.
	Meeting	14-Mar-18	Project update	OVERLAND tabled a draft indicative infrastructure layout of the sun farm to discuss visual impacts and landscape management. OVERLAND permitted to take photos from the landholder's veranda, which were used to inform the assessment of visual impacts and preparation of a photomontage (refer to Photograph 5.5 in Appendix G).
	Community information session	15-Mar-18	General project briefing	Landholders attended the community information session. Landholder had questions about visual, fire management, runoff and erosion, electromagnetic fields, glare, flooding, noise, EIS submission date, land values, animal control/habitat, temperatures, ground water, weed control, project lifespan and decommissioning.
	Phone call	9-Apr-18	Meeting request	Contacted landholders to request a meeting in Sydney at their home on the property to table the draft photomontage.
	Email	10-Apr-18	Request from landholder	Request to provide written response to queries previously discussed.
	Email	12-Apr-18	Landholder follow-up	Follow-up to email of 10-Apr-18.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
	Email	17-Apr-18	Landholder follow-up	Follow-up to email of 10-Apr-18.
	Email	17-Apr-18	Reply to landholder	Provided a reply to the landholders and again requested a meeting.
	Email	18-Apr-18	Reply to landholder	Provided further reply to the landholders advising the requested EIS documents are draft and will be available once the EIS is lodged. OVERLAND again requested a meeting.
	Email	19-Apr-18	Landholder request	Request for EIS documents prior to EIS lodgement.
	Email	30-Apr-18	Landholder request	Follow-up of request for EIS documents prior to EIS lodgement.
	Email	8-May-2018	Landholder request	Follow-up of request for EIS documents prior to EIS lodgement.
R7	Phone call	March 2017	Request for easement	Provided a project brief and enquired if they would be interested in allowing an easement through their land for exporting power from the project. Landholder declined.
	Phone call	13-Mar-18	General project briefing	Provided the landholder with an overview of the Orange Grove Sun Farm project and advised a factsheet had been placed in their letter box. The landholder has read the factsheet and had questions about whether an embankment was being placed around the sun farm. Advised the landholder there's no plan for an embankment around the sun farm site.
	Community Information Session	15-Mar-18	General project briefing	Landholders attended the community information session.
	Phone call	16-Apr-18	Enquiry regarding R13	Contacted the landholder regarding R13 (refer below) as the house is on their property. Advised that their relative lives in the house. Answered questions about flood studies and reaffirmed no embankment is planned around the perimeter of the sun farm.
R8	Property visit	15-Mar-17	Contact landholder	OVERLAND visited the property during mid-afternoon and left a business card plus note to please contact OVERLAND regarding providing land for the sun farm.
	Phone call	13-Mar-18	Arrange meeting	Obtained contact details for the new title owner of the property (resides in Sydney) to introduce OVERLAND and arrange a meeting to provide a project brief. Advised community information sessions on 15 and 16 March in Gunnedah and that a factsheet was delivered to the property.
	Text message	13-Mar-18	Request for information	Landholder requested that a map showing the project area be emailed to them.
	Email	13-Mar-18	Provision of information	OVERLAND emailed a PDF copy of the factsheet that included a project map.
	Email	14-Mar-18	Landholder query	Landholder had a question regarding the project area. OVERLAND sent a reply via email.
	Text message	14-Mar-18	Landholder request	Request from landholder to change Thursday 15 March meeting time. OVERLAND agreed.
	Phone call	15-Mar-18	Landholder advice	Request from landholder to change meeting time / day.
	Phone call	15-Mar-18	Landholder advice	Landholder called to advise they were at the Gunnedah Saleyards and could meet. OVERLAND agreed to meet in park adjacent to main street.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
	Meeting	15-Mar-18	General project briefing	Met with landholder and another party at Wolseley Park, Conadilly Street, Gunnedah. Provided a project overview, confirmed the infrastructure footprint and landholders working with OVERLAND, discussed EIS studies. Landholder had questions about visual, fire management, runoff and erosion, electromagnetic fields, glare, flooding, noise, EIS submission date, land values, animal control/habitat, temperatures, ground water, weed control, project life span and decommissioning.
	Community information session	15-Mar-18	General project briefing	Landholder and another party attended the community information session. Landholder had questions about visual, fire management, runoff and erosion, EMF, glare, flooding, noise, EIS submission date, land values, animal control/habitat, temperatures, ground water, weed control, project life span and decommissioning.
	Community information session	16-Mar-18	General project briefing	Landholder attended the community information session and was the only non-project related attendee. Landholder had questions mainly relating to site selection from an electricity grid perspective.
	Phone call and text message	16-Mar-18	Obtain photo from residence	OVERLAND left voice and text messages with landholder requesting access to allow for a photo to be taken from their house on the Orange Grove property. No response.
	Email	17-Mar-18	Notification and request for information	Landholder requested all correspondence be via email as the property's letter box is only occasionally checked as the landholder resides permanently in the Sydney area. Landholder enquired how the general community would be notified of the 30-day EIS public exhibition period.
	Email	19-Mar-18	Reply to email	OVERLAND acknowledged landholder's request for all correspondence to be via email. Provided a reply regarding DPE's process of notification and advised OVERLAND would also make contact advising the 30-day period had commenced. Provided (as verbally offered) the following: 1. A copy of the preliminary environmental assessment; and 2. A copy of the SEARs. Closed by offering to meet again in person to provide further information on issues of concern.
	Email	23-Mar-18	Request for information and offer to meet	Landholder asked when a response to queries raised would be provided along with those raised at the community information session. Requested: 1. A map showing the distance of the project to the residence; and 2. A copy of the surface water assessment. Offered to meet in Sydney on 29 or 30 March.
	Email	23-Mar-18	Reply to email	OVERLAND advised that no preliminary or draft documents can be emailed to the landholder. Offered to meet in person in Sydney if the landholder is available.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
	Email	27-Mar-18	Outline of landholder's situation and expectations.	Landholder provided an outline of their situation and expectations.
	Email	28-Mar-18	Request to provide further information	OVERLAND requested clarification on landholder's expectations.
	Email	29-Mar-18	Reply to OVERLAND's request	Landholder outlined expectations.
	Phone call	05-Apr-18	Follow-up	OVERLAND contacted landholder and offered to meet at residence in Sydney on 11 or 12 April 2018. Landholder did not want to meet in person and would only like to communicate via email.
	Email	05-Apr-18	Follow-up	Landholder sent email requesting all contact with OVERLAND be handled through email.
	Email	05-Apr-18	Follow-up	OVERLAND reiterated offer to meet in Sydney and informed landholder that there was no set date for the EIS submission, but that Landholder would be made aware once it becomes publically available.
	Email	06-Apr-18	Follow-up	Landholder outlined a series of financial and other commercial terms, that if OVERLAND agreed to enter into, the landholder would be willing to accept the project.
	Email	09-Apr-18	Follow-up	OVERLAND acknowledged receipt of the landholder's email.
	Email	09-Apr-18	Follow-up	Landholder emailed requesting an update on their request for OVERLAND to enter into an agreement with them.
	Email	19-Apr-18	Follow-up	Landholder emailed requesting an update on their request for OVERLAND to enter into an agreement with them.
	Email	20-Apr-18	Follow-up	Landholder emailed requesting an update on their request for OVERLAND to enter into an agreement with them.
	Phone Call	23-Apr-18	Follow-up	Landholder called OVERLAND requesting an update on their request for OVERLAND to enter into an agreement with them. OVERLAND explained that no decision around their request had been made. Landholder set a deadline for OVERLAND to respond.
	Phone Call	24-Apr-18	Follow-up	OVERLAND contacted landholder to advise the landholder that no decision had been made about the financial arrangement the landholder had request.
	Phone Call	27-Apr-18	Follow-up	OVERLAND contacted the landholder requesting permission to access their property to take photos to assess potential impact of the project. Landholder granted access to property.
	Email	01-May-18	Follow-up	Landholder emailed OVERLAND requesting an update on their request for OVERLAND to enter into an agreement with them.
	Phone Call	10-May-18	Follow-up	Landholder phoned OVERLAND requesting an update on their request for OVERLAND to enter into an agreement with them.

Table 5.3 Consultation records and outcomes – surrounding landholders and other stakeholders

Stakeholder	Method of engagement	Date	Purpose	Outcome/comment
R9	Phone call	Multiple	Arrange meeting	Introduce OVERLAND and to arrange a meeting.
	Meeting	12-Mar-18	General project briefing	OVERLAND provided the landholders with an overview of the project. Main issues raised were in relation to construction period traffic during school bus and local peak periods.
	Meeting	15-Mar-18	General project briefing	Landholder attended the community information session.
R10	Phone call	01-Mar-18	Arrange meeting	Requested a meeting to introduce OVERLAND and provide a project overview. Landholder advised they were unwell and would contact again in a week's time.
	Phone call	06-Mar-18	Arrange meeting	Landholder still unwell and unable to meet. Requested a call back in another week or so.
	Phone call	13-Mar-18	General project briefing	Landholder still unwell and unable to meet. Landholder had read the Orange Grove Sun Farm factsheet and did not have any questions.
	Phone call	13-Mar-18	Request	Contacted landholder to request contact information for surrounding landholder.
R11	Phone call	01-Mar-18	Arrange meeting	Introduced OVERLAND and arranged meeting.
	Meeting	06-Mar-18	General project briefing	Met with landholder and provided project briefing. Landholder asked questions about dust suppression and possible road degradation of Orange Grove Road during construction.
R13	Meeting	15-Mar-18	General project briefing	Occupant of residence (who is a relation of R7) attended the community information session.
	Phone call	17-Apr-18	Follow up with resident	Landholder asked questions about flood water impacts.
Namoi Pistol Club	Phone call	14-Feb-18	General project briefing	Contacted club founder and secretary to introduce OVERLAND and provide a project overview. Issues raised were in relation to glare and flooding. Advised community information session is being arranged.
	Phone call	23-Mar-18	General project briefing	Call to obtain the frequency of club meets. Further discussion in relation to glare and flooding. Overall no issue with the project. Secretary was aware the community information session was on but chose not to attend.
Gunnedah Services and Bowling Club	Delivery	13-Mar-18	Deliver factsheets	Orange Grove Sun Farm factsheets dropped off at the Gunnedah Services and Bowling Club for display in the foyer.
Carroll Store	Delivery	13-Mar-18	Deliver factsheets	Orange Grove Sun Farm factsheets pinned to the community notice board at the Carroll Store.
Gunnedah Solar Farm	Phone call	23-Apr-18	General project briefing	OVERLAND contacted Gunnedah Solar Farm to discuss their respective projects and the ongoing consultation with the local community.
	Phone call	24-Apr-18	General project briefing	Project manager from Gunnedah Solar Farm called OVERLAND to discuss their community consultation progress and provide a general project overview.

In addition to the consultation recorded in Table 5.3, representatives from OVERLAND also met and discussed the project with other landholders along Orange Grove Road, Old Blue Vale Road, Wean Road and the Oxley Highway. Some questions were raised by residents along Orange Grove Road in relation to flooding and vehicle movements

along Orange Grove Road, particularly during school bus and peak traffic periods. As part of discussions with these landholders, those who were unable to attend the community information sessions described in Section 5.4.3 were provided feedback on the matters raised by the attendees.

5.5.2 Community factsheet

A factsheet was placed at the office receptions of GSC and the Gunnedah Services and Bowling Club and provided an introduction to the project, as well as contact details for OVERLAND and details of upcoming community information sessions. A copy of the factsheet was also distributed to:

- residents along Kelvin Road, Campbell Road, Orange Grove Road, O'Keefe Avenue and Old Blue Vale Road; and
- community members that attended the community information sessions (refer to Section 5.4.3).

A copy of the factsheet is provided in Appendix B. The Namoi Valley Independent also published details about the project on 2 February 2018. A copy of the article is provided in Appendix B.

5.5.3 Gunnedah community information sessions

Two community information sessions were held in the township of Gunnedah at the Gunnedah Services and Bowling Club, one of which was held on the evening of 15 March, while the other was held on the morning of 16 March. The sessions were advertised in the Namoi Valley Independent on 9, 13 March and 15 March. In addition, an article within the Namoi Valley Independent on 9 March also provided details for the information sessions.

The sessions provided an opportunity for the community to engage directly with representatives from OVERLAND about the project. Information boards were presented, which contained information about OVERLAND, solar farms and renewable energy generation, in general, as well as specific details about the project and the approval process (refer to Appendix B).

The first session was held over two hours with 20 people registering their attendance. In addition, a further 20-30 other residents also attended but chose not to record their attendance. Due to the staggered arrival of attendees throughout the two hour period, one-on-one through to small group briefings were provided by OVERLAND representatives with a variety of questions being raised and answered.

The second session was also held over two hours, however, attendance was significantly less. One community member from the first information session attended. Questions raised were primarily in relation to the wider electrical network. Three project-related community members also attended.

A summary of the matters raised by attendees is given in Table 5.3.

Table 5.3 Matters raised at community information session

Matter	Comment
Flooding	Questions were raised regarding the potential impacts the project may have during large flood events should overland flows extend across part of or the entire development footprint. A number of attendees acknowledged that the development footprint for the project is thought to be less flood prone than areas to the west and south of the development footprint. Of note, the type of boundary fencing to limit obstruction of overland floodwater flows is one area attendees requested attention. These questions have been addressed as part of the surface water assessment (refer to Section 6.9 and Appendix F).
Traffic	Questions were raised about traffic impacts and site access, in particular vehicle movements during peak periods and along school bus routes and dust management along the unsealed section of Orange Grove Road. These questions have been addressed as part of the traffic impact assessment (refer to Section 6.8 and Appendix I). Two access locations have been identified in Figure 3.1 and assessed in Appendix I. In addition, project-related traffic will not be permitted to access the development footprint from an easterly direction.
Visual amenity	Questions were raised about impacts on the visual amenity from surrounding residences. Visual impacts area assessed in Section 6.6 and Appendix G. Landscaping is proposed to minimise impacts to two receptors, R1 and R2 (refer to Section 6.6.4 (i)).
Local employment	Positive views about potential employment benefits for the local community. Questions related to how many local jobs will be generated by the project during construction and positions during operation, as well how recruitment will be undertaken so that the local community had the opportunity to apply for jobs. OVERLAND indicated that local employment was the desirable outcome and that it would endeavour to work with stakeholders to maximise employment opportunities for the local community where possible.
Noise	Questions were raised about impacts on noise during construction and operations. Noise impacts are assessed in Section 6.7 and Appendix G. Noise generated during operations will primarily be associated with the inverters, which will be enclosed within a container. Noise impacts were considered in the placement of electrical infrastructure within the development footprint, including the inverters, electrical collection system and switchyard and connection infrastructure.
Glare and reflectivity	Solar panel glare and reflection was raised. 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 2016a; Solar Trade Association 2016; FAA 2010). Attendees were advised that PV solar panels are not considered to be reflective as they are designed to absorb light. An assessment of the likely visual impacts of the development (including any glare and reflectivity) has been prepared for the project (Appendix G). Section 6.6 of the EIS summarises the visual impact assessment.
Capital investment and government funding	Attendees queried the capital investment value of the project and the value of any government incentives or funding for development of the project. The estimated capital investment of the project will be $94 million and will be privately funded. No Commonwealth or State government funding is currently available for the project.
Weeds	Questions in relation to the project's impacts on weed invasion and distribution. The project may lead to a reduction in biosecurity (ie. reduced pest and weed control) due to the temporary significant increase in vehicle movements to and from the development footprint during construction if not adequately managed. The EMP will include weed management protocols, such as measures for the identification, management and ongoing monitoring of weeds on the development footprint. In addition, topsoil will be stockpiled appropriately to minimise weed infestation.
Bushfire risk	Questions around potential for project infrastructure to contribute to a bushfire. Bushfire risks associated with the project have been assessed in Section 6.11 in accordance with Planning for Bushfire Protection (PBP) (RFS 2006). Section 6.11 describes measures to enable the project to comply with the objectives of PBP. The risk of the project initiating a bushfire will be minimised through the implementation of appropriate management measures.
Runoff and erosion	Questions around potential for project infrastructure to contribute to runoff and erosion within the site and surrounds. Consideration of ground cover beneath the PV solar panels will be included in the EMP to manage erosion and surface water runoff. The area of impervious ground surface will not increase significantly; therefore there is not expected to be an increase in runoff generated from the development footprint.

Table 5.3 Matters raised at community information session

Matter	Comment
Electromagnetic fields	Questions around potential hazards associated with electromagnetic fields and interference. The Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (ICNIRP 1998) were considered in the placement of electrical infrastructure, including the inverters, electrical collection system and switchyard and connection infrastructure. The location of potentially hazardous infrastructure within the development footprint, including the switchyard / on-site substation, BESS and transmission line connection infrastructure, has been informed by proximity to the closest receptors. Further information is provided in Section 6.10.
Groundwater	Questions in with regards to the project's impacts on groundwater. The project is not likely to impact groundwater during construction, operation and decommissioning due to the estimated depth to groundwater within the site boundary and the limited amount of subsurface disturbance activities required during the installation and decommissioning of project infrastructure.
Property devaluation	Questions in regard to the project's impact on the value of surrounding properties. The EIS has assessed the potential impacts of the project and it is not predicted to generate any significant environmental impacts to nearby residences. Some visual impacts have been identified at the nearest residences (R1 and R2) and the proponent is committed to undertaking landscaping to minimise impacts to these two receptors (refer to Section 6.6.4 (i)). The residual impacts associated with the project are predicted to be minimal and considered unlikely to result in any discernible impact on property values.

5.5.4 Aboriginal stakeholders

Aboriginal stakeholders were identified and consulted in accordance with OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a) and the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005). A detailed description of consultation is presented in Appendix D, and discussed in Section 6.3.

6 Impact assessment

6.1 Introduction

A preliminary assessment of biophysical, social and economic matters was included as part of the request for SEARs submitted for the Orange Grove Sun Farm (November 2017). That assessment informed the SEARs which have identified the key matters for assessment in this chapter of the EIS, as follows:

- biodiversity;
- heritage;
- land;
- visual;
- noise;
- transport;
- water;
- hazards and risks;
- socio-economic; and
- cumulative impacts.

In addition to the key matters identified in the SEARs, considerations of impacts to air quality and waste management have also been included in this chapter.

Where relevant, technical reports have been prepared and appended (refer to Appendices C to I). A summary of mitigation and management measures is included in Chapter 7.

6.2 Biodiversity

6.2.1 Introduction

The SEARs require an assessment of the potential impacts of the project on biodiversity. The SEARs state that this EIS must include:

> an assessment of the biodiversity values and the likely biodiversity impacts of the development, a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the development over time, and a strategy to offset any residual impacts of the development in accordance with the NSW *Biodiversity Conservation Act 2016.*

A BDAR has been prepared by EMM for the project (Appendix C). This section of the EIS summarises the results of the BDAR and addresses the SEARs requirements for biodiversity.

6.2.2 Existing environment

i Landscape

A broader ecological study area was adopted for the BDAR, which includes the development footprint plus surrounding land within the site boundary (refer to Figure 6.1). Land within the site boundary is of varying quality, dependent on land use and grazing pressure. To the east of the development footprint is grazing land that contains scattered trees with native grassland. To the south of the development footprint, towards the Namoi River, the grazing land becomes more timbered, with a sparse tree cover and a ground layer containing more native species. Roadside vegetation along Orange Grove Road contains scattered trees over grassy groundcover that contains a mixture of native and exotic species.

The ecological study area occurs within the Brigalow Belt South bioregion and Liverpool Plains subregion. The Liverpool Alluvial Plains soil landscape was used in the assessment as it covers the ecological study area and development footprint. The ecological study area is within the Namoi River catchment in north-western NSW.

ii Native vegetation

The development footprint is currently used for cattle grazing and cropping and has a long history of intensive irrigation and cropping. Native vegetation and fauna habitats have been modified by past disturbances associated with land clearing, cropping, livestock grazing and weed invasion. Native vegetation occurs as isolated paddock trees with a heavily modified ground storey.

Land immediately to the north and south of Orange Grove Road is used for livestock grazing and contains widely scattered paddock trees, no mid-storey and a heavily grazed groundcover dominated by introduced pasture grass species. Land in the far northern portion of the development footprint is used for cropping. This area contains widely scattered paddock trees and a completely cleared mid-storey and ground layer to facilitate crop production.

The development footprint supports 148 ha of native vegetation of low quality (Figure 6.1). The following PCTs were identified within the development footprint:

- PCT 101 *Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion,* in a heavily modified condition due to the land uses outlined above, with a total area of 145.8 ha; and

- PCT 281 *Rough-Barked Apple red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South,* in a heavily modified condition due to the land uses outlined above, with a total area of 2.4 ha.

Heavy cattle grazing and past cropping and intensive irrigation have impacted the groundcover, resulting in heavy weed infestations, soil disturbance and compaction. This has limited recruitment of native shrubs, grasses and eucalypt species. The vegetation is characterised by isolated mature native trees with an understorey dominated by exotic (pasture) grasses and herbs and disturbance tolerant native species. Existing irrigation channels, soil disturbance and lack of shrub species are evidence of past irrigation and cropping activities. The cropped land does not fit in any PCT.

iii Threatened species

The majority of the development footprint contains cleared paddocks which are heavily grazed, with only scattered remnant Bimble Box (*Eucalyptus populnea*) and Yellow Box (*Eucalyptus melliodora*) present. Most of these trees are hollow bearing, but there is little fallen timber, sparse leaf litter, no understorey vegetation and a groundcover of heavily grazed and mainly introduced grasses and herbs. The northern part of the development footprint is largely devoid of native vegetation, with scattered paddock trees only.

The road reserve adjacent to Orange Grove Road has similar features to the woodland areas, however, ground cover is taller with a greater diversity as this area is not being grazed.

No rock outcrops are present on the development footprint.

There are no watercourses or wetlands within the development footprint, apart from one small farm dam surrounded by the heavily grazed and exotic ground cover and one highly disturbed first-order stream within the cropped land in the northern portion of the development footprint.

The development footprint supports suitable habitat features for two species; the Brush-tailed Phascogale (*Phascogale tapoatafa*) and *Cyperus conicus*.

No threatened species were recorded within the development footprint during targeted surveys.

The Koala (*Phascolarctos cinerus*) (probable identification) and Squirrel Glider (*Petaurus norfolcensis*) (positive identification) were recorded by Biosis (2017) within the site boundary. These results, located in the higher quality vegetation over 600 m south of the development footprint, were used to inform the detailed design stage of the project and refine the development footprint (refer to Table 3.1).

One individual Finger Panic Grass (*Digitaria porrecta*) was recorded within the Orange Grove Road reserve, as shown in Figure 6.1.

6.2.3 Impact assessment

i Method

The BDAR for the project was prepared in accordance with the BAM. The extent of native vegetation within the development footprint was determined based upon:

- a review of regional vegetation mapping;
- site investigations involving mapping and assessment of vegetation condition;
- detailed mapping of vegetation communities;
- identification and delineation of PCTs in the field; and
- confirmation of PCT identification using community profile descriptions.

A constraints assessment of land within the site boundary was undertaken by Biosis Pty Ltd in March 2017 (Biosis 2017). As part of this assessment, areas of native vegetation for which a PCT could accurately be assigned were identified and delineated in the field, and vegetation condition determined. Biosis stratified the PCTs into vegetation zones based on condition (low or moderate/good) and ancillary code, and assessed site value using data obtained via a series of plots and transects, as per the methodology outlined in Section 5 of the *Framework for Biodiversity Assessment* (OEH 2014).

EMM has utilised the vegetation data from the previous constraints assessment (Biosis 2017) to inform the BDAR. Further, as the SEARs for the project specify that the project must be assessed in accordance with the BAM (OEH 2017a), additional data was needed to supplement that gathered previously by Biosis (2017). Subsequent field effort was targeted to fill in gaps in the existing site information given the change in method from the *Framework for Biodiversity Assessment* (OEH 2014) to BAM (OEH 2017a), as well as changes to the development footprint during design of the project.

Plot data was collected from the development footprint between 13 -14 February 2018. A total of eight plots and transects were completed within the development footprint. At four locations (Plots 10, 11, 12 and 13), a full survey was undertaken including the assessment of composition, structure and function. At four locations (Plots 2, 3, 4 and 9), data on composition and structure was collected by Biosis (2017). This data was verified in the field with additional data on functional attributes collected to fulfil the requirements of the BAM (OEH 2017a).

The land in the north of the northern portion of the development footprint is used for cropping. Under the BAM (OEH 2017a), land not containing native vegetation is not subject to assessment beyond Section 5.4 (determination of a vegetation integrity score). However, during consultation with OEH, it was noted that site photos showing cropped land and a species list obtained via rapid assessment demonstrating little to no native cover would meet the requirements for the cropped land.

An initial habitat-based fauna assessment was also undertaken by Biosis (2017), which sought to identify fauna habitat features within the site boundary. Biosis (2017) conducted targeted flora and fauna surveys within the site boundary, between 13–17 March 2017.

Targeted flora surveys were undertaken in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016b) and involved walking parallel transects approximately 10 m apart through all potential habitat within the site boundary and adjacent road reserves along Orange Grove Road. Given the quality of vegetation in the development footprint, with little native vegetation cover present, some areas were not targeted, with only random meanders undertaken. Transect surveys were undertaken in areas of PCT 281.

Targeted threatened fauna surveys were undertaken for a greater number of threatened species than the candidate threatened species requiring further assessment. Surveys for these species were undertaken as a part of the constraints analysis performed by Biosis (2017) to ensure the presence of these species was incorporated into measures to avoid and minimise impacts during detailed design.

ii Impacts on native vegetation

Site investigations, identified the presence of two PCTs within the development footprint (Figure 6.1). The PCT, vegetation formation and vegetation class (Keith 2004) are described within Table 6.1. As there were only two PCTs, with each one having no change in condition across the development footprint, no further stratification of the PCTs was required, resulting in a total of two vegetation zones within the development footprint. The vegetation integrity score for each vegetation zone is also described within Table 6.1.

Table 6.1 Plant community types of the development footprint

Plant community type	Vegetation formation	Vegetation class	Vegetation zone	Condition	Area (ha)	Vegetation integrity score
PCT 101 – *Poplar Box - Yellow Box – Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion*	Semi-arid Woodlands (Grassy sub-formation)	Brigalow Clay Plain Woodlands	1	Low (grazed)	145.8	6.1
PCT 281 – *Rough-Barked Apple – Red Gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion*	Grassy Woodlands	Western Slopes Grassy Woodlands	2	Low (grazed)	2.4	6.1

One area of non-native vegetation, which is cropped land, was also identified (Figure 6.1).

As the vegetation integrity scores for all vegetation zones is below 15, then assessment of native vegetation is not required beyond Section 5.4 of the BAM (OEH 2017a) and an assessment of threatened species habitat according to Section 6.2 of the BAM (OEH 2017a) is not required.

iii Impacts on threatened species

a. Ecosystem credit species

As the vegetation integrity score for both vegetation zones is less than 15, an assessment of threatened species habitat according to Section 6.2 of the BAM (OEH 2017a) is not required.

b. Species credit species

An assessment of habitat constraints for threatened species was undertaken in accordance with Step 2 of Section 6.4 of the BAM (OEH 2017a). For those threatened species predicted to occur, for which habitat constraints are listed, an assessment was undertaken of the presence of the habitat features within the development footprint, along with the determination of whether impacts to these habitat features will result from the project. The development footprint supports suitable habitat features for two species; the Brush-tailed Phascogale and *Cyperus conicus*.

To develop a list of species credit species for further assessment, an assessment was undertaken in accordance with Step 3 of Section 6.4 of the BAM (OEH 2017a). The assessment identified four flora species and two fauna species as candidate species requiring further assessment. Targeted surveys were undertaken, and the presence or absence of these species in the development footprint determined, in accordance with Section 6.4 of the BAM (OEH 2017a).

No threatened species were recorded within the development footprint during targeted surveys.

The koala (probable identification) and squirrel glider (positive identification) were recorded by Biosis (2017) within the site boundary explored by OVERLAND. These results, located in the higher quality vegetation over 600 m south of the development footprint, informed the detailed design of the project and the selection of the development footprint.

One individual Finger Panic Grass was recorded within the Orange Grove Road reserve, as shown in Figure 6.1. This species will not be impacted by the project, which will use two existing access points through the Orange Grove Road reserve into the development footprint (refer Figure 3.1). Shoulder widening will occur at the proposed access point for the northern portion of the development footprint, which is located approximately 40 m to the east of the Finger Panic Grass record. This will result in clearance of a small area of disturbed grassland habitat where targeted surveys did not detect the species.

iv Summary of potential impacts

The project has potential for both direct and indirect impacts. The direct impacts arising from the project include:

- the removal of 145.8 ha of PCT 101 - *Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion* in low condition; and
- the removal of 2.4 ha of PCT 281 *Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* in low condition.

Through an iterative design process, the residual impact of the project will be limited to removal of 148.2 ha of low quality native vegetation.

Potential indirect impacts arising from the project include:

- temporary increased noise levels from construction equipment, leading to disturbance of fauna, especially if this occurs during breeding seasons; and
- temporary increase of traffic volume (during construction) leading to higher chance of fauna strike and increased noise levels leading to disturbance of fauna.

The development footprint occurs as low quality vegetation that is already heavily impacted by edge effects. The project will not significantly increase edge effects given the high level of existing clearance.

No threatened species were identified within the development footprint, despite targeted surveys being undertaken. Finger panic grass, koala and squirrel glider were recorded within the site boundary, but not the development footprint, which has been reduced to avoid these biodiversity values.

6.2.4 Management and mitigation

The principal means to reduce impacts to biodiversity values resulting from the project has been to avoid areas of high quality or supporting significant biodiversity values, and minimise the removal of identified native vegetation and fauna habitat.

i Avoidance of impacts

OVERLAND has considered all biodiversity values and sought advice from Biosis (2017) and EMM in the planning and detailed design stages of the project to avoid, where possible, direct impacts to identified biodiversity values.

Based upon the findings of the constraints assessment (Biosis 2017) and further work by EMM in areas to the east of the development footprint, OVERLAND has made significant reductions to the extent of the development footprint, which was originally based upon a much larger area within the site boundary.

OVERLAND has made refinements to the proposed development footprint and has avoided impacts upon the following significant biodiversity features:

- 0.58 ha of PCT 438 - *River Red Gum riparian tall woodland wetland on basaltic alluvial soils mainly in the Liverpool Plains sub-region, Brigalow Belt South Bioregion*, by the Naomi River in a previously proposed transmission line route that crossed the river, over 2 km south of the development footprint;
- 19.13 ha of habitat for Koala and Squirrel Glider, south of the development footprint;
- riparian vegetation along the Namoi River, south of the development footprint;
- potential habitat for Murray Cod (*Maccullochella peelii*), Silver Perch (*Bidyanus bidyanus*) and Flat-headed Galaxias (*Galaxias rostratus*) in the Namoi River, south of the development footprint; and
- potential nest sites for the Black-breasted Buzzard (*Hamirostra melanosternon*) and Square-tailed Kite (*Lophoictinia isura*), south of the development footprint.

Refinements to the development footprint have also significantly reduced impacts upon the following PCTs:

- reduced impact upon PCT 101 - *Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion* from removal of approximately 342.9 ha (based upon the preliminary investigation areas) down to 145.8 ha in the development footprint; and
- reduced impact upon PCT 281 - *Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* from removal of approximately 14.9 ha (based upon the preliminary investigation areas) down to 2.4 ha in the development footprint.

ii Minimise impacts

Additional measures to avoid and minimise direct impacts will be outlined in the EMP and will include:

- avoid and minimise clearing impacts to PCTs, where possible;
- clearing limits will be clearly marked to prevent unnecessary clearing beyond the extent of the development footprint;
- tree clearing and disturbance will be limited to the development footprint;
- appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' will be considered and, where necessary, identified in site inductions;
- removal of trees will be limited to that required within the development footprint in support of the installation of project infrastructure;
- a clearing procedure will be implemented during the clearing of the development footprint, which will include:
    - completion of preclearance surveys to determine if any nesting birds or koalas are present;
    - clearing not to proceed until koalas have moved on;
    - a suitably trained fauna handler will be present during hollow-bearing tree clearing to rescue and relocate displaced fauna if found on-site; and
- appropriate exclusion fencing will be installed around trees and vegetation to be retained in or directly adjacent to the development footprint.

Additional measures to avoid and minimise indirect impacts will also be outlined in the EMP and will include:

- using existing farm gates and tracks to access the development footprint, where possible;
- appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' will be installed on the northern side of Orange Grove Road at the proposed access point for the northern portion of the development footprint that requires shoulder widening (approximately 40 m east of the Finger Panic Grass record) to prevent any indirect impacts to sub-optimal potential habitat for Finger Panic Grass;
- where necessary, signage for 'No Go Zones' or 'Environmental Protection Areas' will be identified in site inductions;
- plant and equipment will be parked in dedicated parking zones within the development footprint and not within the road reserve; and
- an erosion and sediment control plan will be implemented on-site.

iii Offsetting impacts

The vegetation integrity scores of both the vegetation zones within the development footprint are less than 15, and therefore offsets are not required for impacts on native vegetation. The project will not result in any impacts on threatened species that require offsetting. Therefore, the project does not require any offsets and no biodiversity offset strategy is required.

6.2.5 Conclusion

An assessment of biodiversity impacts has been completed in accordance with the BAM (OEH 2017a).

The assessment identified areas of PCT 101 *Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion* and PCT 281 *Rough-Barked Apple - Red Gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* within the development footprint. PCT 281 represents White Box Yellow Box Blakely's Red Gum Woodland endangered ecological community, an EEC listed under BC Act. Both PCTs identified within the development footprint are heavily grazed and were identified to be in very low condition.

Measures to avoid and minimise impacts to vegetation were considered during the planning and detailed design stages of the project, resulting in avoidance of all significant biodiversity values, and minimisation of impacts on other areas of native vegetation. This iterative process has resulted in the project impacting upon native vegetation of low quality only. Additional measures to mitigate minor residual impacts have also been recommended. The residual impact of the project will be limited to removal of 148.2 ha of low quality native vegetation.

The vegetation integrity score of both vegetation zones within the development footprint is such that offsets are not required for impacts on native vegetation. Therefore, the project does not require any offsets and no biodiversity offset strategy is required.

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Source: EMM (2018); OSF (2018); Biosis (2017); DFSI (2017); GA (2015); DPI (2013)

KEY

- Development footprint
- Indicative site access point
- Local road
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland EEC
- Cropped/disturbed land

Plant community types in the development footprint

- PCT101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion - Low (grazed)
- PCT281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion - Low (grazed)

Threatened flora

- Finger panic grass (*Digitaria porrecta*)

Plant community types in the development footprint

Orange Grove Sun Farm
Environmental impact statement
Figure 6.1

EMM

6.3 Aboriginal heritage

6.3.1 Introduction

The SEARs require an assessment of the potential impacts of the project on Aboriginal cultural heritage. The SEARs state that this EIS must include:

> An assessment of the likely Aboriginal and historic (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community.

EMM has prepared an ACHAR for the project (Appendix D). This section of the EIS summarises the report and addresses the SEARs requirements for Aboriginal cultural heritage assessment. Historic heritage is addressed in Section 6.4.

6.3.2 Existing environment

i Landscape context

A 422 ha study area (refer Figure 6.2) was adopted as part of the Aboriginal cultural heritage assessment (ACHA). This study area is larger than the development footprint and was part of a wider area investigated during project design and development.

The study area is in the Brigalow Belt South Bioregion, which extends from Dubbo in central-western NSW to the central-Queensland coast. The study area is within the landscape of an extensive floodplain for the Namoi River, which, at its closest point is approximately 1.3 km south-west of the study area.

Locally, the study area is characterised by a landform pattern of mixed stagnant alluvial plains and features a single and continuous plain landform element. Overall, the study area can be described as level, featuring slopes of less than 1%.

The study area is flanked approximately 2 km to the north-east by rolling to very steep hills of Devonian and Carboniferous geologies of the Melville Ranges. Slopes are moderately inclined to steep (greater than 20% slope but generally less than 50%) and feature up to 30% rock outcrop which can form localised scarps and scree slopes (OEH 2017b).

According to Tindale (1974), the site falls within the Aboriginal language group boundary of the Kamilaroi. The Kamilaroi language group boundary was recorded as covering one of the largest geographic areas in NSW, roughly spanning from Walgett in the west, north into Queensland, Tamworth in the east and south to the headwaters of the Hunter River.

Historical sources provide some insight into the traditional customs of the Kamilaroi. For example, there are records of an escaped convict, George Clarke, who lived with a group of Kamilaroi near Boggabri. Oral histories completed for the region show that local Aboriginal communities express a common understanding that the broader landscape is interconnected through complex patterns of movement that are centred around Aboriginal kinship ties (RACAC 2002). Interviewed Aboriginal people have placed particular cultural importance on elements in their landscape, such as flora and fauna, rivers and forests, with community life (RACAC 2002). The site is within the boundary of the Red Chief Local Aboriginal Land Council.

The study area is relatively disturbed due to previous and ongoing agricultural uses, such as grazing and cropping, however, possible indications of Aboriginal land use are evident in the landscape in areas of remnant vegetation and less disturbed landforms.

A search of the Aboriginal Heritage Information Management System (AHIMS) register identified eight Aboriginal sites within a 20 km x 20 km area centred on the study area. The closest Aboriginal site is an artefact scatter almost 8 km south-west of the site directly adjacent to a first-order tributary of the Mooki River. However, most of the stone artefact sites are adjacent to the major water systems of the area comprising the Namoi River and Mooki River. One stone quarry site is registered 11 km to the north-east on the shore of Lake Keepit (AHIMS #20-5-0021) and one scar tree is registered 8 km to the west in an area that appears to be partially cleared native remnant open forest (AHIMS #20-4-0052).

No Aboriginal sites have been registered within the site boundary.

6.3.3 Impact assessment

i Aboriginal community consultation

Aboriginal stakeholders were identified in accordance with OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a) and the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005). The guidelines prescribe a four stage process, outlined below.

ii Stage 1 – Notification and registration

Relevant bodies were notified of the project, including OEH, Red Chief LALC (Deerubbin LALC), GSC, North West LLS, National Native Title Tribunal (NNTT), the Office of the Registrar of Aboriginal Owners and NTSCorp.

A search conducted by the Office of the Registrar listed no Aboriginal Owners with land within the site boundary. A search conducted by NNTT listed a Registered Native Title Claim that overlaps with the study area. This Registered Native Title Claim (NC2011/006) is from the Gomeroi People, who registered their interest in the consultation process for the project. The claim has not received a determination.

An advertisement was published in the *Namoi Valley Independent* on 12 October 2017 inviting Aboriginal people who hold cultural knowledge to register their interest to provide assistance in determining the significance of Aboriginal object(s) and/or places in the vicinity of the project.

Eleven Aboriginal parties (RAPs) registered their interest in the consultation process, and are listed below in Table 6.2.

Table 6.2 List of registered Aboriginal parties

Registered Aboriginal party name
AGA Services
Shirley May Talbott
AT Gomilaroi Cultural Consultancy
Cacatua General Service (Cacatua Culture Consultants)
Gomeroi People NC2011/006 (via NTSCORP)
Gunjeewong Cultural Heritage Aboriginal Corporation
Katrina Mckinnon
Murra Bidgee Aboriginal Corporation, Cultural Heritage
Natasha Rodgers
Red Chief Local Aboriginal Land Council
Ronald Long

a. Stage 2 – Presentation of project information

A project information pack was provided to RAPs on 31 October 2017. The project information pack included information about the project, the ACHA process, the project schedule, and the responsibilities and roles of the different parties involved in the project.

b. Stage 3 – Gathering information about cultural significance

RAPs were given 28 days to review and prepare feedback on the proposed methodology. No comments from RAPs were received regarding the methodology of the ACHAR. Offers to assist with the proposed fieldwork were received.

c. Stage 4 – Review of draft Aboriginal cultural heritage assessment report

A copy of the ACHAR (Appendix D) has been provided to the RAPs for review and comment. RAPs have been provided with 28 days to provide their comments on the ACHAR. No comments were received within the 28 day period provided.

d. Site prediction modelling

A model was formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist throughout the study area and where they are more likely to be located. This model is based on:

- landscape features in the study area and its surrounds;
- pre-colonial period ecological conditions;
- advice from Aboriginal knowledge holders;
- ethno-historical information about Aboriginal life and material culture; and
- the type and distribution of Aboriginal sites described in previous reports and AHIMS data.

The predictive model assessed the potential for certain Aboriginal heritage sites to be present within the site boundary as shown in Table 6.3.

Table 6.3 Site type and distribution

Site type	Predictions
Open artefact sites and isolated finds	Open stone artefact scatters and isolated finds are the site types most likely to occur in the study area. These may occur anywhere as background scatter, but are most likely to occur within 200–300 m of watercourses, possibly near the ephemeral streams adjacent to the study area. However, being a considerable distance from the Namoi River, the material would be sparsely distributed in infrequent number and possibly displaced by ploughing.
Modified trees	Modified trees (either carved or scarred) may occur where native vegetation has been preserved. The most likely areas include river, creek and wetland reserves but may occur further away but more sporadically where mature native trees occur.
Grinding grooves and grind stones	It is unlikely that grinding grooves occur at the site as there are no suitable rock outcrops and no water sources in close proximity. However, portable grindstones could be present as these items could have been imported into the area.
Hearths	The extent of site cultivation (primarily vegetation clearance and ploughing) has led to widespread disturbance, which is likely to have removed or destroyed archaeological traces of this site type.
Burials	Burials can occur anywhere in the landscape but their identification is very rare. Generally they would be identified by mounds of earth, carved trees or stone markers. Archaeological evidence of burial sites is rare in the region.
Stone arrangements	The level of land use and disturbance in the study area is likely to have destroyed archaeological evidence of this site type.
Rock engravings	These are unlikely to occur in the study area because outcropping sandstone does not occur in the study area.
Middens	Freshwater shell middens may occur along extensive and reliable river systems. It is unlikely that middens will occur in the study area because of the distance to water and its proximity to ephemeral streams only.
Rock shelters	Rock shelters occur in areas with suitable geological formation processes and outcrops of rock. No rock shelters have been identified in the region and it is unlikely that any will be found in the study area as the landscape does not have suitable rock outcrops.
Quarries (stone or ochre)	The level of land use and disturbance in the study area is likely to have destroyed archaeological evidence of this site type. Furthermore, the geology and soils of the site are not known to feature these site types.

iii Aboriginal cultural heritage field survey

A field survey of the study area was undertaken on 30 November 2017. The archaeological surveys were conducted on foot with a field team of four members. The survey effort targeted land closest to watercourses and areas where mature native trees were present. A full coverage survey was not adopted primarily because the predictive model indicated that the study area is generally outside land areas commonly associated with Aboriginal sites.

A pedestrian survey was conducted following the archaeological survey code, namely the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b), and industry best practice methodology. Eight transects were walked across the study area with the four surveyors typically walking approximately 5 m apart. Occasionally low ground visibility due to thick grass necessitated some parts of the pedestrian survey being completed in a vehicle. Ground exposures which were observed were then inspected on foot. A vehicle survey was conducted in order to inspect all mature trees within the study area.

The survey team identified two isolated stone artefacts (OG_IS1 and OG_ISF2) and two tree scars that are possibly of Aboriginal origin (OG_PST1 and OG_PST2). To date, no information has been received that identifies specific heritage values related to the potentially Aboriginal sites and objects in the site boundary.

In response to their prior requests and subsequent to the archaeological survey completed on 30 November 2017, both Steve Talbott, on behalf of Gomeroi People Native Title Claimants, and Aaron Talbott, on behalf of AT Gomilaroi Cultural Consultancy, were invited to attend a site visit on 7 December 2017. Both Aaron and Steve indicated that they would attend, however only Aaron was present on the day. Aaron was escorted over the site by a representative from OVERLAND and was provided with a description of the project and an outline of the results of the archaeological survey.

iv Significance assessment

An assessment of significance was completed for each of the newly identified potentially Aboriginal sites within the study area.

A summary of the potential archaeological impacts of the project on known Aboriginal sites within the study area is provided in Table 6.4.

Table 6.4 Summary of potential Aboriginal cultural heritage archaeological impact

Site name	AHIMS number	Site type	Significance	Type of harm	Degree of harm	Consequence of harm
OG_ISF1	20-4-0819	Isolated artefact	Low	None	None	Not applicable
OG_ISF2	20-4-0818	Isolated artefact	Low	Direct	Total disturbance	Total loss of value
OG_PST1	20-4-0817	Potentially a scarred tree	Moderate	None	None	Not applicable
OG_PST2	20-4-0820	Potentially a scarred tree	Moderate	None	None	Not applicable

The archaeological significance of the stone artefacts was judged to be low given their highly disturbed context and common material and artefact type. The archaeological significance of the scar trees is presently undetermined as it is not certain whether the scars are of natural or Aboriginal origin.

Stone artefacts may occur very sporadically (probably as isolated artefacts) outside of the survey transect paths in an unpredictable pattern representative of background scatter. These artefacts would be in a highly-disturbed context and areas predicted to be of low archaeological significance similar to known sites OG_ISF1 and OG_ISF2. It is acknowledged the project may disturb a limited quantity of artefacts, which is similar or less than the level of disturbance already caused by intensive cultivation practices.

6.3.4 Management and mitigation

The initial decision to place the project in an area that is away from reliable water, and which has been previously cleared and cultivated, is arguably the most significant measure to minimise harm to Aboriginal sites and objects. Accordingly, undisturbed land that would typically have higher archaeological potential will not be disturbed to accommodate the project.

The development footprint has been refined from a concept design that covered the entire study area. The decision to refine the development footprint was based on the outcomes of the archaeological and ecological assessments so as to minimise potential environmental impacts from the project. As such, the potential scar trees, OG_PST1 and OG_PST2, and isolated artefact, OG_ISF1, will be avoided.

Additionally, the extent of developing practical measures to avoid harm must be weighed against the significance of the Aboriginal sites that are likely to be harmed by the project.

The study area has been subject to widespread disturbance through intensive cultivation of the ground surface. The extent of disturbance that has already occurred has significantly reduced the archaeological significance in the study area.

The project cannot be altered to avoid isolated artefact, OG_ISF2, without having a significant impact on the preferred project infrastructure layout (refer to Figure 3.1 and Figure 6.2), as the site is placed where PV solar panel arrays are proposed to be installed.

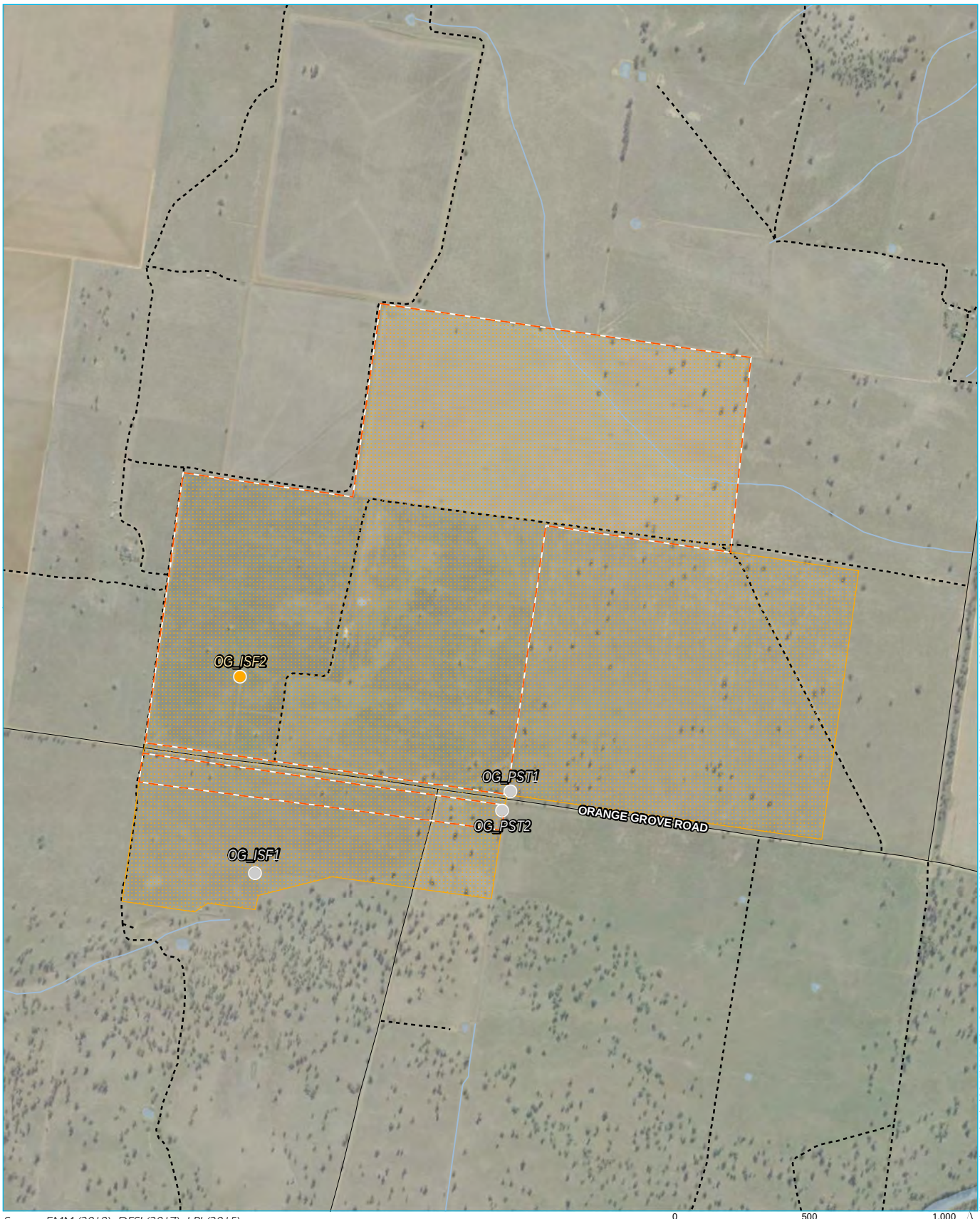
The following management and mitigation measures will be implemented:

- fencing and signage will be installed close to OG_PST2 to avoid impacts;
- consultation with the RAPs will continue with regard to the management of Aboriginal cultural heritage sites within the study area throughout the construction stage of the project in keeping with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a);
- at the completion of the construction stage of the project, consultation with the RAPs will be undertaken should there be any changes to the project layout that may result in ground disturbance or removal of trees in keeping with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a);
- should any unanticipated Aboriginal objects be encountered during works associated with the project, works will cease in the vicinity and the find will not be moved until assessed by a qualified archaeologist;
- should unanticipated relics be discovered during the course of the project, work in the vicinity will cease and an archaeologist will be contacted to make a preliminary assessment of the find. The Heritage Council of NSW will be notified if the find is assessed as a relic;
- if any suspected human remains are discovered during any activity the following will occur:
    - all work will immediately cease at that location and remains will not be further moved or disturbed;
    - the NSW Police and State Coroner will be notified (as required for all human remains discoveries);
    - the site supervisor or other nominated senior staff member will contact OEH for advice on identification and management of Aboriginal skeletal material;
    - if it is determined that the skeletal material is of Aboriginal ancestry, the RAPs will be contacted and consultative arrangements will be made to discuss ongoing care or reinterment of the remains. Work will not recommence at that location unless authorised in writing by OEH; and
    - if the find is likely to be non-Aboriginal in origin and more than 100 years in age, the Heritage Council of NSW will be notified of the find under s.146 of the Heritage Act.

6.3.5 Conclusion

The project design has avoided impacts to three newly identified Aboriginal heritage sites within the study area. The project is unable to avoid impacts to one isolated artefact, OG_ISF2. The archaeological significance of this artefact was judged to be low given its highly disturbed context and common material and artefact type.

The implementation of the management and mitigation measures listed in Section 6.3.4 will reduce the impacts of the project on Aboriginal cultural heritage values.



Source: EMM (2018); DFSI (2017); LPI (2015)

0 500 1,000 m

GDA 1994 MGA Zone 56

N

KEY

- Development footprint
- Study area
- Local road
- Vehicular track
- Watercourse / drainage line
- Waterbody

Aboriginal heritage sites - level of impact

- Total disturbance
- None

Location of Aboriginal heritage sites

Orange Grove Sun Farm
Environmental impact statement
Figure 6.2

EMM

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6.4 Historic heritage

6.4.1 Introduction

The SEARs require an assessment of the potential impacts of the Orange Grove Sun Farm project on historic heritage. The SEARs state that this EIS must include:

> an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community.

EMM conducted a desktop assessment of the potential impact of the project on historic heritage. This section of the EIS summarises the results of this assessment and addresses the SEARs for historic heritage. Aboriginal cultural heritage is addressed in Section 6.3.

6.4.2 Existing environment

The Heritage Act provides for the protection and conservation of the natural and cultural history of NSW, including scheduled heritage items, sites and relics, and makes provisions for items of both local and State significance. The State Heritage Register (SHR) is enforced under the Heritage Act. The Gunnedah LEP also makes provisions for heritage significance.

There are 24 items of local heritage significance and one item of State heritage significance listed within the Gunnedah LEP. The closest item of local heritage significance to the development footprint is Frogmore Woolshed, south of the Oxley Highway, approximately 3.8 km south-west of the southern portion of the development footprint across the Namoi River (refer Figure 2.1).

A search of the SHR on 30 January 2018 returned the following results for the Gunnedah Shire LGA:

- one item listed under the Heritage Act, Gunnedah Railway Station group, approximately 12.8 km west of the development footprint; and
- 33 items listed by local government and state agencies, the closest of which is Frogmore Woolshed, approximately 3.8 km south-west of the development footprint.

A search of the Australian Heritage Database on 30 January 2018 identified 10 results within the Gunnedah Shire LGA, five of which were listed as registered sites in the Register of the National Estate. The Register of the National Estate was closed in 2007 and is no longer a statutory list, however, it is still maintained on a non-statutory basis as a publicly available archive and educational resource. Nonetheless, the closest site to the development footprint is the Gunnedah Courthouse, which is in the township of Gunnedah approximately 12 km west of the development footprint.

6.4.3 Impact assessment

No items of heritage significance have been identified on or in close proximity to the development footprint. The project will not impact any items of local, State, National or World heritage significance identified on the SHR, Gunnedah LEP or Australian Heritage Database.

6.4.4 Management and mitigation

An unexpected finds protocol will be followed if unexpected historical archaeology is discovered during construction of the project.

If unexpected historical archaeology is discovered during construction, work in the immediate area will cease and an archaeologist will be contacted to make a preliminary assessment of the find. If it is determined to be a relic under the Heritage Act, further investigation may be required and the Heritage Council may need to be notified.

6.4.5 Conclusion

The project will not impact any items of local, State, National or World heritage significance, or the potential significance of any known items.

6.5 Land

6.5.1 Introduction

The SEARs requires an assessment of the potential impacts of the Orange Grove Sun Farm project on land use. The SEARs states that this EIS must include:

> an assessment of the impact of the development on agricultural land (including impacts to Biophysical Strategic Agricultural land) and flood prone land, a soil survey to consider the potential for erosion to occur (including impacts associated with sodic soils) and paying particular attention to cumulative impacts and compatibility of the development with existing land uses on the site and adjacent land (e.g. Gunnedah Solar Farm, operating mines, extractive industries, mineral or petroleum resources, exploration activities, aerial spraying, dust generation and risk of weed and pest infestation) during operation and after decommissioning, with reference to the zoning provisions applying to the land.

An assessment of the site was undertaken, including a soil survey, and review and assessment of relevant publicly available information about the site. Consultation with the landholders, affected landholders surrounding the site boundary and members of the local community has also been undertaken (refer to Section 5.4).

EMM has prepared a soil erosion assessment for the project (Appendix E). This section of the EIS also summarises the soil erosion assessment and addresses the SEARs requirements for a soil survey to consider the potential for erosion to occur.

Hydro Engineering and Consulting Pty Ltd (HEC) has prepared a surface water assessment for the project (Appendix F), which assesses the flood risk of the development footprint, potential surface water impacts from the project and proposed mitigation measures to address these impacts. The impact of the project on surface water resources and flooding is addressed further in Section 6.9.

6.5.2 Existing environment

i Zoning

The site is zoned RU1 Primary Production under the Gunnedah LEP (Figure 2.3). The objectives of this zone are discussed in Section 4.1.4.

The project will alter the current land use of the development footprint, being agriculture, to electricity generation by solar energy. As noted in Section 4.1.4, the project will impact the availability of land for other primary production. However, it will also allow for and encourage diversity in the area's land use, and will provide economic stimulus and support to rural communities.

ii Geology, soils and land capability

As noted in Section 2.4, the site is within the Brigalow Belt South bioregion, and is part of an extensive floodplain of the Namoi River. Locally, the site is characterised by a landform pattern of mixed stagnant alluvial plains and features a single and continuous plain landform element. The surface geology of the site is mapped as part of Quaternary alluvial deposits (0 to 2.5 million years old) within DPE-DRE's Interactive Geological Map of NSW. The alluvial deposits consist of current and recent mud, silt, sand and gravel deposited by the Namoi River.

As noted in Section 2.4, the site is part of the Burburgate soil landscape – characterised by a complex distribution of soils consisting of moderately drained brown clays, and poorly drained red-brown earths, with smaller areas of high floodplain often consisting of solodic soils (OEH 2011). The depth of alluvium to basement material varies from 5 m to more than 50 m.

As part of the soil erosion assessment (Appendix E), a survey was completed to examine the soil and landform properties of the site and inform erosion potential. This included taking soil samples for further laboratory analysis. The results of the laboratory analysis are provided in Appendix E. The soils generally had slightly acidic A horizons and neutral to alkaline pH in the B horizon and low organic matter with depth. Soils within the development footprint were not found to be saline or sodic and would be considered relatively stable and soil erodibility was found to be low to moderate overall.

In addition to the soil erosion assessment, as part of the desktop assessment, information was extracted from the Sharing and Enabling Environmental Data (SEED) Portal (NSW Government 2018), including extracts from the following datasets:

- the Australian Soil Classification (ASC) Soil Type Map of NSW, which provides soil types across NSW using the Australian Soils Classification at Order level;
- the Estimated Inherent Soil Fertility of NSW, which uses the best available soils and natural resource mapping to describe soil fertility in NSW according to a five class system;
- the NSW SRLUP, which maps strategic agricultural land capable of sustaining high levels of productivity or critical industry clusters, ie. equine and viticulture clusters; and
- the Land and Soil Capability (LSC) mapping for NSW, which uses eight key soil and landscape limitations to assess the capability of land according to an eight class system.

Relevant extracts from the SEED Portal are summarised below in Table 6.5.

Table 6.5 Environmental data for the site from the SEED portal

Dataset	Environmental data
ASC Soil Type Map of NSW	The site is mapped in its entirety as Vertosols. Vertosols are clay soils that shrink and swell, and crack as the soil dries. Vertosols occur in the arid and semi-arid interior of Australia and are predominantly used for grazing, extensive dry-land agriculture (where rainfall is adequate) and irrigated agriculture (CSIRO 2017). The results of the soil erosion assessment (Appendix E) generally supported this mapping, however, minor variations in the soils were evident in each test location.
Estimated Inherent Soil Fertility of NSW	The site is mapped in its entirety as moderate inherent soil fertility.
SRLUP	As noted in Section 2.1, the site is mapped in its entirety as BSAL. BSAL is land with high quality soil and water resources capable of sustaining high levels of productivity (NSW Government 2018).
LSC mapping for NSW	The site is mapped in its entirety as LSC Class 2 (very high capability land). Land identified under this classification has slight limitations, which can be managed by readily available, easily implemented management practices (OEH 2012). LSC Class 2 land is capable of most land uses and land management practices (OEH 2012).

There are no known occurrences of acid sulphate soils within the development footprint.

A search of the EPA's contaminated land public record of notice and list of sites notified to the EPA under Section 60 of the NSW Contaminated Land Management Act 1997 (CLM Act) did not return any information on reported contamination or any regulatory notices issued for the site (EPA 2018a; EPA 2018b). There are nine contaminated sites within the township of Gunnedah that have been notified to the EPA (2018a).

A search of the contaminated land record of notices revealed four sites within the Gunnedah Shire LGA that have been issued notices. Each of these notices applied to land within the township of Gunnedah approximately 12 km west of the site.

Clause 7 of SEPP 55 requires that a consent authority take into consideration whether the land is contaminated. The contaminated land planning guidelines, *Managing Land Contamination Planning Guidelines: SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning 1998), identify activities with the potential to cause contamination. These guidelines list 'agricultural/horticultural activities' as activities which can potentially cause contamination. Agricultural activities have occurred on and in the vicinity of the development footprint. Therefore, agriculturally derived contaminants could be present within the development footprint. However, as noted in Section 3.5, construction of the project will require limited site preparation and civil works. Subsequently, the level of surface disturbance will be minimal.

iii Agricultural land

The project is within the Gunnedah Shire LGA, which covers an area of 4,994 km^2 in the North West Slopes region of NSW, adjacent to the Liverpool Plains. The site is part of the Namoi River catchment. Land use within this catchment is dominated by extensive agricultural operations with grazing (61.2%), dryland cropping and horticulture (16.2%) and irrigation (3%) occupying more than 80% of the total catchment area (Office of Water 2011).

As noted in Section 2.1, the site is currently being used for livestock grazing and cropping. Agriculture is the primary land use in the Gunnedah Shire LGA, accounting for 88.5% of the total land area (or 441,969 ha), of which dryland agriculture accounts for 77.4% (or 386,536 ha) and irrigated agriculture accounts 5.6% of the total land area (or 27,966 ha) (Insite 2016). Agriculture is also the predominant economic activity in the Gunnedah Shire LGA and is the areas highest employment sector (Insite 2016). Agricultural production activities within the Gunnedah Shire LGA include a range of summer and winter crops including wheat, sorghum, barley, cotton, canola, sunflowers, faba beans, soya beans, chick peas and vegetables, as well as a vast livestock industry (GSC 2014).

The site boundary encompasses an area of approximately 817 ha, representing approximately 0.16% of the Gunnedah Shire LGA, whilst the development footprint encompasses an area of 253 ha (approximately 0.05%).

A total of 2.8 million ha of BSAL has been identified and mapped at a regional scale across NSW, including over 1.5 million ha within the New England North West Region, which encompasses a total of 12 LGAs in regional NSW including the Gunnedah Shire LGA (NSW Government 2017). BSAL is land with high quality soil and water resources capable of sustaining high levels of productivity (NSW Government 2018). The total area of land mapped as BSAL within the Gunnedah Shire LGA is approximately 199,317 ha or 40%.

The site is mapped in its entirety as BSAL. The site boundary encompasses an area of approximately 817 ha, representing approximately 0.03% and 0.4% of the total land area mapped as BSAL within NSW and the Gunnedah Shire LGA, respectively. The development footprint is defined as the land area within the site where project infrastructure will be constructed and operate for the project life and encompasses an area of 253 ha, representing approximately 0.009% and 0.1% of the total land area mapped as BSAL within NSW and the Gunnedah Shire LGA, respectively.

Given the size of the development footprint (253 ha) in the regional context, the loss of agricultural land and BSAL from the project will only result in a negligible reduction in the overall agricultural productivity of the Gunnedah Shire LGA and New England North West Region for the life of the project.

Once the project reaches the end of its investment and operational life, the project infrastructure will be decommissioned and the development footprint returned to its pre-existing land use, or other land use in consultation with the landholders, as far as practicable.

iv Biosecurity

Invasive species, which include pest animals and weeds, are among the biggest threats to biodiversity in NSW (Eco Logical Australia 2015). Pest animals can cause significant economic losses to agricultural production, pose a risk of exotic disease, threaten the survival of native species and contribute to environmental degradation (LLS Riverina 2017). Weeds significantly impact agricultural productivity activities including cropping and grazing and threaten approximately 40% of vulnerable and endangered species in NSW (Eco Logical Australia 2015).

LLS North West play a key role in managing invasive species risk in north-west NSW, including the Gunnedah Shire LGA. The *North West Local Strategic Plan 2016-2021* was prepared in 2016 by LLS North West and identifies priorities for the management of biosecurity within the Gunnedah Shire LGA, including invasive species management (such as pigs and plague locusts) and management of biosecurity risks associated with livestock industries (including poultry, saleyards and beef feedlots).

The *North West Strategic Weed Management Plan* (LLS North West 2017) outlines how government, industry, and the community will share responsibility and work together to identify, minimise, respond to and manage weeds. The plan also supports regional implementation of the BS Act. No State or regional level priority weeds, as identified within the plan, were recorded within the development footprint.

v Surface water resources and flooding

The site is within the floodplain of the Namoi River and lies within GSC's flood planning area as mapped under the Gunnedah LEP (refer Figure 2.3). Median elevation across the site is approximately 9 m above the surveyed Namoi River channel. Under the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016), the site is mapped as part of the Upper Management Zone BL, which covers a significant portion of the catchment. This management zone is described as 'flood storage and secondary flood discharge areas'.

As noted in Section 2.4.2, elevation across the site is relatively uniform at approximately 272-276 m AHD. Site survey topographic contours for the development footprint are provided in Figure 2 of Appendix F. These contours show a broad swale in the north-east of the development footprint with a maximum depth of 1 m. This swale is mapped as a first-order stream on NSW topographic maps. It is not evident from available topographic mapping whether this swale represents a breakout channel from the north side of the Namoi River or whether it is a channel conveying runoff from the hills to the north of the development footprint.

A small farm dam exists within the development footprint, however, this would be removed as part of site establishment activities by backfilling with adjacent material and levelling.

vi Mining and minerals

As noted in Section 2.2, two mineral tenements which encompass the site were identified in a search of the NSW Department of Industry – Resources and Energy DIGS database, EL7241 and PEL0001. EL7241 and PEL0001 cover an area of 2,575 km^2 and 5,246 km^2, respectively; in north-western NSW (refer Figure 2.4).

vii Crown land

There is a small parcel of Crown land adjacent to the eastern boundary of the site (Lot 1 of DP 245982). This parcel of Crown land is identified on Figure 2.4. The project will not impact this parcel of Crown land.

viii Property vegetation plans

A property vegetation plan (PVP) is a voluntary, legally binding agreement between a landholder and LLS. A public register of PVPs is maintained by the Land Property Management Authority under the NSW *Real Property Act 2000*. There are no PVPs that will be affected by the project. PVPs are therefore not discussed further in this EIS.

6.5.3 Impact assessment

i Introduction

The project will result in the direct disturbance of approximately 253 ha within the development footprint.

As noted in Section 3.5.1, due to the development footprint's relatively flat terrain and predominantly cleared landscape, limited site preparation and civil works will be required. Direct disturbance of the land within the development footprint will primarily be limited to:

- the establishment of a temporary construction site compound in a fenced off area within the development footprint;
- construction of access tracks and boundary fencing;

- posts will be placed into the ground to provide support for the mounting framework required for the PV solar panels;
- foundations for the inverter blocks will be prepared;
- underground cabling will be installed between the PV solar panels and the collection circuit;
- connection infrastructure between the project electrical switchyard and Transgrid's 132 kV transmission line will be constructed;
- the management hub will be constructed; and
- permanent fencing will be constructed.

The installation of approximately 330,000 PV solar panels may affect the capture and flow of runoff within the development footprint, which could result in soil erosion if not appropriately managed.

The project will also result in an increase in vehicle movements to and from the development footprint during construction. Subsequently, the project may result in increased levels of soil erosion.

An erosion and sediment control plan will be established and is outlined in Section 6.5.4.

ii Rural residential development and subdivision

All land surrounding the site is zoned RU1 Primary Production under the Gunnedah LEP, with associated minimum lot sizes of 200 ha, and therefore would not support rural residential development in the immediate vicinity of the site under the current land zoning provisions.

The nearest rural residential development is the village of Carroll, located on the eastern side of the Namoi River, approximately 4 km from the development footprint at its closest extent (Figure 2.3). This land is zoned RU5 Village under the Gunnedah LEP and has associated minimum lot sizes of 1,000 m^2. The land immediately to the west of the village is also zoned RU1, and therefore would not support further rural residential development in closer proximity to the project under the current land zoning provisions.

Potential impacts to the village have been considered as part of preparation of the EIS. Due to the distance from the development footprint, only temporary traffic related impacts are anticipated. As noted in Section 6.8.2, it is noted that during construction only 40% of the project-related light vehicle movements and 20% of the project-related heavy vehicle movements will travel along the Oxley Highway through the village of Carroll. During construction, there will be an increase in traffic along the Oxley Highway, however there is sufficient capacity along this road to accommodate the estimated increased traffic volume and no significant impacts to the village are anticipated (refer Section 6.8).

Due to the separation distance, topography and remnant vegetation in the corridor between the project and the village, the project infrastructure will not be visible from this location.

Approximately 1 ha of land is proposed to be subdivided within Lot 2 of DP 945590 to enable the construction of the on-site switchyard and transformation area (Figure 3.1). At the end of the operational life of the electrical infrastructure, the infrastructure on the subdivided lot will be decommissioned and the lot will be reconsolidated back into the residual lot.

iii Geology, soils and land capability

As noted above, the project may result in increased levels of soil erosion. The susceptibility of soils to erosive forces is dependent on their inherent properties, namely texture, structure and dispersibility (Charman 1978). As noted in Table 6.5, the site is mapped in its entirety as Vertosols. Vertosols have high agricultural potential with high chemical fertility and water-holding capacity, however significant rainfall is required to make water available to plants (Australian Soil Club n.d.).

The results of the soil erosion assessment described in Appendix E generally supported this mapping, however, minor variations in the soils were evident in each test location. Soil erodibility was found to be low to moderate overall.

iv Agricultural production

The development footprint will be removed from potential agricultural production during the life of the project (in the order of 30 years). This is approximately 253 ha of BSAL and LSC Class 2 land. The project has been developed to avoid and minimise land disturbance and overall impacts on agricultural land, where possible. Revisions to the development footprint as part of the detailed design process for the project have significantly reduced the project's impacts on BSAL and agricultural productivity. Specifically, more than 550 ha of BSAL and LSC Class 2 land within the site boundary will remain available for agricultural production throughout the life of the project.

The site is mapped in its entirety as BSAL. The site boundary encompasses an area of approximately 817 ha, representing approximately 0.03% and 0.4% of the total land area mapped as BSAL within NSW and the Gunnedah Shire LGA, respectively.

The development footprint is defined as the land area within the site where project infrastructure will be constructed and operate for the project life and encompasses an area of 253 ha, representing approximately 0.009% and 0.1% of the total land area mapped as BSAL within NSW and the Gunnedah Shire LGA, respectively.

As noted by BRE (2014), solar farm developments cause minimal ground disturbance with project infrastructure typically occupying approximately 5% of the total land area. At the completion of site establishment works, actual surface disturbance within the development footprint will be limited to the installation of the mounting frames to support the PV solar panels and the installation of underground cabling between the PV solar panels and the collection circuit. The rows of PV solar panels will be spaced out approximately 6 m apart and will be supported on mounting frames on top of vertical driven or screwed posts. Underground cables will be buried at a depth of approximately 600 millimetres and will be designed and fitted in accordance with relevant Australian industry standards. The minimal ground disturbance required within the development footprint is unlikely to result in significant impacts to the future viability of the development footprint for agricultural production.

Consultation with surrounding landholders and the local community has been undertaken to minimise the impacts of construction on agricultural operations adjacent to the development footprint (refer to Section 5.4).

Consultation with surrounding landholders has confirmed that aerial spraying operations are uncommon on agricultural land surrounding the development footprint. Nonetheless, the project will not pose a collision or flight risk to the safety of aircraft conducting aerial spraying operations in the vicinity of the development footprint due to the low height of the project infrastructure and the limited amount of reflectivity from PV solar panels. Reference materials from the NSW Government's DoI-DRE (2016a), Solar Trade Association (2016) and the Federal Aviation Administration of the United States (2010) indicate that, in general, as little as 2% of the light received is reflected by PV solar panels. 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.

v Biosecurity

The project may lead to a reduction in biosecurity (ie. reduced pest and weed control) due to the temporary significant increase in vehicle movements to and from the development footprint during construction if not adequately managed. In addition, pest animals may also be encouraged by food sources from construction works and general disturbance.

The project may contribute to further encroachment of invasive exotic weed species which could lead to loss of habitat and suppression of native seedling establishment resulting in changes to vegetation communities over time.

vi Surface water resources and flooding

As part of the surface water assessment (Appendix F), potential impacts on surface water resources and flooding have been identified as:

- generation of turbid or sediment-laden runoff to downslope areas as a result of ground disturbance; and
- accidental spills or fuel leaks from vehicles or other motorised equipment operating within the development footprint.

No interception of runoff is planned by project infrastructure and therefore there should be no net reduction in runoff from the development footprint.

The project should not impact on the relevant large design flood (refer Section 6.9.3).

The impact of the project on surface water resources and flooding is discussed further in Section 6.9.3.

vii Mining and minerals

As part of the consultation process for the project, OVERLAND has engaged with the relevant license holders regarding potential interactions between the project and EL7241 and PEL0001, respectively (refer to Section 5.3). The project will not sterilise extractable resources or conflict with prospecting activities in EL7241 or PEL0001. Exploration activities will be able to continue within areas of EL7241 and PEL0001 that are outside the site boundary.

viii Crown land

There is a small parcel of Crown land adjacent to the eastern boundary of the site (Lot 1 of DP 245982). This parcel of Crown land is identified on Figure 2.4. The project will not impact this parcel of Crown land.

6.5.4 Management and mitigation

i Construction

The EMP will address land management and detail measures to minimise impacts to agricultural land with reference to DPI's publication *Infrastructure proposals on rural land* (Kovac and Briggs 2013). To address the potential impacts of the project on rural land, measures will be implemented during construction, including:

- a site access protocol will be developed that lists the relevant landholder's contact details and includes measures to minimise adverse impacts, such as driving carefully to minimise disturbance to livestock, crops and pastures;
- the timing of construction and the location/design of temporary access routes will be positioned to minimise impacts on neighbouring agricultural operations;
- access tracks in areas adjacent to the development footprint will remain accessible to the landholders and avoid any impacts to the operation and sustainability of neighbouring agricultural activities; and
- soil resources will be managed to ensure the future viability of the development footprint for agricultural production, including separation of storage of topsoil and subsoil to ensure that soil is replaced in the right order and to avoid unnecessary impacts on soil and existing vegetation structure.

An erosion and sediment control plan in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004) will be implemented and monitored during the life of the project to minimise impacts. This plan will include provisions to:

- install erosion and sediment controls (if required) prior to and during construction;
- regularly inspect erosion and sediment controls, particularly following large rainfall/wind events;
- minimise tracking of sediment from vehicles, plant and equipment on to Orange Grove Road;
- during excavation, separate topsoils and subsoils to ensure that they are replaced in their natural configuration;
- stockpile topsoil appropriately to minimise weed infestation and maintain soil organic matter, soil structure and microbial activity; and
- minimise the total area of disturbance from excavation and compaction.

A number of standard erosion and sediment control measures are recommended within the soil erosion assessment (Appendix E). Where surface disturbance occurs, the installation of the recommended erosion and sediment control measures could minimise the risk of dispersion. Where disturbance or stripping of soil is required, an ameliorant, such as lime, could be applied to manage the slight acidity of the topsoil and provide for more effective future use.

As noted in Section 3.5.1, disturbance of the land within the development footprint will be limited. This should further assist in controlling the potential for erosion during and after construction, operations and rehabilitation (refer to Appendix E).

The EMP will include weed management protocols, such as measures for the identification, management and ongoing monitoring of weeds within the development footprint.

The EMP will include a spill response plan which will be implemented during construction and throughout the project's operational stage to avoid potential for contamination.

ii Operations

During the operational stage of the project, a number of land management and mitigation measures will be implemented to reduce the impact of the project on:

- land and soil capability within the development footprint, including BSAL;
- neighbouring agricultural operations;
- regional biosecurity;
- erosion; and
- surface water runoff.

In consultation with the project landholders, land management will include consideration of the viability of sheep grazing or machine vegetation management as a means of vegetation maintenance throughout the life of the project. Sheep have been successfully employed to manage grassland in solar farm developments both within Australia and overseas (Sibson 2016; BRE 2014). Sheep are considered an appropriate means of managing grassland between and underneath PV solar panels with research suggesting that overall production levels can be maintained at levels sustained on open grassland under similar conditions (BRE 2014). Grassland may also be managed through the use of mechanised mowing equipment. As noted by BRE (2014), solar farm developments cause minimal ground disturbance with project infrastructure typically occupying approximately 5% of the total land area. Subsequently, approximately 95% of the total land area is still accessible for vegetation growth, which can be used to support agricultural activity over the life of a solar farm development.

To mitigate impacts to biosecurity, vehicle movements will be restricted to the formed access tracks. In addition, if implemented, sheep grazing within the development footprint will help maintain weed levels while maintaining a multi-purpose land use throughout the life of the project.

Consideration of ground cover beneath the PV solar panels will be included in the EMP to manage erosion, weed infestation and surface water runoff.

The area of impervious ground surface will not increase significantly; therefore there is not expected to be an increase in runoff generated from the development footprint.

iii Decommissioning

As noted in Section 3.7, once the project reaches the end of its investment and operational life, the project infrastructure will be decommissioned and the development footprint returned to its pre-existing land use, or other land use in consultation with the landholders, as far as practicable.

During decommissioning, all above ground facilities will be removed from the development footprint. This will involve the removal of the materials on-site including:

- PV solar panels and mounting frames;
- metals from posts and cabling; and
- all other equipment including inverters and the switchyard / on-site substation.

During decommissioning, underground cables may be left *in situ* to avoid unnecessary ground disturbance. Only deep-rooting trees, such as those associated with horticultural practices, would be likely to disturb the electrical conduit trenches and their respective cabling (Burges et al. 2008). However, based on the historical uses of the land, horticultural practices involving deep-rooting trees are unlikely to be a viable future land use; as such, it is unlikely that cables, if left in situ, would impinge on any future agricultural production within the development footprint.

The access tracks within the development footprint may be retained if requested by the landholders at the time of decommissioning.

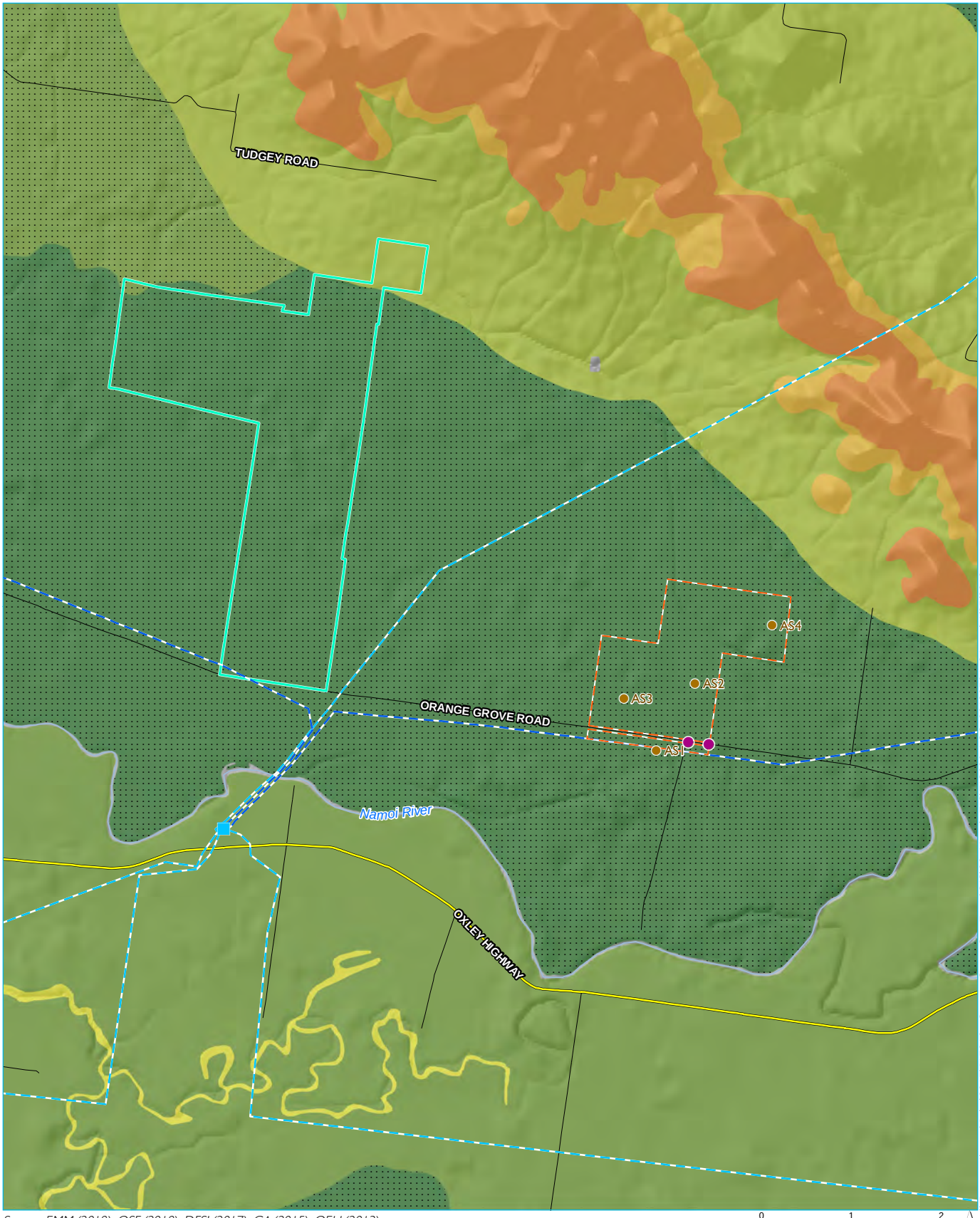
A project decommissioning plan will be prepared following the completion of project construction and commissioning and will feature rehabilitation objectives and strategies for returning the development footprint to agricultural production. The plan will include:

- an outline of the methods used to remove infrastructure at the end of the project's operational life;
- disposal options for infrastructure once it has been removed; and
- a soils sampling plan to evaluate the status of the soil resource within the development footprint and to provide base information to the landholder to inform the restoration of the land to its former LSC and BSAL classification, if required by the landholder.

The plan will also establish specific timelines for each of the activities outlined above.

6.5.5 Conclusion

The project has been developed to avoid and minimise land disturbance and overall impacts on agricultural land. Throughout the life of the project, soil resources will be managed with consideration of the future viability of the development footprint for agricultural production. In addition, an EMP will be implemented to mitigate the potential impacts of the project on the land within the development footprint.



Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015); OEH (2013)

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GDA 1994 MGA Zone 56

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KEY

- Development footprint
- Indicative site access point
- Gunnedah Solar Farm (SSD 8658 - proposed by Photon Energy Generation Pty Ltd)*
- Gunnedah Substation
- 132 kV transmission line
- 66 kV transmission line
- Main road
- Local road
- Biophysical Strategic Agricultural Land
- Soil sample sites

Land and soil capability class (OEH, 2013)

- 2
- 3
- 4
- 5
- 6
- 7

Land and soil capability

Orange Grove Sun Farm
Environmental impact statement
Figure 6.3

EMM

** DPE 2017, Gunnedah Solar Farm, viewed 11 October 2017, http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8658*

6.6 Visual

6.6.1 Introduction

The SEARs require an assessment of the potential visual impacts of the Orange Grove Sun Farm. The SEARs state that this EIS must include:

> 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.

EMM has prepared a visual impact assessment for the project (Appendix G). This section of the EIS summarises the visual impact assessment and addresses the SEARs requirements for potential visual impacts.

6.6.2 Existing environment

The site has been modified by previous and current land uses, including land clearing, irrigation development, cropping, livestock grazing and weed invasion and is currently used for livestock grazing and cropping. Photos illustrating the general condition of the site are provided in Chapter 2.

On a landscape scale, the site is part of an extensive floodplain of the Namoi River. Locally, the site is characterised by a landform pattern of mixed stagnant alluvial plains and features a single and continuous plain landform element. Elevation across the development footprint is relatively uniform at approximately 272–276 m AHD.

The site is in a semi-rural setting, with the wider region characterised by grazing and cropping properties, small-scale farm businesses, natural areas, scattered rural dwellings, villages and towns, and major transport infrastructure including the Oxley and Kamilaroi Highways.

The majority of land surrounding the site is zoned RU1 primary production under the Gunnedah LEP (Figure 2.3). Land uses surrounding the site are predominantly agricultural and include both dryland and irrigated broad acre crop production and livestock grazing. The geography, climate, and environment within the Gunnedah Shire LGA are favourable for a variety of agricultural activities including the production of a variety of summer and winter crops (GSC 2014).

The project will connect to the TransGrid 132 kilovolt (kV) electricity distribution network that feeds TransGrid's Narrabri to Gunnedah and Gunnedah to Tamworth network system (Figure 2.1). TransGrid's 132 kV transmission line runs parallel to the southern boundary of the southern portion of the development footprint (Figure 2.1).

The site has suitable access to the local and regional road network including the Kamilaroi and Oxley Highways, Orange Grove Road and Kelvin Road (Figure 2.1).

The Namoi Pistol Club is located approximately 1.6 km from the north-eastern corner of the development footprint. The Namoi Pistol Club is accessed directly from Orange Grove Road and consultation with the secretary of the Namoi Pistol Club has confirmed that it is primarily used by members on selected weekends.

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

6.6.3 Impact assessment

i Project design

The development footprint, 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 site assessment studies, community consultation, preparation of the visual impact assessment and this EIS. Specifically, the parcels of land which comprise the development footprint and the placement of infrastructure including PV solar panels, inverters, electrical collection system and switchyard and connection infrastructure have been identified through ongoing consultation with the landholders, to minimise visual impacts and land use conflicts and enable agricultural production and land management practices to continue on surrounding land.

ii Viewpoint selection

A visual assessment was conducted from a number of representative viewpoints surrounding the site and development footprint. The viewpoints were selected to represent views close to receptors (ie. dwellings) and Orange Grove Road. The locations of the six viewpoints are illustrated in Figure 6.4. The rationale for the selection of each of the viewpoints analysed are summarised in Table 6.6.

Table 6.6 Assessed viewpoints and receptors

Assessment location	Viewpoint type	Rationale for selection
Viewpoint 1	Dwelling	Views are representative of a receptor (ie. dwelling) west of the development footprint, R1, approximately 150 m from the western boundary of the northern portion of the development footprint (Figure 6.4). As part of the site inspection in January 2018, access to R1 was not possible. Subsequently, the location of Viewpoint 1 was selected as it was considered to be representative of potential views of project infrastructure from R1.
Viewpoint 2	Dwelling	Views are representative of a receptor (ie. dwelling) north-east of the northern portion of the development footprint, R2, approximately 760 m from the development footprint's north-eastern boundary (Figure 6.4). As part of the site inspection in January 2018, access to R2 was not possible. Subsequently, the location of Viewpoint 2 was selected as it was considered to be representative of potential views of project infrastructure from R2.
Viewpoint 3 Viewpoint 4 Viewpoint 6	Motorists	Views are representative of those experienced by motorists travelling along Orange Grove Road. Daily traffic estimates indicate that approximately 89 vehicles travel along the unsealed section of Orange Grove Road per day (refer to Appendix I of the EIS). These viewpoints were selected on the basis that motorists travelling along this road corridor may experience views of project infrastructure at these locations.

Table 6.6 Assessed viewpoints and receptors

Assessment location	Viewpoint type	Rationale for selection
Viewpoint 5	Motorists Dwellings	Views are representative of receptors (ie. dwellings) to the west of the development footprint off Orange Grove Road (Figure 6.4): R8 – 1.9 km; R9 – 1.6 km; R10 – 1.8 km; and R11 – 2.1 km. Views are also considered representative of those experienced by motorists travelling east along Orange Grove Road, west of the development footprint. Daily traffic estimates indicate that approximately 89 vehicles travel along the unsealed section of Orange Grove Road per day (refer to Appendix I of the EIS). This viewpoint was selected on the basis that motorists travelling along this road corridor may experience limited views of project infrastructure at this location. This viewpoint is approximately 1.1 km east of the proposed site for the Gunnedah Solar Farm (refer to Section 2.6 and Figure 6.4).

To determine potential visibility of project infrastructure, a viewshed analysis was completed. The results of the viewshed analysis are presented in Figure 6.5, which identifies the likely changes to the viewshed experienced at each viewpoint as a result of the installation of the project infrastructure within the development footprint. As noted in Section 3.4.1, 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 2.4 m. As part of the viewshed analysis the maximum height of project infrastructure across the development footprint has been assumed to be 2.4 m.

The construction and operation of the project within the development footprint will result in one of two changes to the existing viewshed experienced at each viewpoint, namely loss of viewshed (ie. features of the existing landscape will no longer be visible due to project infrastructure) and gain of viewshed (ie. parts of the landscape will become more visible due to project infrastructure) (refer to Figure 6.5). The results of the viewshed analysis indicate that project infrastructure will be visible to varying degrees from each of the six viewpoints. As highlighted in Figure 6.5, viewpoints 1, 2 and 4 will likely experience the greatest loss of existing viewshed as a result of the project.

Due to the scattered nature of remnant vegetation within the landscape surrounding the development footprint, the effects of existing vegetation in screening views of project infrastructure were not considered as part of the viewshed analysis. However, based on aerial imagery and ground truthing, the majority of the rural residential dwellings surrounding the site feature extensive vegetation screens on their boundaries. A key observation made during the site inspection conducted on 18 January 2018 was that the presence of vegetation screens as well as stands of both scattered and more dense vegetation between the development footprint and a number of rural dwellings means that views to the development footprint are typically at least partially obstructed from most locations, with the exception of views of the development footprint for passing motorists travelling along Orange Grove Road.

iii Construction impacts

During construction, views of the development footprint will change with the installation of project infrastructure, which will add new features to the visual landscape. Motorists travelling along Orange Grove Road will experience views of the development footprint during construction.

It is assumed the focus of these motorists will be in line with their direction of travel along this road corridor. In addition, views of the northern portion of the development footprint during construction will also be possible from R1 and R2, respectively.

Due to their temporary nature (ie. approximately nine months), the site establishment works and construction activities are considered unlikely to have any significant visual impacts on passing motorists or nearby receptors. Subsequently, landscaping is not proposed to mitigate visual impacts during the construction stage of the project.

iv Operation impacts

A summary of the results of the assessment of visual impacts for each of the four viewpoints is provided in Table 6.7.

Table 6.7 Summary of results of visual impacts at each viewpoint

Viewpoint	Distance to development footprint	Project infrastructure visible based on viewshed analysis	Magnitude of change	Visual sensitivity	Evaluation of significance	Significant impact?	Additional mitigation required?
Viewpoint 1	0 m*	Yes	High	Moderate	Substantial	Yes	Yes
Viewpoint 2	670 m**	Yes	Moderate	Moderate	Moderate	No	Yes
Viewpoint 3	1.2 km	Yes	Moderate	Low	Slight/Moderate	No	No
Viewpoint 4	12 m	Yes	Moderate	Low	Slight/Moderate	No	No
Viewpoint 5	1.8 km	Yes	Low	Moderate	Slight/Moderate	No	No
Viewpoint 6	2.8 km	Yes	Negligible	Low	Negligible	No	No

**Viewpoint 1 is representative of views of project infrastructure from R1. The closest project infrastructure to R1 will be approximately 150 m from this residence.*

***Viewpoint 2 is representative of views of project infrastructure from R2. The closest project infrastructure to R2 will be approximately 760 m from this residence.*

Due to existing remnant 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 development footprint from two rural residential properties (R1 and R2) and parts of Orange Grove Road.

As part of the visual impact assessment, Viewpoint 2 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 2 was selected as it is representative of one of the closest receptors (ie. dwellings), namely R2. Based on the site inspection, consultation with the landholders at R2 and the results of the viewshed analysis, project infrastructure is predicted to be visible from this viewpoint.

The existing views from Viewpoint 2and the photomontage for this viewpoint is provided in Section 5.3 of the visual impact assessment (refer to Appendix G). The photomontage conservatively assumes the height of the PV solar panels (ie. the dominant project infrastructure) will be 2.4 m.

As a result of its proximity to the western boundary of the development footprint, R1 will be exposed to views of project infrastructure. Although a significant level of vegetation was observed along the eastern boundary of this property, this vegetation is unlikely to provide a sufficient level of mitigation to reduce the visual impacts experienced from this viewpoint during the operation of the project. The proponent will provide landscape screening to mitigate the visual impacts from this receptor. The proposed mitigation measures are discussed in detail in Section 6.6.4.

As illustrated within the photomontage provided within Section 5.3 of the visual impact assessment (refer to Appendix G), the relatively low height of the project infrastructure and distance to the development footprint will limit the scale of change and degree of contrast for any views from the closest receptor to the north-east of the development footprint, R2. A conceptual landscaping plan has been provided and would further reduce the visibility of project infrastructure from R2.

Project infrastructure in the northern portion of the development footprint may also be visible from the Namoi Pistol Club. Consultation with the Namoi Pistol Club has been undertaken as part of the preparation of the EIS for the project (refer to Section 5.4 and Appendix B). The results of this consultation confirmed that the pistol range is aligned north to south, with members firing to the north and therefore no visual screening would be required as the changes to the visual landscape are not considered significant due to the low visual sensitivity of the Namoi Pistol Club and 1.6 km distance from the development footprint. As part of this consultation, questions were asked about potential reflectivity and glare impacts on recreational users of the Namoi Pistol Club. Reflectivity and glare are discussed in detail in Section 5.4 of the visual impact assessment.

As noted above, a number of nearby receptors (ie. dwellings) 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 development footprint and these dwellings.

v Reflectivity and glare

Reference materials from the NSW Government's DoI-DRE (2016a), Solar Trade Association (2016) and the Federal Aviation Administration of the United States (2010) indicate that, in general, as little as 2% of the light received is reflected by PV solar panels.

The potential impacts of reflectivity on receptors, primarily dwellings within close proximity of the development footprint and motorists travelling along Orange Grove Road, 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 PV solar panels, with lower angles producing less glint and glare (Morelli 2014).

As described in Section 3.4.1, the project's PV solar panels will be constructed in a single axis tracking configuration. This configuration will allow the PV solar panels to pivot from east to west during the day tracking the sun's movement. Consequently, the degree of glint and glare experienced by receptors will be variable depending on the time of day and viewing location. For example, receptors east of the development footprint will only have potential to be impacted by glint and glare during the morning tracking period. Contrastingly, receptors west of the development footprint will only have potential to be impacted by glint and glare during the afternoon tracking period. However, as noted above, as little as 2% of the light received is reflected by PV solar panels, which is less than the reflectivity produced by a wide variety of surfaces in the existing environment surrounding and within the development footprint.

Reflection in the form of glint and glare will only be possible when direct sunlight occurs, therefore, in those instances where glint and glare from the PV solar panels may occur, receptors will also likely experience direct sunlight, which will be a significantly brighter and more intense source of light than reflection from the PV solar panels within the development footprint. Nonetheless, glint and glare may result from the project and may have an impact on nearby receptors and motorists travelling along Orange Grove Road. Existing remnant vegetation in the landscape will reduce both the duration and location from which reflection from the PV solar panels may be visible.

The Gunnedah Airport is approximately 12 km west of the development footprint. The Gunnedah Airport's primary runway is positioned in an approximate north-west to south-east orientation (refer to Figure 2.1). Due to the distance between the Gunnedah Airport and the development footprint, it is unlikely that aircraft using this facility will pass directly over the development footprint during the critical phases of flight, namely approach and landing (Spaven Consulting 2011).

OVERLAND consulted with CASA during the preparation of the visual impact assessment to discuss the potential impact of the project on flights to and from the Gunnedah Airport. As part of this consultation, CASA acknowledged that, "*modern solar panels are designed to absorb light and not to reflect it and in addition the majority of designs on the market also have an anti-glare coating to further reduce visual impact.*" As noted in Section 3.4.1, the PV solar panel designs considered for the project feature anti-reflective coating. As part of this consultation, CASA also noted that there is the possibility that there are unregistered or uncertified aerodromes in the general vicinity of the site, however, their records indicate the closest is Lake Keepit Aircraft ALA 13 km from the site (Figure 1.1). Therefore, CASA acknowledged that the site is sufficient distance from both Gunnedah Airport and Lake Keepit ALA to not be of any concern to air navigation.

The potential for low angled reflected sunlight to cause a distraction to drivers travelling along Orange Grove Road was considered as part of the traffic impact assessment for the project (Appendix I). Due to the anti-reflective properties of the PV solar panels, they are not expected to cause a distraction to motorists travelling along Orange Grove Road.

During consultation with the landowners at R2 (Figure 6.4) and the Namoi Pistol Club, questions were raised about the potential impacts of glare from the PV solar panels. Where screening in the form of existing remnant vegetation or landscaping removes the PV solar panels from view, potential impacts from glint or glare will be limited.

The closest PV solar panels will be approximately 800 m south-west of the residence at R2. In addition to the distance to the closest PV solar panel, the proposed landscaping to mitigate potential visual amenity impacts at R2 (Figure 6.6) will also limit views of the PV solar panels from this receptor and glint and glare impacts at this residence will not be significant.

The firing range at the Namoi Pistol Club is aligned in a north-south direction and is approximately 1.6 km east of the development footprint at its closest point. Given the alignment of the firing range, distance to the closest PV solar panels and presence of remnant vegetation within the landscape between the development footprint and the firing range, glint or glare are unlikely to present a significant impact to recreational users of the Namoi Pistol Club.

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

- receptors within the vicinity of the development footprint;
- people engaged in agricultural activities in the surrounding landscape;
- recreational users of the Namoi Pistol Club;

- motorists travelling along the minor road corridor of Orange Grove Road;
- motorists travelling along a number of minor unsealed rural property access roads and farm tracks; and
- aircraft arriving at or departing from the Gunnedah Airport and Lake Keepit ALA.

Where screening in the form of existing remnant vegetation or landscaping removes the PV solar panels from view, potential impacts from glint or glare will be limited.

6.6.4 Management and mitigation

The project infrastructure is described in detail in Chapter 3. Development of the project 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. The visual impact assessment has led to further refinement of the project to reduce visual impacts through consultation with surrounding landholders (refer to Section 5.4).

i Landscaping

A conceptual landscaping plan is provided in Figure 6.6, which presents landscaping options along the closest boundary of the development footprint to receptors R1 and R2. The proposed landscaping along the western boundary of the development footprint immediately adjacent to R1 would reduce the visibility of project infrastructure from R1. The proposed landscaping along portions of the northern and eastern boundaries of the development footprint would further reduce the visibility of project infrastructure from R2.

The final location and extent of landscaping will be determined during detailed design and following subsequent discussions with the project landholders and the property owners of R1 and R2 as part of preparation of the EMP. Landscaping would involve planting of native shrub species between 1-3 m in height with a screening canopy height of 4-5 m. A suggested species list is provided in Table 6.8.

Table 6.8 Suggested native shrub species for landscaping

Scientific name	Common name	Suggested planting spacing
Eucalyptus populnea	Bimble Box	6 m
Brachychiton populneus	Kurrajong	6 m
Acacia harpophylla	Brigalow	6 m
Acacia pendula	Weeping Myall	2-3 m
Acacia salicina	Cooba Wattle	2-3 m

ii 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 be consistent with the local farming landscape and will be similar to existing farm buildings located in the surrounding area.

iii Night lighting

Localised night lighting may be required during general maintenance activities conducted during the operation stage of the project. If required, lighting will be motion-activated and will be linked with security cameras, which will be positioned in strategic locations around the perimeter of the development footprint. The use of motion-activated lighting will minimise impacts on surrounding areas. All night lighting will comply with Australian Standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting.

The site is within the Dark Sky Region of NSW, centred upon Siding Spring Observatory. Good lighting design within the Dark Sky Region supports the ongoing successful functioning of the Siding Spring Observatory. The *Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring* (DPE 2016) demonstrates how light from development can be managed to reduce impacts on the operation of the Siding Spring Observatory. Temporary, localised night lighting for the project will be installed in accordance with the good lighting design principles listed within the *Dark Sky Planning Guideline* (DPE 2016), which include directing light downwards, using shielded fittings, avoiding 'over' lighting, switching lights off when not required, and using energy efficient light bulbs.

iv Reflectivity and glare

The specifications of PV solar panels being considered for the project feature anti-reflective coating to minimise reflectivity and glare.

6.6.5 Conclusion

The implementation of additional mitigation measures, namely landscaping at R1 and R2, will ensure that the project will not have any significant adverse visual impacts on the locality.

Six viewpoints have been assessed to demonstrate the visual impacts of the project. Due to existing remnant 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 development footprint from two rural residential properties (R1 and R2) and parts of Orange Grove Road. Project infrastructure in the northern portion of the development footprint may also be visible from the Namoi Pistol Club.

The project design, development footprint and placement of infrastructure have progressively evolved to minimise or avoid visual impacts, where possible. 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.

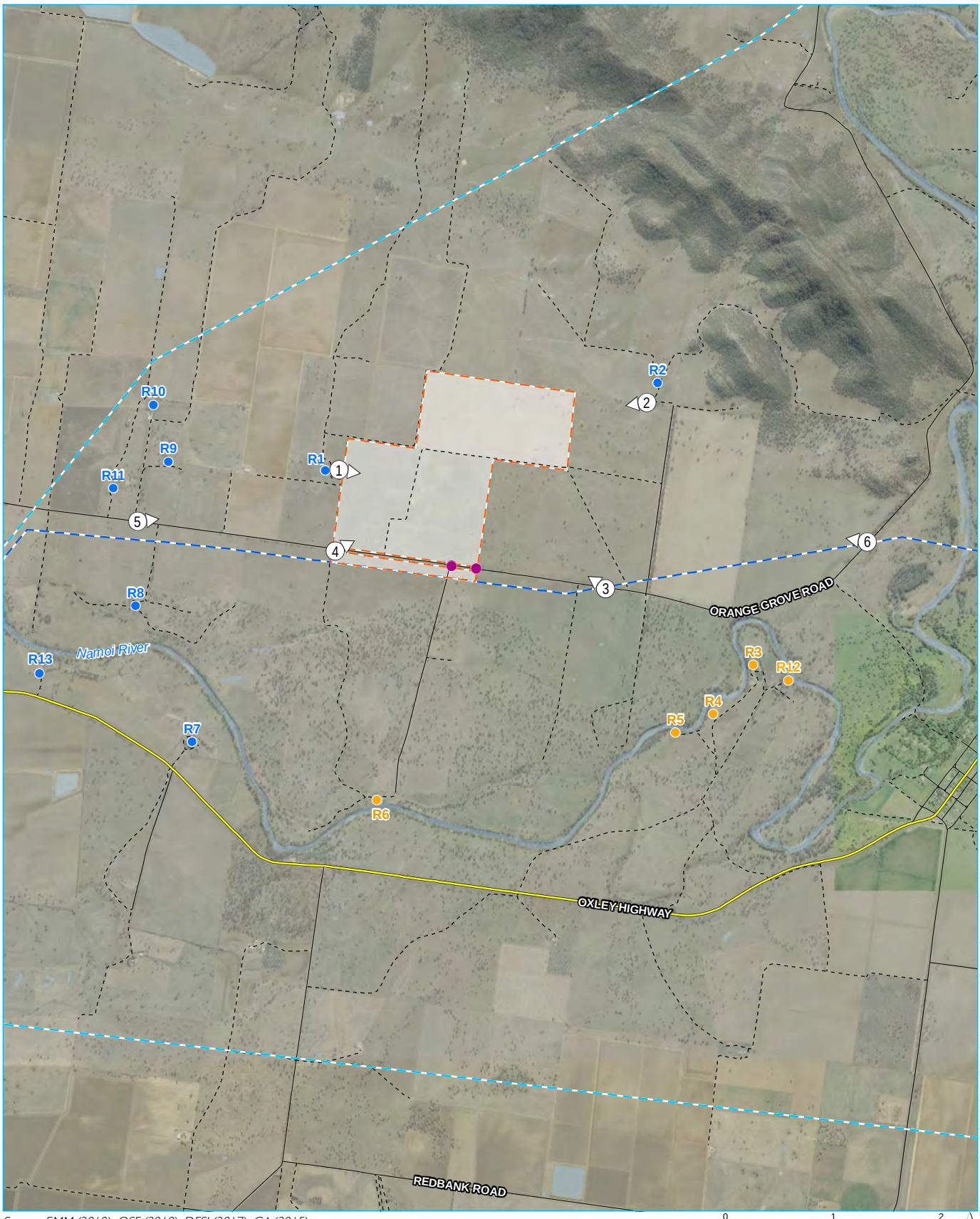
The visual assessment determined that, of the viewpoints assessed, infrastructure may be visible to varying degrees from five viewpoints. Based on the presence of vegetation, combined with the relatively low height of the project's infrastructure, the impact assessment predicts:

- a negligible visual impact for Viewpoint 6;
- a slight/moderate visual impact for viewpoints 3, 4 and 5;
- a moderate visual impact for Viewpoint 2 (representative of views from R2); and
- a potentially significant impact for Viewpoint 1 (representative of views from R1) for the unmitigated scenario.

As a result of its close proximity to the western boundary of the development footprint, without the implementation of appropriate mitigation measures, R1 will be exposed to views of project infrastructure. Although a significant level of vegetation was observed along the eastern boundary of this property, this vegetation is unlikely to provide a sufficient level of mitigation to reduce the visual impacts experienced from this viewpoint during the operation of the project. The proponent will provide landscape screening to mitigate the visual impacts from R1.

The relatively low height of the project infrastructure and distance to the development footprint will limit the scale of change and degree of contrast for any views from R2, which is approximately 760 m north-east of the northern portion of development footprint. The proponent will provide landscape screening to further reduce the visibility of project infrastructure from R2.

The final location and extent of landscaping at R1 and R2 will be determined during detailed design and following subsequent discussions with the project landholders and the property owners of R1 and R2 as part of preparation of the EMP.



Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

0 1 2 km
GDA 1994 MGA Zone 56

N

KEY

- Development footprint
- Indicative site access point
- 132 kV transmission line
- 66 kV transmission line
- Main road
- Local road
- Vehicular track
- Waterbody
- Viewpoint location and number

Receptors

- Non project-related receptors
- Project-related receptor

Viewpoint locations

Orange Grove Sun Farm
Environmental impact statement
Figure 6.4

EMM

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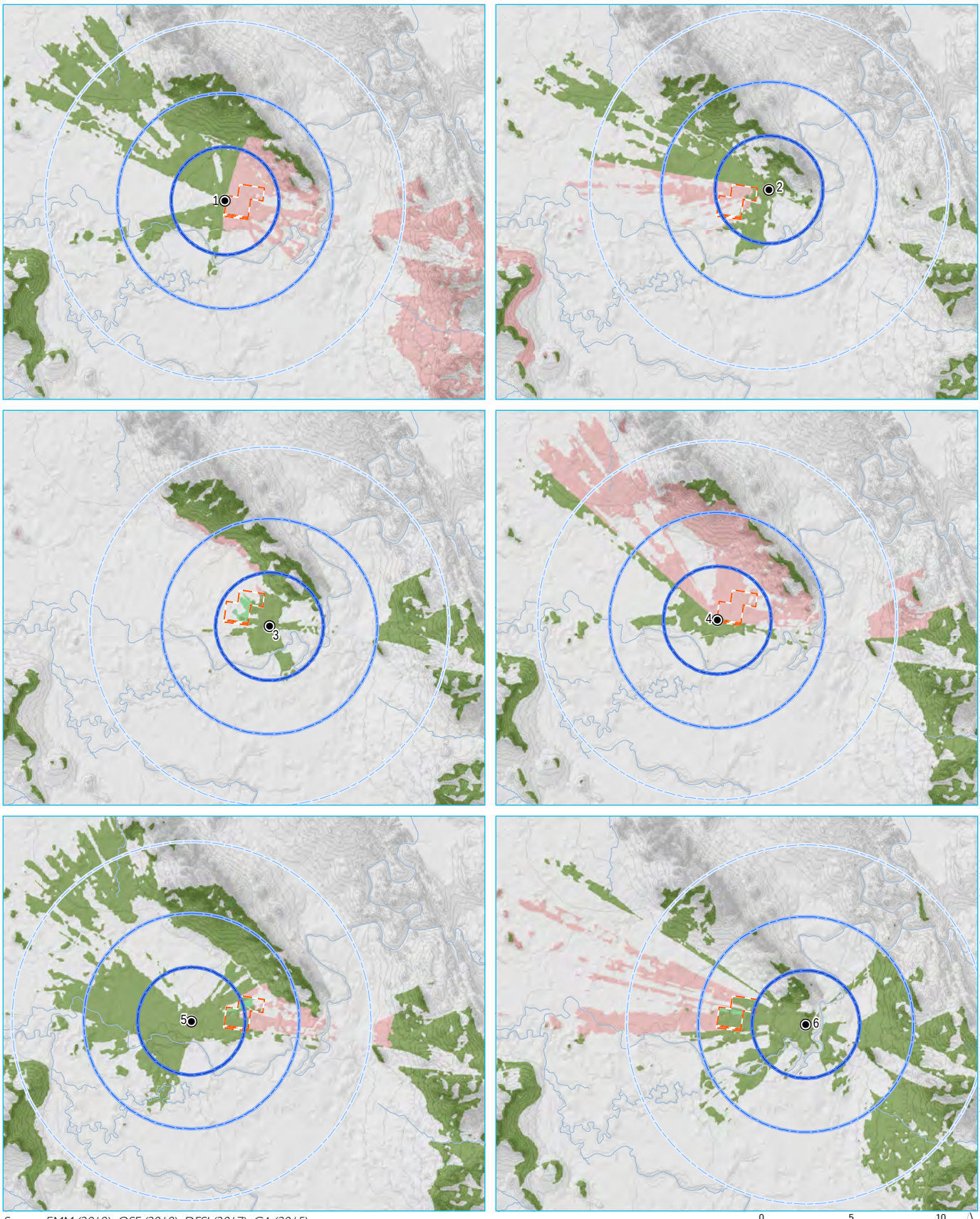

Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

0 5 10 km
GDA 1994 MGA Zone 56

N

KEY

- Development footprint
- Watercourse / drainage line
- Contour (10 m)
- Viewpoint

Viewpoint buffer

- 3 km
- 6 km
- 10 km

Changes to viewshed due to project infrastructure

- No change to existing viewshed
- Viewshed gained after project construction
- Loss of existing viewshed

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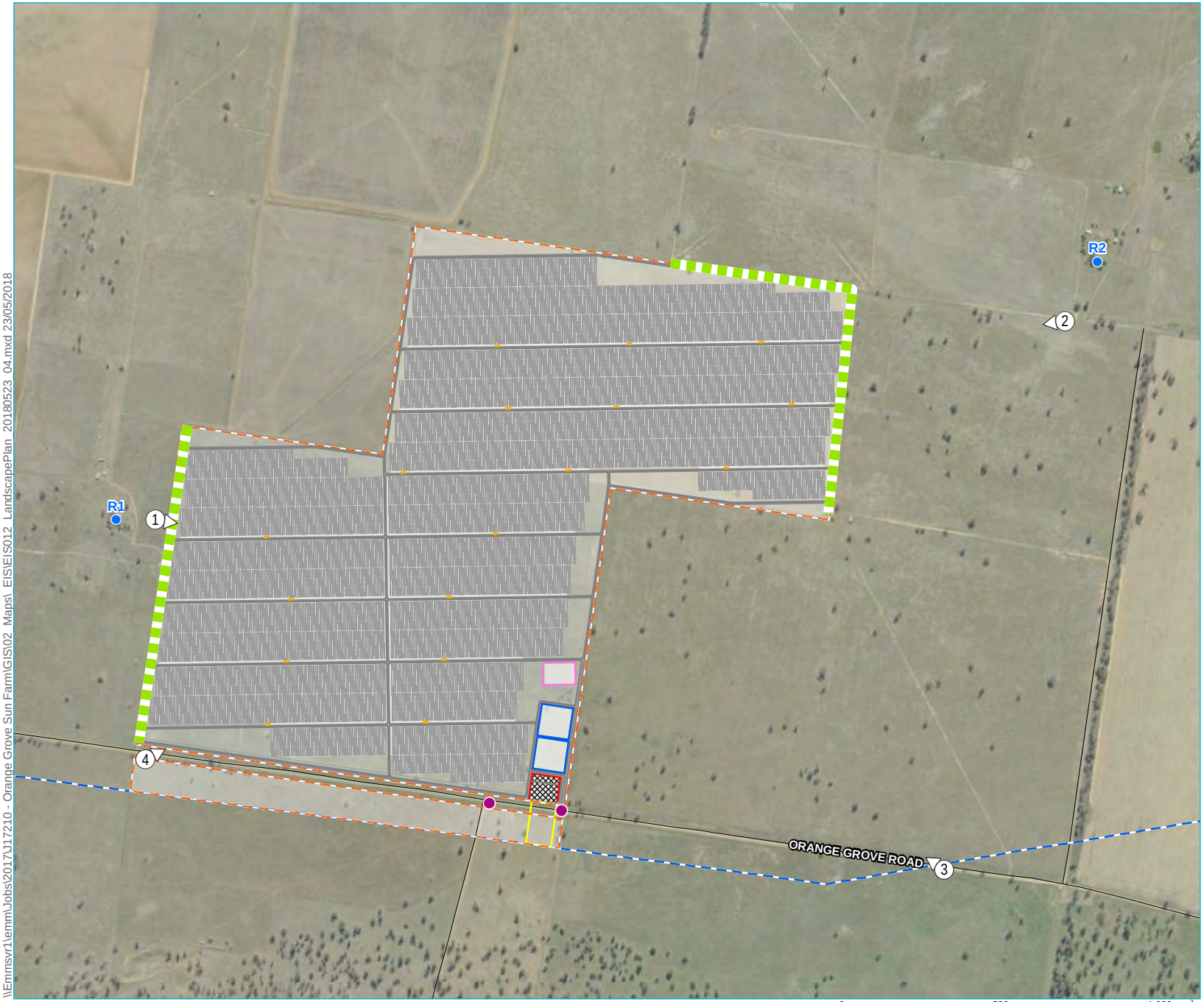
Viewshed analysis within the development footprint from viewpoints 1 to 6

Orange Grove Sun Farm
Environmental impact statement
Figure 6.5

EMM



KEY

- Development footprint
- Area to be subdivided
- Indicative site access point
- 132 kV transmission line
- Main road
- Local road
- Non project-related receptors
- Viewpoint location and number

Project infrastructure

- Solar panel layout
- Internal road
- Management hub and potential future battery storage
- On-site switchyard and transformation area
- Inverter
- Temporary laydown area
- Transmission corridor
- Area of proposed landscaping (not to scale)

Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

0 500 1,000 m

GDA 1994 MGA Zone 56

N

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Conceptual landscaping plan

Orange Grove Sun Farm
Environmental impact statement
Figure 6.6

EMM

6.7 Noise

6.7.1 Introduction

The SEARs require an assessment of the potential impacts of the Orange Grove Sun Farm project on noise. The SEARs state that this EIS must include:

> an assessment of the construction noise impacts and cumulative impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG) and operational noise impacts in accordance with the *NSW Noise Policy for Industry* (NPI); and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.

EMM has prepared a noise and vibration impact assessment for the project (Appendix H). This section of the EIS summarises the assessment and addresses the SEARs requirements for potential noise impacts.

6.7.2 Existing environment

i Ambient noise

Land uses are primarily agricultural as described in Chapter 2. Given the area and surrounding agricultural land uses, existing ambient noise levels at assessment locations are likely to be dominated by rural noise sources and road traffic noise. The rating background noise levels (RBLs) at assessment locations are expected to be low (30 dB or below). Therefore, the NSW EPA's *Noise Policy for Industry* (NPfI) (EPA 2017) minimum RBLs of 35 dB and 30 dB have been adopted for this assessment for the daytime and evening/night-time periods, respectively.

The nearest receptor, R1, is approximately 150 m from the western boundary of the development footprint, with a further four receptors, R2, R8, R9 and R10, within 2 km (Figure 6.7). In total, eleven representative receptors were selected for the purposes of the noise assessment, and are referred to as assessment locations (R1-R11) shown in Figure 6.7. It is considered that if noise criteria can be satisfied at the assessment locations closest to the development footprint, then noise criteria will be satisfied at other noise-sensitive locations that are located further from the development footprint.

ii Meteorology

Noise propagation over distance can be affected by the prevailing weather conditions. Of most interest are source to receiver winds as these conditions can enhance received noise levels.

Meteorological data from the nearest BoM Automatic Weather Station (AWS) were analysed, and identified that there were no feature winds during the day, evening or night periods. Accordingly, only calm meteorological conditions were adopted for the construction noise modelling.

6.7.3 Impact assessment

i Noise criteria

a. Construction noise criteria

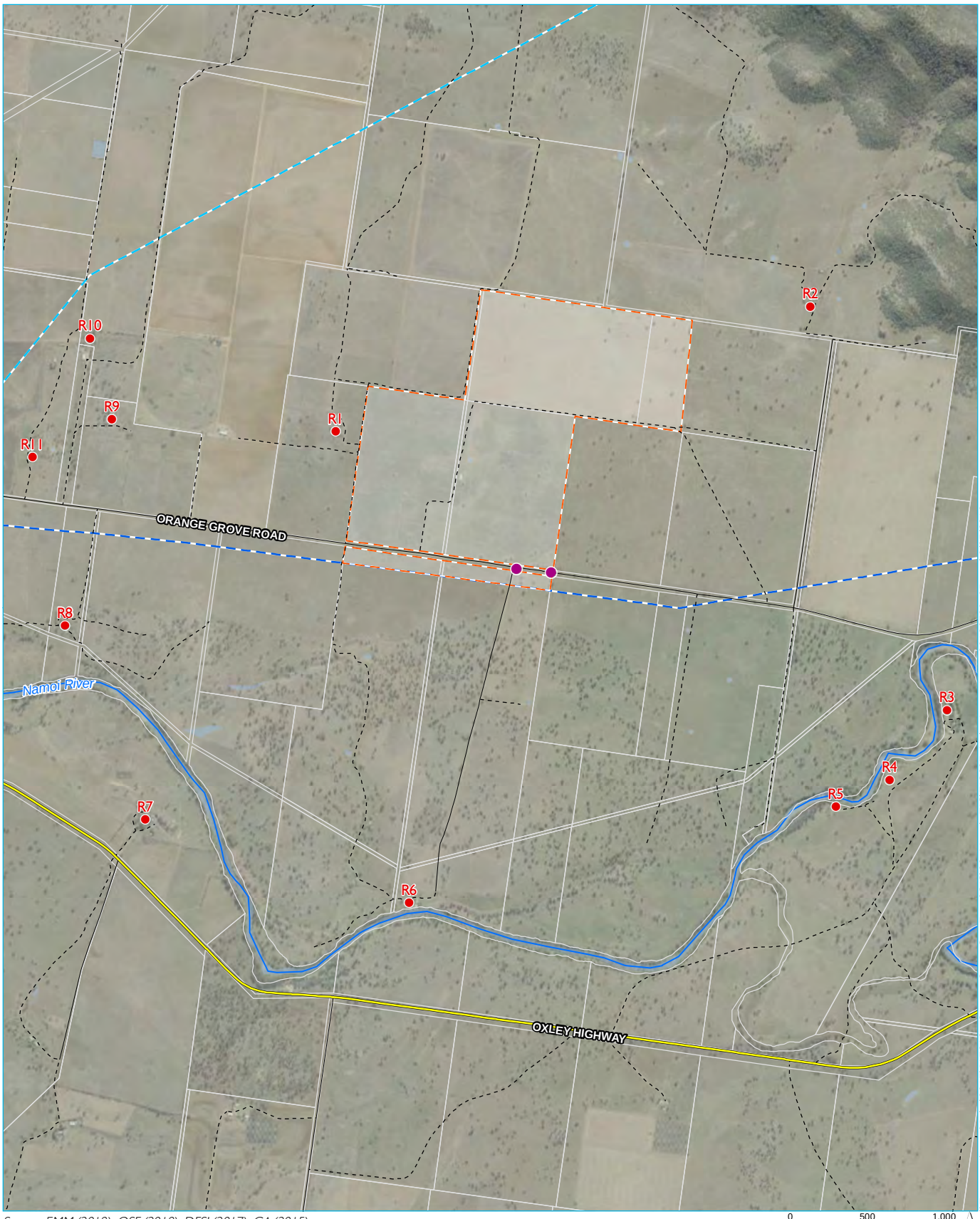
The NSW EPA's *Interim Construction Noise Guideline* (ICNG) (DECC 2009) sets out noise management levels (NMLs) for residential and other noise-sensitive receivers and how they are to be applied.

The construction NMLs for the project have been based on the adopted NPfI minimum RBL of 35 dB in accordance with the ICNG (DECC 2009). The policy suggests restrictions to the hours of construction that apply to activities that generate noise at residences above the 'highly affected' NML. The NMLs are shown in Table 6.9.

Table 6.9 Construction noise management levels

Assessment locations	Period	Adopted RBL, dB(A)	NML, LAeq,15 minute (RBL + 10 dB)
R1-R11	Standard hours1	35	45
			75 (highly affected)

Notes: 1. Standard hours as per the ICNG are Monday to Friday from 7am to 6pm, Saturday from 8am to 1pm, no work on Sundays and public holidays.



Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

0 500 1,000 m
GDA 1994 MGA Zone 56

N

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KEY

- Development footprint
- Indicative site access point
- Assessment location
- 132 kV transmission line
- 66 kV transmission line
- Main road
- Local road
- Vehicular track
- Namoi River
- Waterbody
- Cadastral boundary

Noise assessment locations

Orange Grove Sun Farm
Environmental impact statement
Figure 6.7

EMM

b. Road traffic noise criteria

The principal guidance for assessing the impact of road traffic noise on receivers is the NSW EPA's *Road Noise Policy* (RNP) (DECCW 2011).

It is anticipated that road trucks will deliver all equipment and material (eg. posts, frames, cables, PV solar panels, inverters etc) to development footprint. Both the northern and southern portions of the development footprint will be accessed directly from Orange Grove Road, however it is noted that the majority of equipment and material will be delivered to the northern portion of the development footprint as no PV solar panels are proposed for the southern portion of the development footprint. From Gunnedah, it is assumed that the majority of light vehicles would travel north along Chandos Street across Cohens Bridge and onto O'Keefe Avenue and Kelvin Road before turning onto Orange Grove Road. Due to the width restriction on Cohens Bridge, it is proposed that all project-related heavy vehicles will follow an alternate route (Figure 6.8). This would involve turning off the Kamilaroi Highway onto Blue Vale Road, located 4 km to the north-west of Gunnedah, and then turning onto Old Blue Vale Road before rejoining Kelvin Road, thereby bypassing Cohens Bridge.

The sections of the Kamilaroi and Oxley Highways leading to the project are classified as freeway/arterial road and sub-arterial roads while Old Blue Vale, Blue Vale, Kelvin and Orange Grove roads are classified as local roads. Table 6.10 presents the road noise assessment criteria for these road categories and has been reproduced from Table 3 of the RNP (DECCW 2011).

Table 6.10 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	LAeq,15 hour 60 (external)	LAeq,9 hour 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	LAeq,1 hour 55 (external)	LAeq,1 hour 50 (external)

The RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB.

ii Construction noise assessment

Construction noise levels were modelled using Brüel and Kjær 'Predictor' software. 'Predictor' calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources. The model has considered factors such as location, distance, ground effects, atmospheric absorption, topography, and applicable meteorological conditions. Predicted noise levels over a typical worst case 15-minute scenario were modelled and assessed for comparison against the relevant NMLs. The construction noise impact assessment has adopted sound power levels from the EMM noise database for plant and equipment items used on similar projects. Plant and equipment items, sound power levels and quantities adopted in the noise modelling are provided in Appendix H.

Modelling results indicate site preparation works will have the most potential for noise impacts.

Predicted construction noise levels for the site preparation works during standard construction hours are presented in Table 6.11. Construction noise levels are predicted to satisfy the recommended NMLs at all locations. Therefore, noise levels during all construction activities are expected to satisfy the NMLs at all locations.

Table 6.11 Predicted noise levels during construction (site preparation)

Assessment locations	Land use	Distance to the development footprint (km)	Predicted construction noise level LAeq,15 minute, dB	Construction NML1 LAeq,15 minute, dB
R1	Residential	0.2	45	45
R2	Residential	0.8	33	45
R3**	Residential	2.5	<30	45
R4**	Residential	2.3	<30	45
R5**	Residential	2.2	<30	45
R6**	Residential	2.2	31	45
R7	Residential	2.1	<30	45
R8	Residential	1.9	30	45
R9	Residential	1.6	32	45
R10	Residential	1.8	30	45
R11	Residential	2.1	<30	45

Notes: 1. Standard hours only: Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no construction work on Sundays or public holidays.

***The residences at these locations are owned by the project landholders.*

iii Road traffic noise assessment

The proposed construction works will generate traffic movements associated with the construction workforce as well as the delivery of all construction materials by road trucks. Construction of the project will take approximately nine months from the commencement of site establishment works. Daily average (and peak) traffic movements during construction are summarised in Table 6.12. Project-generated traffic movements would be travelling via Orange Grove Road and Kelvin Road.

Table 6.12 Daily average traffic movements during construction

Construction scenario	Daily heavy vehicles movements	Daily workforce movements (light vehicles)	Total daily movements	Hourly heavy vehicle movements	Hourly workforce movements (light vehicles)	Total hourly movements
Average	32	48	80	8	16	24
Peak	56	60	116	12	24	36

Baseline daily traffic volumes for the affected roads (project access routes) have been determined primarily using published RMS daily traffic surveys, for the years between 2007 and 2017. In addition, GSC provided their most recent available traffic count data for the local road network. As noted in Section 6.8.2, to establish a baseline year 2018 daily traffic volume, +1% annual (linear) traffic growth has been added to the most recent annual survey along these roads. In the absence of traffic count data for Old Blue Vale Road, the existing traffic volume has been estimated using the RMS *Guide to Traffic Generating Developments Updated Traffic Surveys* (RMS 2013).

Road traffic noise levels during construction works are predicted to be below the relevant criteria at the affected residential dwellings on the surrounding road network, as shown in Table 6.13.

Table 6.13 Predicted road traffic noise during construction

Stage	Road	Distance to road (m)	Speed (km/h)	Calculated existing traffic noise level, dB	Predicted project generated traffic noise level, dB1	Future traffic noise level, dB	Criteria, dB
Peak	Orange Grove Rd	45	100	42 LAeq,1 hour	51 LAeq,1 hour	51 LAeq,1 hour	55 LAeq,1 hour
	Kelvin Rd	50	100	48 LAeq,1 hour	45 LAeq,1 hour	50 LAeq,1 hour	55 LAeq,1 hour
	Old Blue Vale Road	70	100	36 LAeq,1 hour	47 LAeq,1 hour	48 LAeq,1 hour	55 LAeq,1 hour
	Oxley Hwy	10	70	57 LAeq,15 hour	46 LAeq,15 hour	58 LAeq,15 hour	60 LAeq,15 hour
	Kamilaroi Hwy	20	100	58 LAeq,15 hour	49 LAeq,15 hour	58 LAeq,15 hour	60 LAeq,15 hour

Notes: 1. Based on the peak hourly workforce movements (light vehicles) and construction delivery (heavy vehicle) movements.

iv Operational noise impacts

Noise impacts during operation of the project were assessed at each of the assessment locations. Noise sources considered during the operational stage of the project included inverters with integrated transformers, tracker motors (for the PV solar panels) and light vehicle movements. The tracker motors and light vehicles were assumed to operate during the daytime period only. It is noted that noise from the inverters with integrated transformers can be tonal in nature and therefore a 5 dB penalty has been applied to the predicted noise contributions from this source in accordance with the NPfI (EPA 2017).

The assessment identified that noise levels from the project's operation would satisfy the minimum daytime and evening/night-time NPfI (EPA 2017) trigger levels of 40 dB and 35 dB, respectively at all assessment locations.

v Vibration assessment

The majority of vibration generating activities associated with the proposed construction works includes the use of a roller and a piling drill rig. As a guide, safe working distances for typical items of vibration intensive plant are listed in Table 6.14. The safe working distances are quoted for both 'Cosmetic Damage' (refer British Standard BS 7385) and 'Human Comfort' (refer British Standard BS 6472-1).

Table 6.14 Recommended safe working distances for vibration intensive plant

Plant item1	Rating/description	Safe working distance	
		Cosmetic damage (BS 7385)	Human response (BS 6472)
Vibratory Roller	<50 kN (typically 1–2 tonnes)	5 m	15 to 20 m
	<100 kN (typically 2–4 tonnes)	6 m	20 m
	<200 kN (typically 4–6 tonnes)	12 m	40 m
	<300 kN (typically 7–13 tonnes)	15 m	100 m
	>300 kN (typically 13–18 tonnes)	20 m	100 m
	>300 kN (>18 tonnes)	25 m	100 m
Small hydraulic hammer	(300 kg - 5 to 12 tonne excavator)	2 m	7 m
Medium hydraulic hammer	(900 kg - 12 to 18 tonne excavator)	7 m	23 m
Large hydraulic hammer	(1,600 kg - 18 to 34 tonne excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2–20 m	20 m
Pile boring	800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Source: Transport Infrastructure Development Corporation Construction's Construction Noise Strategy (Rail Projects), November 2007.

Notes: 1. Plant items shown are indicative to illustrate safe working distances, not all plant items will be used.

The nearest residence, R1, is approximately 150 m from the nearest point of potential vibration producing plant. Given this distance is well outside the safe working distance for cosmetic damage and human comfort, the assessment predicts no vibration impacts on receptors throughout the approximate nine month duration of the construction stage of the project.

6.7.4 Management and mitigation

The noise and vibration impact assessment predicts that impacts are not likely to be significant during construction or operation of the project, nor would the project result in adverse impacts from road traffic noise or vibration during construction. Therefore based on the results of the noise and vibration impact assessment, no specific mitigation or management measures are required.

6.7.5 Conclusion

The potential construction noise levels are predicted to be below relevant criteria throughout the approximate nine month duration of the construction stage of the project. Operational noise levels are shown to satisfy the NPfI (EPA 2017) noise trigger levels at all assessment locations during the daytime, evening and night-time periods. Traffic generated by the project is not expected to result in any noticeable increase in average road traffic noise levels at the nearest residential locations surrounding the project routes. Vibration associated with the proposed construction works is highly unlikely to generate impacts at the nearest vibration-sensitive receivers for the duration of the construction stage of the project. Additional noise management and mitigation measures are not predicted to be required to achieve the relevant operational or construction noise goals.

6.8 Transport

6.8.1 Introduction

The SEARs require an assessment of the potential impacts of the Orange Grove Sun Farm project on traffic and transport. The SEARs state that this EIS must include:

> an assessment of the site access route (including Kamilaroi Highway, Oxley Highway, Orange Grove Road and Kelvin Road), site access point, any potential rail safety issues and likely transport impacts and cumulative transport impacts (including peak and average traffic generation, over dimensional vehicles and construction worker transportation) of the development on the capacity and condition of roads (including on any Crown land); a description of the measures that would be implemented to mitigate any impacts during construction; a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); and a demonstration about potential cost sharing with the Gunnedah Solar Farm project.

EMM has prepared a traffic impact assessment for the project (Appendix I). This section of the EIS summarises the assessment and addresses the SEARs requirements for potential traffic and transport impacts.

6.8.2 Existing environment

i Road network

The main transport routes that would primarily be used by the project are the Oxley and Kamilaroi Highways, Kelvin Road, Orange Grove Road, O'Keefe Avenue, Old Blue Vale Road and Blue Vale Road. The existing road network is shown in Figure 6.8.

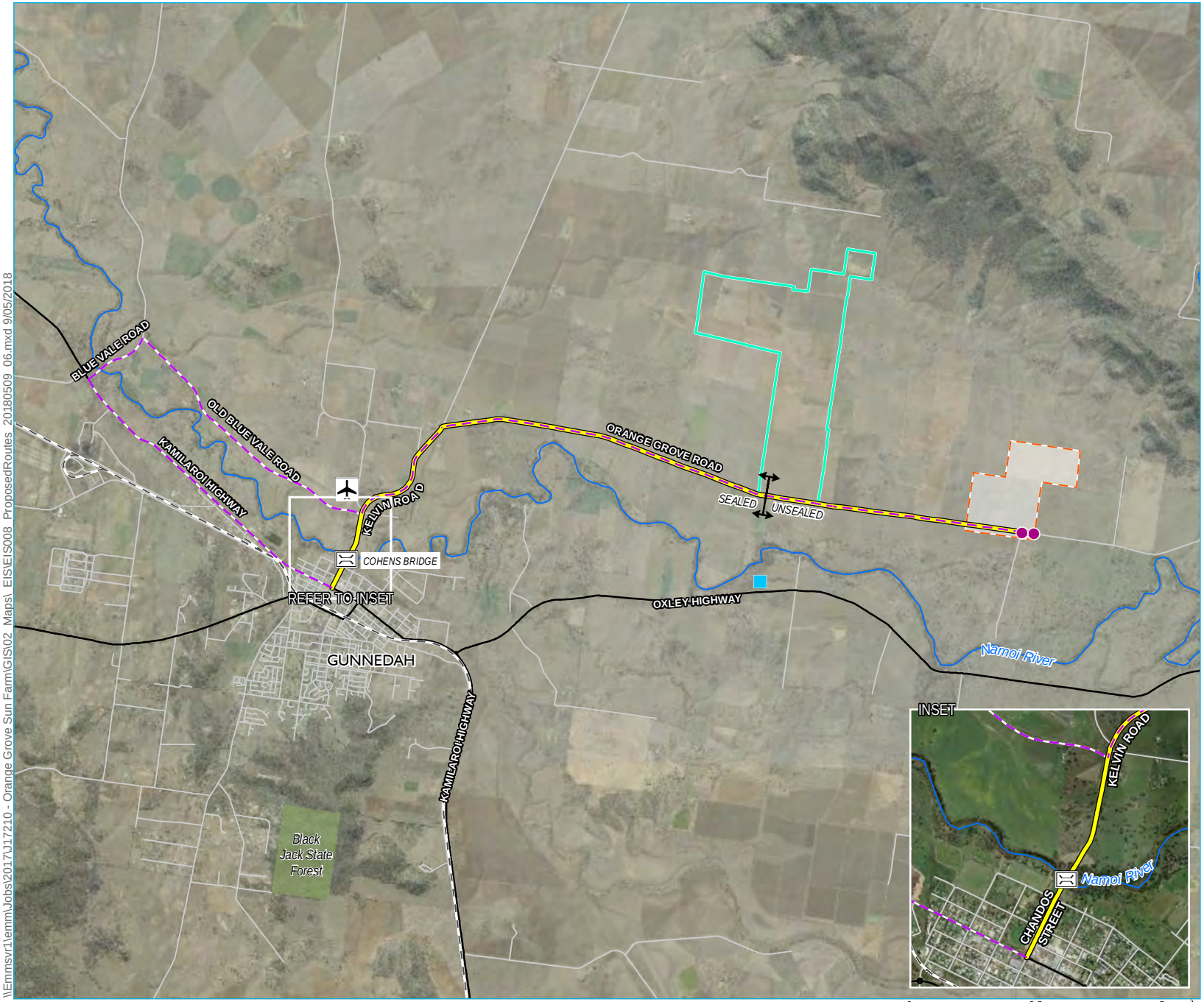
The Oxley Highway is a state funded rural highway, which connects in a general east-west direction through a major part of north-eastern NSW, from Nevertire in the west, linking up with the Mitchell Highway at various points, and running via Gunnedah and Tamworth to Port Macquarie on the eastern coast of NSW. The Kamilaroi Highway is a state funded highway, which runs from the Mitchell Highway at Bourke in a south-easterly direction via Brewarrina, Walgett, Narrabri, Gunnedah and Quirindi before linking with the New England Highway close to the township of Willow Tree.

Orange Grove Road is a two-lane local road with a speed limit of 100 km/hr. It has a straight and level alignment and good visibility, however, it has no centreline markings. Orange Grove Road is sealed from the intersection with Kelvin Road for approximately 6 km to the east. The sealed section extends to approximately 4 km west of the western boundary of the development footprint, while the remaining section that extends to the two proposed access locations for the project is not sealed (Figure 6.8).

Kelvin Road is a two-lane local road with a speed limit of 100 km/hr. It has a straight and level alignment and good visibility. The segment that would generally be used by most project-related traffic has centreline markings. On the approach to Gunnedah, Kelvin Road connects into O'Keefe Avenue where there is a narrow two lane bridge (Cohens Bridge) crossing over the Namoi River and the road then continues as Chandos Street to the centre of the township of Gunnedah.

Due to the width restriction on Cohens Bridge, it is proposed that all project-related heavy vehicles will follow an alternate route (Figure 6.8). This would involve turning off the Kamilaroi Highway approximately 5 km north-west of Gunnedah onto Blue Vale Road and then turning right onto Old Blue Vale Road before rejoining Kelvin Road, thereby bypassing Cohens Bridge.

During consultation with GSC, it was noted that road upgrade works are currently scheduled for Old Blue Vale Road in 2019. These upgrades would likely include widening the sealed width of Old Blue Vale Road from 4 m to 7.2 m.



KEY

- Development footprint
- Potential site access point
- Gunnedah Solar Farm (SSD 8658 - proposed by Photon Energy Generation Pty Ltd)*
- Gunnedah Substation
- Gunnedah Airport
- Narrow bridge (Cohens Bridge)
- Main road
- Local road
- Rail line
- Namoi River
- State forest

Proposed traffic routes

- Light vehicle traffic route
- Heavy vehicle traffic route

\\Emmsvr1\emm\Jobs\2017\117210 - Orange Grove Sun Farm\GIS\02 Maps\ EIS\EIS008 ProposedRoutes 20180509 06.mxd 9/05/2018

Source: EMM (2018); OSF (2018); DFSI (2017); GA (2015)

** DPE 2017, Gunnedah Solar Farm, viewed 11 October 2017, http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8658*

0 2.5 5 km

GDA 1994 MGA Zone 56

N

Proposed traffic routes

Orange Grove Sun Farm
Environmental impact statement
Figure 6.8

EMM

ii Traffic volumes

Baseline daily traffic volumes for the affected roads (project access routes) have been determined primarily using published RMS daily traffic surveys, for the years between 2007 and 2017. To establish a baseline year 2018 daily traffic volume, +1% annual (linear) traffic growth has been added to the most recent annual survey. Traffic volumes are presented in Table 6.15.

Table 6.15 Historic and projected daily vehicle volumes on major roads

Road	Historic daily traffic volumes			2018 projected daily traffic volume1	Average proportion of heavy vehicles
	2007	2011	2017		
Kamilaroi Highway at Gunnedah	5,931	6,250	N/A	6,690	N/A
Kamilaroi Highway, east of Gunnedah (near Curlewis)	1,633	N/A	N/A	1,810	17%
Kamilaroi Highway, north-west of Gunnedah (near Blue Vale)	1,595	N/A	N/A	1,770	18%
Oxley Highway, east of the development footprint (near Carroll)	2,520	1,504	N/A	1,610	13%
Oxley Highway, west of the development footprint (3.7 km east of Gunnedah)	N/A	N/A	3,588	3,620	17%

Note: + 1% annual (linear) traffic growth has been adopted, which gives a growth factor x 1.01 from the 2017 volume, x 1.07 from the 2011 volumes and x 1.11 from the 2007 volumes.

In addition to the daily vehicle volumes provided in Table 6.15, GSC provided their most recent available traffic count data for the local road network, more specifically Kelvin Road and Orange Grove Road. Blue Vale Road has not been formally surveyed by GSC, however, an estimate of the daily traffic volume and average proportion of heavy vehicles was provided during consultation with GSC. Traffic volumes are presented in Table 6.16.

Table 6.16 Historic and projected daily traffic volumes on local roads

Road	Year	Historic daily traffic volume	2018 projected daily traffic volume1	Average proportion of heavy vehicles
Kelvin Road south of Orange Grove Road	2014	559	581	4.0%
Kelvin Road north of Orange Grove Road	2015	372	383	5.2%
Orange Grove Road (sealed portion)	2015	166	171	3.3%
Orange Grove Road (unsealed portion)	2015	86	89	3.4%

Note: 1+ 1% annual (linear) traffic growth has been adopted, which gives a growth factor x 1.03 from the 2015 volumes and x 1.04 from the 2014 volume.

No formal traffic data was available for Old Blue Vale Road. However, GSC indicated that the current daily traffic volume for Old Blue Vale Road is low and primarily relates to traffic to and from rural dwellings along Old Blue Vale Road. As such, it is appropriate to estimate the baseline traffic volume for Old Blue Vale Road using the methodology for estimating traffic generation in the RMS (2013) *Guide to Traffic Generating Developments Updated Traffic Surveys*. According to this methodology, the number of dwellings using a section of rural road is multiplied by a factor of 7.4. The estimated daily traffic volume for Old Blue Vale Road, based on nine dwellings observed on the road, is 67 daily vehicle movements.

Road width design standards for low volume (generally rural) roads are defined by the Austroads *Guide to Road Design* (Austroads 2010) and are based on daily traffic volumes. The current design standards, which are applicable to major roads in the Gunnedah Shire LGA, are presented in Table 6.17.

Table 6.17 Daily traffic volumes and corresponding design standards

Daily traffic volume	Austroads (2010) design standard	Applicable roads	Meets design standard?
1–150	8.7 m wide total carriageway (if unsealed), or minimum 3.7 m wide seal	Orange Grove Road (unsealed segment)	Yes
150–500	Minimum 7.2 m wide seal	Orange Grove Road (sealed segment), Kelvin Road north of Orange Grove Road	Yes
500–1,000	Minimum 7.2 m – 8 m wide seal	Kelvin Road south of Orange Grove Road	Yes
1,000–3,000	Minimum 9 m wide seal	Kamilaroi Highway east of Gunnedah, Kamilaroi Highway north-west of Gunnedah, Oxley Highway east of the development footprint	Yes
>3,000	Minimum 10 m wide seal	Kamilaroi Highway at Gunnedah, Oxley Highway west of the development footprint	Yes

*Note: *Low volume rural roads are also frequently not sealed, where the local traffic conditions and traffic safety permit this.*

As shown in Table 6.17, the current cross sections of the major and local roads that are proposed to be used for the project access meet the Austroads (2010) road design standard for the daily traffic volumes that are currently using these roads. In most cases, there is also a reasonable margin of spare traffic capacity to accommodate significant daily traffic increases, without requiring any increase to the design standard of the route.

iii Safety

Traffic safety conditions in the vicinity of the Orange Grove Road and Kelvin Road are considered to be acceptable, with good intersection visibility in both directions at all locations along Kelvin Road and Orange Grove Road.

The accident history for the five year period 2012-2016 from the Transport for NSW interactive accident history database indicates a total of 155 recorded traffic accidents within the Gunnedah Shire LGA over this period (refer to Appendix I). Of these 155 recorded traffic accidents, there were 11 recorded traffic accidents on the Oxley Highway between Gunnedah and Carroll, including 3 fatalities, and 37 recorded traffic accidents on the Kamilaroi Highway between Gunnedah and Willow Tree, including 3 fatalities. Driver behaviour and delays in persons receiving medical treatment after road accidents due to the remoteness of some accident locations are probably significant contributory factors in the above average proportion of fatal traffic accidents which have occurred in recent years on these sections of the Oxley Highway and Kamilaroi Highway.

There were no recorded traffic accidents on Kelvin Road, Orange Grove Road, Blue Vale Road or Old Blue Vale Road.

6.8.3 Impact assessment

i Traffic generation

The following generated daily traffic movements and corresponding vehicle types have been calculated for the average construction, peak construction and operations stage activities for the project (Table 6.18). During the peak construction stage of the project, an average of 10 truck loads daily may also be required for the delivery of water to the development footprint. This will effectively be one additional truck movement per hour into and out of the development footprint. It is anticipated that the use of shuttle buses could be used for approximately 60% of the project construction workforce transport arrangements, including for a proportion of the workforce travelling to the development footprint from Gunnedah and surrounds. As noted in Chapter 3, the construction of the project will take approximately nine months from the commencement of site establishment works (including a three month peak construction period). The operational lifespan of the project may be in the order of 30 years, depending on the nature of solar PV technology and energy markets.

Table 6.18 Additional daily and hourly traffic volumes generated by the project

Project phase	Average construction		Peak construction		Operation	
	Daily	Peak hour	Daily	Peak hour	Daily	Peak hour
Workforce (light vehicle) traffic movements	48	16	60	24	6	2
Delivery (truck) traffic movements	32	8	56	12	4	1
Total project-related traffic movements	**80**	**24**	**116**	**36**	**10**	**3**

The proposed transport routes for the project light vehicle traffic and heavy vehicle traffic will primarily be as follows:

- For the workforce (light vehicle) traffic:
  - 40% of the workforce will be based in the Gunnedah area, residing in either permanent or temporary accommodation, travelling to and from the development footprint via Kelvin Road and Orange Grove Road;
  - 40% of the workforce will be either permanently or temporarily residing in Tamworth and surrounds to the east and commuting to and from the development footprint in a range of vehicles including private cars, utes and small trucks via the Oxley Highway; and
  - 20% of the workforce will be permanently or temporarily residing in Narrabri, Boggabri and surrounds to the north and commuting to and from the development footprint in a range of vehicles including private cars, utes and small trucks via the Kamilaroi Highway.
- For construction vehicles and deliveries (heavy vehicle) traffic:
  - 60% of heavy vehicle traffic will travel to and from the south via the Kamilaroi Highway (ie. deliveries from Sydney/Melbourne);
  - 20% will travel to and from the north via the Kamilaroi Highway (ie. deliveries from Brisbane); and
  - 20% will travel to and from the east via the Oxley Highway (10% coming from the north and 10% from the south, using the Oxley Highway as an alternative to the Kamilaroi Highway).

ii Capacity

The effective current daily traffic capacities for the various roads were considered, according to the current Austroads (2010) road design standards, and are given in Table 6.17 above. To assess the impact of the project on the existing design capacity of these roads, a comparison of the existing volumes and additional daily traffic volumes generated during the project's construction and operational stages were calculated for the affected travel routes (Kamilaroi Highway, Oxley Highway, Kelvin Road and Orange Grove Road). The predicted traffic volume impacts during the average and peak construction periods are summarised in Table 6.19.

Table 6.19 Future daily traffic assessment for project peak and average construction traffic

Route	Projected baseline daily traffic volume (year 2018)	Future total daily traffic (including project)		Austroads rural daily traffic volume standard
		Average	Peak	
Kamilaroi Highway at Gunnedah	6,688	6,768	6,804	>3,000
Kamilaroi Highway south-west of the development footprint (near Curlewis)	1,813	1,832	1,847	1,000–3,000
Kamilaroi Highway northwest of the development footprint (near Blue Vale)	1,770	1,786	1,793	1,000–3,000
Oxley Highway east of the development footprint (near Carroll)	1,609	1,635	1,644	1,000–3,000
Oxley Highway west of the development footprint (3.7 km east of Gunnedah)	3,624	3,650	3,659	>3,000
Kelvin Road (south of Orange Grove Road)	581	661	697	500–1,000
Orange Grove Road (sealed segment)	171	251	287	150–500
Orange Grove Road (unsealed segment)	89	169	205	150–500
Blue Vale Road south of Old Blue Vale Road	300	332	356	150-500
Old Blue Vale Road	67	99	123	1-150

The results presented in Table 6.19 show that the highest proportional daily traffic increases from the project during the peak and average construction periods will be on Orange Grove Road, Kelvin Road, Blue Vale Road and Old Blue Vale Road. The predicted traffic increases will cause the unsealed segment of Orange Grove Road to move into a higher band in the Austroads rural daily traffic volume classification system (ie. from 1–150 to 150–500). As evidenced in Table 6.19, total daily traffic along the unsealed segment of Orange Grove Road will be 169 and 205 vehicle movements during the average and peak stages of construction, respectively. The predicted traffic increases will be in the lower end of this higher band. At all other assessed traffic locations, the increases in daily traffic are expected to be much lower (generally less than 2%) and within the current Austroads design and capacity standards and within the current Austroads design and capacity standards.

For the duration of the project construction period, a road maintenance program will be undertaken for the unsealed section of Orange Grove Road to maintain the safety and serviceability of the road for all road users.

The predicted traffic volume impacts during the operational stage of the project are summarised in Table 6.20.

Table 6.20 Future daily traffic assessment for project operations traffic

RMS traffic count location or road with estimated number of dwellings	Projected baseline daily traffic volume (year 2018)	Daily traffic from the project	Future total daily traffic	Percent traffic increase	Austroads rural daily traffic volume standard
Kamilaroi Highway at Gunnedah	6,688	10	6,698	<1%	>3,000
Kamilaroi Highway south-west of the development footprint (near Curlewis)	1,813	2	1,815	<1%	1,000–3,000
Kamilaroi Highway northwest of the development footprint (near Blue Vale)	1,770	2	1,772	<1%	1,000–3,000
Oxley Highway east of the development footprint (near Carroll)	1,609	3	1,612	<1%	1,000–3,000
Oxley Highway west of the development footprint (3.7 km east of Gunnedah)	3,624	3	3,627	<1%	>3,000
Kelvin Road	581	10	591	<2%	150–500
Orange Grove Road (sealed segment)	171	10	181	5.8%	150–500
Orange Grove Road (unsealed segment)	89	10	99	11.2%	1–150
Blue Vale Road south of Old Blue Vale Road	300	4	304	<2%	150500
Old Blue Vale Road	67	4	71	6.0%	1150

The predicted increases to traffic volume on each of the affected routes are predicted to be within the relevant Austroads traffic volume thresholds during the operational stages of the project. The traffic volumes generated by the project are therefore anticipated to have minimal effects on the future traffic operations, level of service and traffic safety at the completion of the nine month construction period.

iii Site access and parking

Two access road locations off Orange Grove Road will be used to access the development footprint, one each for the northern and southern portions of the development footprint, respectively (Figure 6.8). Both of these access intersections will consist of a three-way intersection with Orange Grove Road, with a connecting access road extending into the respective northern and southern portions. Project-related traffic during both the construction and operations stages will principally access the northern portion of the development footprint. Gravel shoulder widening would be constructed at both locations to facilitate turning movements to and from the development footprint by large trucks.

The proposed access intersection requirements have been discussed with RMS and GSC and agreed in principle. RMS and GSC will be consulted further in relation to the detailed design requirements for the preferred access road intersections prior to construction.

The internal roads within the development footprint will generally be unsealed. Parking for the project construction and operations workforces will be provided on-site in gravel surfaced parking areas with appropriate dimensions to accommodate the number and size of vehicles.

iv Intersections

The existing peak hourly volumes of eastbound and westbound through traffic using Orange Grove Road (approximately 9 vehicles per hour) at the proposed access intersections is anticipated to increase as a result of project-related traffic travelling to and from the west. From the forecast future project traffic volumes for each stage of construction, the maximum peak hourly turning traffic volumes, which would principally be using the northern access intersection, would be:

- a maximum of 24 hourly vehicle movements from the west during the average project construction period; and
- a maximum of 36 hourly vehicle movements from the west during the peak project construction period.

Therefore, a maximum of approximately 45 peak hourly movements from the west of the development footprint could be expected along the 5.4 km unsealed portion of Orange Grove Road.

It has been assumed that 98% of the future project traffic would turn left into the northern portion of the development footprint. This bias for the northern portion of the development footprint is based on the fact that no PV solar panels are proposed to be installed on the southern portion of the development footprint and, therefore, the vast majority of traffic during all phases of construction and operations will require access to the northern portion of the development footprint.

The need for additional turning lanes at the two proposed access intersections has been assessed by reference to the 100 km/hr Austroads intersection design warrant chart and the Austroads intersection road design guide extracts (refer to Appendix I).

The findings of this intersection traffic assessment, using the forecast major road and minor road traffic volumes for each leg of the intersection, show that only the minimum (Type BAR/BAL) intersection left or right turn safety treatment (using gravel shoulder widening) is required to accommodate the predicted levels of traffic accessing the development footprint at the two proposed access intersections. The potential addition of one additional truck movement per hour (into and out of the development footprint) for water deliveries will not have a measurable effect on the future access intersection arrangements.

For the Kelvin Road and Orange Grove Road intersection, the same (Type BAR/BAL) intersection turning treatment would also be required (using asphalt surfaced road pavement). It is assumed that the existing intersection design meets this standard as it is the minimum Austroads design standard for any rural road intersection.

The traffic impact assessment has also considered the potential impact of project-related vehicle movements on all intersections along the proposed heavy vehicle route from Gunnedah to the development footprint, namely the intersection of the Kamilaroi Highway and Blue Vale Road, Blue Vale Road and Old Blue Vale Road and Old Blue Vale Road and Kelvin Road (Figure 6.8). Each of these intersections would satisfy the standard design requirements with the addition of project-related vehicle movements during the peak and average stages of construction and the ongoing operation of the project.

v Glare and distraction

The potential impacts of reflectivity on motorists travelling along Orange Grove Road 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).

The potential for low angled reflected sunlight to cause a distraction to drivers travelling along Orange Grove Road was considered. Due to the anti-reflective properties of the PV solar panels, they are not expected to cause a distraction to motorists on Orange Grove Road.

An assessment of visual impacts is provided in Section 6.6 and Appendix G.

6.8.4 Management and mitigation

i Construction traffic management

A construction traffic management plan (CTMP) and Driver Code of Conduct will be incorporated into the EMP and will be prepared prior to commencement of construction, which will incorporate the proposed access intersection treatments utilising Austroads and RMS guidelines for the major road intersection operations and worksite traffic control throughout the project construction period.

As part of input on the SEARs, RMS has noted the following requirements are to be included in the CTMP and Driver Code of Conduct for the project:

- map of the primary haulage routes highlighting critical locations;
- safety initiatives for haulage through residential areas and/or school zones;
- an induction process for vehicle operators and regular toolbox meetings;
- a complaint resolution and disciplinary procedure, and
- any community consultation measures for peak haulage periods.

In order to minimise impacts on traffic flow along Orange Grove Road, deliveries and other vehicle movements will avoid peak hour and school bus times, whenever possible.

All traffic movements during the construction stage of the project will be from the west of the development footprint.

Generally, during the construction period, the largest vehicles which are anticipated to be visiting the development footprint for construction deliveries on a regular basis will be 19 m long semi trailers. Temporary traffic control arrangements may be required at the proposed access intersections during the peak stages of construction traffic activity or on days when deliveries by oversize vehicles may be required.

ii Intersection improvements

Two new intersections are proposed for access into the development footprint, both of which will be located on Orange Grove Road, serving the southern and northern portions of the development footprint.

Both of these access intersections will consist of a three-way intersection with Orange Grove Road, with a connecting access road extending into the respective northern and southern portions of the development footprint.

The proposed intersections will require some gravel shoulder widening on the approaches to and from Orange Grove Road, generally within the Orange Grove Road reserve, to accommodate the swept path turning movement by the largest types of trucks requiring access to the development footprint.

The sight distance visibility along Orange Grove Road is excellent for the future potential turning traffic at both of the proposed access locations and no additional vegetation clearing would be required to improve visibility.

The proponent would be required to lodge a Section 138 Certificate (Work on Public Lands) for GSC approval before any future road work for the proposed intersection construction/improvement is carried out.

iii Road maintenance program

During the project construction period which is estimated to continue for nine months, a road maintenance program will be implemented for the 5.4 km unsealed section of Orange Grove Road, west of the development footprint, which will include regrading of the road surface to repair potholes and road corrugations (at three monthly intervals) and a commitment by the proponent to restore the gravel road surface to its pre-construction condition, at the completion of the project's construction.

Additionally, the proponent will treat the road surface of the unsealed section of Orange Grove Road to reduce potential dust generation by project-related traffic during the construction period.

6.8.5 Conclusion

The predicted additional daily traffic usage of the surrounding roads during the peak stage of project construction will be approximately 116 daily vehicle trips, reducing to approximately 80 daily vehicle trips during the earlier and later (average) stages of project construction and a maximum of 10 daily vehicle trips during operation.

To accommodate the peak construction stage traffic, which is anticipated to extend for a three month period, the unsealed portion of Orange Grove Road will be subject to a road maintenance program to maintain the safety and serviceability of the road for all road users. To minimise dust generation, the proponent will treat the road surface of the unsealed section of Orange Grove Road to reduce potential dust generation by the project-related traffic during the construction period.

6.9 Water

6.9.1 Introduction

The SEARs require an assessment of the potential impacts of the Orange Grove Sun Farm on water. The SEARs state that this EIS must include:

> an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including the Namoi River and its catchment, wetlands, riparian land, groundwater dependent ecosystems and acid sulphate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; details of water requirements and supply arrangements for construction and operation; and a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004).

A desktop assessment of the site was undertaken, incorporating review and assessment of relevant publicly, including flood management plans for townships of Gunnedah and Carroll. Consultation with the landholders, affected landholders surrounding the site boundary and members of the local community has also been undertaken (refer to Section 5.4).

HEC has prepared a surface water assessment for the project (Appendix F), which assesses the flood risk of the development footprint, potential surface water impacts from the project and proposed mitigation measures to address these impacts.

6.9.2 Existing environment

i Surface water resources and flooding

The site is within the floodplain of the Namoi River and lies within GSC's flood planning area as mapped under the Gunnedah LEP (refer Figure 2.3). Under the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016), the site is mapped as part of the Upper Management Zone BL, which covers a significant portion of the catchment. This management zone is described as 'flood storage and secondary flood discharge areas'.

Available regional 10 m contours provided only a course interpretation of topography across the development footprint and the geometry of the Namoi River channel approximately 2.5 km to the south. Reliance on such topographical interpretation for the purposes of the surface water assessment for the EIS was not considered adequate, therefore detailed topographical information was obtained to a 0.1 m contour interval by undertaking a detailed ground survey of the development footprint and a cross-section (approximately 6,750 m in length) of the Namoi River and adjacent areas. The results of the survey are presented in Figure 2 and Figure 4 of Appendix F.

The development footprint slopes gently from east to west with elevations ranging from approximately 275.6 m AHD in the north-east to approximately 272.5 m AHD in the south-west. Median elevation across the development footprint is approximately 9 m above the surveyed Namoi River channel.

The contours show a broad swale of approximately 300 m in width in the north-east of the development footprint with a maximum depth of 1 m. This swale is identified as a first-order stream on NSW topographic maps. It is not evident from available topographic mapping whether this swale represents a breakout channel from the north side of the Namoi River or whether it is a channel conveying runoff from the hills to the north of the development footprint.

A small farm dam exists within the development footprint, however, this would be removed as part of site establishment activities by backfilling with adjacent material and levelling.

ii Groundwater resources

The site is within the Upper Namoi Alluvium groundwater management area which is characterised by an inland alluvial aquifer. Groundwater at the site is of fresh to moderate quality (0-1,500 TDS mg/L) and is suitable for domestic, stock and some irrigation purposes (Office of Water 2011). There is a groundwater monitoring bore adjacent to the western boundary of the development footprint that is listed on the DPI Water database (GW036237). The latest values indicate that the depth to groundwater at this location is approximately 12.35 m.

Twelve registered groundwater bores were identified within the site boundary, four of which are located within the development footprint, however only one (GW901524) is operational and in use for stock purposes (NSW Government 2018). One groundwater bore within the site boundary (GW902401) has a current water access licence with an entitlement of 10 megalitres (ML) of water from the Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gin's Leap) Groundwater Source.

6.9.3 Impact assessment

i Surface water resources and flooding

As part of the surface water assessment (Appendix F), potential impacts on surface water resources and flooding have been identified as:

- generation of turbid or sediment-laden runoff to downslope areas as a result of ground disturbance; and
- accidental spills or fuel leaks from vehicles or other motorised equipment operating within the development footprint.

No interception of runoff is planned by project infrastructure and therefore there should be no net reduction in runoff from the development footprint.

The site is within the floodplain of the Namoi River and lies within GSC's flood planning area as mapped under the Gunnedah LEP (refer Figure 2.3). Median elevation across the site is approximately 9 m above the surveyed Namoi River channel. Under the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016), the site is mapped as part of the Upper Management Zone BL, which covers a significant portion of the catchment. This management zone is described as 'flood storage and secondary flood discharge areas'.

Flood modelling and assessment was undertaken by SMEC (2003) for the Namoi and Mooki Rivers from upstream of Carroll and Breeza to downstream of Boggabri, which reported modelling for four historical floods that occurred in 1955, 1984, 1998 and 2000 and included flood mapping of the land within the development footprint and other surrounding areas adjacent to the Namoi River.

The flooding characteristics of the development footprint have been described based on the findings presented as part of the SMEC (2003) assessment and with reference to the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016) (refer Chapter 5 of Appendix F) and in consideration of the topographical survey and cross-section information gathered for this project.

The assessment has identified that the land on which project infrastructure will be placed within the development footprint is situated above the level of the relevant large design flood considered in the *Draft Floodplain Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016) and therefore should not affect flood levels. In consideration of the historical flood events considered by SMEC (2003) the following is noted in Chapter 5 of Appendix F:

- the relevant large design flood for the development footprint is the 1984 flood. Based on modelling of the 1984 flood by SMEC (2003), the level of this flood (271.9 m AHD) is well below the lowest surveyed level within the development footprint (272.5 m AHD) and therefore the project should not impact on the relevant large design flood (as defined in the *Draft Flood Management Plan for the Upper Namoi Valley Floodplain* (DPI Water 2016)); and
- the plotted 1955 flood profile (refer to Figure 7.3a of SMEC (2003)) appears to indicate a modelled flood level of approximately 272.3 m AHD in the river adjacent to the site, which is lower than the lowest surveyed surface level across the development footprint (272.5 m AHD).

ii Groundwater resources

The project is not likely to impact groundwater during construction, operation and decommissioning due to the estimated depth to groundwater within the site boundary and the limited amount of subsurface disturbance activities required during the installation and decommissioning of project infrastructure.

Access to private groundwater bores adjacent to the development footprint will not be impacted throughout the life of the project. During operations, the project may require access to GW902401, which has a current water access licence with an entitlement of 10 ML of water from the Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gin's Leap) Groundwater Source. This will be the subject of consultation with the project landholder.

iii Water licensing

Basic landholder rights enable landholders to extract water from an aquifer underlying their properties for domestic and stock purposes without the need for a licence under the WM Act. Should water be required for stock watering purposes, the relevant water supply work approvals would be sought under the WM Act.

The WM Act also contains provisions relating to harvestable rights. Harvestable rights allow landholders to collect a proportion of the runoff on their property and store it in one or more farm dams up to a certain size. Any runoff harvested from the development footprint would be within the volume permitted under harvestable rights.

The project will not impact licensed water users.

iv Water supply arrangements

The water needs of the project during construction are expected to be in the order of 15 ML for the nine month duration of construction. Water demands will be met via a combination of potable water trucked to the development footprint and/or extraction from the Upper Namoi Zone 4 Namoi Valley (Keepit Dam To Gin's Leap) Groundwater Source.

The Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gin's Leap) Groundwater Source has an established water trading market, with in the order of 4,700 water allocation assignment shares being traded in the period 1 July 2016 to 30 June 2017. For the 2016/2017 water year, a total volume of 21,032 ML of water under aquifer access licences were made available, of which the total year usage was approximately 70% at 15,139 ML. For the 2017/2018 water year, a total volume of 21,032 ML of water under aquifer access licences has been made available (NSW Water Register accessed 1 March 2018). Based on the availability of water within this water source and the active trading market, it is anticipated that the required volume would be able to be purchased readily from the water trading market.

In addition, the proponent has commenced discussions with a neighbouring landholder who has tradable water available to provide supply during the construction period.

As noted, during operations, the project may require access to GW902401, which has a current water access licence with an entitlement of 10 ML of water from the Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gin's Leap) Groundwater Source. This will be the subject of ongoing consultation with the project landholder. It is estimated that annual water requirements during operations will be in the order of 3 ML primarily for the cleaning of the PV solar panels.

6.9.4 Management and mitigation

i Surface water resources and flooding

Accidental spills within the development footprint could result in transient impacts to water quality if they were to coincide with a period of rainfall. The development footprint is not adjacent to a major watercourse and therefore any spills will be immediately obvious to personnel. A portable oil/fuel spill clean-up kit will be available on-site and employed if spills occur. Any residual contaminated soil will be removed from the development footprint and transported to the Gunnedah Waste Management Facility for disposal.

As noted previously, no interception of runoff is planned by project infrastructure and therefore there should be no net reduction in runoff from the development footprint.

The project should not impact on the relevant large design flood.

ii Erosion and sediment control

An erosion and sediment control plan in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004) will be prepared in consultation with GSC and will be implemented and monitored during the life of the project to minimise impacts. This plan will include provisions to:

- install erosion and sediment controls (if required) prior to and during construction;
- regularly inspect erosion and sediment controls, particularly following large rainfall/wind events;
- minimise tracking of sediment from vehicles, plant and equipment on to Orange Grove Road;
- during excavation, separate topsoils and subsoils to ensure that they are replaced in their natural configuration;
- stockpile topsoil appropriately to minimise weed infestation and maintain soil organic matter, soil structure and microbial activity; and
- minimise the total area of disturbance from excavation and compaction.

6.9.5 Conclusion

The project is unlikely to have a significant impact on local or regional flooding, surface water and groundwater resources.

Water supply arrangements for the project will be the subject of further consultation with the project landholders, surrounding landholders, GSC and relevant agencies.

An erosion and sediment control plan will be prepared in consultation with GSC and will be implemented during the life of the project to minimise impacts.

6.10 Electromagnetic interference

6.10.1 Background

Electric and magnetic fields (EMFs) exist wherever electricity is generated, transmitted, distributed or used and are strongest closest to their source (ARPANSA 2015). Electric fields are produced by voltage, while magnetic fields are produced by current (ARPANSA 2016). In Australia, EMFs associated with the use of electricity are generated at a frequency of 50 hertz (Hz) (ARPANSA 2016). This frequency falls within the extremely low frequency (ELF) range of 0–3,000 Hz, as defined by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) (2015). Subsequently, power lines, substations, transformers and other electrical sources all emit ELF EMFs (ARPANSA 2015).

The units commonly used to express the strength of a magnetic field include the Tesla (T) or microtesla (μT) and the Gauss (G) or milligauss (mG), where 1 mG is equal to 0.1 μT. The typical values of magnetic fields measured near significant electrical infrastructure in Australia, including distribution lines, substations and transmission lines are provided in Table 6.21. It should be noted that distribution lines operate at significantly lower voltage than transmission lines (ARPANSA 2016).

Table 6.21 Typical values of magnetic fields measured near powerlines and substations

Source	Location of measurement	Range of measurements (mG)*
Distribution line	Directly underneath	2–30
Distribution line	10 m away	0.5–10
Substation	At substation fence	1–8
Transmission line	Directly underneath	10–200
Transmission line	At edge of easement	2–50

Notes: ** Levels of magnetic fields may vary from the range of measurements shown.*

Source: *ARPANSA (2016)*

Extensive research has been conducted to determine whether exposure to ELF EMFs produces adverse health consequences (WHO 2007). As noted by the World Health Organisation (WHO 2007), the health effects related to short-term, high-level exposure to EMFs have been established and form the basis of two international exposure limit guidelines, namely, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1998), Guidelines for limiting exposure to time varying electric, magnetic and electromagnetic fields (up to 300 GHz), and the Institute of Electrical and Electronics Engineers (IEEE) Standards Coordinating Committee (2002), Standard for safety levels with respect to human exposure to electromagnetic fields, 0–3kHz.

As noted by ARPANSA (2015), the majority of research indicates that ELF EMFs exposure levels normally encountered in the environment, including in the vicinity of power lines, does not pose a risk to human health. Further, there is no established evidence that exposure to magnetic fields from power lines, substations, transformers or other electrical sources causes any health effects (ARPANSA 2015). Nonetheless, the ICNIRP guidelines (1998) define reference levels for occupational and general public exposure to prevent potential adverse health effects from exposure to EMFs. These reference levels are shown in Table 6.24. The ranges of measurements listed within Table 6.22 are well below the exposure limits of 2,000 mG or 200 μT defined by international guidelines (ARPANSA 2016).

Table 6.22 ICNIRP reference levels for occupational and general public exposure

Exposure characteristics	Electric field strength (kilo volts per metre - kV/m)	Magnetic flux density (μT)
Occupational	10	1,000
General public	5	200

A study by Chang and Jennings (1994) investigated the level of EMFs generated at two utility-scale PV solar developments in the United States. Specifically, the study compared the magnetic fields generated by these developments with published data on more prevalent magnetic field sources. The study concluded that magnetic fields, considered by Chang and Jennings (1994) to be of greatest public concern, generated by PV solar panel arrays were significantly less than for common household applications. For example, magnetic field measurements taken from the back of a PV solar panel were recorded as significantly less than those recorded from within close proximity of a hair dryer, microwave and television, respectively. Therefore, Chang and Jennings (1994) concluded that EMFs generated by PV solar panel arrays should not generate concern.

Other infrastructure installed as part of the PV solar developments assessed by Chang and Jennings (1994), such as transformers, exhibited more significant magnetic fields. However, these sources were found to be localised and could not be detected at the perimeters of each of the developments assessed (Chang and Jennings 1994). Further, it was noted that concerns about EMFs generated by transformers would also apply to a number of other electricity generation and storage technologies (Chang and Jennings 1994).

6.10.2 Impact assessment

Staff involved in the construction and decommissioning stages of the project will be exposed to EMFs during works on the connection infrastructure, which will connect the project to TransGrid's 132 kV transmission line, which runs parallel to the southern boundary of the southern portion of the development footprint (Figure 2.1). Staff exposure levels will be below the recommendations for general public and occupational exposure throughout the construction and decommissioning of the connection infrastructure.

As noted in Chapter 3, construction of the project includes the installation of electrical infrastructure within the development footprint including cabling, inverters, switchgear and the on-site substation, as well as, connection infrastructure to connect the project to TransGrid's 132 kV transmission line and the installation of a large number of PV solar panels. As this infrastructure will be involved in the generation, transmission and distribution of electricity, EMFs will be produced. The EMFs produced will be strongest closest to their respective sources.

Once operational, the project infrastructure will generate EMFs. The degree of exposure to EMFs within the development footprint will vary depending on proximity to different components of the project infrastructure. Staff exposure during the operational stage of the project will be intermittent and limited to exposure encountered during ongoing maintenance of the development footprint and project infrastructure. The combination of low exposure rates and the intermittent exposure of staff to elements of the project infrastructure capable of generating EMFs indicate that adverse impacts from EMFs are unlikely as a result of the project.

As noted in Chapter 3, public access to the development footprint will be restricted throughout the life of the project. Landholders accessing agricultural land in close proximity to the project infrastructure will not be exposed to EMFs generated by the project infrastructure for extended periods of time.

The closest receptor, R1, is approximately 150 m west of the western boundary of the development footprint and will not be exposed to a higher level of EMFs due to the construction and operation of the project.

The switchyard / on-site substation will be located within the development footprint, adjacent to the northern portion of the development footprint's south-eastern boundary (refer to Figure 3.1). At this location, the switchyard / on-site substation will be offset from the closest receptor (R1) by approximately 1.5 km.

6.10.3 Management and mitigation

As noted in Chapter 3, all project infrastructure will be designed in accordance with relevant industry standards. All relevant procedures in relation to a high voltage installation will be adhered to throughout the life of the project. Further, public access to the development footprint will be restricted throughout the life of the project.

6.11 Bushfire

6.11.1 Introduction

Bushfire risks associated with the project have been assessed in accordance with *Planning for Bushfire Protection* (PBP) (RFS 2006). Appendix 4.1 of PBP sets out submission requirements for DAs on bushfire prone land. Section 2.5 of PBP requires proponents of major projects, for example SSDs, to consult PBP when undertaking environmental assessments.

Section 63(2) of the RF Act requires the owners of land to prevent the ignition and spread of bushfires on their land. The recommended measures in this section, and any measures in a subsequent bushfire management plan for the project, will ensure that the risk of bushfire ignition and spread will be as low as practically possible.

6.11.2 Existing environment

The RFS Bush Fire Prone Land online mapping tool and GSC bushfire prone mapping indicate that the site is not bushfire prone, however, a brief assessment and recommendations have been made to address how a grass fire impacting on and structural fire emanating from the project will be managed.

6.11.3 Impact assessment

If a fire is ignited within the development footprint, this could spread to the surrounding area. The risk of this occurring will be reduced by adoption of measures that would be outlined in a bushfire management plan, and are discussed in Section 6.11.4.

6.11.4 Management and mitigation

A bushfire management plan will be prepared and implemented for the project, and will contain the measures detailed below.

Water, gas and electricity services will be will be incorporated into the detailed project design as follows:

- located and installed in a manner that reduces the potential for them to contribute to fire hazard;
- water for fire fighting will be supplied by truck or an on-site bore and stored in an on-site water tank;
- fire hydrants at buildings will be installed, spaced, sized and pressured in accordance with Australian Standard 2419.1-2005 Fire hydrant installations – System design, installation and commissioning. If required water pressures of the standard cannot be met, engineering principles will be used to determine the locations, sizing and number of hydrants;
- electricity and gas services will be located so they do not contribute to the risk of fire to a building;
- overhead electrical transmission lines will be installed and managed in accordance with Ausgrid 2010 NS179 Vegetation Safety Clearances;
- if required, AS/NZS 1596:2008 The storage and handling of LP gas will be followed for bottled gas installation and maintenance, including the use of metal piping;
- there will be minimum 10 m distance between fixed gas cylinders (if required) and flammable materials and shielding will be placed on the hazard side of the cylinders; and
- release valves on gas cylinders close to buildings will be directed away from the building and be a minimum of 2 m from combustible material. Metal connections will be used.

The development footprint will be accessed via Orange Grove Road which can accommodate passing vehicles and support vehicles that weigh over 15 t. A minimum vertical clearance of 4 m will be provided to any overhead obstructions including branches along internal access roads.

The risk of igniting a fire within the development footprint will be reduced by adoption of the following measures:

- refuelling will be undertaken in designated refuelling bays (there will not be any vegetation in these areas), especially when the fire danger rating is very high or above;
- fire extinguishers will be maintained in buildings, vehicles and refuelling areas;
- there will be no smoking within the development footprint;
- spill response kits will be available should there be a spill of flammable substances;
- a UHF/VHF communication system will be established, enabling rapid response to emergencies;
- risk reduction, such as slashing, will be undertaken where appropriate, such as along fencelines; and
- the RFS will be contacted if there is a fire.

Section A4.1 of PBP requires an assessment of whether specific buildings are capable of complying with the bushfire construction levels described in Australian Standard 3959 – 2009 Construction of buildings in bushfire prone areas (AS 3959 – 2009). The specific buildings are classified by the Building Code of Australia (BCA) as class 1, 2, 3 and 4 buildings; and some class 9 and 10 buildings (Australian Building Codes Board 2013). Project related structures do not correlate to these BCA classes and, therefore, do not have bushfire construction levels specified in AS 3959 – 2009. Notwithstanding, PBP requires that such buildings comply with the general bushfire construction requirements in Section 3 of AS 3959 – 2009. The structures will be constructed to comply with these requirements.

6.11.5 Conclusion

This section describes measures to enable the project to comply with the objectives of PBP. The risk of the project initiating a bushfire will be minimised through the implementation of appropriate management measures.

6.12 Air quality

6.12.1 Existing environment

The site is in a rural setting, with the nearest concentration of receptors in the village of Carroll, approximately 3 km south-east of the site, and the township of Gunnedah, approximately 12 km west of the site. The area surrounding the site is sparsely populated.

The primary economic activities within the Gunnedah Shire LGA are agriculture and coal mining, which is likely to have a significant influence on local and regional air quality.

Existing sources of air pollution within close proximity of the site are limited and are primarily comprised of dust and vehicle and machinery exhaust emissions associated with transport and agricultural activities. Bushfires would also likely be a source of seasonal dust generation.

There are six facilities within the Gunnedah Shire LGA that are required to report their emissions as part of the National Pollutant Inventory (NPI) (DoEE 2018), which include two poultry facilities, Whitehaven Coal Mining Pty Limited's Rocglen Coal Mine and rail siding, Gunnedah Leather Processors and Gunnedah's wholesale petroleum depot. Emissions from these facilities are variable depending on the types of activities performed and include: volatile organic compounds, ammonia, carbon monoxide, oxides of nitrogen and particulate matter, among others.

Thirteen rural dwellings have been identified within an approximate 3 km radius of the site, identified as receptors R1-R13 (Figure 2.1). The nearest receptor, R1, is approximately 150 m west of the western boundary of the northern portion of the development footprint.

6.12.2 Impact assessment

i Construction

Emissions to the atmosphere from the project during construction will be temporary, and restricted to dust caused by land disturbance, and vehicle, plant and equipment exhaust emissions. Construction of the project will take approximately nine months from the commencement of site establishment works.

Due to the relatively flat terrain and predominantly cleared landscape of the development footprint, limited site preparation and civil works will be required. During site establishment and construction, surface disturbance works will be limited to:

- removal of above and below ground level irrigation structures;
- construction of access tracks and boundary fencing;
- installation of posts to provide support for the mounting framework required for the PV solar panels;
- preparation of foundations for the inverter blocks;
- installation of underground cabling between the PV solar panels and the collection circuit;
- construction of transmission infrastructure between the project switchyard and TransGrid's 132 kV transmission line; and
- erection of permanent fencing and security.

Exhaust emissions will also be generated by the plant and equipment required for the construction of the project. This would include:

- vehicles travelling to and from site;
- earthmoving machinery and equipment for site preparation;
- cable trenching and laying equipment;
- post-driving equipment;
- assisted material handling equipment (forklifts and cranes);
- machinery and equipment for connection infrastructure establishment; and
- water trucks for dust suppression.

During decommissioning, no additional air quality impacts to those described above are anticipated. Total vehicle movements to and from site during decommissioning will be similar to those experienced during construction. However, it is anticipated that the length of the decommissioning stage will be shorter than the construction stage and therefore emissions to the atmosphere will also be experienced over a shorter period of time.

ii Operation

Ongoing maintenance of the development footprint and project infrastructure will be required during operation. The infrastructure maintenance activities listed in Section 3.6 will result in minor, localised vehicle emissions and generation of dust from vehicles travelling along the internal, unsealed access roads (Figure 3.1). Provided the recommended mitigation measures are implemented, predicted impacts will be adequately managed.

6.12.3 Management and mitigation

The project will not generate significant air quality impacts during construction, operation or decommissioning provided the following mitigation measures are implemented:

- use of a water truck(s) during construction for dust suppression along internal, unsealed access roads and disturbed areas;
- vehicle movements will be minimised where possible;
- all vehicles, plant and equipment will be cleaned and washed regularly;
- all vehicles, plant and equipment will be regularly inspected and maintained to ensure that they are operating efficiently;
- regular maintenance of unsealed access roads will be undertaken to minimise wheel generated dust; and
- dust suppression requirements during construction will take into consideration weather and the likelihood of extended dry periods which could exacerbate impacts.

Additionally, the proponent will treat the road surface of the unsealed section of Orange Grove Road to reduce potential dust generation by project-related traffic during the construction period.

6.12.4 Conclusion

The implementation of the recommended mitigation measures will ensure that the project will not generate significant air quality impacts during construction, operation or decommissioning.

6.13 Socio-economic

6.13.1 Existing environment

Gunnedah is the largest township in the Gunnedah Shire LGA with a population of approximately 9,726 and is the region's commercial and administrative centre. The population of the Gunnedah Shire LGA in 2016 was 12,215 compared to 12,066 in 2011, which reflects an increase of 149 people (or 1.2%) residing in the area (ABS 2013a; ABS 2017a). Similarly, the township of Gunnedah and the village of Carroll both experienced increases in population over this period from 9,340 and 176 in 2011 to 9,726 and 337 in 2016, respectively (ABS 2013b; ABS 2013c; ABS 2017b; ABS 2017c).

The economy within the Gunnedah Shire LGA is relatively diverse with the primary economic activities being agriculture and coal mining (GSC 2014). Agriculture is the predominant employing industry within the Gunnedah Shire LGA, with sheep, beef cattle and grain farming the area's primary employer (12.2%) (ABS 2013a).

Coal mining is the area's second largest employer, accounting for 6.3% of the region's employment in 2011 (ABS 2013a). The Gunnedah Shire LGA is within the Gunnedah Basin, which contains more than 11% of the estimated recoverable coal reserves in NSW (GSC 2014). Within the township of Gunnedah, coal mining accounts for more than 7% of the town's employment and is the town's predominant employing industry (ABS 2013b). Other mining activities within the Gunnedah Shire LGA include coal seam gas exploration and hard rock quarrying. Within the Gunnedah Shire LGA, the unemployment rate is 6.3%, which is higher than both the NSW (4.9%) and Australian (5.7%) unemployment rates (DoE 2017).

Gunnedah is the Gunnedah Shire LGA's commercial and administrative centre. There are a range of retail, commercial, professional and personal services available within the town, as well as a number of accommodation options, which support the Gunnedah Shire LGA's strong visitor economy. As noted above, coal mining is the dominant industry of employment for the township of Gunnedah's population. Local government administration features among the township's other major employers reflecting its role as an administrative centre within the Gunnedah Shire LGA (ABS 2017b). The most common occupations in Gunnedah township include machinery operators and drivers, technicians and trades workers, professionals, managers, labourers, clerical and administrative workers and community and personal service workers (ABS 2017b).

As noted within the Gunnedah Shire LGA's *Economic Development Strategy* (GSC 2014), significant growth in the mining sector within the Gunnedah Basin has driven population growth and investment in the Gunnedah Shire LGA, contributing to growth across a number of the area's economic activities. Further growth is likely to be constrained by competition between the mining sector and other sectors for access to labour, particularly skilled labour, resources and infrastructure (GSC 2014). Future growth in the mining sector within the Gunnedah Shire LGA also presents a number of challenges and needs to be balanced with social and environmental considerations, including protecting the area's physical environment and agricultural production systems and retaining the broader community's quality of life (GSC 2014).

The township of Gunnedah hosts the majority of the Gunnedah Shire LGA's largest social, cultural and recreational events, including the Gunnedah Country Music Muster; AgQuip, which is Australia's largest agricultural field day; Weeks of Speed Festival; and the Gunnedah Show. Each of these events make important contributions to the local economy. Within the township of Gunnedah, there are a number of short-term accommodation options available for tourists and visitors, including hotels, motels, motor inns, furnished apartments and cabins. A review of available accommodation indicates that there are more than 20 accommodation options available within the township of Gunnedah and surrounds. Additional short-term accommodation options are also available in the township of Boggabri, approximately 40 km north-west of the site.

Further short-term accommodation options are available in Tamworth (approximately 55 km east of the site) and Narrabri (approximately 90 km north-west of the site), with at least 60 and 25 options available, respectively.

6.13.2 Impact assessment

Based on the results of stakeholder engagement (refer to Section 5.4), there is a positive attitude and broad community support for the Orange Grove Sun Farm.

The project will make important contributions to the production of renewable energy in NSW while creating employment opportunities, diversifying local revenue streams and generating direct and indirect benefits to the local economy during the life of the project.

i Direct and indirect economic benefits

The project will diversify and strengthen the region's economic base and benefit local businesses through direct expenditure and employment, as well as indirect benefits such as employee expenditure locally and use of local services.

The project will provide economic benefits to the township of Gunnedah and the Gunnedah Shire LGA, as well as neighbouring LGAs. The project will also provide additional economic stimulus, employment opportunities and investment in community infrastructure and services, along with increased demand for community and retail services within the township of Gunnedah.

One of the objectives of the Gunnedah Shire LGA's *Community Strategic Plan*, which is of relevance to the area's goal to experience ongoing economic development, is to encourage investment in new technologies and renewable energy. As noted in Section 3.2, the Gunnedah Shire LGA experiences a consistently high availability of solar radiation making it ideal for large scale solar developments. Investments in renewable energy, such as the project, would have both direct and indirect economic benefits for the local and regional economy, driving economic growth, employment, prosperity and diversity within the township of Gunnedah and, more generally, within the wider Gunnedah Shire LGA and north-western NSW region.

As noted in Section 4.4.1, in the short term, the focus of the *New England North West Regional Plan 2036* is on supporting cities, important farmland, renewable energy projects and tourism opportunities to help diversify the region's economy. To achieve this goal, the plan defines nine directions, one of which is to grow New England North West as the renewable energy hub of NSW. Large-scale renewable energy projects have potential to generate new employment opportunities and investment from construction, operations and connection to the State's electricity grid.

The project will create employment opportunities and have direct and indirect benefits to the local and regional economy during the life of the project. The project will contribute to the diversification of the energy sector while strengthening the New England North West region's economy.

ii Workforce

During construction an average of 80 FTEs will be required for a nine month period, which will create demand for short and medium term accommodation options. The workforce will be sourced from the local and wider region, and is expected to comprise of a combination of people residing locally, and those who would travel from other regional or metropolitan areas and reside temporarily in short and medium term accommodation (eg. motels, rental accommodation) during construction.

For the purposes of this assessment, it has been assumed that the workforce will be distributed between three LGAs which border and/or are in close proximity to the project, as shown in Table 6.23. It is anticipated that a proportion of the workforce will be from the resident population within these LGAs.

Table 6.23 Construction workforce location of residence (temporary and resident) during construction

Local government area	Population1	Proportion of workforce (%)	Residing construction workforce (temporary and resident)	
			Average	Peak
Gunnedah Shire	12,215	40	32	40
Tamworth	59,663	40	32	40
Narrabri Shire	13,084	20	16	20

Notes: 1. Population estimates based on ABS national regional profile data last updated in 2016.

As described above, some of the workforce is likely to travel from other regional or metropolitan areas and reside in the area temporarily. This will create demand for short and medium term accommodation. As described in Section 6.13.1, there are more than 20 suitable accommodation options available in Gunnedah township and surrounds. The temporary influx of workers during the project's construction may place pressure on local short-term accommodation and other services within the township of Gunnedah. If not managed, this could have adverse flow-on effects on local tourism. For example, the project may restrict the availability of supply of short-term accommodation to other users during peak demand periods such as weekends coinciding with any of the region's major festivals and annual events. However, given some of the workforce are expected to comprise some of the resident population, the temporary demand for accommodation in the Gunnedah Shire LGA or neighbouring LGAs (refer Table 6.23) is not likely to place significant strain on existing temporary accommodation for the majority of the duration of construction.

As noted in Section 3.6 and Section 3.7, the project will also create employment opportunities during operation and decommissioning. Up to three FTEs will be required during the operational stage of the project. It is not yet known how many employment opportunities will be available during decommissioning, however it is expected that less staff will be required on-site than during construction. The duration of decommissioning will also determine the extent of direct and indirect economic benefits made available for local businesses and industries during the final stage of the project.

Due to the relatively small volume of potential new residents to the Gunnedah Shire LGA as a result of the project, it is not anticipated that this will impact the availability of housing for existing or other new residents.

iii Amenity

There will be temporary increases in traffic travelling along local roads during the peak of construction. As noted in Section 6.8, the predicted additional daily traffic generated at the peak stage of project construction will be approximately 116 daily vehicle movements, reducing to approximately 80 daily vehicle movements during the earlier and later (average) stages of project construction and approximately 10 daily vehicle trips during the operational stage of the project. Further discussion of the potential impacts of the project on traffic is provided in Section 6.8.

The potential impacts of the project on air quality (Section 6.12), noise (Section 6.7), land (Section 6.5) and the visual landscape (Section 6.6) have been discussed in more detail in relevant sections of the EIS.

6.13.3 Management and mitigation

The project is anticipated to have social and economic benefits for the region. The proposed management and mitigation measures focus on maximising the potential benefits of the project and, where possible, resolving potential conflicts before they are encountered.

The proposed management and mitigation measures that will be implemented for the project include:

- a preference for local employment where appropriate skills and expertise exist;
- a preference for use of local businesses such as motels, motor inns, restaurants and service providers to support project needs;
- consideration of demand on local short-term accommodation and potential conflicts with the region's major festivals and annual events; and
- provision of information to the community about the timing of the project construction period and need for employees and services from local business.

6.13.4 Conclusion

Through the provision of additional economic stimulus, employment opportunities and investment in community infrastructure and services, the net community benefit of the project is considered to be positive. The implementation of the proposed management measures will mitigate potential adverse impacts from the project, such as impacts to the availability of local short-term accommodation during defined periods, such as during any of the region's major festivals and annual events.

6.14 Waste management

6.14.1 Impact assessment

The project will produce a number of waste streams during the nine month construction period. Minor quantities of waste will also continue to be generated by the day-to-day operation of the project.

Waste streams likely to be generated during the construction and ongoing operation of the project will include, general waste, scrap metal, comingled recycling, waste oil, pallets/timber recycling, oily rags, oil filters, oil drums, waste batteries and confidential documents.

A summary of the waste types, classification, proposed management methods, and estimated annual quantities of wastes produced during the construction and ongoing operation of the project would be provided in the EMP.

Wastes generated by the project may be disposed of at the Gunnedah Waste Management Facility approximately 18 km west of the site.

6.14.2 Management and mitigation

To encourage the efficient use of resources and reduce potential environmental impacts from the project, all waste will be managed in accordance with the POEO Act, the NSW *Waste Avoidance and Resource Recovery Act 2001* and the following hierarchy, which is listed in order of preference:

- reduce waste production;
- recover resources; and
- dispose of waste appropriately.

All wastes produced by the project will be classified, stored and handled in accordance with the *Waste Classification Guidelines – Part 1: Classifying Waste* (EPA 2014). In addition, the following waste management measures will be included in the project's EMP:

- unnecessary resource consumption will be avoided;
- where possible, waste material will be reused and recycled;
- no waste material will be received or disposed of on-site; and
- all waste material will be removed from site as soon as practicable and will be sent to an appropriately licensed waste facility for disposal.

As noted in Section 6.14.1, the EMP will include a summary of the waste types, classification, proposed management methods, and estimated annual quantities of wastes produced during the construction and ongoing operation of the project.

6.14.3 Conclusion

The project will produce a number of different types of waste during the nine month construction period. Minor quantities of waste will also continue to be generated by the day-to-day operation of the project. All wastes produced by the project will be classified, stored and handled in accordance with the *Waste Classification Guidelines – Part 1: Classifying Waste* (EPA 2014).

6.15 Cumulative impacts

6.15.1 Introduction

The SEARs require an assessment of the potential cumulative impacts of the project with the proposed Gunnedah Solar Farm (refer to Figure 2.1). This includes consideration of visual amenity, compatibility of land use, capacity of the electricity transmission network, traffic and construction noise impacts.

As noted in Section 2.6, Photon Energy propose to construct the Gunnedah Solar Farm, a 155 MW PV solar farm approximately 3 km west of the site (refer Figure 2.1), SEARs for which were issued by DPE on 25 August 2017. Available information indicates that the proposed solar farm will be developed on Lot 1 of DP 1202625, Lots 151, 153 and 264 of DP 754954, Lot 2 of DP 801762 and Lot 1 of DP 186590 and that the project infrastructure will cover a total area of approximately 205 ha within the 692 ha site identified in Figure 2.1. OVERLAND has engaged with Photon Energy as part of the consultation process for the project (refer to Section 5.3).

6.15.2 Impact assessment

i Visual amenity

The construction of the project and the Gunnedah Solar Farm on Orange Grove Road will expand the overall area within the Gunnedah Shire LGA that is occupied by solar infrastructure. Collectively, project infrastructure for the two developments will cover an area of over 450 ha, which represents approximately 0.09% of the total land area within the Gunnedah Shire LGA. Once constructed, the PV solar panel arrays will be the prominent visual feature of both developments throughout their respective operational stages (refer to Photograph 3.1).

A cumulative visual impact may result from the project being constructed in conjunction with the Gunnedah Solar Farm, however, due to the height of the dominant project infrastructure, both projects would be visible only within a local setting.

Project infrastructure from both projects will be visible to motorists travelling along Orange Grove Road, however, based on separation distances and the relatively low height of the dominant project infrastructure, it is anticipated that these views will be of only one site at any given time.

A number of receptors (ie. dwellings) may experience combined views of the project infrastructure from both projects (namely R8, R9, R10 and R11 – Figure 6.4). Spatial separation between the proposed sites for the project and the Gunnedah Solar Farm, in conjunction with vegetation present around these receptors and project-specific mitigation measures are considered appropriate to mitigate potential cumulative impacts.

As noted in Section 6.6.4, landscaping is proposed to mitigate views from houses within a sensitive proximity to the development footprint for the project, namely R1 and R2. Individual landscaping plans will be prepared in consultation with the landowners.

Based on the relatively low height of the dominant project infrastructure, namely the PV solar panels, and separation distances between the proposed site for the project and the Gunnedah Solar Farm, it is anticipated that there is limited potential for significant combined views of the project and the Gunnedah Solar Farm.

ii Compatibility of land use

As noted in Section 6.5.3, the development footprint for the Orange Grove Sun Farm will be removed from potential agricultural production during the life of the project (in the order of 30 years).

This is approximately 253 ha of BSAL and LSC Class 2 land. Similarly, if constructed, the proposed Gunnedah Solar Farm would remove approximately 205 ha of BSAL and LSC Class 2 land from potential agricultural production during the life of the project (in the order of 25 years) (Pitt&Sherry 2017).

As noted in Table 6.5, land identified under the LSC Class 2 classification has slight limitations, which can be managed by readily available, easily implemented management practices and is capable of most land uses (OEH 2012). BSAL is land with high quality soil and water resources capable of sustaining high levels of productivity (NSW Government 2018).

The Orange Grove Sun Farm has been developed to avoid and minimise land disturbance and overall impacts on agricultural land, where possible. Revisions to the development footprint as part of the detailed design process for the project have significantly reduced the project's impacts on BSAL and agricultural productivity. Specifically, more than 550 ha of BSAL and LSC Class 2 land within the site boundary will remain available for agricultural production throughout the life of the project. As noted in Section 3.2, the final site boundary and development footprint for the project have been selected to avoid fragmenting the landholder's residual agricultural land.

Agriculture is the primary land use in the Gunnedah Shire LGA, accounting for 88.5% of the total land area (or 441,969 ha) (Insite 2016). Agriculture is also the predominant economic activity in the Gunnedah Shire LGA and is the areas highest employment sector (Insite 2016). The two developments will result in the removal of approximately 0.1% of the total land area within the Gunnedah Shire LGA that is currently used for agricultural production. However, as noted in Section 4.1.4, economic constraints and the intermittent availability of a reliable supply of irrigation water from the Namoi River have restricted the agricultural productivity potential of parcels of land within the development footprint.

The site boundary encompasses an area of approximately 817 ha, representing approximately 0.16% of the Gunnedah Shire LGA, whilst the development footprint encompasses an area of 253 ha (approximately 0.05%).

During decommissioning of the project and the Gunnedah Solar Farm, project infrastructure will be removed and, if required, land within the respective site boundaries will be rehabilitated to their pre-existing condition. At the completion of decommissioning, both sites will be available for agricultural production. Therefore, neither development will result in the permanent removal of land within the Gunnedah Shire LGA from agricultural production.

iii Traffic

As part of the traffic impact assessment (Appendix I), cumulative impacts were considered with the construction of the Gunnedah Solar Farm. This assessment assumes that construction of the two projects occurs concurrently. In reality, this is not likely to eventuate, and is therefore considered to be conservative. Traffic volumes for the Gunnedah Solar Farm were obtained from the publically available preliminary environmental assessment (Pitt&Sherry 2017). The results are summarised in Table 6.24.

Table 6.24 Future cumulative construction traffic assessment including the Gunnedah Solar Farm

Traffic generation route	Projected baseline daily traffic volume (year 2018)	Peak daily traffic from both projects		Future total daily traffic	Percent traffic increase
		Orange Grove Sun Farm	Gunnedah Solar Farm1		
Kamilaroi Highway at Gunnedah	6,688	116	90	6,894	3.1%
Kamilaroi Highway south-west of the development footprint (near Curlewis)	1,813	34	26	1,873	3.2%
Kamilaroi Highway northwest of the development footprint (near Blue Vale)	1,770	23	18	1,811	2.3%
Oxley Highway east of the development footprint (near Carroll)	1,609	35	27	1,671	3.9%
Oxley Highway west of the development footprint (3.7 km east of Gunnedah)	3,624	35	27	3,686	1.7%
Kelvin Road	581	116	90	787	35.5%
Orange Grove Road (sealed segment)	171	116	90	377	120.5%
Orange Grove Road (unsealed segment)	89	116	0	205	130.3%
Blue Vale Road south of Old Blue Vale Road	300	56	43	399	33%
Old Blue Vale Road	67	56	43	166	147.8%

Notes: 1. Traffic distribution amongst major roads in the Gunnedah area is assumed to be similar as that for the Orange Grove Sun Farm.

The results in Table 6.24 show the highest potential daily traffic increases from the concurrent construction of the two projects will be on Orange Grove Road (+120.5% and +130.3% for the sealed and unsealed sections, respectively), Old Blue Vale Road (+147.8%), Kelvin Road (+35.5%) and Blue Vale Road (33%).

The predicted traffic increases would move the unsealed segment of Orange Grove Road into a higher band in the Austroads rural daily traffic volume classification system (from 1–150 to 150–500). A road maintenance program will be required on the unsealed section of Orange Grove Road for the duration of the project's construction (refer to Section 6.8.3).

Importantly, under the cumulative scenario presented in Table 6.24, unlike the peak construction scenario for the project-related traffic (refer Table 6.19), the combined heavy vehicle traffic along Old Blue Vale Road from the concurrent construction of the project and the Gunnedah Solar Farm would move it into a higher band in Austroads rural daily traffic volume classification system (from 1–150 to 150–500). The exceedance of the 1-150 daily traffic volume standard on Old Blue Vale Road is marginal (ie. 16 daily vehicle movements) and assumes concurrent construction of the project and the Gunnedah Solar Farm. During consultation with GSC, it was noted that road upgrade works are currently scheduled for Old Blue Vale Road in 2019. These upgrades would likely include widening the sealed width of Old Blue Vale Road from 4 m to 7.2 m. The scheduled upgrades to Old Blue Vale Road would satisfy the Austroads (2010) design standard for daily traffic volumes of 150-500 vehicle movements. Therefore, at the completion of the proposed works, no further upgrades would be required for the maximum cumulative construction traffic of the project and the Gunnedah Solar Farm.

While the increases to daily traffic volumes on Kelvin Road, Orange Grove Road and Old Blue Vale Road are significant (refer Table 6.24), they would only apply for the peak construction period of the project (approximately three months) and future traffic volumes would decrease to lower levels during the average construction period and to significantly lower levels following the completion of all construction work for both projects.

At the assessed locations on the Kamilaroi and Oxley Highways, the cumulative construction traffic increases are expected to be much lower (between 1.7% and 3.9%), which will not generally be noticeable for most of the traffic using these roads, and will comply with the future traffic capacity design standards for these routes according to the Austroads (2010) rural road design and capacity standards.

Overall these traffic increases would not have any significant long-term effect on the future traffic capacity, levels of service or traffic safety for these roads, provided that a road maintenance program is undertaken for the unsealed section of Orange Grove Road (refer to Section 6.8.3).

iv Noise

As part of the noise and vibration impact assessment (Appendix G), it was noted that the construction works for the Gunnedah Solar Farm have potential to occur at the same time as construction works for the project. The modelling results presented in Appendix G and summarised in Section 6.7, indicate that the proposed construction works for the project satisfy the NMLs at all assessment locations. The predictions assume plant and equipment are operating simultaneously and at the nearest locations to relevant assessment locations, hence it is likely that actual noise levels from the proposed construction works will be lower than predicted.

Based on the size of the Gunnedah Solar Farm, distances of nearest assessment locations and predicted levels for the project, the total cumulative construction noise level from both developments is predicted to satisfy the NMLs during standard hours at the identified assessment locations. Therefore, cumulative noise from the project and the Gunnedah Solar Farm is not anticipated to cause an impact at nearby identified assessment locations.

There is potential for cumulative road traffic movements from both the project and the Gunnedah Solar Farm. Road traffic noise predictions for the Gunnedah Solar Farm were unavailable during the preparation of the EIS, however, given the predicted levels for the project, as well as predicted traffic volumes in the preliminary environmental assessment for the Gunnedah Solar Farm (Pitt&Sherry 2017), the total cumulative road traffic noise levels may exceed the relevant RNP criteria during a concurrent construction scenario. There is potential for approximately nine months of concurrent construction activities, however, it is unlikely that construction activities would overlap for this entire period, if at all. Furthermore, the application of the RNP criteria to construction projects is highly conservative given the RNP is designed for permanent scenarios and not temporary impacts possible from construction activities.

v Capacity of the electricity transmission network

Consultation with Transgrid and associated electricity network studies have confirmed that there is available capacity within the network for the project.

vi Additional potential cumulative impacts

The concurrent construction and operation of the two developments will also result in cumulative impacts to biodiversity and the social and economic environment within the Gunnedah Shire LGA.

Avoiding and minimising disturbance of native vegetation was a major consideration in the site selection and design process for the Orange Grove Sun Farm. The PCTs within the development footprint are heavily grazed and were identified to be in very low condition.

As noted in Section 6.2, the removal of vegetation has been limited to 148.2 ha of low quality vegetation within the development footprint. The vegetation integrity score of both vegetation zones within the development footprint is such that offsets are not required for impacts on native vegetation. Therefore, the project does not require any offsets and no biodiversity offset strategy is required. The construction of the Gunnedah Solar Farm may also require the clearing of native vegetation. Should clearing of native vegetation be required for the construction of the Gunnedah Solar Farm, a biodiversity offset strategy may be required to offset the impacts from the project.

The temporary influx of workers during the potential concurrent construction of the two developments may place pressure on local short-term accommodation and other services within the township of Gunnedah and surrounding LGAs. This could have adverse flow-on effects on local tourism. For example, the two developments may restrict the availability of supply of short-term accommodation to other users during peak demand periods such as weekends coinciding with any of the region's major festivals and annual events.

6.15.3 Management and mitigation

To avoid and minimise cumulative impacts, the proponent will consult with Photon Energy regarding the proposed construction schedule for the Gunnedah Solar Farm. The proponent will consult with GSC and local stakeholders to provide information about the timing of the project's peak construction period.

6.15.4 Conclusion

The implementation of the management and mitigation measures listed in Section 6.14.3 will reduce the potential for cumulative impacts to be encountered during the concurrent construction and operation of the project and the Gunnedah Solar Farm.

7 Statement of commitments

A summary of the management and mitigation measures for the project, including those documented in this EIS and appended technical reports is presented in Table 7.1. These management and mitigation measures will be incorporated into the environmental management strategy and relevant management plans and protocols.

Table 7.1 Summary of management and mitigation measures

Key issue	Management and mitigation measures
Biodiversity	Additional measures to avoid and minimise direct impacts will be outlined in the EMP and will include: • avoid and minimise clearing impacts to PCTs, where possible; • clearing limits will be clearly marked to prevent unnecessary clearing beyond the extent of the development footprint; • tree clearing and disturbance will be limited to the development footprint; • appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' will be considered and, where necessary, identified in site inductions; • removal of trees will be limited to that required within the development footprint in support of the installation of project infrastructure; • a clearing procedure will be implemented during the clearing of the development footprint, which will include: - completion of preclearance surveys to determine if any nesting birds or koalas are present; - clearing not to proceed until koalas have moved on; and - a suitably trained fauna handler will be present during hollow-bearing tree clearing to rescue and relocate displaced fauna if found on-site; and • appropriate exclusion fencing will be installed around trees and vegetation to be retained in or directly adjacent to the development footprint. Additional measures to avoid and minimise indirect impacts will also be outlined in the EMP and will include: • using existing farm gates and tracks to access the development footprint, where possible; • appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' will be installed on the northern side of Orange Grove Road at the proposed access point for the northern portion of the development footprint that requires shoulder widening (approximately 40 m east of the Finger Panic Grass record) to prevent any indirect impacts to sub-optimal potential habitat for Finger Panic Grass; • where necessary, signage for 'No Go Zones' or 'Environmental Protection Areas' will be identified in site inductions; • plant and equipment will be parked in dedicated parking zones within the development footprint and not within the road reserve; and • an erosion and sediment control plan will be implemented on-site.

Table 7.1 Summary of management and mitigation measures

Key issue	Management and mitigation measures
Aboriginal heritage	• fencing and signage will be installed close to OG_PST2 to avoid impacts; • consultation with the RAPs will continue with regard to the management of Aboriginal cultural heritage sites within the study area throughout the construction stage of the project in keeping with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a); • at the completion of the construction stage of the project, consultation with the RAPs will be undertaken should there be any changes to the project layout that may result in ground disturbance or removal of trees in keeping with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a); • should any unanticipated Aboriginal objects be encountered during works associated with the project, works will cease in the vicinity and the find will not be moved until assessed by a qualified archaeologist; • should unanticipated relics be discovered during the course of the project, work in the vicinity will cease and an archaeologist will be contacted to make a preliminary assessment of the find. The Heritage Council of NSW will be notified if the find is assessed as a relic; • if any suspected human remains are discovered during any activity the following will occur: - all work will immediately cease at that location and remains will not be further moved or disturbed; - the NSW Police and State Coroner will be notified (as required for all human remains discoveries); - the site supervisor or other nominated senior staff member will contact OEH for advice on identification and management of Aboriginal skeletal material; - if it is determined that the skeletal material is of Aboriginal ancestry, the RAPs will be contacted and consultative arrangements will be made to discuss ongoing care or reinterment of the remains. Work will not recommence at that location unless authorised in writing by OEH; and - if the find is likely to be non-Aboriginal in origin and more than 100 years in age, the Heritage Council of NSW will be notified of the find under s.146 of the Heritage Act.
Historic heritage	• an unexpected finds protocol will be followed if unexpected historical archaeology is discovered during construction of the project. • if unexpected historical archaeology is discovered during construction, work in the immediate area will cease and an archaeologist will be contacted to make a preliminary assessment of the find. If it is determined to be a relic under the Heritage Act, further investigation may be required and the Heritage Council may need to be notified.

Table 7.1 Summary of management and mitigation measures

Key issue	Management and mitigation measures
Land	• a site access protocol will be developed that lists the relevant landholder's contact details and includes measures to minimise adverse impacts, such as driving carefully to minimise disturbance to livestock, crops and pastures; • the timing of construction and the location/design of temporary access routes will be positioned to minimise impacts on neighbouring agricultural operations; • access tracks to and from the land adjacent to the development footprint will remain accessible to the landholders to avoid any impacts to the operation and sustainability of neighbouring agricultural activities; • soil resources will be managed to ensure the future viability of the development footprint for agricultural production, including separation of storage of topsoil and subsoil to ensure that soil is replaced in the right order and to avoid unnecessary impacts on soil and existing vegetation structure. • an erosion and sediment control plan in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004) will be implemented and monitored during the life of the project to minimise impacts; • the EMP will include weed management protocols, such as measures for the identification, management and ongoing monitoring of weeds within the development footprint; • the EMP will include a spill response plan which will be implemented during construction and throughout the project's operational stage to avoid potential for contamination; • vehicle movements will be restricted to the formed access tracks; • a project decommissioning plan will be prepared following the completion of project construction and commissioning and will feature rehabilitation objectives and strategies for returning the development footprint to agricultural production; • during decommissioning, all above-ground equipment and facilities will be removed from the development footprint; and • during decommissioning underground electrical collection systems may be left in situ in order to avoid unnecessary ground disturbance.
Visual	• implementation of the landscaping plan in Figure 6.6; • colours will be chosen for project infrastructure to minimise visual impacts; • buildings and building materials will be designed such that they are not in conflict with the local farming landscape and existing farm buildings located in the surrounding area; • all night lighting will be motion activated and comply with Australian Standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting; and • the panel designs considered for the project will feature anti-reflective coating.
Noise and vibration	No specific mitigation or management measures are required.

Table 7.1 Summary of management and mitigation measures

Key issue	Management and mitigation measures
Traffic and transport	• a CTMP and Driver Code of Conduct will be incorporated into the EMP and will be prepared prior to commencement of construction, which will incorporate the proposed access intersection treatments utilising Austroads and RMS guidelines for the major road intersection operations and worksite traffic control throughout the project construction period; • in order to minimise impacts on traffic flow along Orange Grove Road, deliveries and other vehicle movements will avoid peak hour and school bus times, whenever possible; • temporary traffic control arrangements may be required at the two proposed access intersections during the peak stages of construction traffic activity or on days when deliveries by oversize vehicles may be required; • the proposed access intersections will require some gravel shoulder widening on the approaches to and from Orange Grove Road, generally within the Orange Grove Road reserve, to accommodate the swept path turning movement by the largest types of trucks requiring access to the development footprint; • the proponent will lodge a Section 138 Certificate (Work on Public Lands) for GSC approval before any future road work for the proposed intersection construction/improvement is carried out; • a road maintenance program will be implemented for the 5 km unsealed section of Orange Grove Road, west of the development footprint, which will include: - regrading of the road surface to repair potholes and road corrugations (at three monthly intervals); and - a commitment by the proponent to restore the gravel road surface to its pre-construction condition, at the completion of the project's construction; • the proponent will treat the road surface of the unsealed section of Orange Grove Road to reduce potential dust generation by project-related traffic during the construction period.
Water	• a portable oil/fuel spill clean-up kit will be available on-site and employed if spills occur. Any residual contaminated soil will be removed from the development footprint and transported to the Gunnedah Waste Management Facility for disposal; • an erosion and sediment control plan in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom 2004) will be prepared in consultation with GSC and will be implemented and monitored during the life of the project to minimise impacts. This plan will include provisions to: - install erosion and sediment controls (if required) prior to and during construction; - regularly inspect erosion and sediment controls, particularly following large rainfall/wind events; - minimise tracking of sediment from vehicles, plant and equipment on to Orange Grove Road; - during excavation, separate topsoils and subsoils to ensure that they are replaced in their natural configuration; - stockpile topsoil appropriately to minimise weed infestation and maintain soil organic matter, soil structure and microbial activity; and - minimise the total area of disturbance from excavation and compaction.
Electromagnetic interference	• all project infrastructure will be designed in accordance with relevant industry standards; and • all relevant procedures in relation to a high voltage installation will be adhered to throughout the life of the project.

Table 7.1 Summary of management and mitigation measures

Key issue	Management and mitigation measures
Bushfire	• a bushfire management plan will be prepared and implemented for the project, and will contain the measures detailed below; • water, gas and electricity services will be will be incorporated into the detailed project design as follows: - located and installed in a manner that reduces the potential for them to contribute to fire hazard; - water for fire fighting will be supplied by truck or an on-site bore and stored in an on-site water tank; - fire hydrants at buildings will be installed, spaced, sized and pressured in accordance with Australian Standard 2419.1-2005 Fire hydrant installations – System design, installation and commissioning. If required water pressures of the standard cannot be met, engineering principles will be used to determine the locations, sizing and number of hydrants; - electricity and gas services will be located so they do not contribute to the risk of fire to a building; - overhead electrical transmission lines will be installed and managed in accordance with Ausgrid 2010 NS179 Vegetation Safety Clearances; - if required, AS/NZS 1596:2008 The storage and handling of LP gas will be followed for bottled gas installation and maintenance , including the use of metal piping; - there will be minimum 10 m distance between fixed gas cylinders (if required) and flammable materials and shielding will be placed on the hazard side of the cylinders; and - release valves on gas cylinders close to buildings will be directed away from the building and be a minimum of 2 m from combustible material. Metal connections will be used. • the development footprint will be accessed via Orange Grove Road which can accommodate passing vehicles and support vehicles that weigh over 15 t. A minimum vertical clearance of 4 m will be provided to any overhead obstructions including branches along internal access roads; and • the risk of igniting a fire within the development footprint will be reduced by adoption of the following measures: - refuelling will be undertaken in designated refuelling bays (there will not be any vegetation in these areas), especially when the fire danger rating is very high or above; - fire extinguishers will be maintained in buildings, vehicles and refuelling areas; - there will be no smoking within the development footprint; - spill response kits will be available should there be a spill of flammable substances; - a UHF/VHF communication system will be established, enabling rapid response to emergencies; - risk reduction, such as slashing, will be undertaken where appropriate, such as along fencelines; and - the RFS will be contacted if there is a fire.
Air quality	• use of a water truck(s) during construction for dust suppression along internal, unsealed access roads and disturbed areas; • vehicle movements will be minimised where possible; • all vehicles, plant and equipment will be cleaned and washed regularly; • all vehicles, plant and equipment will be regularly inspected and maintained to ensure that they are operating efficiently; • regular maintenance of unsealed access roads will be undertaken to minimise wheel generated dust; and • dust suppression requirements during construction will take into consideration weather and the likelihood of extended dry periods which could exacerbate impacts.

Table 7.1 Summary of management and mitigation measures

Key issue	Management and mitigation measures
Socio-economic	• a preference for local employment where appropriate skills and expertise exist; • a preference for use of local businesses such as motels, motor inns, restaurants and service providers to support project needs; • consideration of demand on local short-term accommodation and potential conflicts with the region's major festivals and annual events; and • provision of information to the community about the timing of the project construction period and need for employees and services from local business.
Waste management	• all waste will be managed in accordance with the POEO Act, the NSW *Waste Avoidance and Resource Recovery Act 2001* and the following hierarchy, which is listed in order of preference: - reduce waste production; - recover resources; and - dispose of waste appropriately. • all wastes produced by the project will be classified, stored and handled in accordance with the *Waste Classification Guidelines – Part 1: Classifying Waste* (EPA 2014); and • the following waste management measures will be included in the project's EMP: - unnecessary resource consumption will be avoided; - where possible, waste material will be reused and recycled; - no waste material will be received or disposed of on-site; and - all waste material will be removed from the development footprint as soon as practicable and will be sent to an appropriately licensed waste facility for disposal.
Cumulative impacts	• the proponent will consult with Photon Energy regarding the proposed construction schedule for the Gunnedah Solar Farm; and • the proponent will consult with GSC and local stakeholders to provide information about the timing of the project's peak construction period.

8 Conclusion and justification

8.1 Introduction

The SEARs require the EIS to address the reasons why the development should be approved having regard to the biophysical, economic and social costs and benefits of the development. This justification is summarised below with reference to the outcomes of the impacts of the project presented in Chapter 6. The strategic justification for the project is presented in Section 1.3, and an analysis of site suitability is presented in Section 3.2.

This chapter also considers the other relevant requirements under Schedule 2 of the EP&A Regulation not already addressed in the EIS, specifically the objects of the EP&A Act.

8.2 Biophysical, social and economic justification

8.2.1 Biophysical

The biophysical aspects of the project are assessed in Chapter 6. Biophysical impacts of the project include:

- Biodiversity – removal of 148.2 ha of native vegetation within the development footprint and other indirect biodiversity impacts (including potential encroachment of weeds and temporary noise impacts). The PCTs within the development footprint are heavily grazed and were identified to be in very low condition. The project has been designed to avoid and minimise impacts to biodiversity. The vegetation integrity score of both vegetation zones within the development footprint is such that offsets are not required for impacts on native vegetation. Therefore, the project does not require any offsets and no biodiversity offset strategy is required.
- Aboriginal cultural heritage – the project is unable to avoid impacts to OG_ISF2, an isolated artefact in the northern portion of the development footprint. As the artefact is of low archaeological significance and he been sufficiently recorded, salvage in the form of collection is not considered warranted.
- Land – temporary change of land use for 253 ha of the development footprint, the majority of which is currently used for agricultural purposes, and which would be removed from agricultural production for the life of the project (in the order of 30 years). Land management practises will avoid or minimise impacts with adjoining land uses, and ensure that the development footprint is not precluded from being returned to a productive agricultural use at the end of operation.
- Visual - 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. A conceptual landscaping plan to screen views of project infrastructure from the nearest receptors (ie. R1 and R2) has been developed (refer Figure 6.6) and will be refined in consultation with the landholders. Landscaping will reduce the visibility of project infrastructure.
- Traffic – the predicted traffic increases during construction will cause the unsealed segment of Orange Grove Road to move into a higher band in the Austroads rural daily traffic volume classification system (ie. from 1-150 to 150500). The predicted traffic increases will be in the lower end of this higher band. For the duration of the project construction period, a road maintenance program will be undertaken for the unsealed section of Orange Grove Road to maintain the safety and serviceability of the road for all road users.

Impacts to all other aspects were predicted to meet relevant criteria and/or be negligible as a result of the project. Through the site selection and project design process, described in Section 3.2, the project has avoided and minimised impacts to the biophysical environment as far as practicable.

8.2.2 Economic

Economic impacts of the project are detailed in Section 6.13. The project is justified economically due to the economic benefits and stimulus it would provide to the local region.

Construction of the project will require an average workforce of 80 people, with up to 100 people during the peak of construction. In the order of three FTEs will be employed during the operational stage of the project.

The project is consistent with the strategic objectives of the NSW Government in terms of renewable energy generation, and will provide economic stimulus to the local region.

8.2.3 Social

The project is justified on social grounds for three principal reasons; it is broadly supported by the local and regional community (refer to Section 5.4), it will contribute to the local and regional economy (refer to Section 6.13), and provide indirect benefits through the use of services and facilities both locally and regionally.

8.2.4 Objects of the EP&A Act

The project's consistency with the relevant objects of the EP&A Act is considered below. However, the overall conclusion is that the project is consistent with the objects of the EP&A Act either wholly or in the majority.

8.2.5 Proper management, development and conservation of resources

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

Resources within the development footprint include land that is being used for agricultural production, and land which has biodiversity and cultural heritage values. This constitutes the 'natural resources', which must be properly managed, developed or conserved.

As stated previously, the development footprint will be removed from agricultural use, however land management practises will avoid or minimise impacts with adjoining land uses, and ensure that land is not precluded from being returned to a productive agricultural use at the end of the operational stage of the project.

For the reasons given above the project will maintain 'social and economic welfare' and achieve 'a better environment'.

8.2.6 Orderly development

(a) to encourage:.

...(ii) the promotion and co-ordination of the orderly and economic use and development of land,

The project provides an opportunity for orderly and economic use and development of land with benefits to the local region. The project's planning and design process, including site selection (see Section 3.2) has taken into account all potential impacts and incorporates measures to avoid, minimise or compensate for these impacts. Thus, it will be an orderly development.

8.2.7 Communication and utility services

(a) to encourage:

...(iii) the protection, provision and co-ordination of communication and utility services,

At its closest point, the site is approximately 4.2 km north-east of TransGrid's Gunnedah Substation (refer Figure 2.1). TransGrid's 132 kV transmission line runs parallel to the southern boundary of the southern portion of the development footprint (refer Figure 2.1). The existing utility services within the Gunnedah Substation and surrounds (including TransGrid's 132 kV transmission line) will not be affected. This represents an orderly and coordinated approach to utility connections. The project will not affect any other communication and utility services.

8.2.8 Land for public purposes

(a) to encourage:

...(iv) the provision of land for public purposes,

The project will not affect the provision of land for public purposes, as it is currently freehold and privately owned. The project is considered to have an overall benefit for the public associated with renewable energy generation, therefore it is considered to be consistent with this objective.

8.2.9 Community services and facilities

(a) to encourage:

...(v) the provision and co-ordination of community services and facilities, and

The project is likely to utilise existing community services and facilities. The greatest impact would occur during construction when the workforce requirements are at their peak. The socio-economic assessment provided in Section 6.13 indicates that there is current capacity for this demand.

8.2.10 Protection of the environment

(a) to encourage:

...(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

OVERLAND has sought to minimise impacts on native vegetation resulting in avoidance of all significant biodiversity values and minimisation of impacts on other areas of native vegetation. The project does not require any offsets.

8.2.11 Ecologically sustainable development

(a) to encourage:

...(vii) ecologically sustainable development, and

The principles of ESD, for the purposes of the EP&A Act, are provided in Clause 7(4) of Schedule 2 of the EP&A Regulation. It states:

The principles of ecologically sustainable development are as follows:

(a) the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The four principles of ESD and the project's compatibility with each are considered below.

In addition, the Commonwealth's National Strategy for Ecologically Sustainable Development defines ESD as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'.

Conservation of ecological resources will be achieved through avoiding valuable areas.

i Precautionary principle

This means that if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. This EIS, prepared by experts in their respective fields, has identified and assessed the potential environmental impacts, and appropriate mitigation and management measures have been developed in response. Taking these measures into account, it is considered that there will be no threat of serious or irreversible damage to the environment as a result of the project.

ii Inter-generational equity

Inter-generational equity is the concept that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations, while intra-generational equity is applied within the same generation.

The project incorporates a range of design, mitigation and management measures to minimise potential impacts on the environment. These measures aim to maintain the environmental conditions within and surrounding the project such that detrimental impacts do not affect the future health, diversity and productivity of the environment.

iii Conservation of biological diversity and maintenance of ecological integrity

Through design, the project has actively sought to avoid and minimise impacts to biodiversity (to the extent that the project does not require any offsets). The PCTs within the development footprint are heavily grazed and were identified to be in very low condition. Removal of vegetation has been limited to removal of 148.2 ha of low quality vegetation, which is characterised by isolated mature native trees with an understorey dominated by exotic (pasture) grasses and herbs and disturbance tolerant native species.

iv Improved valuation and pricing of environmental resources

One of the common broad underlying goals or concepts of ESD is economic efficiency, including improved valuation and pricing of environmental resources.

In the past, it was assumed that some environmental resources were free or underpriced, leading to their wasteful use and consequent degradation. Consideration of economic efficiency, with improved valuation of environmental resources, aims to overcome the underpricing of natural resources and has the effect of integrating economic and environment considerations in decision making, as required by ESD.

As previously stated, the project incorporates a range of design, mitigation and management measures to minimise potential impacts on the environment. The costs associated with these measures are incorporated into the capital investment and operating costs of the project.

Having considered all aspects of ESD, the conclusion is that the project is consistent with the objects of the EP&A Act, and with its specific components.

8.2.12 Increased public involvement

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

Community consultation has been completed during the preparation of the EIS, and OVERLAND has actively sought to involve the community in the planning and assessment process (refer to Chapter 5).

The engagement activities undertaken included community information sessions, phone calls, meetings and informal discussions, thus providing opportunity for public involvement and participation in environmental planning and assessment.

8.3 Conclusion

There is a sound justification for the project, founded on the following:

- The site is suitably located:
  - in a region with ideal climatic conditions for large-scale solar energy generation, with ideal physical conditions;
  - within close proximity of infrastructure with adequate capacity to receive the energy proposed to be generated; and
  - proximate to land uses compatible with large-scale solar energy generation at a capacity which matches the availability of the network.
- The project will not result in significant biophysical, social or economic impacts, and the project design has actively sought to avoid and minimise impacts, in particular to biodiversity (to the extent that the project does not require any offsets), heritage and land use, through the siting and design of project infrastructure.
- The project will generate direct and indirect economic benefits, through the creation of employment opportunities and benefits to the local economy through income and expenditure during the life of the project.
- The production of renewable energy directly aligns with the objectives of the State's renewable energy targets and the objectives of the NSW Government's REAP, and will contribute to increased energy security through valuable contributions to a more diverse energy mix.

A suite of design, mitigation and management measures are proposed in this EIS to avoid, minimise and manage impacts of the project. The project will enable the orderly and logical use of natural, physical and human resources existing in the area and region. There will be economic investment and employment benefits for the local region and a realised opportunity for renewable energy generation, while minimising potential environmental and social impacts.

The overall benefits of the project are considered to be in the public interest.

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Abbreviations

ACHAR	Aboriginal cultural heritage assessment report
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ALA	aircraft landing area
ARI	average recurrence interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ASC	Australian Soil Classification
AWS	Automatic Weather Station
BAM	Biodiversity Assessment Method
BCA	Building Code of Australia
BC Act	NSW *Biodiversity Conservation Act 2017*
BDAR	biodiversity development assessment report
BoM	Bureau of Meteorology
BSAL	biophysical strategic agricultural land
CASA	Civil Aviation Safety Authority
CL Act	NSW *Crown Land Act 1989*
DA	development application
DoE	Commonwealth Department of Employment
DoEE	Commonwealth Department of the Environment and Energy
DoI-DRE	NSW Department of Industry - Division of Resources and Energy
DoI Lands	NSW Department of Industry - Lands
DPE	NSW Department of Planning and Environment
DPE-DRE	NSW Department of Planning and Environment – Division of Resources and Energy
DPI	NSW Department of Primary Industries
EEC	endangered ecological community

EIS	environmental impact statement
ELF	extremely low frequency
EMM	EMM Consulting Pty Limited
EMP	environmental management plan
EMFs	electric and magnetic fields
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW Environmental Planning and Assessment Regulation 2000
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPL	environment protection licence
ESD	ecologically sustainable development
G	gauss
GSC	Gunnedah Shire Council
Gunnedah LEP	Gunnedah Local Environmental Plan 2012
GWh	gigawatt hours
ha	hectare
Heritage Act	NSW *Heritage Act 1977*
Hz	hertz
IBRA	Interim Biogeographic Regionalisation for Australia
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICOMOS	Australia International Council on Monuments and Sites
IEEE	Institute of Electrical and Electronic Engineers
Infrastructure SEPP	State Environmental Planning Policy (Infrastructure) 2007
km	kilometre
kW	kilowatt
LALC	Local Aboriginal Land Council
LGA	local government area
LLS	Local Land Services

LSC	Land and Soil Capability
m^2	square metres
mG	milligauss
ML	megalitres
mm	millimetres
MNES	matters of national environmental significance
MW	megawatt
NMLs	noise management levels
NNTT	National Native Title Tribunal
NPI	National Pollution Inventory
NPfI	Noise Policy for Industry
NPW Act	NSW *National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service
NSW	New South Wales
NSW LPI	NSW Land and Property Information
NTSCORP Limited	NSW Native Title Services Corporation Limited
OEH	NSW Office of Environment and Heritage
OVERLAND	OVERLAND Sun Farming Pty Ltd
PADs	potential archaeological deposits
PBP	Planning for Bushfire Protection
PCT	plant community type
PHA	preliminary hazard assessment
POEO Act	NSW *Protection of the Environment Operations Act 1997*
Proponent	Orange Grove Sun Farm Pty Ltd
PV	photovoltaic
PVP	property vegetation plan
RAPs	registered Aboriginal parties
RBL	rating background noise level
RDA	Regional Development Australia

REAP	Renewable Energy Action Plan
RF Act	NSW *Rural Fires Act 1997*
RMS	NSW Roads and Maritime Services
RNP	Road Noise Policy
RTS	response to submissions
Rural Lands SEPP	State Environmental Planning Policy (Rural Lands) 2008
SEARs	Secretary's environmental assessment requirements
SEED	Sharing and Enabling Environmental Data
SEPP 33	State Environmental Planning Policy No 33 - Hazardous and Offensive Development
SEPP 55	State Environmental Planning Policy No 55 - Remediation of Land
SHR	State Heritage Register
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SRLUP	NSW Strategic Regional Land Use Policy
SSD	State significant development
T	tesla
TDS	total dissolved solids
TEC	threatened ecological community
TSR	travelling stock reserve
VIS	Vegetation Information System
WM Act	NSW *Water Management Act 2000*
μT	microtesla