Environmental Impact Statement
SUNDOWN SOLAR FARM

Prepared for Sundown Solar Pty Ltd
June 2023

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creating opportunities

Environmental Impact Statement

Sundown Solar Farm

Sundown Solar Pty Ltd

J210075 RP1

June 2023

Version	Date	Prepared by	Approved by	Comments
1	25 January 2023	Mary-Anne Siebert	Paul Freeman	Provided with Development Application
2	20 June 2023	Mary-Anne Siebert	Paul Freeman	Final. Includes agriculture assessment and PHA.

Approved by

Paul Freeman
Associate Director
Energy Sector Lead
20 June 2023

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EIS declaration

Project details	
Project name	Sundown Solar Farm
Application number	SSD 8911
Address of the land in respect of which the development application is made	Sturmans Road, Spring Mountain, NSW 2360
Applicant details	
Applicant name	Sundown Solar Pty Ltd
Applicant address	Principle place of business: Level 4, Suite 4.02, 99 King Street, Melbourne, Victoria, 3000 Registered office: Level 10, 68 Pitt Street, Sydney, NSW 2000
Details of person by whom this EIS was prepared	
Name	Mary-Anne Siebert
Address	EMM Consulting, 4/74 Pirie Street, Adelaide SA 5001
Professional qualifications	Graduate Diploma, Environmental Health Practice Bachelor of Applied Science, Environmental Management
Declaration by registered environmental assessment practitioner	
Name	Paul Freeman
Registration number	136427
Organisation registered with	Planning Institute of Australia

Declaration

The undersigned declares that this EIS:

- has been prepared in accordance with Part 8 of the Environmental Planning and Assessment Regulation 2021
- contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the EIS relates
- does not contain information that is false or misleading
- addresses the Planning Secretary's environmental assessment requirements (SEARs) for the project
- identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments
- has been prepared having regard to the Department's State Significant Development Guidelines – Preparing an Environmental Impact Statement
- contains a simple and easy to understand summary of the project as a whole, having regard to the economic, environmental and social impacts of the project and the principles of ecologically sustainable development
- contains a consolidated description of the project in a single chapter of the EIS
- contains an accurate summary of the findings of any community engagement
- contains an accurate summary of the detailed technical assessment of the impacts of the project as a whole.

Signature 

Date 20 June 2023

Executive summary

ES1 Introduction

Sundown Solar Pty Ltd (Sundown Solar) proposes to develop the Sundown Solar Farm (the project), which is a large-scale solar photovoltaic (PV) electricity generation facility and associated battery energy storage system (BESS). The solar component of the project will have an indicative capacity of 360 megawatts (MW). The BESS component will have an indicative capacity of up to 150 MW for a four-hour duration.

The electricity generated onsite will contribute to the national electricity grid via the existing Transgrid 330 kilovolt (kV) transmission line that traverses the site. The BESS will draw and store energy from the grid and/or from the project during off-peak periods. This energy will be dispatched back into the grid during peak periods, thereby improving grid reliability and network stability.

The site is located in Spring Mountain, approximately 30 km east of Inverell and 38 km west of Glen Innes in the New England Tablelands region of northern NSW (Figure 1.1).

This environmental impact statement (EIS) accompanies a State significant development (SSD) application (SSD-8911) for the project.

ES2 Strategic context

The National Electricity Market (NEM) is undergoing rapid and significant transformation from a centralised system of large fossil fuel (coal and gas) generation towards an array of smaller scale, widely dispersed wind and solar and other renewable energy generators. This change is being driven by consumer preferences, ageing infrastructure, weather and advances in technology. It is expected that all existing NSW coal fired generation infrastructure (capacity approximately 8,000 MW) will be retired by 2040 and replaced with renewable energy (DPE 2020a).

The project is consistent the NSW *Electricity Infrastructure Investment Act 2020*, as it will contribute to the growth of renewable energy generation and storage capacity in NSW. The project will generate approximately 900,000 tonnes per annum less greenhouse gas emissions when compared to the emissions from a coal-fired power plant.

ES3 The project

The project comprises the following key components:

- construction and operation of a large-scale solar farm with a generation capacity of approximately 360 MW (AC)
- construction and operation of a BESS with up to four-hour storage capacity of approximately 150 MW (AC).

The Sundown Solar Farm will connect to the electricity network via the existing onsite 330 kV Transgrid powerline.

The project will also include the upgrade of the access road and Gwydir Highway/Spring Mountain Road intersection.

The conceptual site layout is show in Figure 3.1.

The project area covers approximately 2,097 hectares (ha) and the development footprint covers approximately 651 ha. During the preparation of the EIS, the development footprint within the project area has been refined to consider any environmental constraints identified, outcomes of stakeholder engagement, community consultation and design of project infrastructure with the objective of developing an efficient project that avoids and minimises environmental impacts.

The project will have a targeted electricity generating capacity of up to 360 megawatts (alternating current) (MW (AC)) and up to 150 MW(AC) 4 hour energy storage. The final number of PV modules will be dependent on detailed design, availability, and commercial considerations at the time of construction.

ES4 Engagement

Sundown Solar has been actively engaging with the community and stakeholders since it bought the project from CWP Renewables (CWP) in February 2021. Prior to this, CWP had been actively engaging with the community and stakeholders since 2017.

Engagement has comprised direct consultation with stakeholders via face-to-face meetings, interviews, a solar farm site visit, a community information session, project newsletters and a dedicated project website and email.

Sundown Solar has engaged with local, State and Commonwealth government agencies, registered Aboriginal parties (RAPs), land and business owners, interest groups and the broader community. Matters raised in engagement activities have been considered in the preparation of the EIS. Key concerns raised include potential impacts to State-listed threated species and communities, potential impacts to areas of Aboriginal significance, site access, accessibility of local accommodation services and employment opportunities.

Mitigation measures have been incorporated into the project design, such as revised layout to minimise impacts to biodiversity, development of an Aboriginal Cultural Heritage Management Plan (ACHMP) and upgrade of the Gwydir Highway/Spring Mountain intersection and the access road. A social impact assessment has also considered in detail the employment opportunities and the accommodation needs for the anticipated construction workforce and identified measures to address these requirements.

Sundown Solar will continue stakeholder engagement activities to ensure matters raised by the community and other stakeholders are understood and addressed. Future engagement and consultation activities for the project will include public exhibition of this EIS, responding to the submissions received during the public exhibition, regular updates to the project website, and continued meetings with Government agencies, project landowners and adjoining landowners, at each stage of the project, as necessary.

ES5 Assessment of impacts

ES5.1 Biodiversity

A biodiversity development assessment report (BDAR) (Appendix C) was prepared for the project. A number of field surveys were undertaken between May 2021 and October 2022 to inform the potential biodiversity impacts of the project (Table 6.3).

Native vegetation comprises approximately 30% of the disturbance footprint, with most of the vegetation representing cultivation. Native vegetation occurs in both woodland and derived grassland form. Considering the active use of land within the disturbance footprint for agriculture, much of the native vegetation mapped is represented by native pastures derived from woodland clearing. The condition of the derived native grassland areas is variable and is influenced by disturbance history and current agricultural management.

The surveys found four plant community types (PCTs) in the disturbance footprint, which correspond to White Box – Yellow Box – Blakely's Red Gum Grassy Woodland (Box Gum Woodland). This community is listed as a Threatened Ecological Community under the *Biodiversity Conservation Act 2017.* It is also listed as critically endangered under the Commonwealth *Environmental Protection Biodiversity Conservation Act 1999*. Around 2.5 ha of woodland would require to be cleared for the project and around 216 ha of derived native grassland.

Eight threatened species were recorded within or near the disturbance footprint:

- Brown Treecreeper (*Climacteris picumnus victoriae*)
- Diamond Firetail (*Stagonopleura guttata*)
- Dusky Woodswallow (*Artamus cyanopterus*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Scarlet Robin (*Petroica boodang*)
- Little Eagle (*Hieraaetus morphnoides*)
- Bluegrass (*Dichanthium setosum*)
- Austral Toadflax (*Thesium australe*).

The six threatened bird species recorded are predicted species and are accordingly assessed for ecosystem credits along with a list of other predicted species associated with the PCTs recorded in the disturbance footprint. It is noted that although Little Eagle is a dual credit species, no breeding was detected during seasonal surveys. Little Eagle is only assessed for ecosystem credits for predicted impacts on foraging habitat and further assessment for species credit is not required.

Bluegrass and Austral Toadflax are candidate species for the purposes of application of the Biodiversity Assessment Method (BAM), and species polygons have been prepared to assess these species for species credits.

Presence is assumed for one candidate species, namely the Eastern Pygmy-possum (*Cercartetus nanus*).

The following Matters of National Environmental Significance (MNES) are known to occur, or have potential to occur and to be impacted by the project:

- Box Gum Woodland
- Bluegrass
- Austral Toadflax
- Regent Honeyeater
- Swift Parrot
- Painted Honeyeater.

Box Gum Woodland is addressed by the BAM as native vegetation requiring further assessment for ecosystem credits. Likewise, Regent Honeyeater, Swift Parrot and Painted Honeyeater are addressed by the BAM as predicted species that are further assessed for ecosystem credits (for foraging habitat).

Regent Honeyeater and Swift Parrot are dual credit species that require assessment for species credits only if a development proposes to clear native vegetation on land mapped as important habitat areas for these species. The project will not require vegetation clearing on land mapped as important habitat areas for Regent Honeyeater and Swift Parrot and therefore, no species credits are required to be assessed by the BAM.

Bluegrass and Austral Toadflax are addressed by the BAM as threatened candidate species that are further assessed for species credits.

The project has used as much of the cultivated land as possible and has incorporated avoidance and mitigation measures to design around areas of high biodiversity value. This has resulted in a design which has sacrificed around 33 MW direct current (DC) of energy generating capacity.

The residual biodiversity impacts of the project will be offset under the available mechanisms of the *Biodiversity Conservation Act 2016.*

ES5.2 Aboriginal heritage

An Aboriginal cultural heritage assessment (ACHA) was prepared for the project (Appendix D).

A search of the Aboriginal Heritage Information Management System (AHIMS) database in May 2021 identified no Aboriginal heritage sites listed within the project area. An archaeological survey was conducted in September 2021 with Registered Aboriginal Parties (RAPs). The survey results identified the presence of 36 previously unrecorded sites within the project area, comprising artefact scatters, isolated finds and scarred trees. The survey also identified the presence of two ochre resource areas within the project area. One of the proposed temporary laydown areas was identified as having potential archaeological deposit (PAD). To further characterise the significance and extent of the PAD, EMM undertook a 3 day test excavation in June 2022, with RAPs. The test excavation determined there is a low-density artefact scatter across the area of PAD.

Avoidance of Aboriginal cultural heritage values was a key aspect of the project refinement process, and the results of the survey were used to refine the development footprint. Consequently, 26 of the 36 sites will be avoided (including all scarred trees). The remaining 10 sites will be salvaged prior to commencement of construction. The two ochre resource areas will also be avoided.

An Aboriginal cultural heritage management plan (ACHMP) will be developed for the project in consultation with the Department of Planning and Environment (DPE), RAPs and Heritage NSW. The ACHMP will include details of the management and mitigation of known Aboriginal sites and will outline the protocol for management of unanticipated finds.

ES5.3 Historical heritage

A historical heritage impact assessment was prepared for the project (Appendix E).

There are no heritage items listed on the National Heritage List, Commonwealth Heritage List, State Heritage Register or Inverell LEP within 5 km of the study area.

EMM conducted an archaeological survey of the development footprint in September 2021. The survey identified the presence of four (unlisted) historical heritage sites within the development footprint. When assessed individually, none of the four sites meets the threshold for local significance. However, when assessed as part of the broader cultural landscape the sites have the potential to contribute to an understanding of historical land use patterns and therefore have local significance when considered collectively. Each of these four sites will be directly impacted by the project. These sites will be archivally recorded prior to being disturbed.

ES5.4 Land, soil and erosion

A land, soil and erosion impact assessment was prepared for the project (Appendix F).

The project area comprises predominantly moderate capability land (LSC Class 4) with some good quality (LSC class 3) and some constrained low capability land (LSC Class 6) and is unlikely to be verified Biophysical Strategic Agricultural Land (BSAL). The project will result in a temporary and reversible change in land use for land within the development footprint, noting there is potential for dual land use, as sheep grazing or apiculture will be possible across much of the development footprint during operation.

Properties adjacent to the project area will be able to continue agricultural activities unimpeded during all phases of the project.

At the end of the project life, project infrastructure will be removed[1] from the development footprint and the site will be rehabilitated and returned to agricultural activity. Implementation of the proposed mitigation measures will ensure that the LSC within the development footprint is unlikely to change from its current capability and that land, soil and erosion risks are adequately managed and impacts to agriculture are minimised.

ES5.5 Visual

A visual impact assessment was prepared for the project (Appendix G).

Visual assessments were undertaken from eight representative viewpoints selected based on their proximity to the development footprint, location to receptors, positioning on roads, topography and presence of vegetation. The assessment determined that project infrastructure may be visible from one of the eight viewpoints. Due to the presence of mature vegetation, variable elevation and undulation in the landscape, and the height of the dominant project infrastructure, namely the PV panels, infrastructure within the development footprint will be shielded from view at the majority of viewpoints considered as part of this assessment. The impact assessment predicts:

- a negligible visual impact for Viewpoint 4
- a slight visual impact for Viewpoints 1, 2, 5, 6, 7 and 8
- a slight/moderate visual impact for Viewpoint 3.

No viewpoint locations were found to have a high impact rating.

Based on the calculated magnitude of change and evaluations of significance assigned to each of the eight viewpoints, no landscaping is warranted.

ES5.6 Noise and vibration

A noise and vibration impact assessment was prepared for the project (Appendix H).

Construction works are proposed to occur during standard hours, namely Monday to Friday (7:00 am–6:00 pm) and on Saturdays from 8:00 am–6:00 pm. Maximum construction noise and vibration impacts are expected to occur during the site establishment phase of the construction program. Construction noise levels are predicted to exceed noise management levels under the *Interim Construction Noise Guideline* (ICNG) at up to nine assessment locations. This predicted noise exceedance is due to the upgrade of the access road (these assessment locations are in close vicinity to the intersection and the access road), and not due to the construction of the solar farm/BESS infrastructure. All remaining assessment locations satisfy the NMLs.

Based on setback distances from proposed works, construction vibration impacts are considered negligible, with the exception of two assessment locations where vibration levels are predicted to exceed acceptable human response thresholds. This is largely in relation to the use of vibratory rollers during upgrade of the site access road. Vibration impacts will be managed using standard mitigation measures.

During peak construction, increases in traffic noise will occur along the Gwydir Highway, Spring Mountain Road and Sturmans Road. Assessed road traffic noise levels indicate that predicted levels will remain below the thresholds provided in the *Road Noise Policy* (RNP) (DECCW 2011).

Operational noise is predicted to satisfy the *Noise Policy for Industry* (NPfI) project noise trigger level (PNTL) for all assessment locations.

[1] Some infrastructure may remain, such as the access roads, sheds, water crossings and hard stand areas. This will be decided in consultation with landowners.

Decommissioning phase noise and vibration are expected to satisfy all applicable criteria.

By applying the proposed mitigation measures, the project is not anticipated to generate significant noise or vibration impacts.

ES5.7 Traffic and transport

A traffic impact assessment was prepared for the project (Appendix I).

During the construction and operation phases, Gwydir Highway will be the main transport route to and from the site. From the Gwydir Highway, the site will be accessed via the Spring Mountain Road and Sturmans Road.

The existing level of service (LOS) for Gwydir Highway/Spring Mountain Road intersection is LOS A (i.e. good operation) and is predicted to remain at LOS A during construction and operation of the project.

The available sight distance on Gwydir Highway at the Gwydir Highway/Spring Mountain Road intersection to the right meets the minimum requirements but does not meet the minimum requirements to the left. This will be managed via the installation of applicable warning signs.

To accommodate the temporary increase in construction traffic, the Gwydir Highway/Spring Mountain Road intersection will be upgraded to include a right turn traffic lane (type (CHR(S)) at the eastbound approach, as well as a Basic Right Turn (BAR) treatment and a Basic Left Turn (BAL) (if the BAL has not already been installed by Goldwind Australia, noting this is a requirement of the White Rock Wind Farm development consent).

To accommodate the temporary increase in construction traffic, the access road will be widened to 8.7 m and the watercrossings will be upgraded.

A construction traffic management plan (CTMP) will be developed by the construction contractor in consultation with Inverell Shire Council and Transport for NSW (TfNSW) prior to the commencement of works.

With the implementation of the proposed mitigation measures, the project is not expected to result in any significant traffic-related impacts to regional or local road networks.

ES5.8 Water resources

A water assessment was prepared for the project (Appendix J).

Regionally, the depth to groundwater typically ranges between 11 and 62 m below ground level (mbgl). Several ephemeral watercourses traverse the development footprint. No aquatic groundwater dependent ecosystems (GDEs) are mapped in the vicinity of the project.

The water demand for the project will be low. During the 21 month construction period the estimated water demand is 75 megalitres (ML). During the operation period the estimated water demand is 475 kilolitres (kL) (over the entire 35 years). The primary water source for construction and operation phases will be trucked-in water. Groundwater take via bores for construction use is not currently proposed but is being investigated. If viable, further assessment of groundwater impacts will be undertaken, including the necessary applications.

The assessment concluded that no significant project-related impacts are anticipated in relation to:

- surface water quality, quantity, flooding and impacts to watercourses and riparian corridors
- groundwater levels, quality and impacts to existing users.

Overall, potential surface water and groundwater impacts during construction and operation are considered minor and can be adequately managed through the implementation of the recommended mitigation measures.

ES5.9 Hazards and risk

A preliminary hazards assessment (PHA) was prepared for the project (Appendix K).

The assessment concluded that the project:

- is not considered to be potentially hazardous within the meaning of the Hazards and Resilience SEPP
- is located in a suitable area (i.e. a rural area) with considerable separation distance to sensitive receptors and in an area without any other hazardous developments in the vicinity of the project site
- is not expected to have significant offsite hazard impacts
- is not expected to generate electric and magnetic fields (EMF) levels that exceed International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines levels for occupational exposure or for general public exposure levels
- meets the *Hazardous Industry Planning Advisory Paper* (HIPAP) 4 (DoP 2011c) qualitative risk criteria.

Assuming the proposed mitigation measures are implemented, the project is not expected to result in any significant hazards or risks.

ES5.10 Bushfire

A bushfire assessment was prepared for the project (Appendix L).

A portion of the project site and its surrounds is mapped as bushfire prone land. The proposed mitigation measures include installation of asset protections zones (APZs), adequate fire-fighting infrastructure, appropriate access for emergency vehicles, visitors and staff as well as implementation of fire protection procedures.

ES5.11 Social

A social impact assessment (SIA) was prepared for the project (Appendix M). The SIA assessed both negative and positive aspects of the project on different groups of people within local and regional communities.

The outcomes of the SIA indicate that unmitigated, the project has potential to result in temporary negative impacts during the construction phase relating to increases in traffic, increased demand for local services and impacts on amenity. However, after the application of the proposed mitigation measures, none of these impacts are assessed as being of high significance.

The project has potential to result in the following positive impacts (benefits):

- increase in employment due to increase in project-related opportunities relating to employment and training
- increase in economic prosperity for local businesses due to increase in local supply opportunities.

Following application of the proposed enhancement measures, the benefits are expected to be of very high significance.

The project will result in a range of socioeconomic benefits in the local region including employment opportunities, the establishment of a community benefits fund and the provision of clean energy. With the implementation of the proposed mitigation measures, the project is not expected to result in any significant negative socioeconomic impacts.

ES5.12 Other impacts

The EIS also considers potential impacts related to waste. Potential impacts are considered to be unlikely/low and a range of mitigation measures have been proposed that will effectively manage these aspects during construction and operation of the project.

ES6 Project justification and conclusion

The project involves the development and operation of a large-scale solar PV generation facility along with battery storage and associated infrastructure. The project will be within the NSW Government declared New England REZ and will play an important part in achieving the objectives of the New England REZ by contributing to the continued growth of renewable energy generation and storage capacity. It will support the Commonwealth and State governments in achieving their respective renewable energy and greenhouse gas emission reduction targets.

The project is justified economically due to the significant economic benefits and stimulus it will provide to the local region. The project will generate of approximately 200 full time equivalent (FTE) jobs during construction (including up to 400 FTE jobs during peak construction) and two to three FTE jobs throughout operation. The majority of the construction and operation workforce is expected to be sourced from the region, which will provide ongoing economic benefits for the local economy and broader region. Sundown Solar will work in partnership with Inverell Shire Council and the local community to ensure that, as far as possible, the benefits of the projected economic growth in the region are maximised and impacts minimised.

The site is suitable for the project due to several factors, notably its location within the New England REZ. In addition, the study area is favourable for the construction and operation of a solar and battery project due to the available solar resource, physical conditions (flat to gently undulating topography and predominantly cleared, agricultural land), land capability and relatively few neighbours living within close proximity. Another advantage is the site's proximity to the existing transmission line.

The residual environmental and social impacts identified throughout the EIS will be effectively managed through the mitigation and management measures described throughout, such that the project will not result in significant impacts on the environment or the local community, while achieving the following key benefits:

- contributions to energy security and reliability in NSW by diversifying the State's energy mix and helping to prepare for the retirement of large-scale coal-fired power generation
- alignment with Commonwealth and NSW Government electricity policies and strategies and regional plans
- provision of ongoing economic benefits for both the local economy within the Inverell LGA and the Glenn Innes LGA and more broadly
- provision of significant employment opportunities during the 21 month construction period.

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1 Introduction

1.1 Overview

Sundown Solar Pty Ltd (Sundown Solar) proposes to develop the Sundown Solar Farm (the project), which is a large-scale solar photovoltaic (PV) electricity generation facility and associated battery energy storage system (BESS).

The project comprises the following key components:

- construction and operation of a large-scale solar farm with a generation capacity of approximately 360 MW (AC)
- construction and operation of a BESS with up to four-hour storage capacity of approximately 150 MW (AC).

The electricity generated onsite will contribute to the national electricity grid via a new onsite substation connected to the existing Transgrid 330 kilovolt (kV) transmission line that traverses the site.

The electricity generated from the project will be sold to one or more registered energy retailing organisations, large energy users (governmental or private) or to the National Electricity Market (NEM) that is operated by the Australian Energy Market Operator (AEMO).

The project is located within the New South Wales (NSW) Government-declared New England Renewable Energy Zone (REZ). The project will complement nearby operational renewable energy generation assets; White Rock Wind Farm (Stage 1), White Rock Solar Farm and Sapphire Wind Farm (Figure 1.1) as well as the approved but not yet developed assets: White Rock Wind Farm (Stage 2), Sapphire Solar Farm and Glenn Innes Wind Farm. The project will contribute to the overall storage capacity and reliability of the NEM. The project will also support State and Commonwealth greenhouse gas emission reduction commitments by facilitating renewable energy input into the grid network.

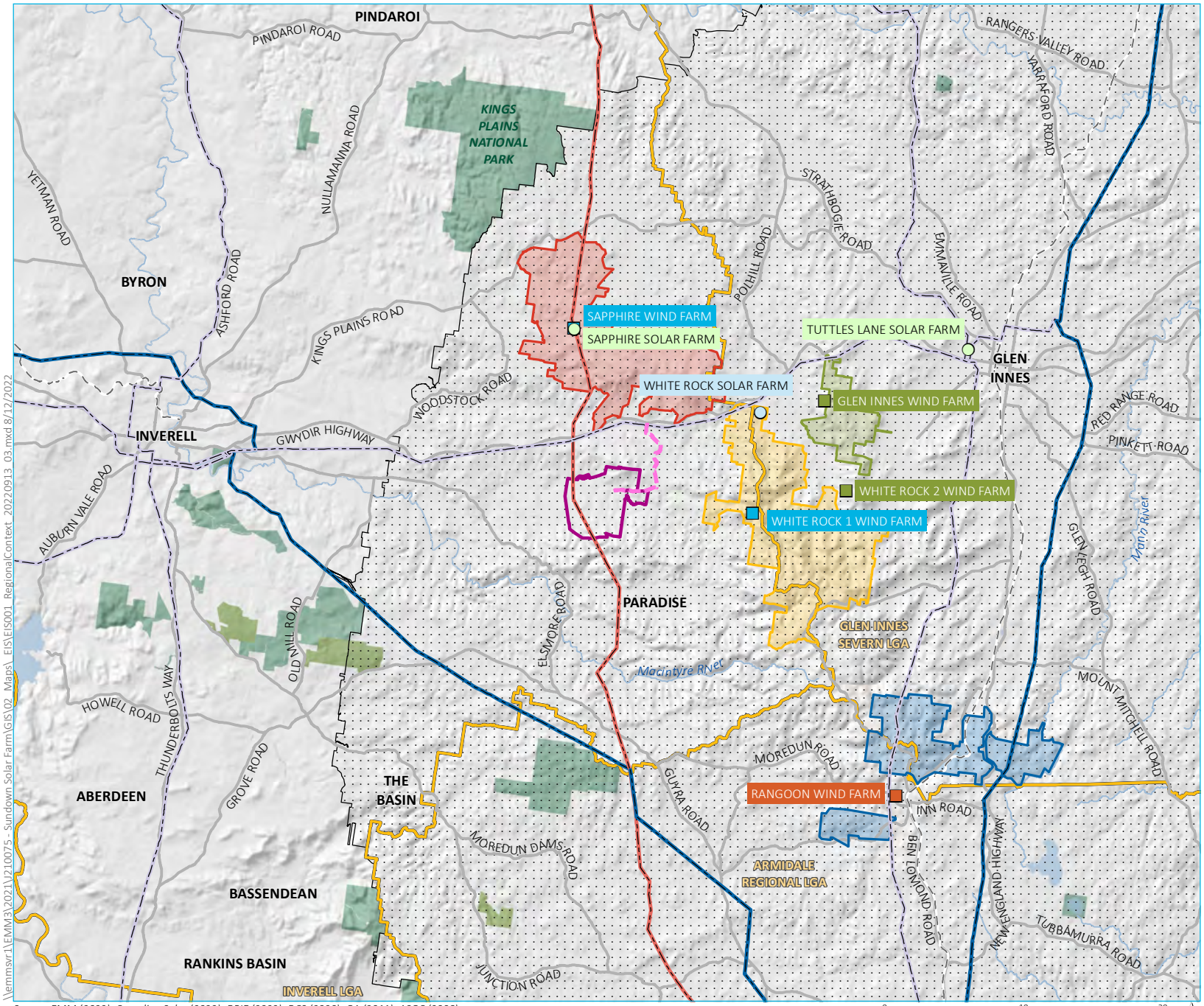
The project is located at Spring Mountain, approximately 30 kilometres (km) east of Inverell in the Inverell Shire Council local government area (LGA), and in the New England Tablelands region of northern NSW (Figure 1.1). The site will be accessed from the Gwydir Highway, Spring Mountain Road and Sturmans Road (Figure 3.1).

The project area comprises three privately owned lots, namely Lot 148 DP 753299 (Glen Eisle), Lot 141 DP 753305 (Spring Valley) and Lot 1, DP 1064358 (Newstead) (Figure 3.2). The entire site is zoned RU1 – Primary Production under the *Inverell Shire Local Environmental Plan 2012* (Inverell LEP) and is currently and has historically been used for farming (cropping and grazing). The surrounding land is used for farming (Figure 3.3).

Construction of the project is anticipated to commence in early 2024, subject to project approval, labour and equipment availability. The construction period is anticipated to be 21 months.

Operation of the project is expected to commence from late 2025 for a period of approximately 35 years, at which point the project will be decommissioned. Throughout its operational life, certain components and technologies may be replaced and/or upgraded, however such works are unlikely to be intensive. Sundown Solar Farm will operate 24 hours a day, 7 days a week and be monitored remotely, with regular infrastructure maintenance undertaken onsite.

The project is described in further detail in Chapter 3.



KEY

- Proposed Sundown Solar Farm (Project area)
- Access road
- New England Renewable Energy Zone

Electricity transmission line

- 66 kV
- 132 kV
- 330 kV

Surrounding renewable development

Solar development

- Operational
- Approved

Wind development

- Operational
- Approved
- In planning
- Glen Innes Wind Farm
- Rangoon Wind Farm
- Sapphire Wind and Solar Farm
- White Rock Wind and Solar Farm

Existing environment

- Rail line
- Major road
- River
- Named waterbody
- NPWS reserve
- State forest
- Local government area

Source: EMM (2022); Canadian Solar (2022); DPIE (2022); DCS (2020); GA (2011); ASGC (2006)

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Regional context

Sundown Solar Farm
Environmental impact assessment
Figure 1.1

EMM creating opportunities

1.2 Project infrastructure

The project will comprise the following key components:

- a network of approximately 660,000 PV panels and associated mounting infrastructure
- a 150 MW (AC) battery BESS (4 hour)
- 330 kV onsite substation
- electrical collection and conversion systems, including inverter and transformer units, switchyard and control room
- underground and aboveground cables
- a management hub, including demountable offices and amenities and equipment sheds
- onsite creek crossings
- security fencing
- temporary laydown areas (during construction and decommissioning)
- parking and internal access roads
- lighting
- firefighting infrastructure.

The Sundown Solar Farm will connect to the electricity network via the existing onsite 330 kV Transgrid powerline.

The conceptual site layout is shown in Figure 3.1.

The project will also include the upgrade of the access road and Gwydir Highway/Spring Mountain Road intersection.

1.3 Project objectives

The project has the following key objectives:

- to support the NSW Electricity Strategy (DPIE 2019a) and NSW Electricity Infrastructure Roadmap (DPIE 2020a) by facilitating renewable energy input into the electricity network and by contributing to energy storage capacity in NSW
- to supply approximately 360 MW of electricity generating capacity to the NEM, thereby significantly contributing to the New England REZ
- to contribute to the overall storage capacity of the NEM
- to improve network reliability by providing back-up power during network disruptions
- to decrease average prices by smoothing out price differences (i.e. by arbitraging electricity price differences during peak and off-peak periods)

- to support the realisation of the *New England North-West Regional Plan 2036* (NSW Government 2017) goal to grow the New England North-West region as the renewable energy hub of NSW.

The project will create investments in local and regional economies, as well as flow-on benefits to local businesses and the local community. The project will also generate approximately 200 full time equivalent (FTE) jobs during the 21 month construction period (including approximately 400 FTE jobs during peak construction). The majority of workers are expected to be sourced from Inverell and Glen Innes.

1.4 The proponent

The proponent details are outlined in Table 1.1.

Table 1.1 Proponent details

Proponent	Sundown Solar Pty Ltd
Postal address	Principal place of business: Level 4, Suite 4.02, 99 King Street, Melbourne, Victoria, 3000 Registered office: Level 10, 68 Pitt Street, Sydney, NSW 2000
Contact	Samantha Coras
ABN	34 620 649 096
Details	Sundown Solar is a subsidiary of Canadian Solar (Australia) Pty Limited. Canadian Solar is an Australian-owned and operated business engaged in the development of a portfolio of solar energy projects across Australia. Canadian Solar provides PV solar panels, inverters and other related infrastructure, as well as solar services. Canadian Solar has been providing solar solutions to commercial and residential customers in more than 150 countries since 2001. Originally founded in Canada, Canadian Solar has over 14,000 employees globally, including over 50 employees in Australia.
Environmental record	No proceedings relating to environmental protection and conservation matters have been brought against or Sundown Solar Pty Ltd. It is considered that Sundown Solar Pty Ltd has a satisfactory record of responsible environmental management.

1.5 Background to the project

Sundown Solar Farm was originally owned by CWP Renewables Pty Ltd (CWP). In November 2017 CWP submitted the Preliminary Environmental Assessment (PEA) to the then Department for Planning, Industry and Environment (DPIE – now the Department of Planning and Environment, or DPE). DPIE issued the original Secretary's environmental assessment requirements (SEARs) to CWP on 15 December 2017. In April 2020, CWP requested revised SEARs, as the 2017 SEARs had expired. DPIE issued revised SEARs on 14 August 2020.

In February 2021, Sundown Solar purchased Sundown Solar Farm from CWP.

This EIS is based on the 2020 SEARs and the supplementary SEARs received on 4 October 2022 as a result of the project being deemed a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

During the preparation of the EIS, the development footprint within the project area was refined to consider the environmental constraints identified, outcomes of stakeholder engagement, community consultation and design of project infrastructure with the objective of developing an efficient project that avoids and minimises environmental impacts (Chapter 6).

1.6 Objective of this report

This EIS has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Sundown Solar to support an application for development consent under Part 4, Division 4.7 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The project is classified as State significant development (SSD) under the EP&A Act as it is within the meaning of 'electricity generating works' (clause 20) under Schedule 1 of the State Environmental Planning Policy (Planning Systems) 2021.

This EIS addresses the specific requirements provided in the SEARs issued by the DPIE (now DPE) on 14 August 2020 (SSD-8911), and the supplementary SEARs received on 4 October 2022 as a result of the project being deemed a controlled action under the EPBC Act.

The EIS has been prepared in general accordance with the following guidelines:

- *State Significant Development Guidelines – Preparing an Environmental Impact Statement* (DPIE 2021a)
- *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE 2021b)
- *Undertaking Engagement Guidelines for State Significant Projects* (DPIE 2021c)
- *Social Impact Assessment Guideline for State Significant Projects* (DPIE 2021d)
- *Large-Scale Solar Energy Guideline* (DPE 2022).

This EIS has also been prepared in accordance with the form and content requirements specified in clause 190 of the NSW Environmental Planning and Assessment Regulation 2021 (EP&A Regulation).

The primary objective of this EIS is to inform the public, government authorities and other stakeholders about the project and the measures that will be implemented to mitigate, manage and or monitor potential impacts, together with a description of the residual social, economic and environmental impacts.

1.7 Structure of this report

This EIS consists of a main report and a series of appendices (Appendix A–Appendix N). The main report describes the project in the context of the existing environment, the planning framework, key environmental issues, potential impacts, proposed mitigation measures and residual impacts. The main report is informed by the technical assessments contained in Appendix C to Appendix M and provides a summary of each technical assessment.

The SEARs are attached in Appendix A, with a reference to where each requirement has been addressed within this EIS. The structure of the EIS is summarised in Table 1.2.

Table 1.2 EIS structure

Chapter	Content
Preliminary	EIS certification and executive summary.
Chapter 1: Introduction	Introduces the project and the applicant; provides a brief discussion on the background of the project; discusses the objectives and benefits of the project; and outlines the document structure.
Chapter 2: Strategic context	Describes the strategic justification of the project; provides a brief overview on the regional context of the project and site suitability; and discusses the feasible alternatives to the project.
Chapter 3: Project description	Describes the project including construction and operational parameters, as well as the project location.
Chapter 4: Statutory context	Identifies the relevant State and Commonwealth environment and planning legislation and regulations, the applicable local and regional environmental planning instruments and discusses other approvals and permits that may be applicable to the project.
Chapter 5: Engagement	Describes the engagement strategies for the project, and details how consultation has been addressed in the project's design and assessment.
Chapter 6: Assessment of impacts	Assesses the key environmental issues, identifying the potential impact of the project. A description of the management measures proposed to mitigate and reduce potential adverse environmental risk of the project and/or offset any unavoidable impacts are provided.
Chapter 7: Justification	Summarises the evolution of the project design; strategic justification; statutory compliance; alignment with community views; the project impacts; cumulative impacts; how compliance will be ensured; key uncertainties, proposed mitigation measures; and conclusions.
Abbreviations	Contains abbreviations used in this EIS.
References	Contains references used in this EIS.
Appendices	
Appendix A	SEARs compliance table
Appendix B	Statutory compliance table
Appendix C	Biodiversity development assessment report
Appendix D	Aboriginal cultural heritage assessment
Appendix E	Statement of heritage impact
Appendix F	Land and rehabilitation assessment
Appendix G	Visual impact assessment
Appendix H	Noise and vibration impact assessment
Appendix I	Traffic impact assessment
Appendix J	Water assessment
Appendix K	Hazards and risk assessment
Appendix L	Bushfire risk assessment
Appendix M	Social impact assessment
Appendix N	Summary of mitigation measures

1.8 Key terminology

The key terminology applied throughout the EIS is outlined in Table 1.3.

Table 1.3 Key terminology

Terminology	Description
The project	The Sundown Solar Farm. This refers to all elements that comprise the project for which approval is sought.
The site	The area proposed to be developed as Sundown Solar Farm.
Project area	Comprises the three lots on which the project will be developed. The project area comprises the development footprint as well as the areas that will remain undeveloped. The project area comprises an area of approximately 2,097 ha.
Development footprint	The extent of surface area within the project area that will comprise project-related infrastructure (such as the PV panels, BESS, substation, switchroom, internal access roads etc). The development footprint comprises an area of approximately 651 ha.
Disturbance footprint	The extent of surface area within the project area that will be disturbed to facilitate the construction of the project plus the extent of surface area associated with the access road that will be disturbed to facilitate the construction of the access road and associated intersection (Figure 3.4). The disturbance footprint comprises an area of approximately 729 ha (including approximately 7.6 ha associated with the access road).

2 Strategic context

2.1 Introduction

The strategic context for the project takes into consideration the State and local strategic planning frameworks, the State and Commonwealth energy policy context and the land-uses in the region, including nearby renewable energy developments.

2.2 Project need

The NSW Government has an objective to achieve net zero greenhouse gas emissions by 2050. It also has an objective to deliver a 50% reduction in greenhouse gas emissions by 2030 compared to 2005 levels.

There are currently no plans for the development of new coal-fired power stations in NSW, and the development of renewable energy sources, such as solar, wind and pumped hydro is experiencing rapid growth (DPIE 2021f).

The NEM is a wholesale spot market for selling electricity and a transmission grid for transporting electricity to customers. The NEM experienced record levels of wind and solar generation in 2020, accounting for approximately 20% of total electricity generation (AER 2021). This growth is expected to increase into the future, with 26–50 gigawatts (GW) of large-scale wind and solar capacity forecast to come online over the next 20 years (AER 2021).

A range of studies and reviews have confirmed the need for sustainable renewable energy generation and storage projects. In particular, the *Independent Review into the Future Security of the National Electricity Market 2017* (Finke et al 2017), commissioned by the Council of Australian Governments (COAG) Energy Council, identifies solar and batteries as playing a critical role to support grid reliability when deployed at scale. It further recognises these energy sources as a critical enabler of greenhouse gas emissions reductions.

AEMO publishes an inaugural Integrated System Plan (ISP) which is updated every two years. The draft *2022 Integrated System Plan* (AEMO 2021) (draft 2022 ISP) was released in December 2021 for public comment. The draft 2022 ISP finds that the NEM must triple its overall generation and storage capacity if it is to meet the economy's electricity needs. The 2022 ISP also identifies the need for 45 GW/620 gigawatt-hour (GWh) of dispatchable storage capacity to efficiently operate and firm variable renewable energy into the future. The project will contribute to the generation, storage and dispatchability requirements identified in the 2022 ISP.

2.3 Commonwealth policy context

2.3.1 Commonwealth Government Net Zero 2050

*Australia's Long-Term Emissions Reduction Plan (*Commonwealth Government 2021) (ALERP) was released by the Commonwealth Government in October 2021.

ALERP provides a pathway for Australia to meet its obligations under the Paris Agreement's global goals, including limiting warming to "well below 2°C", and reaching global net zero emissions. ALERP focusses on the implementation of lower cost low emissions technologies, accelerating their deployment at scale, and positioning the economy to take advantage of new and traditional markets. It supports existing industries and workers to realise these benefits.

ALERP states that most major industry sectors in Australia will grow strongly to 2050, even as the world decarbonises, some sectors will be globally challenged and new industries such as clean hydrogen are expected to create new export markets and jobs. Sectors such as thermal, coal and natural gas are expected to be affected by falling global demand and the shifting choices of international consumers.

2.3.2 Large scale renewable energy target

The Australian Government Clean Energy Regulator administers the Large-scale Renewable Energy Target which incentivises investment in renewable energy projects. The Large-scale Renewable Energy Target of 33,000 GW hours of additional renewable electricity generation was met at the end of January 2021 (Clean Energy Regulator 2021). The annual target will remain at 33,000 GW hours until the scheme ends in 2030. Notwithstanding, the Clean Energy Regulator expects large-scale renewable generation will exceed this target.

2.4 NSW policy context

2.4.1 NSW Electricity Strategy

The *NSW Electricity Strategy* (DPIE 2019a) is the NSW Government's plan for a reliable, affordable and sustainable electricity future that supports a growing economy and sets out an approach to respond to emerging challenges. The Strategy recognises that where variable generators are unable to satisfy demand, other technologies that can provide electricity on demand (such as storage) is required.

Principle 1 of the *NSW Electricity Strategy* acknowledges renewables, firmed by dispatchable technologies, are the lowest cost form of reliable electricity generation and calls upon investment into these technologies to reduce electricity prices and ensure network reliability.

The Hunter-New England Renewable Energy Zone is one of the identified REZ's across the State to be coordinated by the Energy Corporation of NSW (EnergyCo NSW) under the Strategy and is planned to deliver of the order of 8 GW of new network capacity by 2030.

2.4.2 NSW Electricity Infrastructure Roadmap

The *NSW Electricity Infrastructure Roadmap* (DPIE 2020a) builds on the framework set out by the *NSW Electricity Strategy* (DPIE 2019a) and sets out a rationale for the policies and programs that are specifically designed to attract and secure that large-scale investment in new electricity infrastructure.

The *NSW Electricity Infrastructure Roadmap* (DPIE 2020a) recognises the findings of the 2020 ISP which finds that by mid-2030, NSW could need up to 2.3 GW of storage with 4 to 12 hours of duration to maintain system reliability and security under most scenarios. The project will contribute to this need for additional energy storage by providing peak capacity of up to 150 MW that can be dispatched as required to meet demand.

2.4.3 Net Zero Plan Stage 1: 2020-2030

The *Net Zero Plan Stage 1: 2020–2030* (DPIE 2020b) sets out how the NSW Government will deliver upon an objective to achieve net zero emissions by 2050 and has an objective to deliver a 50% cut in emissions by 2030 compared to 2005 levels. The project will support this objective by generating renewable energy and allowing for energy dispatch during periods where intermittent generators are not generating energy.

2.5 Strategic planning framework

2.5.1 New England North West Regional Plan 2036

The *New England North West Regional Plan 2036* (NSW Government 2017) (regional plan) is the key State strategic planning document for the Inverell region. One of the primary goals of the regional plan is to create economic diversity, and the plan identifies the growth of the New England North West region as the renewable energy hub of NSW. The project meets the objectives of the regional plan as it will contribute to the diversification of the regional economy and continue the successful investment in renewable energy projects in the Inverell LGA.

2.5.2 Inverell Community Strategic Plan 2009–2029

The principles of *Inverell's Community Strategic Plan 2009–2029* (Inverell Shire Council 2009) (strategic plan) include aspirations to protect and sustain the environment (see Destination 3 of the plan) and further develop a strong local economy (see Destination 4 of the plan). The project meets the principles of the strategic plan as the land when developed will continue to allow sustainable agriculture to occur on land within the project site and it will create construction jobs using local labour where possible and foster a strong demand for local services.

2.5.3 Large-Scale Solar Energy Guideline

The *Large-Scale Solar Energy Guideline* (DPE 2022) (the guideline) identifies the key planning considerations for solar energy development in NSW. It sets out guiding principles for a range of impacts, including the effects of renewable energy projects on agricultural activities.

This EIS considers the key principles of the guideline, including the sustainable growth of the solar industry, minimising impacts to agricultural land, managing visual impacts and sharing benefits with the community, while ensuring that impacts are appropriately considered, effective stakeholder engagement is undertaken, and investment in the industry is balanced with community interests. The project will contribute to greenhouse gas emissions reductions, and it will create jobs and investment in regional NSW. The option to run agriculture activities within the development footprint during operations is also possible (e.g. apiculture or grazing).

2.6 Site suitability

The site is suitable for the proposed development as it provides the following important benefits:

- presence of an electricity transmission corridor (with available network capacity) onsite
- within a renewable energy zone (REZ)
- zoned RU1 which is a prescribed zone where electricity generating works are a permissible land-use and the environmental and planning constraints can be effectively managed
- conveniently accessed from the Gwydir Highway
- adequate development footprint size
- suitable topography
- land that is primarily land soil classification (LSC) class 4 and 6
- landholder willingness to enter into access agreements
- suitable distance from potentially sensitive receptors
- suitable distance from major townships (approximately 30 km)
- avoids areas of high biodiversity value where possible.

2.7 Key features of the site and surrounds

2.7.1 Inverell LGA

The Inverell LGA covers an area of 8,600 km^2. The major towns within the LGA are Inverell, Ashford, Yetman, Delungra, Gilgai and Tingha. The key industry in the Inverell LGA is agriculture, primarily cropping.

Recreation areas in Inverell LGA comprise Single National Park (16 km south of the site), Kings Plains National Park (18 km north of the site), Mount Topper State Forest and Tingha Plateau State Conservation Area (both 16 km south-west). None of these areas would be affected by the project.

2.7.2 Site features

The potential constraints which have been considered in the project design are shown in Figure 2.1. The site has been used for agriculture for an extensive period of time. There are two 3rd order watercourses (Jessie Creek and Kateys Creek) which traverse the site. Swan Brook and Kings Creek traverses the access road.

The project would be accessed via the Gwydir Highway which connects Walgett to Grafton. The local roads providing direct access to the site (Spring Mountain Road and Sturmans Road) are terminating roads and predominantly provide access to rural properties.

The Armidale to Dumaresq Transgrid 330 kV transmission line directly crosses the site. There is a local 132 kV network that runs north of the site between the Inverell and Glen Innes substations.

White Rock Wind Farm has constructed a 132 kV line from the Inverell-Glen Innes line and has approval to connect the 132 kV line to the 330 kV line through an easement north of Sturmans Road. This proposed realigned connection would not interact with Sundown Solar Farm.

There are two associated properties within the project area and 21 non-associated properties (namely R1–R21) within a 4 km buffer of the project area boundary (Figure 2.2).

2.7.3 Extractive industry

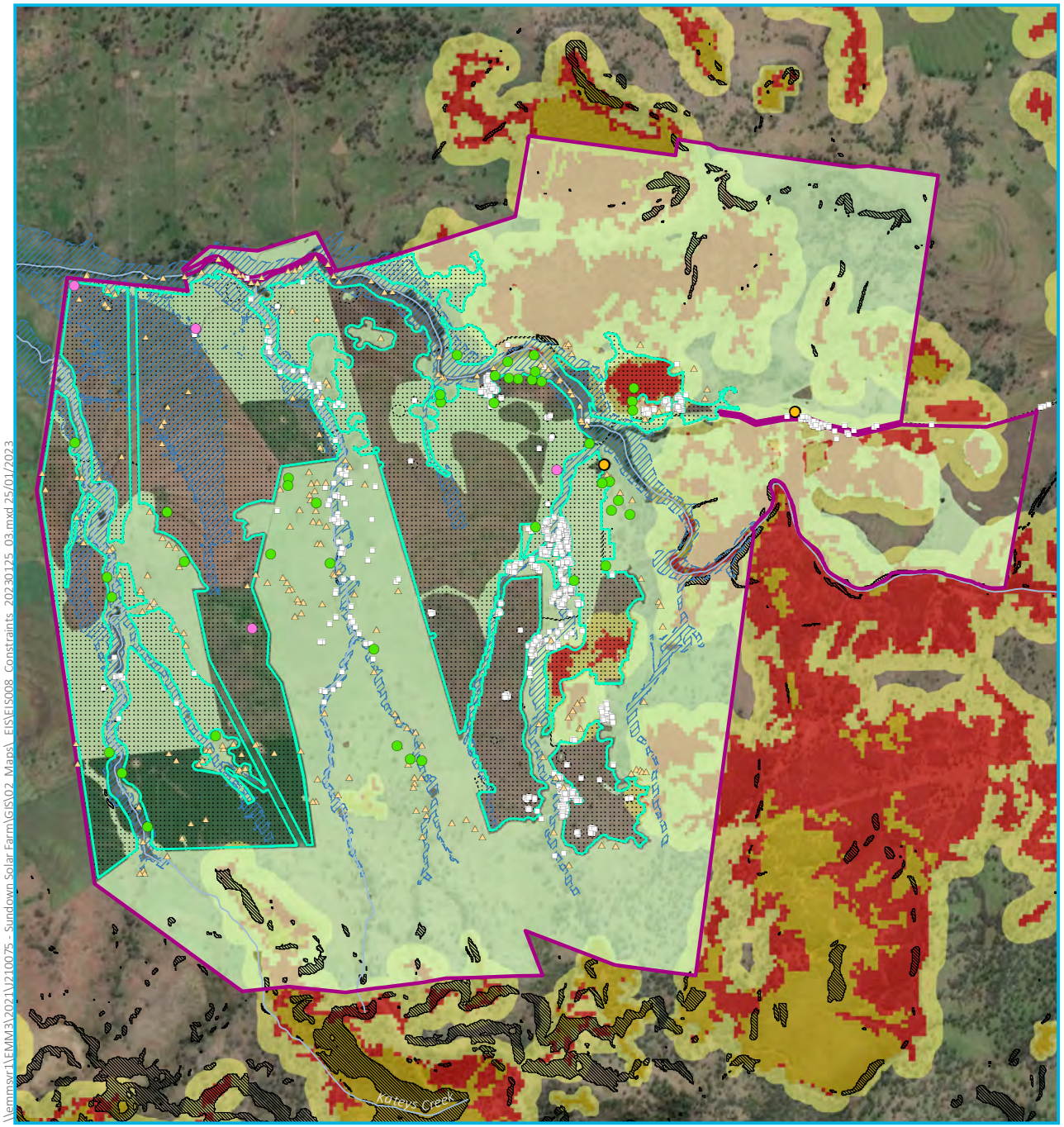
A small rhyolite quarry known as Frazier's Quarry is located on Lot 141 DP 753305, south of Sturmans Road, within the project area (Figure 3.3). The quarry is approved to operate under a local development consent issued by Inverell Shire Council (DA–78/2017) however is not currently operating.

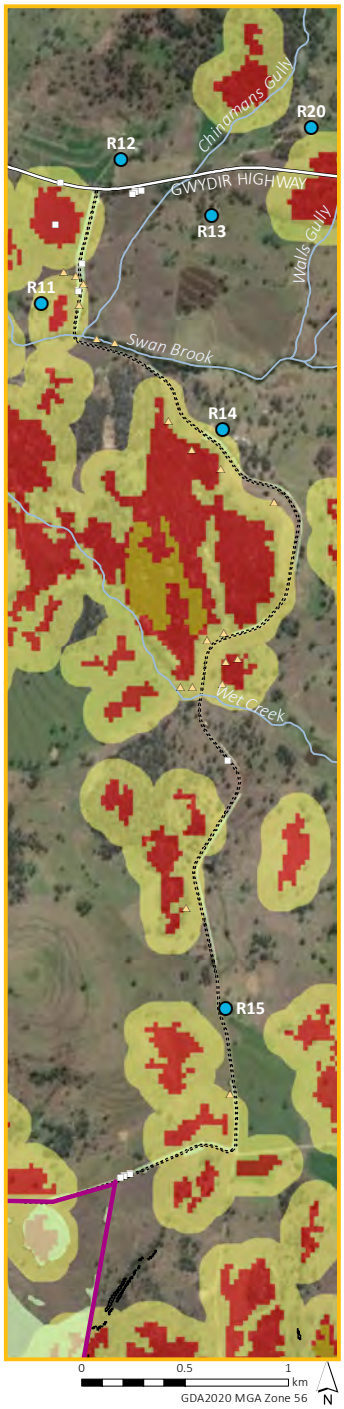
2.7.4 Mining lease 1505

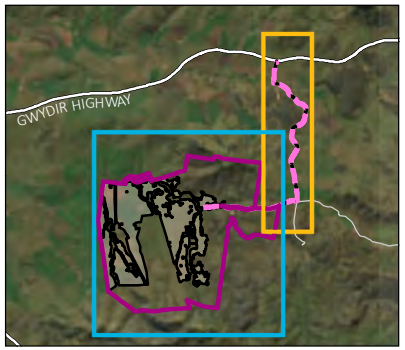
Mining lease (ML 1505) is located on Spring Mountain Road and includes a portion of the access road. ML 1505 is wholly outside of the development footprint. A lease cancellation request was made on 9 February 2021 with the NSW Government and was gazetted on 21 February 2021. The proposed Sundown Solar Farm project does not conflict with ML 1505.

2.7.5 Climate

Based on long-term climatic data for Inverell Research Centre (Bureau of Meteorology Station No. 0560180; (BoM 2021a) the climate of the project area has a warm temperate climate and is characterised by hot summers and cooler winter months. Long-term mean maximum annual temperature is 22.9°C, average annual rainfall is 793 mm/year and annual average pan evaporation rates between 1,400–1,600 mm/year (BoM 2021a, BoM 2021b).







KEY

- Proposed Sundown Solar Farm (Project area)
- Conceptual disturbance footprint
- Access road (refer to inset)
- Major road
- Minor road
- Named watercourse
- Associated property
- Non-associated property (noise assessment location)
- Aboriginal heritage site
- Historic heritage site
- Hollow-bearing tree
- Threatened species
- Box gum woodland
- Asset protection zone (APZ) - 10 m
- PMF flood extent
- Slope >20 degrees

NSW bush fire prone land category

- Vegetation category 1
- Vegetation category 2
- Vegetation buffer

Source: EMM (2023); DPIE (2022); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2020); RFS (2020)

0 0.5 1 km

0 0.5 1 km

GDA2020 MGA Zone 56

N

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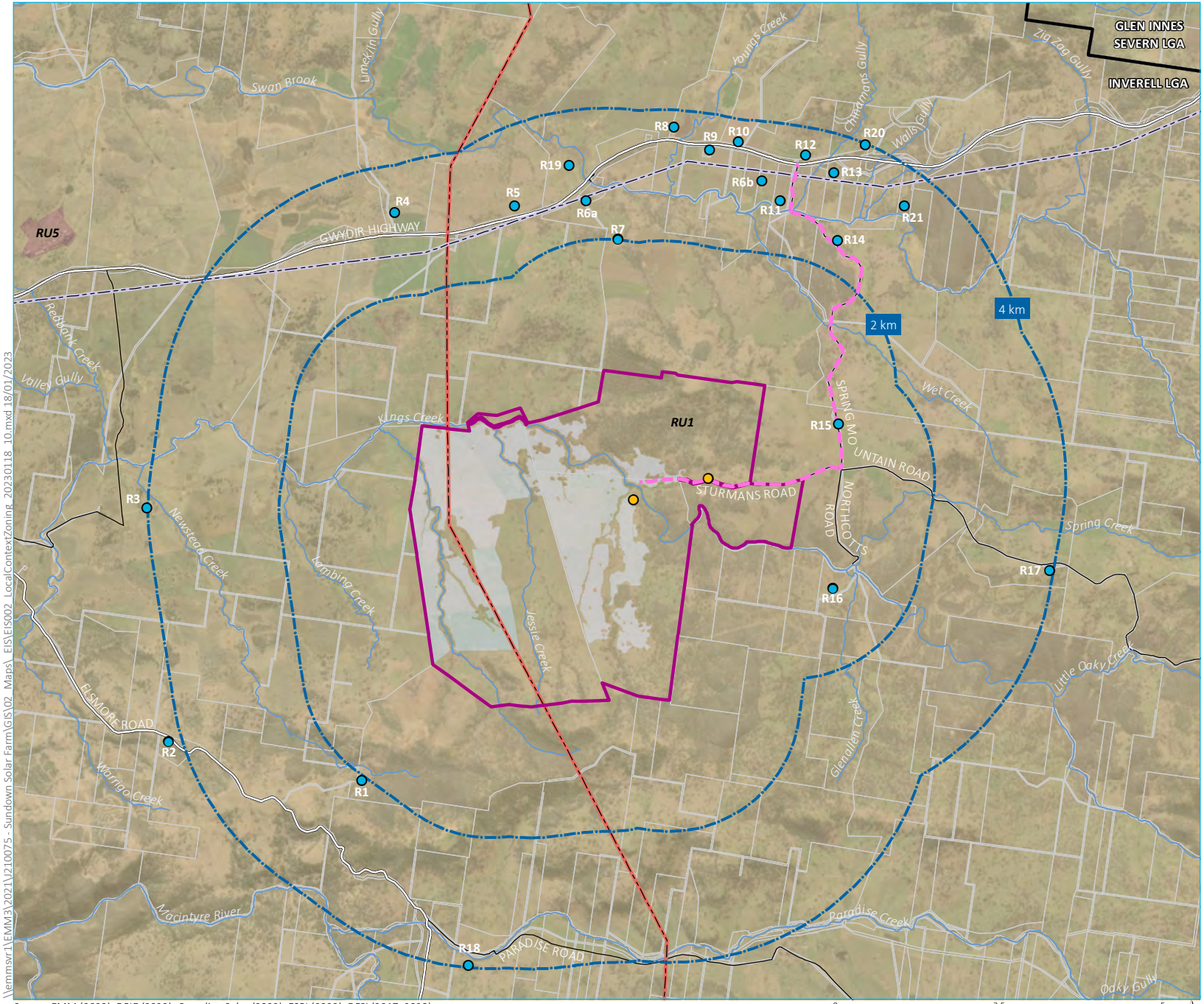
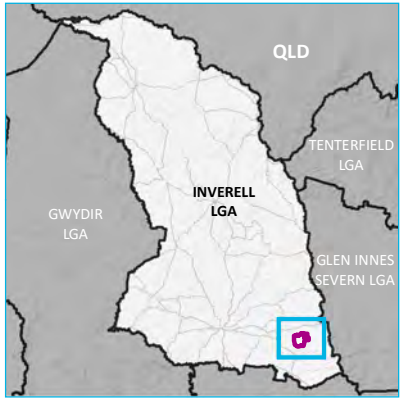
Constraints map

Sundown Solar Farm
Environmental impact assessment
Figure 2.1

EMM
creating opportunities





KEY

- Proposed Sundown Solar Farm (Project area)
- Access road
- Conceptual disturbance footprint
- Proposed Sundown Solar Farm (Project area) buffer
- Associated property
- Non-associated property (noise assessment location)
- Major road
- Minor road
- Named watercourse
- Cadastral boundary
- Local government area

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Inverell Local Environmental Plan 2012

Land zoning

- RU1 | Primary Production
- RU5 | Village

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Source: EMM (2023); DPIE (2022); Canadian Solar (2022); ESRI (2023); DFSI (2017, 2020)

0 2.5 5 km

GDA2020 MGA Zone 56

N

Local context and zoning

Sundown Solar Farm
Environmental impact assessment
Figure 2.2

EMM creating opportunities

2.7.6 Topography

The site consists of two primary ridges, sloping from south to north, subdivided by Jessie Creek and bordered by Kateys Creek to the west and an unnamed first order stream to the east. These ridges originate in a main ridge, running roughly east to west to the south of the project area at an elevation of over 900 m Australian Height Datum (AHD). Elevation at the southern end of the development footprint is around 805 m AHD sloping to 720 m AHD in proximity to Kings Creek at the northern end of the project area.

2.8 Nearby renewable energy projects

There are three operational renewable energy projects within the broader region, namely White Rock Wind Farm, White Rock Solar Farm and Sapphire Wind Farm. There are a further three that have been approved but have not yet been developed, namely White Rock Wind Farm stage 2, Sapphire Solar Farm and Glen Innes Wind Farm. These renewable energy projects are summarised in Table 2.1 and shown in Figure 1.1.

Table 2.1 Local renewable projects

Project	Generating capacity	Status	Approximate distance from Sundown Solar Farm project area
White Rock Wind Farm (Goldwind Australia) – approved in 2012. Stage 1 comprises 70 turbines. Stage 2 comprises 49 turbines.	175 MW	Stage 1 – operational Stage 2 – approved, yet to be developed	4 km east 4 km east
White Rock Solar Farm (Goldwind Australia) – approved in 2016. It is accessed from the Gwydir Highway.	20 MW	Operational	10 km east
Sapphire Wind Farm (CWP Renewables) – approved in 2013. It involves the operation of 109 turbines developed across three areas.	270 MW	Operational	3 km north
Sapphire Solar Farm (CWP Renewables) – was approved in 2018 and modified in 2021.	180 MW	Approved – yet to be developed	15 km north
Glen Innes Wind Farm (Glen Innes Pty Limited) was approved in 2009. It involves developing 25 turbines.	90 MW	Approved – yet to be developed	13 km east

2.9 Cumulative impacts

A screening cumulative impact assessment for the project has been undertaken in accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE 2021b). Cumulative impacts are discussed in Table 2.2 and in the applicable subsections of Chapter 6.

Table 2.2 Cumulative impact assessment

Aspect	Consideration
Agriculture	A very small portion of agricultural land in the Inverell LGA is currently used for renewable energy projects. The project will be developed on land which is currently used for agricultural activity (cropping and grazing). The project's development footprint is comparatively insignificant in comparison to the footprints of nearby renewable energy projects (Figure 1.1). Accordingly, the development of Sundown Solar Farm is not anticipated to have a significant cumulative impact on the removal of regional land available for agricultural use. SoilFutures (2023) has assessed the predicted loss of agricultural production (associated with the development of the 651 ha development footprint) to total $89,588 per annum. This is equivalent to less than 0.1% of the annual production of the Inverell LGA. The project will result in a temporary and reversible change in land use for land within the development footprint, noting there is potential for dual land use, as grazing or apiculture will be possible across much of the development footprint during operation. Implementation of the mitigation measures outlined in Appendix N will mean that the LSC within the development footprint is unlikely to change from its current capability and that land, soil and erosion risks are adequately managed and impacts to agriculture are minimised. After decommissioning, the project area will be rehabilitated and returned to agricultural land use. Accordingly, there are no significant agricultural cumulative impacts anticipated with the project.
Traffic	The site is accessed from the Gwydir Highway, which is a national freight highway and can accommodate the proposed project-related construction traffic. Goldwind Australia has approval to construct White Rock Wind Stage 2. Part of the proposed White Rock Wind Stage 2 (namely the construction of the alternative transmission line) will involve generation of construction traffic at the Gwydir Highway/Spring Mountain Road intersection and on Spring Mountain Road. Approximately 20% of the proposed White Rock Wind Stage 2 construction traffic for the alternative transmission line will use the Gwydir Highway/Spring Mountain Road intersection and on Spring Mountain Road. If this is the case, no cumulative traffic impacts are expected. Notwithstanding, Sundown Solar will continue to consult with Goldwind Australia to manage scheduling of construction works and to avoid/minimise cumulative impacts at the Gwydir Highway/Spring Mountain Road intersection. It is not anticipated that Frazier's Quarry will be operational during the Sundown Solar Farm construction period. However, if the quarry is operational during the Sundown Solar Farm construction period, the cumulative traffic impacts will be minimal as the quarry is restricted to a certain production limit that equates to a maximum of 12 trucks per day. Notwithstanding, Sundown Solar will continue to consult with the operator of Frazier's Quarry (an associated landowner) to manage scheduling and to avoid/minimise cumulative impacts at the intersection and on Spring Mountain Road. Sturmans Road will not be used by other nearby renewable developments during the project's construction or operational period. No other cumulative impacts to traffic are anticipated. Appropriate intersection treatments will be implemented if necessary under a Works Authorisation Deed with TfNSW to ensure safe turning for construction traffic from the Gwydir Highway to Spring Mountain Road.

Table 2.2 Cumulative impact assessment

Aspect	Consideration
Biodiversity	Approved renewable energy developments in the region have clear obligations in their respective approvals to avoid, manage and mitigate biodiversity impacts. Similarly, the Sundown Solar Farm has been designed to avoid and minimise as much biodiversity impact as practicable. The project will require clearing approximately 2.52 ha of Box gum woodland and 216.49 ha of derived native grassland. Large areas of the site that will be developed is cultivated or grazing land. Therefore, the potential biodiversity impacts of the project will be limited to this clearing. An offset strategy for the project will compensate for the residual impacts of the project and offsets will be secured in accordance with the mechanisms in the *Biodiversity Conservation Act 2016*, which will likely include securing a Biodiversity Stewardship agreement on land near to the development footprint. This will assist to improve biodiversity values over time and reduce the cumulative impact on biodiversity with other approved renewable energy projects. Therefore, the cumulative biodiversity impacts with the other approved renewable energy developments are unlikely to be significant if the range of avoidance and mitigation measures are implemented in conjunction with the offset strategy.
Noise	As outlined in the 'Traffic' row of this table, the construction schedule for Sundown Solar Farm is not anticipated to overlap with the construction schedule of other projects (including the construction of White Rock Stage 2). Similarly, it is not anticipated to overlap with the operation of Frazier's Quarry. Notwithstanding, Sundown Solar will continue to consult with Goldwind Australia and Frazier's Quarry to manage scheduling of construction and operation works and to avoid/minimise cumulative impacts, including noise, at the intersection and on Spring Mountain Road. Sundown Solar Farm is located far enough away from other developments to avoid generation of cumulative noise impacts during construction and operation. Nonetheless, standard noise mitigation measures will be implemented.
Aboriginal heritage	36 Aboriginal sites have been identified in proximity to the development footprint. 26 sites will be avoided, and 10 sites will be impacted to some degree. The impacted sites are isolated stone artefacts or low-density artefact scatters of low significance. The key mitigation measure for the impacted sites is surface collection prior to development. While it is acknowledged that the project will result in impacts to Aboriginal heritage sites, the results of the ACHA, along with the collection and cataloguing of artefacts will contribute to knowledge of artefact types and materials in the local area. The project offers the opportunity to maintain a cultural connection with the landscape by having continued access to the ochre site on Jessie Creek and will help to achieve intergenerational equity by allowing retention of cultural materials for the enjoyment and education of future generations. No significant cumulative impacts to Aboriginal heritage are anticipated in relation to the project.
Visual	The closest developments to the project are the White Rock wind and solar farm and the Sapphire wind and solar farm, which are approximately 4 km east and 3 km north of the project area, respectively. Based on the height of the PV panels, the presence of the undulating landscape, the presence of mature vegetation and the separation distances between the project and other renewable energy projects in the area, there is limited potential for combined views of the project and other renewable energy developments. Nonetheless, the visual impact assessment identified the potential for viewpoint 3 to have concurrent views of Sundown Solar Farm and White Rock wind and solar farm. Viewpoint 3 is predicted to experience a slight/moderate (cumulative) visual impact, however the potential impacts are not significant enough to warrant specific mitigation measures.

Table 2.2 Cumulative impact assessment

Aspect	Consideration
Hazards and risk	The PHA concluded that the project: • is not considered to be potentially hazardous within the meaning of the Hazards and Resilience SEPP • is located in a suitable area (i.e. a rural area) with considerable separation distance to sensitive receptors and in an area without any other hazardous developments in the vicinity of the project site • is not expected to have significant offsite hazard impacts • is not expected to generate electric and magnetic fields (EMF) levels that exceed ICNIRP levels for occupational exposure or for general public exposure levels • meets the HIPAP No.4 qualitative risk criteria. Hazard and risk assessments were completed for other renewable developments in the region and no specific cumulative impacts were identified. Assuming the mitigation measures outlined in Table 6.43 are implemented, the project is not expected to result in any significant hazards or risks, and hazard-related cumulative are unlikely to result.
Bushfire	The Bushfire Management Plan will be prepared in consultation with the local NSW RFS district office and will include a requirement to establish and maintain and APZ and to manage the landscaping within the APZ. Appropriate firefighting equipment will be installed, and bushfire prevention procedures will be implemented and will be regularly tested. With the implementation of the bushfire mitigation measures outlined in Appendix L, the risk of bushfire-related cumulative impacts will be minimised.

2.10 Agreements with other parties

2.10.1 Landowners

Sundown Solar had entered into lease agreements with the three associated landowners.

Sundown Solar has not entered into any agreements with associated or non-associated landowners in relation to mitigation of project impacts, as the impacts of the project are not significant enough to warrant such an agreement.

2.10.2 Community

Sundown Solar will establish a community benefits fund which will allocate funds annually for community-based projects. The details of the fund are yet to be determined but will likely be managed through a committee comprising representatives from the project owner, Inverell Shire Council and the local community.

2.10.3 Consent to submit development application

Written consent has been received to submit the development application from the following landowners:

- NSW Crown Lands
- Inverell Shire Council
- Lot 148 DP 753299
- Lot 141 DP 753305
- Lot 1 DP 1064358.

2.11 Feasible alternatives to the project

2.11.1 Do-nothing scenario

A do-nothing option would result in the project not being developed. A do-nothing scenario would result in the following outcomes:

- the community would not be able to take advantage of the proposed low-cost renewable energy generation system able to deliver reliable renewable energy to the grid
- associated landowners would not be able to diversify their land-uses and realise the benefits that would accrue to them under the landowner agreements with Sundown Solar
- opportunities for project-related regional employment (and associated regional spend) would not be realised, including the 400 FTE jobs during the peak construction
- Spring Mountain Road and Sturmans Road would not be upgraded
- the Spring Mountain Road/Gwydir Highway intersection would not be upgraded
- the broader public benefits would not be realised

- the project would not contribute to meeting the objective of the New England REZ, namely, to encourage the development of renewable energy projects within the zone.

2.11.2 Alternatives considered

i Design and layout

The design and layout of solar farms requires careful planning, to ensure maximum generating capacity and the ability to efficiently deliver energy to the grid. The project design is influenced over a period of time as greater knowledge of constraints is gained, and as changes to technologies are realised and implemented.

A number of changes to the project layout have been made since CWP first considered the project, and again since Sundown Solar assumed control of the project. These alternative layouts have in turn responded to site characteristics, constructability and the constraints which have been identified through the environmental studies which have been undertaken in the preparation of this EIS. The design changes have sought to provide maximum flexibility to where the solar arrays would be located. However, as the EIS progressed, and constraints and values of the land identified, the layout has been refined to avoid or minimise environmental impacts while seeking to maximising generating capacity.

Design iterations throughout the assessment process include:

- consideration of alternate access road via a private road west of Spring Mountain Road – this option was not pursued due to private land access constraints
- avoidance of PV panels within certain sections of first order watercourses where threatened species habitat exists
- avoidance of high value vegetation where it is possible to do so, and calculating offset liabilities for any necessary clearing
- not including paddocks in the east of the Newstead property (Figure 6.2) to avoid clearing of native vegetation
- avoiding the highest value LSC agricultural land (i.e. LSC 2) within the site and considering the continued use of the site post-construction for agricultural activities
- selection of 'portrait' orientation for PV panels (as opposed to 'landscape' orientation) – to minimise impact on footprint
- widening Spring Mountain Road and Sturmans Road to 8.7 m instead of creating passing lanes
- positioning infrastructure to avoid Aboriginal cultural heritage sites within the development footprint as far as practicable
- siting of key infrastructure components to minimise hazard and bushfire risks, and in areas less visible from neighbouring properties.

ii Location

The choice of location is a difficult process, taking into consideration a range of factors. The location of any solar farm relies principally on the potential generating capacity of the land and efficient access to the grid. Also, the ability to access to the site from the classified road network to import construction materials is desirable.

The project location was selected following a state-wide screening process by the previous project owner, CWP. The Inverell region was selected due to its suitability for large-scale solar PV and that there is already a number of approved renewable projects within the region. Due to favourable topography, lower levels of remnant vegetation and lower concentration of small-acre residential blocks, this region is more suitable for a large-scale solar development.

The location identified in the Scoping Report produced by CWP was the subject of planning and environmental constraints analyses, which identified the key risks and constraints to the project based on preliminary design considerations, the planning and assessment framework and the environment both within and surrounding the project investigation area. The results of these analyses informed the basis for subsequent surveys and assessment and confirmed the suitability of this location for the proposed development.

The location that was selected provides the following important benefits:

- presence of an electricity transmission corridor (with available network capacity) onsite
- within a renewable energy zone (REZ)
- zoned RU1 which is a prescribed zone where electricity generating works are a permissible land-use and the environmental and planning constraints can be effectively managed
- conveniently accessed from the Gwydir Highway
- adequate development footprint size
- suitable topography
- uses land that comprises mostly LSC 4 or higher
- landholder willingness to enter into legal agreements
- suitable distance from potentially sensitive receptors
- suitable distance from major townships (approximately 30 km)
- avoids areas of high biodiversity value where possible
- sited to minimise the visual impact to surrounding properties.

Alternate locations were considered in the screening process. None of these locations had all the attributes of this location and were not considered viable from technical, economic, social and/or environmental standpoints.

2.11.3 Project refinements

A number of environmental assessments have been undertaken to support this EIS (Chapter 6). The outcomes of these environmental assessments have been used to refine the project to avoid potential environmental impacts wherever possible. In instances where potential impacts cannot be avoided, the project has been refined to minimise environmental impacts. These refinements include design and procedural measures.

A summary of the key environmental constraints considered as part of the project refinement process is outlined in Figure 3.1 and in Table 2.3.

Table 2.3 Matters considered during project refinement

Aspect	Matters considered during project refinement
Biodiversity	A range of measures to avoid and minimise impacts to vegetation were considered during the project refinement process, resulting in avoidance of large areas where there are significant biodiversity values. Several eastern paddocks on the Newstead property were excluded from the project that included high quality grassland and woodland The refinement process to avoid vegetated areas of high biodiversity value has resulted in approximately 33 MW (DC) of generating capacity being sacrificed for the project. A key design principle within the project refinement process has been to maximise the placement of project infrastructure in cleared and cultivated areas and, wherever possible, and limit impacts where possible to areas of native vegetation with lower biodiversity or habitat values. The conceptual road upgrade design remains within the existing road reserve as much as possible and has sought to minimise the clearance of native vegetation. The conceptual development footprint therefore minimises the impacts on the threatened ecological communities and habitats within the site, to the greatest extent possible.
Aboriginal heritage	The project refinements have considered the potential impacts to cultural heritage sites. The placement of PV panels has considered items of higher cultural value (e.g. scarred trees). The construction laydown area was finalised only after first undertaking test pitting, which did not discover significant finds. While 10 sites will be impacted by the project, most of these sites are artefact scatters that will be salvaged prior to the commencement of construction.
Historical heritage	The project area was once part of the larger Newstead Station, however very little development appears to have been located within the portion of the station that comprises the proposed development footprint. There are four historical sites within the development footprint. As it is not practical to avoid these sites, and as none of these sites meet the threshold for local significance, each site will be recorded and will then be developed as part of the project.
Land, soil and erosion	Sundown Solar has refined the project to minimise impacts on agricultural land, wherever possible. The project does not preclude the ability for the land to be used for agriculture during operations and for the land to be returned to its current agricultural use, after closure and decommissioning.
Visual	Due to the local topography and the presence of mature vegetation, no significant visual impacts are anticipated.
Noise and vibration	A number of locations were considered for the noise-generating infrastructure (including the substation and BESS), with the concept design showing these infrastructure components placed as far as practicable from nearby residences. The detailed design will also take into consideration the location of residences and the noise predictions made for the project.
Traffic and transport	Two site access options were considered, namely: • a private road from Gwydir Highway to the north of the site • Spring Mountain Road and Sturmans Road. The private road option was found not to be feasible as it would have required construction of a new highway intersection and would have potentially resulted in a greater amount of high biodiversity value vegetation being cleared in comparison to the selected access route. The proposed access road was selected as it only requires minor upgrades to the existing Gwydir Highway/Spring Mountain Road intersection. The upgrade will result in improved safety for users of the highway. Similarly, the upgrade of Spring Mountain Road and Sturmans Road will improve public safety and accessibility for residents using that route.
Water	The development footprint has been refined to avoid third order streams and to minimise the number of creek crossings required as part of the project's internal access tracks. Flood modelling outputs resulted in refinements being applied to the location of solar panels in the northern area of the site. The majority of first and second order watercourses within the development footprint have reasonably undefined channels. Nonetheless, the placement of project infrastructure within the development footprint will avoid first and second order streams, wherever possible. Sundown Solar has avoided locating critical infrastructure in major flow paths in order not to create significant flood impacts.

Table 2.3 Matters considered during project refinement

Aspect	Matters considered during project refinement
Hazards and risks	The BESS will be designed so that the separation distances between the BESS sub-units meets relevant standards. The site layout allows for adequate separation distance to surrounding land uses (i.e. agricultural operations) and includes fencing to assist in limiting the exposure to EMF for the community.
Bushfire	The conceptual site layout is designed to meet the aims and objectives of *Planning for Bush Fire Protection* (PBP) (RFS 2019) guideline and to comply with the *Rural Fires Act 1997*, as applicable.
Social	The site selection process has considered proximity to local and regional centres and the availability of local businesses, accommodation services and a local labour force.

3 Project description

3.1 Overview of the project

The project involves the development, construction and operation of a solar PV electricity generation facility and associated BESS.

Key infrastructure is shown in Figure 3.1 and comprises:

- a network of approximately 660,000 panels and associated mounting infrastructure
- a 150 MW BESS
- a 330 kV onsite substation
- electrical collection and conversion systems, including inverter and transformer units, switchyard and control room
- underground and aboveground cables
- a management hub, including demountable offices and amenities and equipment sheds
- onsite creek crossings
- security fencing
- temporary laydown areas (during construction and decommissioning)
- parking and internal access roads
- lighting
- firefighting infrastructure.

The project will also include the upgrade of the access road (Spring Mountain Road and Sturmans Road) and the Gwydir Highway/Spring Mountain Road intersection.

During the preparation of the EIS, the development footprint has been refined to consider any environmental constraints identified, outcomes of stakeholder engagement, community consultation and design of project infrastructure with the objective of developing an efficient project that avoids and minimises environmental impacts.

The project will have a targeted electricity generating capacity of up to 360 MW (AC) and up to 150 MW (AC) four-hour energy storage. The final number of PV modules will be dependent on detailed design, availability, and commercial considerations at the time of construction.

Electricity generated by the project will be injected into the grid via a new onsite substation connected to Transgrid's 330 kV transmission line that traverses the site (Figure 3.1 and Photograph 3.1).

The key elements of the Sundown Solar Farm are outlined in Table 3.1.

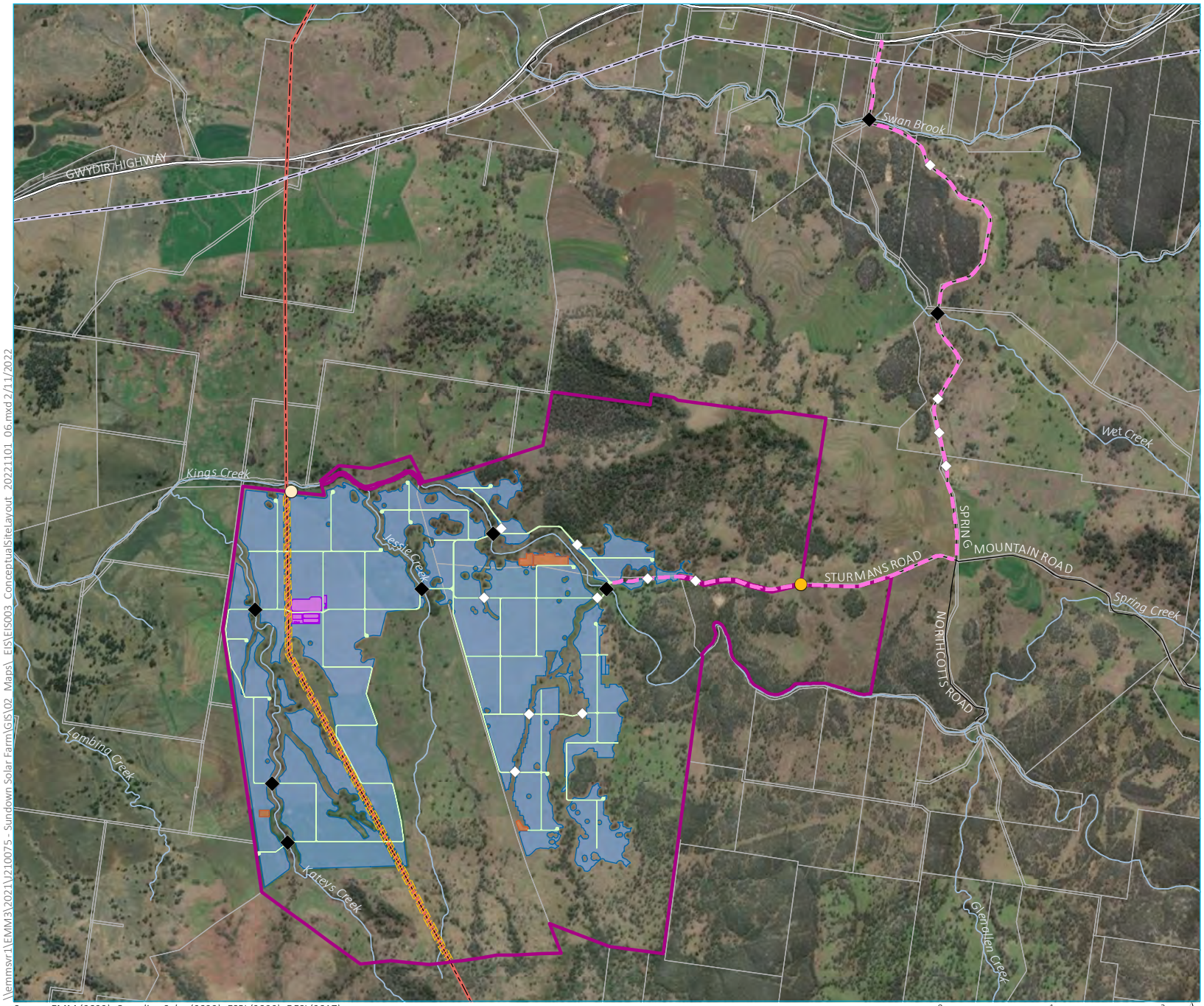
Table 3.1 Key elements of the project

Project element	Summary
Proposed capacity	Generation capacity of 360 MW. Storage capacity of 150 MW (AC) (4 hours).
Key infrastructure	Key infrastructure is shown on Figure 3.1 and comprises: • a network of approximately 660,000 panels and associated mounting infrastructure • a 150 MW battery energy storage system (BESS) • 330 kV substation connected to the existing onsite 330 kV overhead powerline • electrical collection and conversion systems, including inverter and transformer units, switchyard and control room • underground and aboveground cables • a management hub, including demountable offices and amenities and equipment sheds • onsite creek crossings • security fencing • temporary laydown areas (during construction and decommissioning) • parking and internal access roads • lighting • firefighting infrastructure. The project will also include the upgrade of the access road and Gwydir Highway/Spring Mountain Road intersection.
Footprint size	The project area covers approximately 2,097 ha and the development footprint covers approximately 651 ha (Figure 3.1).
Location	Spring Mountain, approximately 30 km east of Inverell and approximately 38 km west of Glen Innes in the New England Tablelands region of northern NSW (Figure 1.1). The site is located within the New England REZ.
Lot and DP description	• Lot 148 DP 753299 • Lot 141 DP 753305 • Lot 1, DP 1064358.
Land use and zoning	The entire site is zoned RU1 – Primary Production under the *Inverell Shire Local Environmental Plan 2012* (NSW Government 2012) (Inverell LEP) and is currently and has historically been used for farming (cropping and grazing). There is some Crown land within the site, largely associated with road reserves. The surrounding land is used for farming. There are three operational renewable energy farms within the broader region, namely White Rock Wind Farm, White Rock Solar Farm and Sapphire Wind Farm. There are a further three that have been approved but have not yet been developed, namely White Rock Wind Farm stage 2, Sapphire Solar Farm and Glen Innes Wind Farm. These renewable energy projects are summarised in Table 2.1 and shown in Figure 1.1.
Site access	The site will be accessed from the Gwydir Highway, then Spring Mountain Road then Sturmans Road (Figure 3.1).
Project schedule	• 2023: Development approval • 2023–2025: Construction period (21 months) • 2025–2060: Operation (up to 35 years) • 2060: Closure and rehabilitation.

Table 3.1 Key elements of the project

Project element	Summary
Construction duration and hours	Construction of the project will take approximately 21 months from the commencement of site establishment works. Construction activities will be undertaken during the standard daytime construction hours of: • 7.00 am–6.00 pm Monday to Friday • 8.00 am–1.00 pm Saturday. In general, no construction activities will occur on Sundays or public holidays. Exceptions to these hours may be required on limited occasions. Regulatory authorities (including the Inverell Shire Council) and surrounding landholders will be notified of any exceptions prior to any works being undertaken.
Operation duration and hours	The project will be operated, 7 days per week, 365 days per year. The project has a life expectancy of approximately 35 years.
Employment	The average construction workforce throughout the 21 month construction period will be approximately 200 FTE jobs. During the peak construction period, a workforce of approximately 400 people will be required on site. The approximate breakdown per stage is: • Stage 1: 100 FTE • Stage 2: 400 FTE (at peak) • Stage 3: 75 FTE. The project will directly employ two to three people FTE during the operation phase. It is anticipated that the majority of the construction and operations workforce will be drawn from the region.
Workforce accommodation	It is anticipated that the majority of the construction and operations workforce will be drawn from the region. Accordingly, there will be limited need for additional accommodation facilities to accommodate the workforce. The exception may be during the peak construction period (stage 2). During stage 2, there may be a need to bring in a portion of the construction workers from outside of the region. If required, this additional workforce will be accommodated in existing short-term accommodation in the region (largely in Glen Innes and Inverell).
Capital investment value	Approximately $689,514,000

Photograph 3.1 Existing onsite overhead transmission line



KEY

- Proposed Sundown Solar Farm (Project area)
- Major road
- Minor road
- Named watercourse
- Cadastral boundary

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Emergency access/egress point

- Primary
- Secondary

Potential water crossing

- Named watercourse
- Drainage line

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Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

0 1 2 km

GDA2020 MGA Zone 56

N

Conceptual site layout

Sundown Solar Farm
Environmental impact assessment
Figure 3.1

EMM creating opportunities

3.2 Project area

The site is located on Sturmans Road, Spring Mountain, approximately 30 km east of Inverell and approximately 38 km west of Glen Innes in the New England Tablelands region of northern NSW (Figure 1.1).

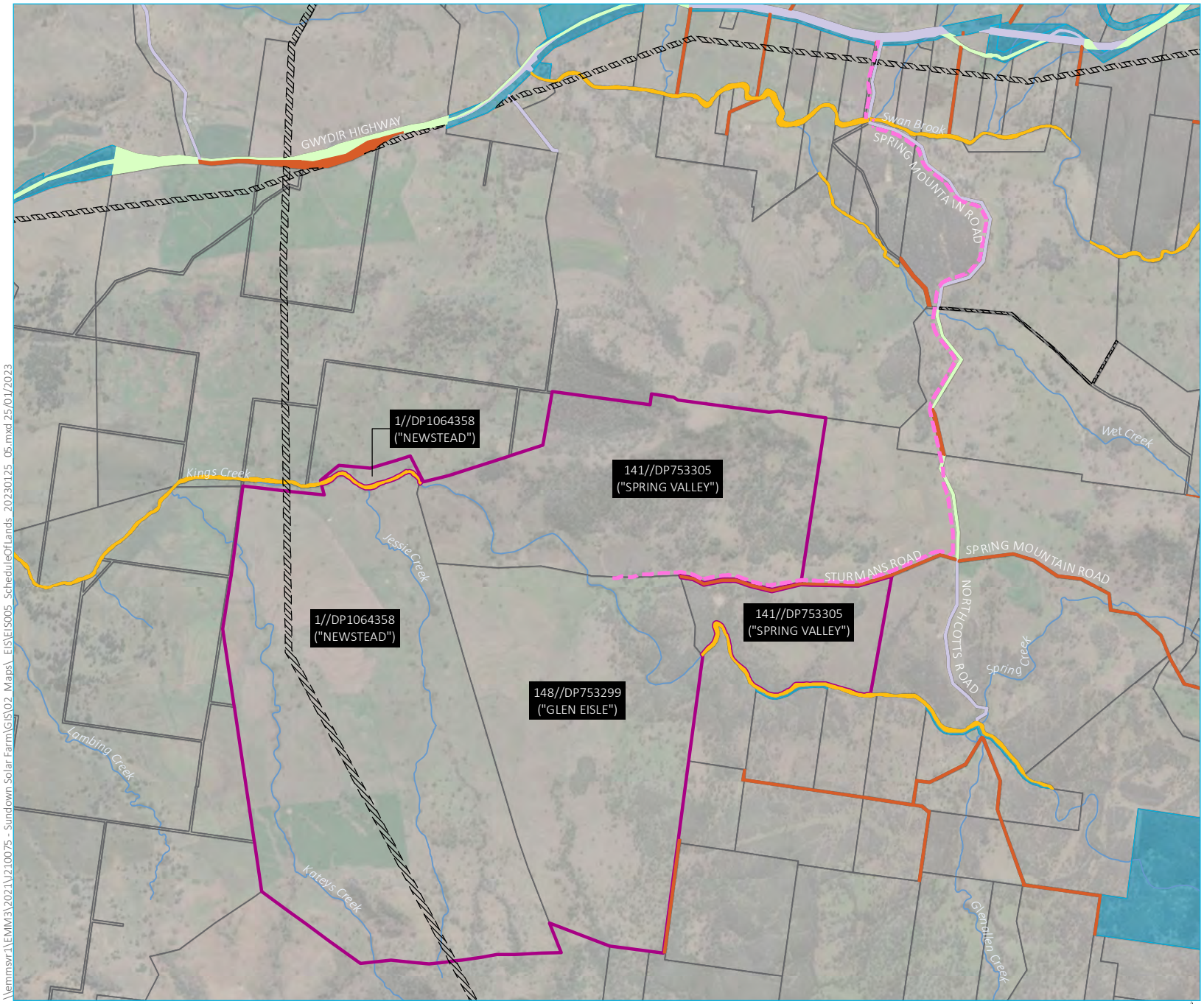
3.2.1 Land use and zoning

The project is located within the Inverell Shire local government area (LGA) (Figure 2.2) and comprises three privately owned lots, namely Lot 148 DP 753299, Lot 141 DP 753305 and Lot 1, DP 1064358 (Figure 3.2). The entire site is zoned RU1 – Primary Production under the Inverell LEP and is currently and has historically been used for farming (cropping and grazing) (Figure 3.3, Photograph 3.2 and Photograph 3.3). The surrounding land is used for farming.

There are three operational renewable energy farms within the broader region, namely White Rock Wind Farm, White Rock Solar Farm and Sapphire Wind Farm. There are a further three that have been approved but have not yet been developed, namely White Rock Wind Farm stage 2, Sapphire Solar Farm and Glen Innes Wind Farm. These renewable energy projects are summarised in Table 2.1 and an example is shown in Photograph 3.4.

A number of Crown roads and/or road reserves are located in the project area (Figure 3.2). This land is currently either subject to closure or will be closed as required in consultation with the NSW DPIE Crown Land department in parallel with the planning assessment and approval process for the project.

The project is located close to Transgrid's 330 kV transmission line, which passes through the site (Figure 3.1 and Photograph 3.1). The site has good access to the Gwydir Highway and is accessed from Sturmans Road via Spring Mountain Road (Figure 3.1).



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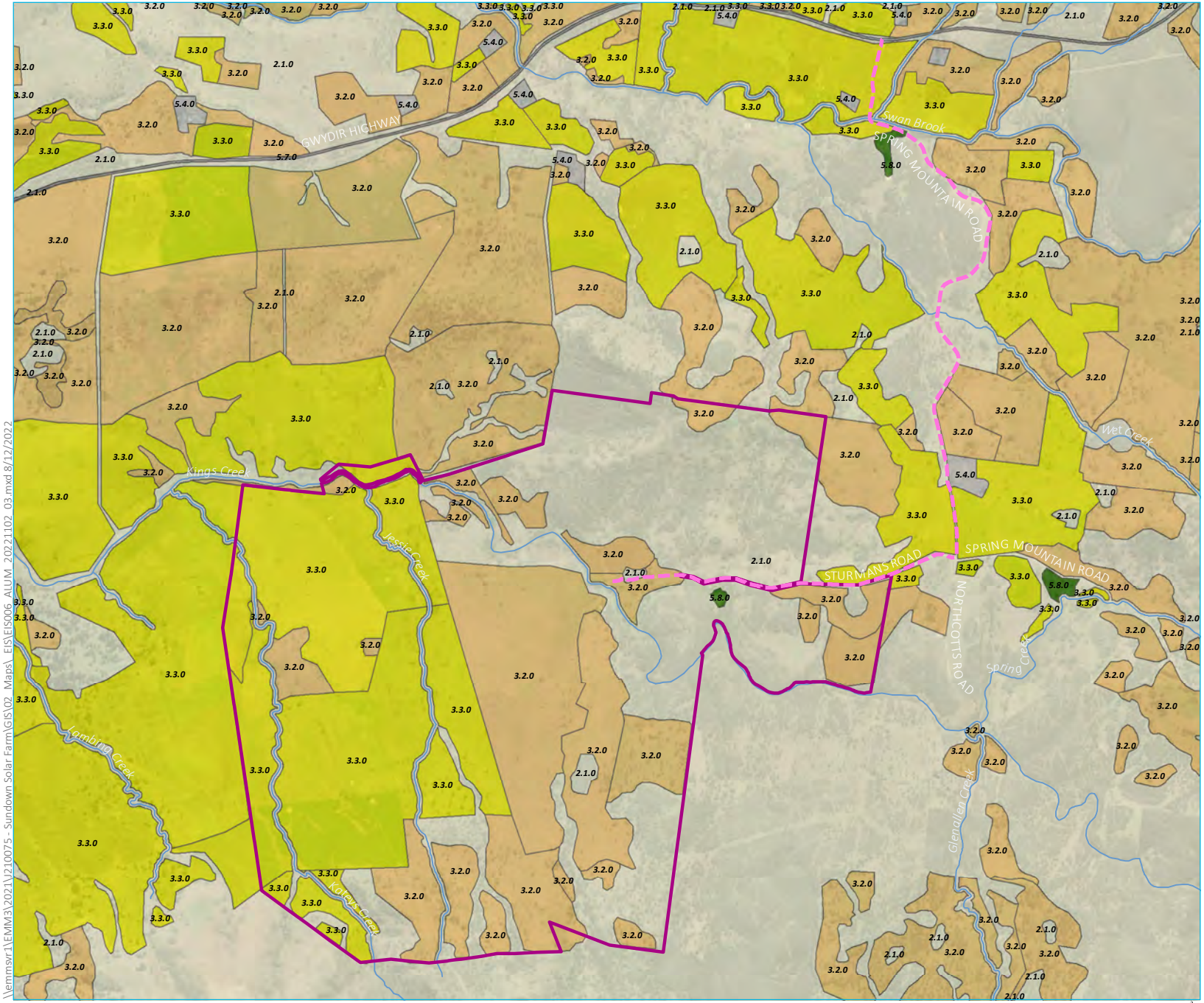
Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017)

Schedule of land

Sundown Solar Farm
Environmental impact assessment
Figure 3.2

EMM
creating opportunities



KEY

- Proposed Sundown Solar Farm (Project area)
- Access road
- Named watercourse

ALUM classification (v1.2)

- 2.1.0 Grazing native vegetation
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 5.4.0 Residential and farm infrastructure
- 5.7.0 Transport and communication
- 5.8.0 Mining

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DPIE (2020) DFSI (2017)

0 1 2 km

GDA2020 MGA Zone 56

N

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Australian Land Use and Management (ALUM) classification mapping

Sundown Solar Farm
Environmental impact assessment
Figure 3.3

EMM creating opportunities

Photograph 3.2 Grazing onsite

Photograph 3.3 Cropping onsite

Photograph 3.4 View from project area of nearby windfarm

3.2.2 Project footprint

The project area covers an area of approximately 2,097 ha and comprises three privately-owned lots and a portion of the access road. The project area comprises the development footprint as well as the areas that will remain undeveloped.

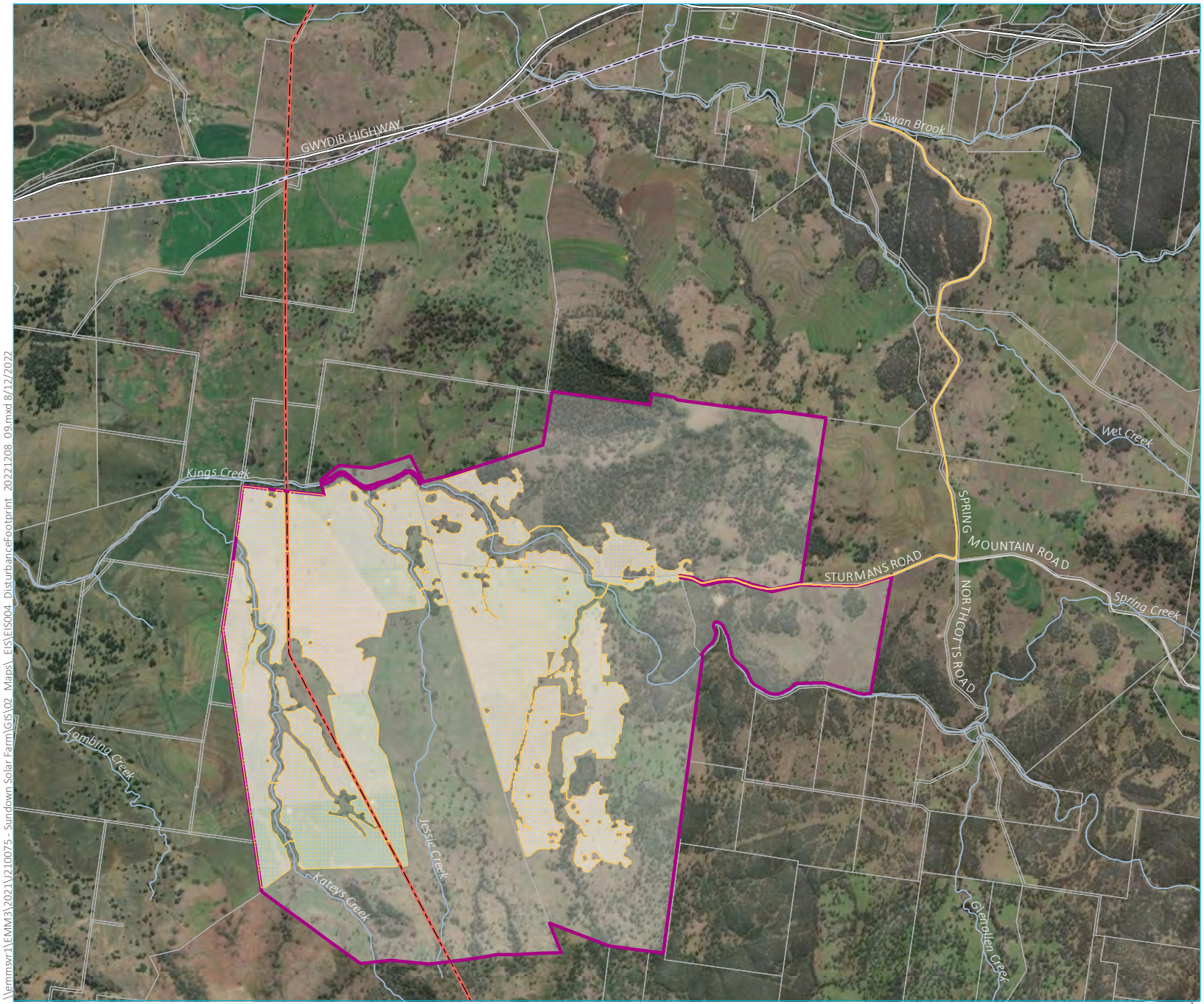
The development footprint covers an area of approximately 651 ha and comprises the land within the project area on which project-related infrastructure will be located, including PV panels, the space between the panel rows, internal access roads, the substation and the BESS etc. The project area and development footprint are shown in Figure 3.1.

Subject to detailed design and consultation with the project landholders, security fencing and creek crossings may be required on land outside of the development footprint, but within the project area.

The disturbance area covers an area of approximately 729 ha and comprises the extent of surface area within the project area that will be disturbed to facilitate the construction of the project (Figure 3.4). It also includes the land that will be disturbed as part of the upgrade of the access road.

3.2.3 Subdivision

To accommodate the substation and the BESS, approval is also sought for the subdivision of Lot 1/1064358. The conceptual subdivision plan is shown in Figure 3.5. The subdivided lot(s) will be less than the minimum 200 ha as allowed under local planning regulations. However, the proposed subdivision is permissible under Section 4.38 of the EP&A Act subject to the approval of the Minister for Planning.



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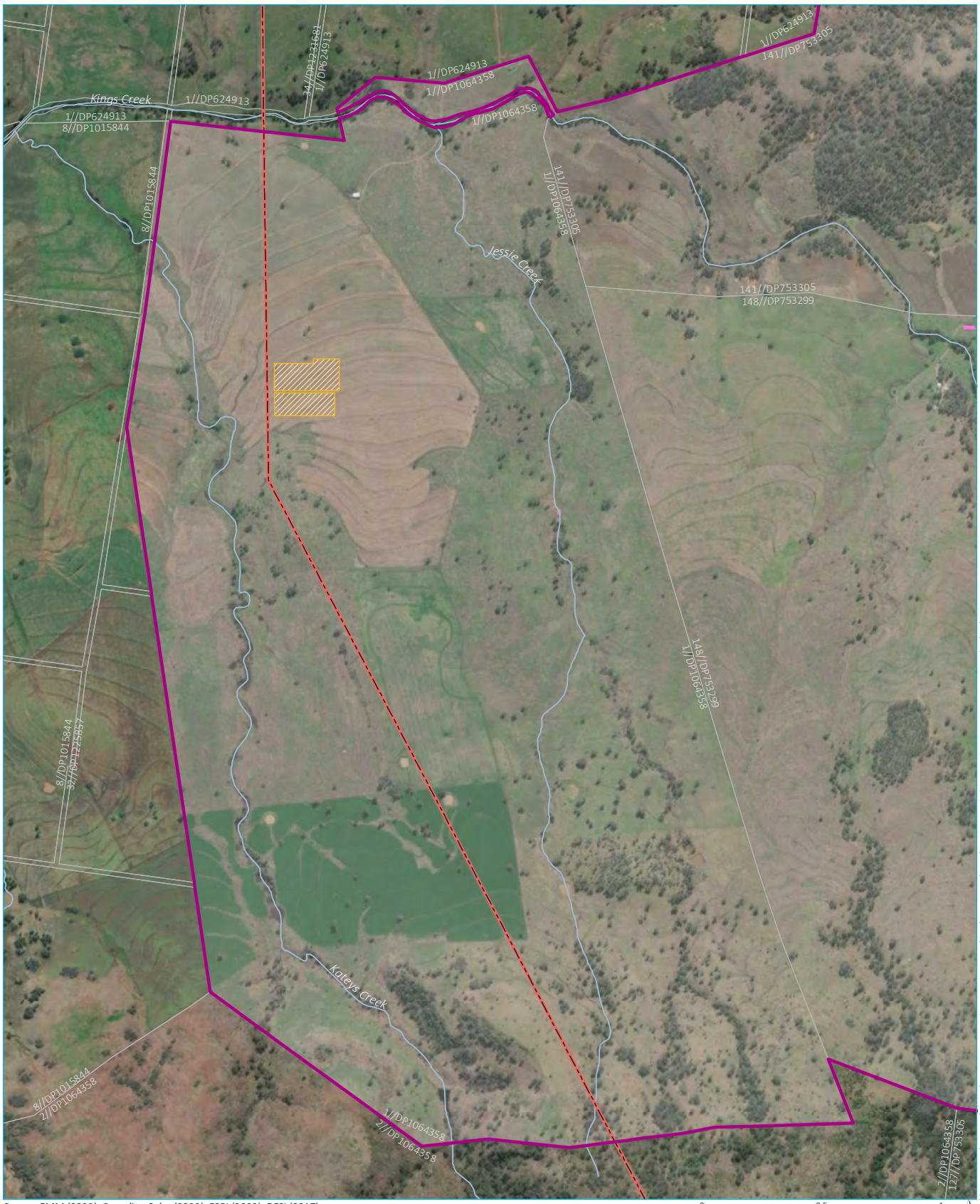
Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

Conceptual disturbance footprint

Sundown Solar Farm
Environmental impact assessment
Figure 3.4

EMM
creating opportunities



Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

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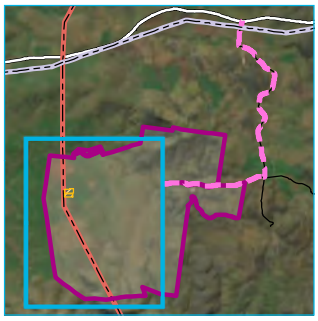


KEY

- Proposed Sundown Solar Farm (Project area)
- Access road
- Conceptual Subdivision Plan

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)
- Major road (refer to inset)
- Minor road (refer to inset)
- Named watercourse
- Cadastral boundary

Conceptual subdivision plan

Sundown Solar Farm
Environmental impact assessment
Figure 3.5

EMM
creating opportunities

3.3 Physical layout and design

The key infrastructure is described in Table 3.1 and Figure 3.1 and comprises:

- a network of approximately 660,000 panels and associated mounting infrastructure
- a 150 MW BESS with up to four-hour storage capacity
- 330 kV substation connected to the existing onsite 330 kV overhead powerline
- electrical collection and conversion systems, including inverter and transformer units, switchyard and control room
- underground and aboveground cables
- a management hub, including demountable offices and amenities and equipment sheds
- onsite creek crossings
- security fencing
- temporary laydown areas (during construction and decommissioning)
- parking and internal access roads
- lighting
- firefighting infrastructure.

The project will also include the upgrade of the access road and Gwydir Highway/Spring Mountain Road intersection.

3.3.1 PV modules

The PV modules will be installed in a series of rows aligned in a north-south direction and spaced approximately 5–7 m apart. The PV modules will be mounted onto a single axis tracker (SAT) system. The SAT system is designed to track the movement of the sun so that the panels constantly move to align towards the sun. An example of rows of PV modules utilising single axis tracking technology is provided in Photograph 3.5.

Photograph 3.5 Example of a PV module row with single axis tracker

The PV modules and the associated SAT will be supported on ground-mounted frames consisting of vertical posts (piles) and horizontal rails (tracking tubes). Rows of piles will be driven or screwed into the ground, depending on the geotechnical conditions, and the supporting racking framework will be mounted on top. Pre-drilling and/or cementing of foundations will be avoided if allowed by the geotechnical conditions.

The height of the PV modules at their maximum tilt angle (typically up to 60 degrees) will be up to 4 m. Additional site-specific clearance of approximately 400 mm may be required to avoid flooding risk or to improve access for sheep to graze underneath the PV modules. If installed at this height, the leading edge of each PV module may be up to 1.2 m from the ground. This would enable sheep to graze fully unimpeded beneath the PV module rows.

The modules will be configured in a portrait orientation, to maximise the area of ground available.

The PV modules will be connected to the inverters via underground cabling.

PV modules will be installed in accordance with the relevant Australian Standards including AS 5033.

3.3.2 Battery energy storage

The BESS will have a capacity of up to 150 MW with up to four hours of energy storage. The BESS will draw and store energy from the grid and/or from the Sundown Solar Farm during off-peak periods. This energy will be dispatched back into the grid during peak periods, thereby improving grid reliability and network stability.

The BESS will be located adjacent to the substation and will be connected to the substation.

The BESS will use lithium-ion batteries. Batteries will be stored in fully enclosed shipping or modular containers, mounted on concrete pads (Photograph 3.6 and Photograph 3.7). Subject to final design and equipment selection, each battery bank will be approximately 13 m long, 3 m wide and 3 m high, similar to a typical 40 foot (ft) shipping container (or two 20 ft shipping containers). The battery banks will be placed in rows and will be separated by a gravel surface.

The height of footings for the battery storage containers will be raised above the mapped 1 in 100 year flood event.

Photograph 3.6 Example of containerised batteries

Photograph 3.7 Example of a modular battery solution

3.3.3 Substation

Power generated onsite will be fed into the 330 kV Transgrid transmission line via the onsite substation.

The substation is required to transform medium voltage (MV) to high voltage (HV), and vice versa. The substation will have a capacity of 33 kV/3,300 kV and will have a footprint of approximately 100 m wide, 160 m long and 10.3 m high.

The substation will be mounted on concrete hardstand or skid and will be raised above the mapped 1 in 100 year flood event.

The substation will likely consist of an indoor switch room to house MV circuit breakers, and an outdoor switch yard to house the transformer(s), gantries and associated infrastructure.

3.3.4 Electrical collection and conversion system

The PV modules will be connected to the inverters via underground cabling. Inverters will convert the DC to alternating current (AC) with medium voltage (MV) and/or high voltage (HV) transformers increasing the voltage for export to the grid.

Contingent on procurement, approximately one inverter and transformer assembly are required for every 5 MW (AC) of installed capacity. These assemblies will be positioned within or adjacent to each block of modules. Inverter and transformer assemblies can be mounted on a steel platform (skid) or slab at ground level and will typically occupy an area of 0.003 ha – equal to a 40 ft shipping container (12 m x 2.4 m).

Cables will be buried and covered to a depth that meets Australian standards and where cables are buried in the same trench, a minimum calculated separation to ensure thermal constraints are complied with will be maintained.

3.3.5 Control room

The entire facility will be controlled remotely via a supervisory control and data acquisition (SCADA) system housed in the control room. The control room will be approximately 8 m wide, 12 m long and up to 6 m high.

The control room will be mounted on concrete hardstand or skid and will be raised above the mapped 1 in 100 year flood event.

3.3.6 Management hub

The management hub will comprise demountable offices, amenities, and equipment sheds.

3.3.7 Intersection upgrades

To ensure project construction traffic does not significantly affect traffic flows on the Gwydir Highway, the project will include the installation of a basic left turn (BAL) treatment (if the BAL has not already been installed by White Rock Wind Farm (noting this is a requirement of their development consent) and a channelised right turn (CHR) treatment at the Gwydir Highway/Spring Mountain Road intersection.

Further detail about the intersection upgrade is provided in Section 6.7.

3.3.8 Access road upgrades

To accommodate the construction traffic, the project will include the widening of the access road (Spring Mountain Road and Sturmans Road) to 8.7 m. The upgraded road will be compacted and gravelled.

The existing reinforced concrete box culvert on Spring Mountain Road (over Swan Brook Creek) and the existing bridge on Sturmans Road (over Kings Creek) will be upgraded to accommodate B-double trucks.

The existing culverts and bed level crossings on the access road will be upgraded to upgraded to accommodate B-double trucks.

Further detail about the access road and water crossing upgrades is provided in Section 6.8.

3.3.9 Operations and maintenance buildings

The operations and maintenance building will be used for undertaking plant and equipment maintenance, storage and for staff amenities. The operations and maintenance building will be approximately 8 m wide, 12 m long and up to 6 m high.

3.3.10 Fencing, security and lighting

The site will be secured with chain mesh fencing approximately 2.2 m to 3 m high and a locked access gate.

Motion-detected tower-mounted security lights and security cameras (closed circuit television (CCTV)) will be installed in key locations across the site.

All lighting will be positioned to minimise light spill to nearby residents and will only be activated for security purposes.

3.3.11 Temporary laydown areas

During construction (and again during decommissioning), temporary, secured, gravelled compounds will be used for storage of plant, equipment, waste material, construction site office and amenities, and laydown areas for equipment delivery and material handling.

3.3.12 Onsite water crossings

To facilitate access between the solar panel arrays, the project will require several water crossings (bed-level crossings or culverts) to be installed (Figure 3.1).

3.3.13 Parking

During operations, carparking will be near the operations and maintenance building. The carparking area will be gravelled and will have capacity for 5 light vehicles.

3.3.14 Internal access roads

Site access will be via the existing Sturmans Road site entrance. Internal access roads will provide access to the PV modules, BESS and ancillary infrastructure (Figure 3.1).

Internal access roads will be approximately 4 m to 6 m in wide. All internal access road will be located within a 10 m asset protection zone that will surround the site infrastructure. Internal roads will be designed to enable swept path turning circle for 26 m B-doubles to enter and exit the development site in a forward direction.

3.3.15 Firefighting infrastructure

Firefighting infrastructure will comply with the *Planning for Bushfire Protection* (RFS 2019) guideline and will include, but not be limited to, a dedicated water tank, fire-fighting equipment, and an asset protection zone around infrastructure.

Firefighting infrastructure is detailed in Section 6.10.4.

3.4 Activities during construction

Prior to commencement of construction, Sundown Solar will ensure that all pre-construction conditions of consent are met, including securing the necessary secondary permits.

Construction of the project would be undertaken in three distinct stages over a period of approximately 21 months:

- Stage 1: site establishment (approximately 3 months).
- Stage 2: civil, mechanical and electrical works and deliveries (approximately 14 months).
- Stage 3: commissioning and testing (approximately 4 months).

3.4.1 Stage 1: site establishment

The key objective of this stage is to prepare the site for receipt of construction materials and infrastructure. This will largely involve removal of unrequired infrastructure, grading of the site and upgrading the road network. Due to the development footprint's relatively flat terrain and predominantly cleared landscape, limited site preparation and civil works will be required. Key activities during this stage include:

- upgrade of the Gwydir Highway/Spring Mountain Road intersection to include a right turn traffic lane (type (CHR(S))) at the eastbound approach (Section 6.7)
- upgrade the site access road (Spring Mountain Road and Sturmans Road) to accommodate 26 m B-double trucks:
    - widen road to 8.7 m
    - compact and gravel road
    - upgrade/replace existing box culvert over Swan Brook Creek

- upgrade/replace bridge over Kings Creek

- remove internal fencing
- relocation of one project-related house and one shearing shed to a location agreed with the landowners
- scrub, grade and minor cut/fill as required to prepare the site surface
- establish a secured temporary construction laydown area comprising a site office, containers for storage and parking areas
- survey to confirm infrastructure positioning
- geotechnical investigations to confirm foundation requirements for infrastructure, as applicable
- install project perimeter fencing.

Note, the first deliveries of construction materials and infrastructure may occur towards the end of this stage.

3.4.2 Stage 2: civil/mechanical/electrical works and deliveries

The key objectives of this stage are to undertake the civil/mechanical/electrical works and to receive delivery of construction materials and infrastructure.

Construction material and infrastructure, including the BESS and the substation, will be transported to the site via road. It is anticipated that most construction material and infrastructure will be delivered using up to 26 m B-double trucks, except for the onsite substation and the BESS which will require oversized vehicles.

The following construction material and infrastructure will be delivered to site:

- solar panels, piles, tracker mounting structures and frames
- electrical equipment and infrastructure including cabling, inverters, transformers, switchgear and the onsite substation
- construction and permanent buildings and associated infrastructure
- earthworks and lifting machinery and equipment.

Key activities during the civil/mechanical/electrical works stage are outlined below:

- drive piles into the ground to support the solar panel mounting structure
- assemble tracker frames and solar panels on top of the piles
- install underground cabling between the solar panels and the inverters, and to the onsite substation
- prepare foundations for the inverter blocks, switchyard and management hub structures
- install combiner boxes, inverters, onsite substation, switchgear and BESS
- construct the management hub
- construct internal access tracks

- construct transmission infrastructure between the project electrical switchyard and the existing overhead transmission line
- install external and internal security fencing and CCTV.

3.4.3 Stage 3: commissioning and testing

The key objective of this stage is to ensure all elements of the development are properly installed. This phase includes cold commissioning, hot commissioning and testing of the power plant. It includes testing of all equipment and circuits, including inverters, cabling, tracker systems, earthing, SCADA and grid-compliance testing according to the transmission network operator and the AEMO requirements.

i Construction plant and equipment

The types and quantities of construction equipment will depend on the design and works sequencing by the EPC contractor, however an indicative list of equipment types and quantities typically used onsite during the construction of a solar farm is outlined in Table 3.2.

Table 3.2 Indicative construction equipment

Plant/equipment	Type/size	Estimated number		
		Stage 1	Stage 2	Stage 3
Vibratory roller	35 Smooth drum	5	5	0
Large hydraulic hammer		0	2	0
Pile driver	Orteco or similar	0	15	0
Dozer	CAT D6-D9	5	5	0
Grader	CAT 12G	5	5	0
Scraper		4	4	0
Flatbed float		5	5	0
Excavator	35 tonne	5	5	0
Bobcat	Tracked	5	5	0
Concrete truck		5	5	0
Drill rig	SM 14	0	10	0
Crane	100 tonne Franna	3	3	0
Forklift	Rough Terrain 5 tonne	0	30	0
Cable trencher	Vermeer	0	1	0
Water truck		1	1	0

ii Construction vehicle haulage routes

There are two major haulage routes for haulage of construction material and infrastructure, namely Newell Highway or the New England Highway then Gwydir Highway, then Spring Mountain Road, then Sturmans Road. The likely haulage route and associated delivery method for various infrastructure components are described in Table 3.3.

Table 3.3 Indicative haulage routes

Infrastructure	Source location	Delivery method	Delivery route
Transformers	Melbourne	26 m B-double truck.	Newell Highway, then Gwydir Highway, then Spring Mountain Road, then Sturmans Road.
Switchgear, PV modules, tracker and BESS components and inverters	Overseas	Ship to Sydney port. 26 m B-double truck from Sydney port.	New England Highway then Gwydir Highway, then Spring Mountain Road, then Sturmans Road.
BESS	Overseas	Ship to Sydney port. Overmass truck from Sydney port.	New England Highway then Gwydir Highway, then Spring Mountain Road, then Sturmans Road.
Substation	Sydney	Overmass truck.	New England Highway then Gwydir Highway, then Spring Mountain Road, then Sturmans Road.
Cables and other equipment	Melbourne, Sydney or overseas	26 m B-double truck.	Newell Highway or the New England Highway, then Gwydir Highway, then Spring Mountain Road, then Sturmans Road.

3.5 Activities during operation

The key activities during the operation phase will comprise:

- operation of the solar arrays and BESS
- maintenance of all electrical and mechanical equipment, including tracker system, low voltage/medium voltage cabling, PV modules, switchgear, BESS and communication systems
- management of vegetation, weeds and pests
- fence and access road management
- landscaping
- panel cleaning, repair and replacement
- site security.

3.6 Activities during decommissioning and rehabilitation

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

The key activities during the decommissioning and rehabilitation phase will comprise:

- removal of all above ground infrastructure except for:
  - overhead transmission line
  - access road including water crossings
  - onsite water crossings
  - internal access tracks if requested by the landholder at the time of decommissioning
- recycling of infrastructure components as much as practicable
- soil sampling (and soil rehabilitation if required)
- revegetation in consultation with landholders.

Underground cabling may remain in-situ to avoid unnecessary ground disturbance, subject to landholder agreement.

A decommissioning and rehabilitation plan will be prepared in consultation with landholders and regulators. The plan will outline the:

- rehabilitation objectives
- proposed method for removal of infrastructure
- disposal options for infrastructure once it has been removed
- performance criteria for rehabilitation, including soil quality
- timelines and responsibilities for implementation of this plan.

3.7 Schedule

The indicative timing of each delivery phase is outlined in Table 3.4. The timing and duration of each stage will be confirmed once the preferred engineering, procurement, and construction (EPC) contractor is selected. This will occur after the project approval has been received and during the contracting and detail design stage of the project.

Table 3.4 Indicative project schedule

Phase	Approximate duration	Approximate timing
Development approval	2 years	2023
Construction	21 months	2023–2025
Operation	35 years	2025–2060
Decommissioning and rehabilitation	1 year	2060–2061

4 Statutory context

This chapter identifies the key Commonwealth, State and local statutory requirements relevant to the project, including the:

- approval pathway
- consent authority
- permissibility of the project under planning law
- pre-conditions to exercising the power to grant approval
- other approvals that are required to operate the project
- mandatory matters for consideration.

Statutory requirements relevant to the various environmental assessments are outlined in Chapter 6, as applicable.

4.1 Approval pathway

The *Environmental Planning & Assessment Act 1979* (EP&A Act) defines the statutory framework for environmental assessment and planning approvals in NSW. The EP&A Act is administered by the Minister for Planning and Public Spaces, statutory authorities, and local councils.

Approval is sought for the development of the Sundown Solar Farm under Part 4, Division 4.7 of the EP&A Act. This Part relates specifically to State Significant Development (SSD). Under Section 4.36 of the EP&A Act, a development is State significant if it is declared to be SSD by any State Environmental Planning Policy (SEPP).

The project is declared to be SSD by *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP). Section 2.6(1) of the Planning Systems 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.

The project meets clause 2.6(1)(a) as it is not permissible without development consent. The project also meets clause 2.6(1)(b), as it is 'electricity generating works' which have a capital investment of more than $30 million as specified in Schedule 1 of the Planning Systems SEPP. Therefore, the project meets the requirements of Clause 2.6(1) and is SSD that requires development consent, in accordance with Part 4, Division 4.7 of the EP&A Act.

4.2 Consent authority

Under Section 4.5(a) of the EP&A Act, the Minister for Planning is the consent authority for SSD if the Independent Planning Commission (IPC) has not been declared to be the consent authority for the development by an environmental planning instrument.

Pursuant to clause 2.7(1) of the Planning Systems SEPP, the IPC is the consent authority for the following types of SSD (unless the application to carry out the development is made by or on behalf of a public authority or the development is declared to be State significant infrastructure related development, neither of which is the case for the project):

(a) development in respect of which the Council of the area in which the development is to be carried out has duly made a submission by way of objection under the mandatory requirements for community participation in Schedule 1 to the Act,

(b) development in respect of which at least 50 submissions (other than from a council) have duly been made by way of objection under the mandatory requirements for community participation in Schedule 1 to the Act,

(c) development the subject of a development application made by a person who has disclosed a reportable political donation under section 10.4 to the Act in connection with the development application.

Sundown Solar has not made political donations disclosures. Therefore, the Minister for Planning will be the consent authority for the project, unless during exhibition of the EIS either Section 2.7(1) or 2.7(2) of the Planning Systems SEPP are triggered.

4.3 Permissibility

The project will be developed on land zoned RU1 Primary Production under the *Inverell Local Environmental Plan 2012* (Inverell LEP). Under the Inverell LEP, development for the purpose of electricity generating works is a prohibited land use in the RU1 zone.

Notwithstanding this prohibition, 'electricity generating works' are a permissible land use with development consent on land in a rural zone pursuant to Section 2.36(1)(b) of *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP), which relevantly states:

(1) Development for the purpose of electricity generating works may be carried out by any person with consent on the following land—

(a) in the case of electricity generating works comprising a building or place used for the purpose of making or generating electricity using waves, tides or aquatic thermal as the relevant fuel source—on any land,

(b) in any other case—any land in a prescribed rural, industrial or special use zone.

Therefore, the project is permissible with development consent.

4.4 Objects of the EP&A Act

The objects of the EP&A Act are specified in Section 1.3 of the Act and seek to promote the management and conservation of natural and artificial resources, while also permitting appropriate development to occur. The consistency of the project with the objects of the Act is considered in Table 4.1.

Table 4.1 Objects of the EP&A Act

Object	Consistency assessment
1. To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The project provides for grid firming and will otherwise support the renewable energy sources in the NEM. Technical specialists have been engaged to assess and report on the potential for the project to impact upon the natural and artificial resources of the project. The impacts on the natural environment have been summarised in Chapter 6 of this EIS.
2. To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	This EIS describes the economic, environmental and social context of the project and the potential impacts to allow informed consideration of these aspects in determining the application. The project provides energy generation, storage and dispatchable firming to support renewable energy projects being developed in the region and throughout NSW.
3. To promote the orderly and economic use and development of land.	The orderly and economic use of land is best served by permissible development, which is permissible under the relevant planning regime and in accordance with the prevailing planning controls. The project comprises a permissible development, which is consistent with the statutory and strategic planning controls and is in close proximity to similar land uses including the nearby transmission line and other renewable energy projects in the region. The project will result in positive economic impacts, with appropriate mitigation measures and management strategies being proposed to reduce any adverse environmental and social impacts.
4. To promote delivery and maintenance of affordable housing.	Not applicable to the project.
5. To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	Wherever possible, direct impacts have been avoided and/or minimised through site selection and through design by minimising distances to the proposed substation and by avoiding impacts to riparian vegetation and species habitats. Avoidance is documented in the BDAR in Appendix C and as summarised in Chapter 6. Indirect impacts will be managed and mitigated through the implementation of the biodiversity management measures detailed in the BDAR. Residual impacts will be compensated through implementation of the biodiversity offset scheme (BOS).
6. To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The project will not significantly impact upon cultural or built heritage values. A comprehensive assessment has been undertaken Chapter 6.
7. To promote good design and amenity of the built environment.	The project is designed to suit the site and promote good design. Potential visual, air quality, and noise impacts on sensitive receivers and the broader community, have been fully assessed and described Chapter 6 respectively.
8. To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	All construction associated with the project will be compliant with the Building Code of Australia and all other relevant statutory requirements. Over the life of the project, infrastructure will be maintained or upgraded to ensure safe and efficient operations.

Table 4.1 Objects of the EP&A Act

Object	Consistency assessment
9. To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	As outlined in this chapter, the project is subject to the provisions of Part 4 of the EP&A Act, and the Minister for Planning and Public Spaces or Independent Planning Commission (IPC) will be the consent authority. Sundown Solar has also consulted regularly with Inverell Shire Council throughout the planning phases of the project and preparation of this EIS (Chapter 5). As such, it is deemed that both local and State levels of government have been provided with sufficient opportunities to share in responsible environmental planning of the project.
10. To provide increased opportunity for community participation in environmental planning and assessment.	As described in Chapter 5, there have been a range of engagement activities to inform the community about the project and to seek community (and other stakeholders) feedback. The EIS will be placed on public exhibition, and the community will be able to make submissions. A Submissions Report will be prepared to respond to the submissions.

4.5 Pre-conditions to exercising the power to grant approval

Pre-conditions to exercising the power to grant approval for the project are provided in Table 4.2.

Table 4.2 Pre-conditions to exercising the power to grant approval

Statutory reference	Pre-condition	Relevance	Where addressed in EIS
State Environmental Planning Policy (Resilience and Hazards) 2021, Part 4.6(1) – Remediation of Land	A consent authority must not consent to the carrying out of any development on land unless: a) it has considered whether the land is contaminated, and b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.	Agricultural activities have occurred on and near the development footprint; however, no potentially contaminated locations have been identified to date. An assessment of land use and soils has been conducted as part of the EIS.	Chapter 6 Appendix F – Land and rehabilitation assessment
State Environmental Planning Policy (Resilience and Hazards) 2021, Section 3.7 – Hazardous and Offensive Development	In determining whether a development is— a) a hazardous storage establishment, hazardous industry or other potentially hazardous industry, or b) an offensive storage establishment, offensive industry or other potentially offensive industry, c) consideration must be given to current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development.	The PHA determined that the project is not considered as 'potentially hazardous' within the meaning of the Resilience and Hazards SEPP.	Chapter 6 Appendix K – Hazards and risk assessment
State Environmental Planning Policy (Resilience and Hazards) 2021, Section 4.6 – Remediation of Land	A consent authority must not consent to the carrying out of any development on land unless, if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out.	The site is currently used for a commercial purpose for cropping. The land concerned is not: • within an investigation area • on land which development for a purpose referred to in contaminated land planning • guidelines is being, or is known to have been, carried out, or • for residential, educational recreational or childcare purposes, or for the purposes of a hospital. The site is therefore not contaminated.	N/A

Table 4.2 Pre-conditions to exercising the power to grant approval

Statutory reference	Pre-condition	Relevance	Where addressed in EIS
State Environmental Planning Policy (Transport and Infrastructure) 2021, Section 2.48 – Determination of development applications – other development	Development likely to affect an electricity transmission or distribution network: • The consent authority must give written note to the electricity supply authority for the area in which the development is to be carried out, inviting comments about potential safety risks, and must take into consideration responses received within 21 days. • The section applies to a development application including development carried out within or immediately adjacent to an easement for electricity purposes (whether or not the electricity infrastructure is existing), or immediately adjacent to an electricity substation, or within 5 m of an exposed overhead electricity power line.	There is electricity infrastructure within the vicinity of the development boundary and the project will require connection to the electricity transmission network. Transgrid is the relevant electricity supply authority. It will be the responsibility of the consent authority to notify Transgrid and consider any response that is received.	N/A
State Environmental Planning Policy (Transport and Infrastructure) 2021, Section 2.118	The consent authority must not grant consent to development on land that has a frontage to a classified road unless it is satisfied that— a) where practicable and safe, vehicular access to the land is provided by a road other than the classified road, and b) the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the development as a result of— i. the design of the vehicular access to the land, or ii. the emission of smoke or dust from the development, or iii. the nature, volume or frequency of vehicles using the classified road to gain access to the land, and c) the development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the development arising from the adjacent classified road.	The project site does not have frontage to a classified road. However Spring Mountain Road which will be used as the access road to the site has an intersection with the Gwydir Highway (a classified road). An upgrade of this intersection is proposed as part of the project. TfNSW has been consulted on the proposed intersection upgrade concept. The proposed intersection upgrade will facilitate the safe turning of traffic into and out of the access road from the Gwydir Highway and will improve road safety for other highway users.	Chapter 6 Appendix I – Traffic impact assessment

Table 4.2 Pre-conditions to exercising the power to grant approval

Statutory reference	Pre-condition	Relevance	Where addressed in EIS
Inverell LEP 2012 Section 2.3(2) – zone objectives	The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.	The key objective of the RU1 zone is to protect the productive capability of agricultural land. The project will not preclude the future use of the land for agricultural purposes.	Chapter 6 Appendix F – Land and rehabilitation assessment
Inverell LEP 2012 4.1B(2) – subdivision minimum lot sizes	Land in Zone RU1 Primary Production may, with development consent, be subdivided to create a lot of a size that is less than the minimum size shown on the Lot Size Map in relation to that land, where the consent authority is satisfied that the use of the land after the subdivision will be the same use (other than a dwelling house or a dual occupancy) permitted under the existing development consent for the land.	The subdivision of the lot(s) that is selected for the onsite substation will result in a lot size that is less than the minimum lot size under the Inverell LEP. Notwithstanding, in accordance with the provisions of Section 4.38 of the EP&A Act, the proposed subdivision will be permissible subject to the approval of the Minister for Planning. The conceptual subdivision plan is shown in Figure 3.5.	Section 3.2.3
Inverell LEP 2012 4.1B(3) - subdivision	Development consent must not be granted for the subdivision of land in Zone RU1 Primary Production unless the consent authority is satisfied that— a) the subdivision will not adversely affect the use of the surrounding land for agriculture, and b) the subdivision is necessary for the ongoing operation of the permissible use, and c) the subdivision will not cause a conflict between the use of the land subdivided and the use of the surrounding land in the locality, and d) the subdivision is appropriate having regard to the natural and physical constraints affecting the land.	The project includes a substation. This will require the site to be subdivided for this purpose. The subdivision will not adversely affect the agricultural use of surrounding land. The substation will allow the transfer of energy to the existing transmission line and therefore not conflict with existing land uses. The substation will be sited to minimise natural and physical constraints.	Chapter 3.1

4.6 Other approvals

This section discusses additional approvals required for the project. These approvals are grouped into the following categories (and are summarised in Table 4.3):

- *consistent approvals*: approvals that cannot be refused and must be substantially consistent with the approval under Section 4.42 of the EP&A Act
- *approvals not required*: approvals that would be required if the project was not SSD in accordance with Section 4.41 of the EP&A Act
- *other approvals*: approvals that are not expressly integrated into the SSD assessment process
- Commonwealth approvals: relating to the EPBC Act 1999 and in consideration of Schedule 4 of the EPBC Act Regulation 2000 and whether the assessment bilateral agreement applies to the project.

Table 4.3 Other approvals

Approval	Requirement
Consistent approvals	
A consent under Section 138 of the *Roads Act 1993*	Intersection works are required at the Gwydir Highway/Spring Mountain Road intersection, which require approval from TfNSW. Works are proposed on Spring Mountain Road and Sturmans Road which require approval from Inverell Shire Council.
An Environment Protection Licence (EPL) under Part 3 of the *Protection of the Environment Operations Act 1997* (POEO Act)	The generation of electricity from solar power is not defined as a scheduled activity in Schedule 1 of the POEO Act and therefore an EPL is not required.
Other approvals	
NSW Conveyancing Act 1919	The development footprint will require a separate lease from the owners of the affected land. Lease of a solar farm site is treated as a lease of premises, regardless of whether the lease will be for more or less than 25 years. The plan defining 'premises' (being the development footprint) will not constitute a 'current plan' within the meaning of Section 7A of the *NSW Conveyancing Act 1919* and therefore will not require subdivision consent under section 23G of the Act. The Minister for Planning can determine the subdivision application under Section 4.38 of the EP&A Act.
NSW Crown Land Management Act 2016	Crown land within the development footprint and access road will require an application for tenure, which will be undertaken in consultation with NSW Crown Lands in parallel with the assessment process for the project.
Approvals not required	
A permit under Section 201, 205 or 219 of the *Fisheries Management Act 1994*	The project includes construction of a creek crossing within habitat which may constitute key fish habitat. These works would have required relevant permits under the *Fisheries Management Act 1994.* The project will require works within waterfront land, including upgrades of existing road crossings and/or establishing new crossings over watercourse within the study area. These works will be undertaken generally in accordance with *Policies and Guidelines on Fish-Friendly Waterway Crossings (DPI undated)*, *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI 2013) and *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018).

Table 4.3 Other approvals

Approval	Requirement
An Aboriginal heritage impact permit under Section 90 of the *National Parks and Wildlife Act 1974*	Avoidance of Aboriginal cultural heritage values has been a key aspect of the project refinement process. 36 Aboriginal sites have been identified in proximity to the development footprint. 26 sites will be avoided and 10 sites will be impacted to some degree. An Aboriginal Cultural Heritage Management Plan (ACHMP) will be developed post determination (and pre-construction) in consultation with DPE, registered Aboriginal parties (RAPs) and Heritage NSW and will detail the management identified and unidentified Aboriginal sites.
Commonwealth approvals	
An approval under Part 3, Division 1 of the EPBC Act 1999, including consideration of Schedule 4 of EPBC Regulation 2000	The Commonwealth Government has determined that the project is a controlled action in accordance with Section 18 of the EPBC Act. The Commonwealth and NSW Governments have agreed that the Bilateral Assessment Process will apply to the project. The matters relating to the controlled action decision have been assessed in Section 6.1.

4.7 Mandatory matters for consideration

The mandatory conditions that must be satisfied before the consent authority may grant approval to the project are listed in Table 4.4.

Table 4.4 Mandatory considerations for the project

Statutory document	Section reference	Mandatory consideration	Consideration for the project and where it is addressed in this EIS
Environmental Planning and Assessment Act 1979	Section 1.3	**Relevant objects of the EP&A Act**	Chapter 6 – Assessment of impacts Chapter 7 – Justification
	Section 4.15(1)	a) the provisions of: (i) any relevant environmental planning instruments, (iii) any development control plan, (iii.a) 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, and (iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	The proposal is consistent with the Inverell LEP and Inverell DCP. There is no nexus for the provision of a planning agreement given the level of impact to local services and mitigation already proposed for the project as described in Chapter 7 – Justification.
		the likely impacts of the development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,	The likely impacts of the development have been comprehensively assessed in accordance with relevant policies and guidelines as described in Chapter 6 – Assessment of impacts.
		the suitability of the site for the development,	The site is suitable for the development as described in Chapter 2 – Strategic context.
		the public interest.	The proposed development is in the public interest as it will provide clean energy, see Chapter 7 – Justification.
Considerations under other legislation			
Biodiversity Conservation Act 2016	Section 7.9	The Minister for Planning, when determining in accordance with the *Environmental Planning and Assessment Act 1979* any such application, is to take into consideration under that Act the likely impact of the proposed development on biodiversity values as assessed in the biodiversity development assessment report. The Minister for Planning may (but is not required to) further consider under that Act the likely impact of the proposed development on biodiversity values.	The BDAR was prepared to detail the potential biodiversity impacts and offsets which apply to the project. The BDAR was prepared by an accredited person in accordance with the Accreditation Scheme for the Application of the *Biodiversity Assessment Method Order 2017*. Biodiversity impacts are discussed in Chapter 6 – Assessment of impacts and in Appendix C – BDAR.

Table 4.4 Mandatory considerations for the project

Statutory document	Section reference	Mandatory consideration	Consideration for the project and where it is addressed in this EIS
Roads Act 1993	Section 138	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 Transport for NSW or local council, depending upon classification of the road.	The project involves intersection works on the classified road network and works on the local road network, which will be subject to approval from the relevant roads authority. The works are described in Chapter 3 and impacts are assessed in Chapter 6 and in Appendix I – Traffic Impact Assessment.
Mandatory relevant considerations under EPIs			
State Environmental Planning Policy (Resilience and Hazards) 2021	Section 3.7	In determining whether a development is— a) a hazardous storage establishment, hazardous industry or other potentially hazardous industry, or b) an offensive storage establishment, offensive industry or other potentially offensive industry, c) consideration must be given to current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development.	Sundown Solar has considered the relevant circulars and guidelines which relate to hazardous and offensive development and is satisfied that the project does not meet these classifications. Hazards are assessed in the Hazard Assessment at Appendix K and summarised in Chapter 6.
State Environmental Planning Policy (Resilience and Hazards) 2021	Clause 4.6	1. A consent authority must not consent to the carrying out of any development on land unless - a) it has considered whether the land is contaminated, and b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.	The land has been used for agriculture and is not contaminated. The land is described in Chapter 2 – Strategic context.

Table 4.4 Mandatory considerations for the project

Statutory document	Section reference	Mandatory consideration	Consideration for the project and where it is addressed in this EIS
Inverell LEP 2012	Clause 2.3(2)	The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.	The consent authority for the purposes of the Inverell LEP 2012 is Council. Notwithstanding, Sundown Solar has had regards for the objectives of the RU1 zone, noting that electricity generating works are a permissible land use in the zone. The land will continue to be used for agriculture and therefore meets the zone objectives. The land-uses are described in Chapter 2 – Strategic context.
Inverell LEP 2012	Clause 4.1(b)(2)	Development consent must not be granted for the subdivision of land in Zone RU1 Primary Production unless the consent authority is satisfied that— a) the subdivision will not adversely affect the use of the surrounding land for agriculture, and b) the subdivision is necessary for the ongoing operation of the permissible use, and c) the subdivision will not cause a conflict between the use of the land subdivided and the use of the surrounding land in the locality, and d) the subdivision is appropriate having regard to the natural and physical constraints affecting the land.	Subdivision for the purpose of developing the substation and the BESS is required. The subdivision is necessary for the operation of the project, will not cause a conflict with surrounding land uses and is appropriate having regard to the natural and physical constraints affecting the land. Subdivision is discussed in Chapter 3 – Project description.

5 Consultation and engagement

5.1 Overview

This chapter provides an overview of the consultation and engagement activities carried out before and during the preparation of this EIS. It also provides an overview of the proposed engagement activities during operation, decommissioning and rehabilitation and it also summarises the community views in relation to the project.

Consultation for the Sundown Solar Farm has been (and will continue to be) undertaken in general accordance with the community participation objectives in the *Undertaking Engagement Guidelines for State Significant Projects* and in accordance with the community engagement requirements in the SEARs.

The key stakeholder consultation objectives for the Sundown Solar Farm project are to:

- build high levels of key stakeholder awareness, understanding and acceptance of the project purpose, scope, timeframes and outcomes
- ensure there is consistent and accurate project information in the public domain
- collect representative key stakeholder and community inputs about existing and potential future risks, impacts, and benefits associated with the project.

CWP Renewables, as the previous project owner, commenced consultation in 2017. In February 2021, Sundown Solar purchased Sundown Solar Farm from CWP and has progressed the consultation since that time.

5.2 Stakeholder identification

When considering who to engage with for the Sundown Solar Farm project, three classifications of stakeholder were used:

- organisations with a role in assessment or approval of the project
- people directly affected by the project
- stakeholders who would be interested in the project.

The stakeholders and their classification are outlined in Table 5.1.

Table 5.1 Stakeholder classifications

Stakeholder classification	Stakeholders
Organisations with a role in assessment or approval of the project.	• Department of Planning and Environment (DPE). • Biodiversity Conservation Division (BCD). • Registered Aboriginal parties (RAPs). • Fisheries NSW. • NSW Crown Lands. • Transport for NSW (TfNSW). • Department of Climate Change, Energy, the Environment and Water (DCCEEW). • Inverell Shire Council. • Glen Innes Severn Shire Council. • Transgrid.

Table 5.1 Stakeholder classifications

Stakeholder classification	Stakeholders
People directly affected by the project.	• Project site landowners: – Lot 148, deposited plan (DP) 753299 – Lot 141, DP 753305 – Lot 1, DP 1064358. • Adjoining landholders/residents. • Landholders/residents on Spring Mountain Road and on Sturmans Road.
Stakeholders who would be interested in the project.	• Local and regional community (including community groups). • Local service providers. • Local renewable energy developments: – White Rock Wind Farm – White Rock Solar Farm – Sapphire Wind Farm – Sapphire Solar Farm – Glen Innes Wind Farm.

5.3 Engagement carried out

5.3.1 Engagement methods

The engagement process was designed to be inclusive, transparent, structured and meaningful for the local community and broader stakeholders. It included a variety of communication tools and activities to promote awareness of the project, provide information and encourage feedback.

The engagement process comprised many opportunities to engage and provide feedback, including a mix of face-to-face engagements, online COVID-safe engagements and traditional communication channels, such as newsletters and telephone calls.

A summary of the engagement methods carried out prior to and during the preparation of the EIS is provided in Table 5.2.

Table 5.2 Engagement methods

Engagement method	Comment
Solar farm site visit	In May 2021, Sundown Solar hosted a tour of Canadian Solar's Gunnedah Solar Farm. A total of three Sundown Solar Farm landholder families attended. The objective of the tour was to allow landholders to find out more about the project, meet the project team and attend a site tour of an operating solar farm. It was also an opportunity for landholders to ask questions and provide direct feedback to Sundown Solar on the project.

Table 5.2 Engagement methods

Engagement method	Comment
Community information sessions	Sundown Solar held a community information session on 19 April 2022 at the Swan Vale Tennis Court Community Hall on Gwydir Highway, Swan Vale. During this session, Sundown Solar provided a project update, including information on the assessment process, an update on the anticipated construction timing, and what to expect during construction phase. Comments and questions were invited during a Q&A period following the presentation. A total of 13 members of the community attended the session. Sundown Solar invited participants to complete feedback forms. The feedback forms were designed to gauge how useful the session was, to invite comments and questions about the project and to direct participants to the project website. However. no feedback forms were received by Sundown Solar. The session was advertised through the Sundown Solar Farm project website and the project newsletter. The session was also advertised through the Inverell Shire Council website, staff newsletter and Facebook page. Sundown Solar also telephoned the project landowners to invite them to the session and invited other specific stakeholders directly through email.
Engagement with neighbouring landholders	CWP Renewables engaged with neighbouring landowners/tenants from 2017–2021. After taking ownership of the project in 2021, Sundown Solar emailed 10 neighbouring landowners/tenants in May 2021. The purpose of this activity was to ensure those most closely located to the site were fully aware of the proposal and to give them an opportunity to ask questions and provide feedback. Follow-up emails were sent in September 2021 and face to face meetings were held with three neighbouring landowner/tenants to further discuss the project. In July 2021, EMM conducted telephone and video meetings with neighbouring landowners/tenants as part of the social impact assessment. Several neighbouring landowners/tenants also attended the community information session in April 2022.
Government agency meetings	The following government agencies have been consulted in relation to the project: • Department of Planning and Environment (DPE) • DPE's Biodiversity Conservation Division (BCD) • Fisheries NSW • NSW Crown Lands • Transport for NSW (TfNSW) • Inverell Shire Council • Glen Innes Severn Shire Council • Transgrid. The objective of the meetings was to introduce the project, confirm the assessment process and to discuss potential project impacts. The meetings typically comprised an introductory letter or email followed by face-to-face/videoconference meetings or telephone calls to further discuss the project. Sundown Solar also provided regular project updates to these regulators, as applicable.
Renewable energy developer meetings	Sundown Solar has liaised with White Rock Wind and Solar Farm regarding construction scheduling in relation to upgrade of the Gwydir Highway/Spring Mountain Road intersection, the upgrade of Spring Mountain Road, access to easements and potential cumulative impacts (Table 5.3).
Community group meetings	In April 2022, Sundown Solar met with the Danthonia Bruderhof community in Elsmore to introduce the project.

Table 5.2 Engagement methods

Engagement method	Comment
Video conference with local service providers	In July 2021, EMM conducted a video conference as part of the Sundown Solar Farm social impact assessment with the following local service providers: • Inverell Chamber of Commerce • Best Employment • Jobs Australia Enterprises Inverell • Anaiwan Local Aboriginal Land Council • Inverell Police • Rural Fire Service • local accommodation provider • real estate service providers.
Aboriginal community engagement	In accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010) Sundown Solar registered the project with Heritage NSW and requested registrations of RAPs. A total of 22 RAPs registered to receive project updates. Sundown Solar provided RAPs with a letter that provided an overview of the project and requested feedback on the proposed ACHA methods and invited further information on cultural values associated with the project. In September 2021, EMM conducted an Aboriginal heritage survey of the site, accompanied by 16 RAPs. In June 2022, test pitting of a proposed construction laydown area was undertaken accompanied by 6 RAPs. In August and September 2022, RAPs reviewed the draft ACHA. Comments have been incorporated into the final ACHA. In September 2022, an Aboriginal focus group meeting was held at the RSM Club Inverell to discuss the draft ACHA and to invite additional questions and comments from RAPs. Further detail on consultation with the Aboriginal community is provided in Section 6.2.
Project website	The Sundown Solar Farm website (sundownsolarfarm.com.au) has been regularly updated to reflect latest project information and responses to frequently asked questions (FAQs) from the local community and stakeholders. The website includes the project newsletters. At the time of preparing this EIS, there have been 417 visitors to the website in the past 12 months. There have been 91 enquiries submitted via the website since the launch of the website in December 2018.
Project email address	The project website includes a dedicated project email address (admin@sundownsolarfarm.com.au) for members of the community to send in project-related comments or questions. 11 emails have been received in the past 12 months from the community about the project. The project email address has been promoted on all community notifications and advertising.
Project newsletters	Project newsletters have been distributed electronically to members of the community (including Inverell Shire Council, participants in the social impact assessment workshops, neighbouring landholders, project landholders, local indigenous groups and anyone else who has registered to receive project updates. Two community newsletters have been issued to date (December 2021 and April 2022). A third newsletter will be released once the EIS is submitted. The newsletters are also available on the project website.
Social media	The project does not have an official social media presence; however the community information days were promoted on the Inverell Shire Council Facebook page.

5.4 Issues raised during engagement

A summary of the issues raised during engagement for the project and where they have been addressed in the EIS is provided in Table 5.3.

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed		Where addressed in EIS
DPE	Project schedule. Status of SEARs.	• DPIE[2] provided SEARs in 2017 whilst the project was owned by CWP Renewables. SEARs were reissued in August 2020 when Sundown Solar took ownership of the project. • In October 2021, Sundown Solar provided DPE with an update on the project and the EIS delivery schedule. • In March 2022, Sundown Solar held a video-conference meeting with DPE to provide an update on the timing of the EIS. • In July 2022, Sundown Solar emailed DPE to provide an update on the EPBC status and to ask whether an extension to the existing SEARs was required. • In July 2022, Sundown Solar had a telephone meeting with DPE to discuss the *Large-Scale Solar Energy Guideline* (DPE 2022) and Planning Circular (PS 21–005) (issued 1 July 2021).		Section 1.5
BCD (north-east branch)	Impacts to State-listed threated species and communities. Classification of category 1 land.	**Consultation**	**Outcome**	Section 6.1
		In March 2022, EMM emailed BCD to provide an update on the project and to request a discussion about the proposed biodiversity assessment method.	Meeting held with BCD in May 2022.	
		In May 2022, BCD was consulted about land classifications of the site.	EMM sought agreement from BCD on the categorisation of Category 1-exempt land on the Sundown Solar Farm project site, for which assessment and offsetting under the BC Act is not required. EMM proposed a map of category 1 and category 2 land for the site, based on the criteria in the Local Land Services Act 2013 and the Local Land Services Regulation 2014, and using the agricultural land use history of the site.	

[2] Now DPE.

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed		Where addressed in EIS
		In June 2022, BCD provided advice regarding Category 1 and 2-regulated land. The BDAR was completed based on this advice and the extent of the project disturbance area was modified to avoid/minimise biodiversity impacts.	BCD reviewed EMMs proposed mapping of land categorisation for the site, and generally agreed with the proposed categorisation but suggested that there may be further areas that would align with category 1 based on disturbance levels. BCD suggested using Vulnerable Lands mapping to bring the category 1 mapping more in line with BCD's draft Native Vegetation Regulatory (NVR) map (unreleased).	
		In September 2022, BCD provided further advice regarding Category 1 and 2-regulated land. As a result of this further advice, the site was resurveyed.	BCD provided new advice that in the absence of an NVR map, any area of Critically Endangered Ecological Community (CEEC), regardless of condition state, must be mapped as Category 2 Regulated Lands. As a result, EMM resurveyed and recategorised the site, due to the presence of the CEEC *White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (Box Gum Woodland) in areas that had previously been considered as Category 1 lands.	
		In November 2022, EMM requested a meeting with BCD to discuss the proposed BDAR approach.	EMM requested a meeting with BCD to seek advice on various aspects of the biodiversity assessment. To facilitate the consultation, EMM provided BCD with a summary of the works completed and the approach to the biodiversity assessment, including vegetation mapping and threatened species records for the site. In particular, EMM was seeking discussion on the approach to vegetation mapping, assessments of SAII entities, threatened flora survey approach and the development of species polygons, the assessment of prescribed impacts for threatened species recorded in cultivated areas, and the assessment of paddock trees in cultivated areas and derived grassland vegetation zones.	

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed		Where addressed in EIS
		In December 2022, EMM held a Teams meeting with BCD to discuss the proposed BDAR approach.	EMM had an in-depth consultation with BCD, and received clarification on the following components of the biodiversity assessment: • Vegetation mapping – Delineation of woodland patches vs scattered trees. – Inclusion of paddock trees in DNG vegetation zones. – Requirement for scattered tree assessment module. • Project design: – Consideration of connectivity and viability of remnant patches of woodland or threatened species habitat. • SAII assessments. • Threatened species polygons: – Advised to include whole vegetation zones in species polygons, except for discrete patches where justifiable. – Prescribed impacts on threatened species need to be creditised. • Indirect impact assessments: – Preference to creditise indirect impacts, 10 m indirect impact zone was accepted. As a result of this consultation, EMM made significant changes to the vegetation mapping in line with the advice received around woodland patches, and created additional vegetation zones in order to creditise impacts to threatened species recorded in cultivated areas. The assessments in the BDAR were prepared according to the advice received in this meeting.	
Fisheries NSW	Impacts to type one fish habitat at Kings Creek (a class one waterway) (in relation to proposed water crossing).	• In April 2022, Sundown Solar met with Fisheries NSW (via telephone) to introduce the project and discuss requirements for the type of water crossing required at Kings Creek, given the creek is a type 1 fish habitat. • In July 2022, Fisheries NSW confirmed via email that Sundown Solar's proposal to construct a box culvert structure to cross Kings Creek is acceptable, providing the culvert is designed to allow passage of debris (so as not to block the fish passage).		Section 6.8.4

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed	Where addressed in EIS
NSW Crown Lands	Use of Crown land at Gwydir Highway/Spring Mountain Road intersection.	• In May 2022, NSW Crown Lands advised (via email) that a Crown land use permit can be issued allow works to proceed on Crown land at the Gwydir Highway/Spring Mountain Road intersection. • In September 2022, NSW Crown Lands granted landowner consent to lodge the development application.	Section 3.2.1 and Figure 3.2
TfNSW	Design of Gwydir Highway/Spring Mountain Road intersection (safety and access). Process for securing a Works Authorisation Deed (WAD).	• In March 2022, Sundown Solar held an online meeting with TfNSW to introduce the project, discuss the results of the draft traffic impact assessment and discuss the proposed upgrades to the Gwydir Highway/Spring Mountain Road intersection. • In March 2022, Sundown Solar submitted the draft concept plan of the intersection to TfNSW for comment. • In April 2022, TfNSW provided preliminary comments on the draft concept plan. • In June 2022, Sundown Solar had email and video-conference conversations with TfSW to further discuss the draft concept plan and to discuss the process and timing for obtaining a WAD.	Section 6.7
Inverell Shire Council Glen Innes Severn Shire Council	Opportunity for local employment.	• The average construction workforce throughout the 21 month construction period will be approximately 200 FTE jobs. During the peak construction period, a workforce of approximately 400 people will be required on site. The project will directly employ a further two to three people FTE during the operation phase.	Section 6.11
	Accessibility of local accommodation services.	• It is anticipated that the majority of the construction and operations workforce will be drawn from the region. Accordingly, there will be limited need for additional accommodation facilities to accommodate the workforce. The exception may be during the peak construction period (stage 2). During stage 2, there may be a need to bring in a portion of the construction workers from outside of the regions. If required, this additional workforce will be accommodated in existing short-term accommodation in the region (largely in Glen Innes and Inverell).	Section 6.11

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed	Where addressed in EIS
	Traffic and transport (access road).	In November 2021 and March 2022, Sundown Solar met with Inverell Shire Council to discuss the proposed upgrades to the site access road (namely Spring Mountain Road and Sturmans Road) and the results of the draft traffic impact assessment. Inverell Shire Council advised that the access road concept was generally acceptable and requested that the proposal be revised to address concerns raised by Inverell Shire Council on a previous application for B-double upgrade, and then submitted in writing for Inverell Shire Council l review. On 27 May 2022, Sundown Solar submitted a letter outlining the proposed road upgrades. The proposal included plans to: • widen the access road from a single to a double carriage width • upgrade/replace existing water crossing over Swan Brook Creek, to accommodate B-double trucks • replacement of the existing water crossing over Kings Creek, to accommodate B-double trucks • upgrade of existing culverts and bed level crossings, to accommodate B-double trucks • compact and gravel the entire road • reinstall existing cattle grids. The proposal also addressed Inverell Shire Council's previous comments raised in a historical risk assessment (circa 2017). Inverell Shire Council had prepared this risk assessment in response to a previous application made by local residents for a road upgrade to accommodate B-double trucks and restricted access vehicles (RAVs). The road upgrade proposal addresses Inverell Shire Council's previous concern including: • low speed turns at traffic management devices (drainage structures and guard rail 720 m from SH12) • structure width (drainage structures and guard rail 720 m from SH12) • concrete floodway width (crash risk) • number and width of cattle grids. Sundown Solar's letter outlining the proposed road upgrade also outlined the proposed traffic safety and environmental protocols during the road upgrade. On 13 September 2022, Inverell Shire Council responded in writing to Sundown Solar's letter dated 27 May 2022, providing in-principle support of the proposed road upgrade. In February 2023, Sundown Solar received written consent from Inverell Shire Council to lodge development application SSD-8911 over Spring Mountain Road and Sturmans Road, in relation to the proposed road upgrades.	Section 6.7

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed	Where addressed in EIS
	Waste management.	• In March and September 2022, Sundown Solar met with Inverell Shire Council to discuss proposed waste management measures. Inverell Shire Council referred to the waste-related conditions of consent applied to nearby renewable energy developments. • In September 2022, Sundown Solar consulted with Armidale Waste Management Facility and Inverell Waste Depot. These two facilities confirmed they have capacity to receive the anticipated types and volumes of project-related waste.	Section 6.12
	Community benefit fund.	• In March 2022, Sundown Solar had a videoconference meeting with Inverell Shire Council to discuss options regarding a potential community benefit fund. • In October 2022, Sundown Solar contacted Inverell Shire Council to continue the discussion in relation to the terms of a community benefit fund to ensure project benefits can be experienced regionally.	Section 2.10 and 7.7.2
RAPs	Impacts to Aboriginal cultural heritage.	Issues raised by the Aboriginal community have been addressed through the cultural heritage assessment that has been conducted for the project, which has incorporated: • four days of archaeological survey of the site was conducted in the presence of RAPs • test pitting of a proposed construction laydown area was conducted with RAPs • avoidance of scar trees in the project design • ongoing access to an onsite ochre source. In August 2022, RAPs reviewed the draft ACHA. Comments have been incorporated into the final ACHA. In September 2022, an Aboriginal focus group meeting was held in Inverell to discuss the draft ACHA and to invite additional questions and comments from RAPs. Comments have been incorporated into the final ACHA.	Section 6.2
Transgrid	Connection to NEM process. Impacts to existing assets. Land tenure and easement.	• In September 2017, CWP Renewables engaged with Transgrid to introduce the project and discuss connection requirements. • In December 2019, CWP received its Connection Enquiry Response from Transgrid and an outline of the connection application process. • In January 2022, Sundown Solar submitted its Generator Performance Standards submission package to Transgrid and formally launched the connection application process. Since then and throughout 2022, Sundown Solar has met with Transgrid regularly (monthly) to discuss requirements and inputs needed to enter into a Connection Agreement (i.e. access road design, substation equipment and delivery, GPS modelling, connection schedule, estimated cost, etc). • In August 2022, Sundown Solar conducted email conversations with Transgrid to discuss the transportation logistics of the transformer. • In September 2022, Sundown Solar met with Transgrid to discuss the proposed substation location and the suitability of the proposed access road upgrades to accommodate delivery of substation.	Chapter 1

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed	Where addressed in EIS
Project landholders	Biodiversity.	• Sundown Solar liaised regularly with project landholder during 2021 and 2022 to obtain evidence of historic, current and planned cropping/grazing areas. • The design of the solar farm layout has been optimised with these landholder inputs to avoid biodiversity impacts.	Section 6.1
	Traffic and transport.	• Installation of a basic left turn (BAL) treatment (if the BAL has not already been installed by White Rock Wind Farm (noting this is a requirement of their development consent) and a channelised right turn (CHR) treatment at the Gwydir Highway/Spring Mountain Road intersection. • The site access road (Spring Mountain Road and Sturmans Road) will be widened to 8.7 m and will be compacted and gravelled. This upgrade is supported by the project landholders and neighbouring landholders. • The upgraded access road will also include cattle grids in strategic locations as determined in consultation with landholders and with Inverell Shire Council's previous risk assessment (circa 2017).	Section 6.7
	Frazier's Quarry.	• In April and October 2022, Sundown Solar met with the owner of Frazier's Quarry (an associated landowner) regarding the potential for the quarry to provide material for the proposed access road upgrade.	Section 2.9
Adjoining landholders and tenants Local/ regional community	Visual amenity.	• Visual impact assessment determined the project will not generate significant visual impact at any nearby residence.	Section 6.5
	Traffic and transport (safety and access).	• Improved safety through installation of a basic left turn (BAL) treatment (if the BAL has not already been installed by White Rock Wind Farm (noting this is a requirement of their development consent) and a channelised right turn (CHR) treatment at the Gwydir Highway/Spring Mountain Road intersection. The intersection treatment will consider an appropriate location for the existing school bus stop at Gwydir Highway/Spring Mountain Road intersection. Traffic impacts will be minimised by use of shuttle buses during the construction period. Construction shifts and deliveries to be scheduled to avoid school pick-up and drop off times. • The site access road (Spring Mountain Road and Sturmans Road) will be widened to 8.7 m and will be compacted and gravelled. The upgraded roads will also replace existing cattle grids.	Section 6.7
	Dust and noise during construction.	• Implementation of approved dust and noise management protocols during construction.	Noise in Section 6.6 Dust in Section 6.4
	Sustainability.	• Most members of the community support this project, as the project will generate renewable energy and generate employment opportunities.	Section 6.11

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed	Where addressed in EIS
	Employment.	• Most members of the community support this project, as the project will generate renewable energy and generate employment opportunities. • The average construction workforce throughout the 21 month construction period will be approximately 200 FTE jobs. During the peak construction period, a workforce of approximately 400 people will be required on site. The project will directly employ a further two to three people FTE during the operation phase. The project will directly employ a further two to three people FTE during the operation phase. It is anticipated that the majority of the construction and operations workforce will be drawn from the region. • Opportunity to train/upskill the local workforce for construction.	Section 6.11
	Accessibility of local accommodation services.	• It is anticipated that the majority of the construction and operations workforce will be drawn from the region. Accordingly, there will be limited need for additional accommodation facilities to accommodate the workforce. The exception may be during the peak construction period (stage 2). During stage 2, there may be a need to bring in a portion of the construction workers from outside of the regions. If required, this additional workforce will be accommodated in existing short-term accommodation in the region (largely in Glen Innes and Inverell). Early consultation with the local community to advise of potential increase in demand for local services.	Section 6.11
	Accessibility of local medical services.	• As it is anticipated that the majority of the construction and operations workforce will be drawn from the region, there will not be a significant increase in demand for medical services. Any increase in demand for medical services can be accommodated within existing services in the region (largely in Glen Innes and Inverell). • Early consultation with the local community to advise of potential increase in demand for local services.	Section 6.11
	Loss of agricultural land. Increased collision risk for livestock due to construction traffic. Potential increase in weeds.	• Loss of cropping land for the project can be mitigated with the opportunity for sheep grazing or apiculture on site during the operational phase. The solar farm also presents the opportunity for educational and/or eco-tourism tours. • To prevent collision risk, livestock fencing of adjoining landowners could be implemented, as applicable. • Existing cattle grids on the access road will be replaced, as applicable. • Weed management will be undertaken during the project construction and operation in accordance with an approved management plan.	Section 6.1 Section 6.4 Section 6.11
	Potential for stewardship sites to be inadequately managed by developer.	• Stewardship sites to be secured under biodiversity stewardship agreements and managed by the relevant landowners, where practicable.	Section 6.1

Table 5.3 Summary of issues raised

Stakeholder	Key issues	How issue was addressed	Where addressed in EIS
	Complaints management.	• Complaints will be managed through the implementation of a complaints management system.	Chapter 5 Section 6.11
	Opportunity to provide local services to the project.	• The project would provide a range of local service opportunities and the implementation of a local services protocol, as applicable. Danthonia Bruderhof community group expressed its interest to Sundown Solar to be engaged to provide project signage. Sundown Solar is also considering the opportunity to engage a project landholder to provide aggregate for project from an existing quarry.	Section 6.11
Local service providers	Emergency planning and response.	• The project layout has been designed to meet applicable emergency services guidelines and regulations (including asset protection zones, fire-fighting equipment, access road and a second access/egress point).	Section 6.8 Section 6.10
	Opportunity to stimulate regional economy.	• The project will provide demand for local/regional goods and services during the 21 month construction period. • There would also be the opportunity for educational and/or eco-tourism tours during the operations stage.	Section 6.11
White Rock Wind Farm and Solar Farm	Scheduling of intersection upgrade. Cumulative impacts on traffic and transport and social impacts.	• In October 2021, Sundown Solar telephoned Goldwind Australia to introduce the project and discuss plans and schedules for the upgrade of the Gwydir Highway/Spring Mountain Road intersection (in relation to the construction of the White Rock Wind Farm and Solar Farm). • In March 2022, Sundown Solar met with Goldwind Australia to discuss construction scheduling and to discuss potential cost sharing options for the upgrade of the Gwydir Highway/Spring Mountain Road intersection. • In May 2022, Sundown Solar followed up with an email inviting further discussion on the scheduling and potential interfaces between both parties. • In July 2022, Sundown Solar met with Goldwind Australia to discuss the location of Goldwind Australia's proposed connection route easement. The parties will continue to consult with one another regarding construction schedules.	Chapter 5 Section 6.7

5.5 Consultation and engagement to be carried out

Sundown Solar will continue to collect feedback and monitor community sentiment through the channels established as part of the project consultation. Ongoing engagement activities will be commensurate with the feedback from Government agencies and the local community.

Key engagement and consultation activities that will continue beyond the assessment stage are:

- Continued operation of the project website.
- Dedicated telephone number to answer questions about the project and to respond to complaints.
- Consultation with Inverell Shire Council and TfNSW about the proposed access road upgrade and the intersection upgrade.
- Consultation with Inverell Shire Council and TfNSW about the construction schedule.
- Consultation with BCD about biodiversity offsets and the appropriate mechanism to retire offset credits. An onsite meeting with EMM and BCD is proposed during the EIS exhibition period.
- Consultation with landowners about securing offset sites.
- Consultation with landowners about the land-use after closure and rehabilitation.
- Consultation with DPE and relevant agencies regarding any post-approval requirements (e.g. management plans).
- Ongoing consultation with RAPs in relation to the salvage or otherwise of artefacts and the protection of cultural resources.
- Consultation with the Inverell Shire Council regarding community about benefits sharing.
- Ongoing support of selected community projects, as applicable.
- Consultation with Inverell Shire Council and accommodation providers regarding workforce strategies and the need to use local short-term accommodation.
- Comments on the EIS will be invited during the public exhibition period. Comments will be responded to in a Submissions Report.
- Regular updates will be made to the project website as necessary as the project progresses.
- Continued use of the project email and telephone with set response times for project enquiries and complaints.
- Continued meetings with Government agencies, project landowners and adjoining landowners, at each stage of the project, as necessary.

6 Assessment of impacts

The preliminary environmental assessment for Sundown Solar Farm was submitted in November 2017. Based on this assessment, the SEARs identified a number of key matters for assessment, as outlined in Table 6.1. These matters have been assessed as 'matters requiring detailed assessment'.

Where relevant, technical reports have been prepared and appended (refer to Appendix C to Appendix M).

A summary of mitigation and management measures is included in Section 6.14.

Table 6.1 Matters requiring detailed assessment

Matter requiring detailed assessment	Where addressed in EIS
Biodiversity	Section 6.1
Aboriginal heritage	Section 6.2
Historical heritage	Section 6.3
Land, soil and erosion	Section 6.4
Visual	Section 6.5
Noise and vibration	Section 6.6
Traffic and transport	Section 6.7
Water	Section 6.8
Hazards and risk	Section 6.9
Bushfire	Section 6.10
Social	Section 6.11
Waste	Section 6.12

6.1 Biodiversity

6.1.1 Introduction

A Biodiversity Development Assessment Report (BDAR) was prepared for the project (Appendix C). The BDAR was undertaken by accredited assessors in accordance with the Biodiversity Assessment Method (BAM) and Clause 6.15 of the *Biodiversity Conservation Act 2016* (BC Act).

As the project was considered likely to impact Matters of National Environmental Significance (MNES), the project was referred to the Commonwealth Minister for Environment. The Commonwealth Minister declared the project to be a controlled action in accordance with Sections 18 and 24 of the EPBC Act on 29 August 2022. This project is being assessed by the NSW Government in accordance with the NSW/Commonwealth assessment bilateral agreement.

The biodiversity-related SEARs are detailed in Table 6.2.

Table 6.2 Biodiversity-related SEARs

SEARs requirement	Section addressed
An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless BCD and DPIE determine the proposed development is not likely to have any significant impacts on biodiversity values.	Chapter 6 Appendix A
The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.	Section 6.1.9
If an offset is required, details of the measures proposed to address the offset obligation	Section 6.1.10

Supplementary SEARs for MNES were provided by DPE on behalf of the Commonwealth (Appendix A).

6.1.2 Existing environment

i Landscape and land use

The project is located in the New England Tablelands Interim Biogeographic Regionalisation for Australia (IBRA) region and is located in the MacIntyre River catchment. The study area occurs on a gently undulating landform featuring remnant grassy woodland and large areas of grassland. Large areas of the project site have been continually cultivated and/or grazed since at least the 1960s.

Retained areas of woodland within the project area are narrow, disconnected patches, particularly along creek lines, and as scattered trees and as regenerating woodland. The hills and slopes contain larger areas of grassy open woodlands, which are grazed or pasture-improved. Where native pastures retain a dominance of native species cover, they are referred to as 'derived native grassland'.

The current land-use of the project area is cropping and grazing. The relative quality of the habitat present in the paddocks is largely representative of the land use history and current cropping cycle. Most paddocks contain some scattered trees, which are a mix of predominantly White Box (*Eucalyptus albens*), Blakely's Red Gum (*Eucalyptus blakelyi*) and Rough-barked Apple (*Angophora floribunda*). The paddock grassland provides limited habitat features for fauna species, except for potential foraging for seed eating birds or birds of prey but does provide potential habitat for threatened flora species. The areas that are currently cropped provide almost no habitat for threatened species.

ii Survey effort

Vegetation surveys of the project area have been conducted on six separate occasions (Table 6.3).

Table 6.3 Vegetation surveys

Dates	Survey type
25 to 26 May 2021	Vegetation mapping, BAM plots
25 to 27 August 2021	Vegetation mapping
15 to 18 October 2021	Vegetation mapping, BAM plots
7 to 8 December 2021	Vegetation mapping, BAM plots
26 April to 1 May 2022	BAM plots

Table 6.3 Vegetation surveys

Dates	Survey type
5 to 6 October 2022	Vegetation mapping, BAM plots

iii Flora species

Approximately 170 native plant species and 80 non-native plant species were recorded in the BDAR study area (which is the area of land that was surveyed for ecological values, including the disturbance footprint and additional adjacent areas to provide context for impacts). Most plant species that were recorded in the study area are typical of grassy woodland environments, and most represented by species in the Poaceae (grass), Asteraceae (daisy) and Fabaceae (pea) families.

Of the 80 non-native species, 12 species are high-threat weeds, with one high-threat weed classed as manageable (ie Moth Vine, *Araujia sericifera*).

iv Native vegetation

The hills and slopes (Figure 6.1) grassy woodland contains White Box (*Eucalyptus albens*), with north south second-order and third-order drainage lines supporting White Box-dominated grassy woodlands upstream (i.e. towards the south) and Ribbon Gum (*E. viminalis*)-Rough-barked Apple (*Angophora floribunda*) open forests further downstream (i.e. towards the north).

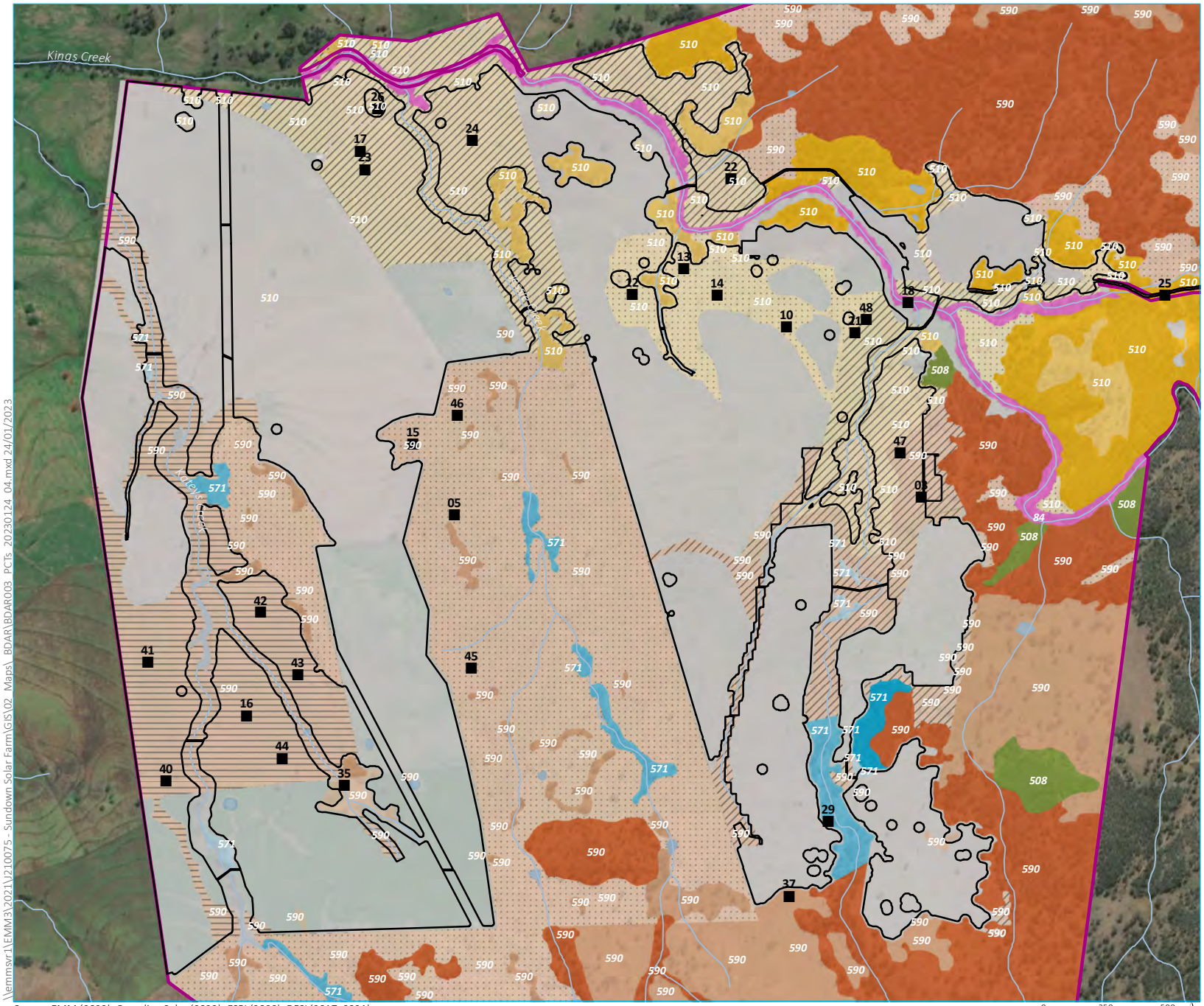
On the floodplain of Kings Creek, the White Box-dominated grassy woodlands transition to grassy box woodlands dominated by Blakely's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*). A gallery forest of River Oak (*Casuarina cunninghamiana*) lines Kings Creek.

v Plant community types

Four plant community types (PCTs) were identified in the disturbance footprint (Figure 6.1 and Table 6.4). These PCTs are classified as being associated "wholly" or "partially" with the following critically endangered ecological community (CEEC) listed under the BC Act and EPBC Act:

> White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.

Under the EPBC Act, this woodland community is named 'White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland' (i.e. Box Gum Woodland).



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road (refer to inset)
- Minor road (refer to inset)
- Watercourse/drainage line
- BAM plot
- Waterbody
- Cleared / exotic / cultivation

PCT 84 | River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion
- Woodland (poor)

PCT 508 | Blakely's Red Gum - Stringybark - Rough-barked Apple open forest of the Nandewar Bioregion and western New England Tableland Bioregion
- Woodland (intact)

PCT 510 | Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion
- Woodland (intact)
- Woodland (moderate)
- Woodland (poor)
- DNG (moderate)
- DNG (low)

PCT 571 | Ribbon Gum - Rough-barked Apple - Yellow Box grassy woodland of the New England Tableland Bioregion and NSW North Coast Bioregion
- Woodland (intact)
- Woodland (moderate)
- Woodland (poor)

PCT 590 | White Box grassy woodland on the Inverell basalts mainly in the Nandewar Bioregion
- Woodland (intact)
- Woodland (moderate)
- Woodland (poor)
- DNG (moderate)
- DNG (low)
- DNG (very low)

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

N

Plant community types and vegetation zones within the study area

Sundown Solar Farm
Environmental impact assessment
Figure 6.1a

EMM creating opportunities

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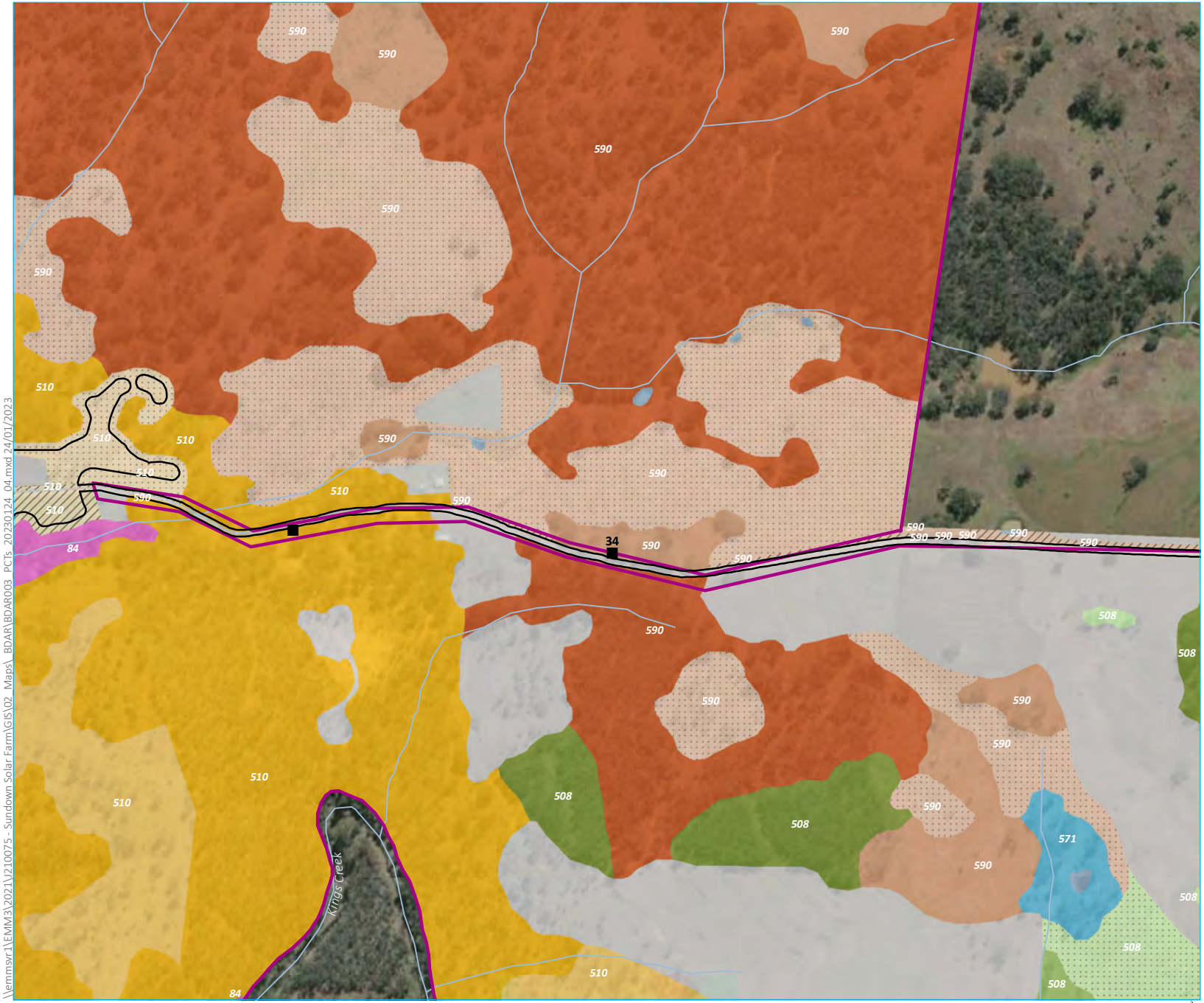

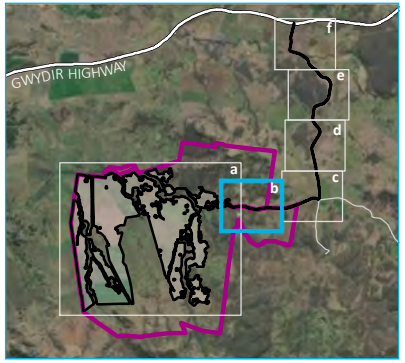

KEY

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- Disturbance footprint
- Major road (refer to inset)
- Minor road (refer to inset)
- Watercourse/drainage line
- BAM plot
- Waterbody
- Cleared / exotic / cultivation

PCT 84 | River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion

- Woodland (poor)

PCT 508 | Blakely's Red Gum - Stringybark - Rough-barked Apple open forest of the Nandewar Bioregion and western New England Tableland Bioregion

- Woodland (intact)
- Woodland (moderate)
- Woodland (poor)
- DNG (moderate)

PCT 510 | Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion

- Woodland (intact)
- Woodland (moderate)
- DNG (moderate)
- DNG (low)

PCT 571 | Ribbon Gum - Rough-barked Apple - Yellow Box grassy woodland of the New England Tableland Bioregion and NSW North Coast Bioregion

- Woodland (moderate)

PCT 590 | White Box grassy woodland on the Inverell basalts mainly in the Nandewar Bioregion

- Woodland (intact)
- Woodland (moderate)
- Woodland (poor)
- DNG (moderate)
- DNG (low)

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Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

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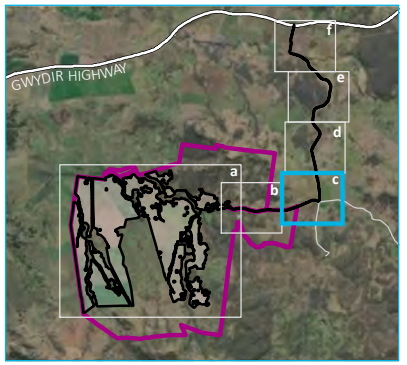
Plant community types and vegetation zones within the study area

Sundown Solar Farm
Environmental impact assessment
Figure 6.1b

EMM creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road (refer to inset)
- Minor road (refer to inset)
- Watercourse/drainage line
- BAM plot
- Cleared / exotic / cultivation

PCT 508 | Blakely's Red Gum - Stringybark - Rough-barked Apple open forest of the Nandewar Bioregion and western New England Tableland Bioregion

- Woodland (intact)
- Woodland (moderate)

PCT 590 | White Box grassy woodland on the Inverell basalts mainly in the Nandewar Bioregion

- Woodland (poor)
- DNG (low)

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Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

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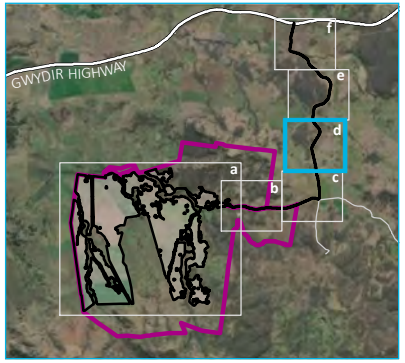
Plant community types and vegetation zones within the study area

Sundown Solar Farm
Environmental impact assessment
Figure 6.1c

EMM creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road (refer to inset)
- Minor road (refer to inset)
- Watercourse/drainage line
- Waterbody
- Cleared / exotic / cultivation

PCT 510 | Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion

- Woodland (poor)
- DNG (low)

\\emmsvr1\EMM3\2021\P210075 - Sundown Solar Farm\GIS\02_Maps_BDAR\BDAR003_PCTs_20230124_04.mxd 24/01/2023

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

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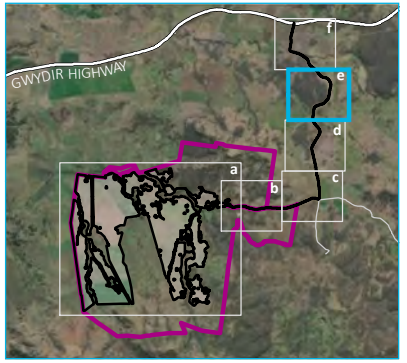
Plant community types and vegetation zones within the study area

Sundown Solar Farm
Environmental impact assessment
Figure 6.1d

EMM creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road (refer to inset)
- Minor road (refer to inset)
- Watercourse/drainage line
- Cleared / exotic / cultivation

PCT 508 | Blakely's Red Gum - Stringybark - Rough-barked Apple open forest of the Nandewar Bioregion and western New England Tableland Bioregion

- DNG (moderate)

PCT 590 | White Box grassy woodland on the Inverell basalts mainly in the Nandewar Bioregion

- Woodland (poor)
- DNG (low)

\\emmsvr1\EMM3\2021\210075 - Sundown Solar Farm\GIS\02_Maps\BDAR\BDAR003_PCTs_20230124_04.mxd 24/01/2023

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

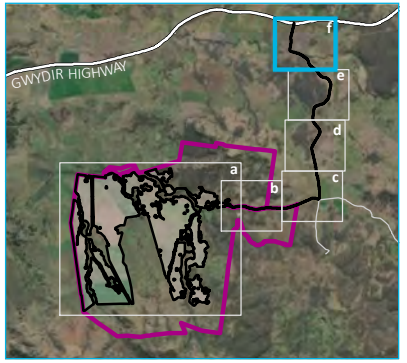
GDA2020 MGA Zone 56

N

Plant community types and vegetation zones within the study area

Sundown Solar Farm
Environmental impact assessment
Figure 6.1e

EMM creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road (refer to inset)
- Minor road (refer to inset)
- Watercourse/drainage line
- BAM plot
- Waterbody
- Cleared / exotic / cultivation

PCT 84 | River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion

- Woodland (poor)

PCT 505 | Black Cypress Pine - Tumbledown Red Gum - Narrow-leaved Ironbark - Stringybark She Oak open forest on acid volcanics of the western New England Tableland Bioregion

- Woodland (intact)

PCT 510 | Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion

- Woodland (moderate)

PCT 590 | White Box grassy woodland on the Inverell basalts mainly in the Nandewar Bioregion

- Woodland (poor)
- DNG (moderate)
- DNG (low)

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Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

N

Plant community types and vegetation zones within the study area

Sundown Solar Farm
Environmental impact assessment
Figure 6.1f

EMM creating opportunities

Table 6.4 Vegetation within the disturbance footprint

Vegetation type	Area (ha)		Subtotals (ha)
	Woodland	Derived native grassland	
River Oak – Rough-barked Apple – red gum – box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion (**PCT 84**)	0.04	0	0.04
Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion (**PCT 510**)	0.59	129.70	130.29
Ribbon Gum – Rough-barked Apple – Yellow Box grassy woodland of the New England Tableland Bioregion and NSW North Coast Bioregion (**PCT 571**)	0.17	0	0.17
White Box grassy woodland on the Inverell basalts mainly in the Nandewar Bioregion (**PCT 590**)	1.72	86.79	88.51
Non-native vegetation			501.25
Cleared			8.15
Waterbody			0.83
Totals	**2.52**	**216.49**	**729.24**

vi Threatened species

Eight threatened species were recorded within or near the disturbance footprint (Table 6.5).

Table 6.5 Threatened species

Birds	Plants
• Brown Treecreeper *(Climacteris picumnus victoriae)* • Diamond Firetail *(Stagonopleura guttata)* • Dusky Woodswallow *(Artamus cyanopterus)* • Little Lorikeet *(Glossopsitta pusilla)* • Scarlet Robin *(Petroica boodang)* • Little Eagle *(Hieraaetus morphnoides)*.	• Bluegrass *(Dichanthium setosum)* • Austral Toadflax *(Thesium australe)*.

The six threatened bird species recorded are predicted species and have accordingly been assessed for ecosystem credits along with a list of other predicted species associated with the PCTs recorded in the disturbance footprint. Bluegrass and Austral Toadflax are candidate species for the purposes of application of the BAM and species polygons have been prepared to assess these species for species credits. Presence has also been assumed for one candidate species, Eastern Pygmy-possum (*Cercartetus nanus*).

vii Bluegrass and Austral Toadflax

Bluegrass and Austral Toadflax were mainly recorded within derived native grassland. However, these species were also recorded in localised areas within cultivation paddocks in between cultivation events (i.e. after harvest and before ploughing, or in paddocks where cultivation activities ceased for several years due to drought).

Approximately 246 Bluegrass records were identified in the general study area representing over 3,700 plants; and 552 Austral Toadflax records in the study area representing over 20,000 plants.

Of these, one record (approximately 1 plant) of Bluegrass, and 50 records (approximately 1,267 plants) of Austral Toadflax are identified within the disturbance footprint.

Bluegrass and Austral Toadflax are assessed by area. Species polygons were prepared for Bluegrass and Austral Toadflax to measure the area of suitable habitat within the disturbance footprint. Assumptions applied to the preparation of the species polygons are described in this BDAR. In total the species polygon for each species is 182.32 ha and 186.73 ha respectively, reflecting the large areas of derived native grassland within the disturbance footprint. The species polygons also includes small areas of cultivated land.

viii Eastern Pygmy-possum

Eastern Pygmy-possum (*Cercartetus nanus*) is associated with woodland habitats. Spotlighting surveys were completed in woodland areas surrounding the disturbance footprint, however, no Eastern Pygmy-possums were found. Information within the Threatened Biodiversity Data Collection (TBDC) notes that the species is especially difficult to detect using this method. For this reason, the species is assumed to be present within woodland habitats.

Eastern Pygmy-possum is also assessed by area and the species polygon captures all potential woodland habitat within the disturbance footprint.

6.1.3 Impact assessment

i Avoidance and minimisation

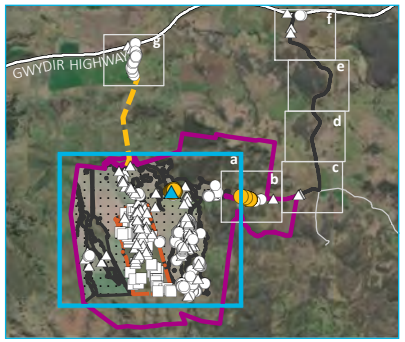
A range of avoidance and minimisation measures have been incorporated into the design of the project (Figure 6.2 and Table 6.6).

Table 6.6 Avoidance and minimisation measures

Item	Description of avoidance and minimisation measures
1	Most woodland patches and derived native grassland areas have been avoided, recognising that most of the native woodland identified in the study area aligns with Box Gum Woodland, which is an SAII entity and is critically endangered under both BC Act and EPBC Act. Several eastern paddocks on the Newstead property (Figure 6.2) were excluded from the project to avoid impacts on Box Gum Woodland including associated derived native grasslands. These paddocks are ideally suited to solar development based on topography and proximity to the existing powerline connection. The exclusion of these areas from the project avoids over 177 ha of derived native grassland, more than 30 hectares of woodland and at least 63 hollow-bearing trees, representing habitat for: • Box Gum Woodland CEEC • known records of Bluegrass (69 records, 1650 individuals) and Austral Toadflax (1 record, 1 individual) • threatened woodland fauna known to occur in the study area (i.e. ecosystem credit species) • hollow-dependent fauna. The derived native grassland avoided by the project represents relatively better-quality grassland compared with derived native grassland in the western paddocks on the Newstead property and compared with the derived native grassland on the Glen Eisle property i.e. avoids 590_DNG_MOD (vegetation integrity score = 20.1) preferentially over 590_DNG_LOW (vegetation integrity score = 17.8) and 590_DNG_V_LOW (vegetation integrity score = 9.1).
2	The project avoids 502 records representing over 18,700 plants of Austral Toadflax from the disturbance footprint. This represents avoidance of approximately 94% of all the plants recorded since 2018. The avoidance of individuals involved moving PV panels out of areas away from certain sections of first order watercourses that were considered for development. These areas were initially considered for development to maximise the generation capacity, since the first order watercourses in these sections are dry most of the time and does not contain wetland or riparian vegetation (derived native grassland not noticeably differentiated from surrounding grassland).
3	The project avoids 245 records representing over 3,700 plants of Bluegrass from the disturbance footprint. This represents avoidance of almost all of the plants recorded since 2018.
4	The project also avoids 206 of 240 (approximately 86%) hollow bearing trees recorded in the study area.
5	Two access road options were considered at early design phase: • Spring Mountain/Sturmans Road • an alternate route via a private road west of Spring Mountain Road. The Spring Mountain Road/Sturmans Road option was selected over the alternative private road access for several reasons, including: • less disturbance required to upgrade Spring Mountain Road/Sturmans Road • avoidance of better-quality roadside grassland vegetation • avoidance of over 62 Bluegrass plants and 1098 Austral Toadflax plants occurring along the private access road. That is, the access route option selected requires less road upgrades and supports fewer threatened flora records in roadside vegetation.

Table 6.6 Avoidance and minimisation measures

Item	Description of avoidance and minimisation measures
6	The disturbance footprint minimises disturbance of existing watercourses and associated riparian corridors and minimises the number of new watercourse crossings required.
7	The disturbance footprint includes 10 metre indirect impact zone from the edge of infrastructure to accommodate vegetation management works, and foot and vehicle traffic. The indirect impact zone will be fully offset but options to further minimise impacts during construction and operation of the project will be fully explored and implemented where possible. The indirect impact zone will be managed and will act as a buffer between the operational areas and retained vegetation outside of the project disturbance footprint.
8	The disturbance footprint is set back from most woodland patches by between 10–20 metres. This is in addition to the 10 m indirect impact zone identified (item 7 above).
9	The PV modules will be installed to minimise the degree of ground disturbance required.



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Alternative private road access option
- Newstead - Eastern Paddocks
- Hollow-bearing tree (Newstead - Eastern Paddocks)
- Major road
- Minor road
- Watercourse/drainage line
- Box Gum Woodland

Avoided records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

Impacted records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m
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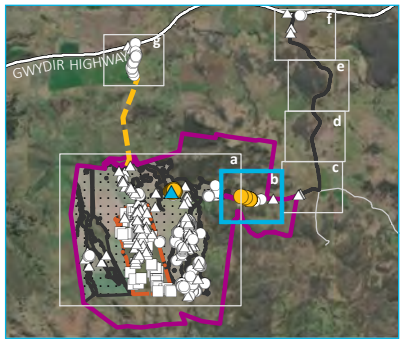
Avoidance and minimisation strategy

Sundown Solar Farm
Environmental impact assessment
Figure 6.2a

EMM
creating opportunities



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- Newstead - Eastern Paddocks
- Hollow-bearing tree (Newstead - Eastern Paddocks)
- Major road
- Minor road
- Watercourse/drainage line
- Box Gum Woodland

Avoided records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

Impacted records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

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Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

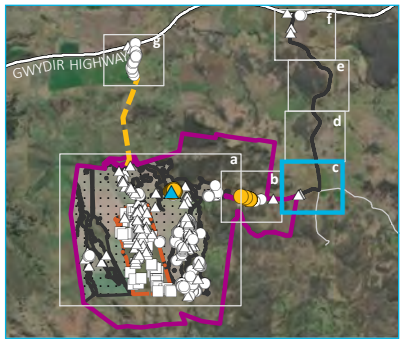
GDA2020 MGA Zone 56

N

Avoidance and minimisation strategy

Sundown Solar Farm
Environmental impact assessment
Figure 6.2b

EMM creating opportunities



KEY

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- Hollow-bearing tree (Newstead - Eastern Paddocks)
- Major road
- Minor road
- Watercourse/drainage line
- Box Gum Woodland

Avoided records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

Impacted records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

\\emmsvr1\EMM3\2021\210075 - Sundown Solar Farm\GIS\02_Maps_BDAR\BDAR013_AvoidanceStrategy_20230124_03.mxd 24/01/2023

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

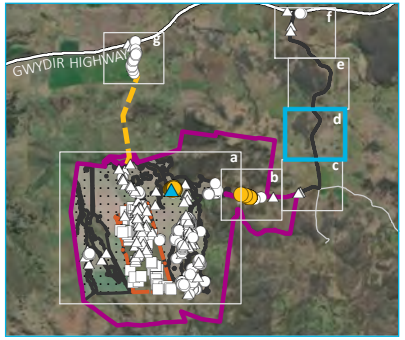
GDA2020 MGA Zone 56

N

Avoidance and minimisation strategy

Sundown Solar Farm
Environmental impact assessment
Figure 6.2c

EMM creating opportunities



KEY

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- Disturbance footprint
- Alternative private road access option
- Newstead - Eastern Paddocks
- Hollow-bearing tree (Newstead - Eastern Paddocks)
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- Minor road
- Watercourse/drainage line
- Box Gum Woodland

Avoided records

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- Austral toadflax (Thesium australe)

Impacted records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

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Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

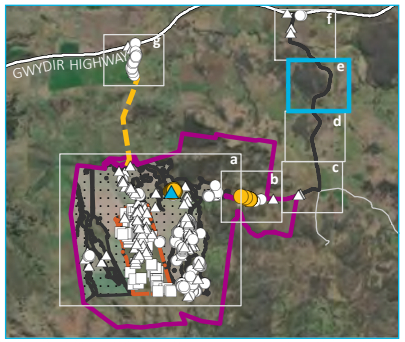
GDA2020 MGA Zone 56

N

Avoidance and minimisation strategy

Sundown Solar Farm
Environmental impact assessment
Figure 6.2d

EMM creating opportunities



KEY

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- Alternative private road access option
- Newstead - Eastern Paddocks
- Hollow-bearing tree (Newstead - Eastern Paddocks)
- Major road
- Minor road
- Watercourse/drainage line
- Box Gum Woodland

Avoided records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

Impacted records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

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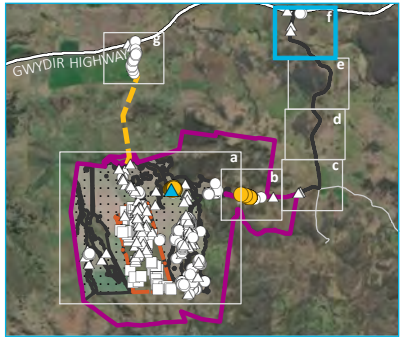
Avoidance and minimisation strategy

Sundown Solar Farm
Environmental impact assessment
Figure 6.2e

EMM creating opportunities



KEY

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- Disturbance footprint
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- Newstead - Eastern Paddocks
- Hollow-bearing tree (Newstead - Eastern Paddocks)
- Major road
- Minor road
- Watercourse/drainage line
- Box Gum Woodland

Avoided records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

Impacted records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

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Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

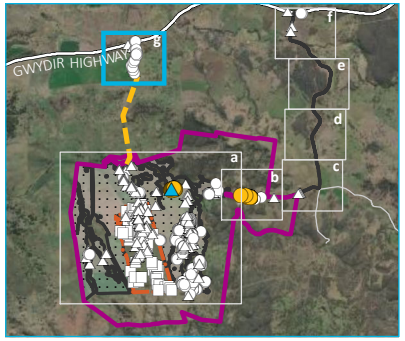
GDA2020 MGA Zone 56

N

Avoidance and minimisation strategy

Sundown Solar Farm
Environmental impact assessment
Figure 6.2f

EMM creating opportunities



KEY

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- Alternative private road access option
- Newstead - Eastern Paddocks
- Hollow-bearing tree (Newstead - Eastern Paddocks)
- Major road
- Minor road
- Watercourse/drainage line

Avoided records

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- Austral toadflax (Thesium australe)

Impacted records

- Bluegrass (Dichanthium setosum)
- Austral toadflax (Thesium australe)

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Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

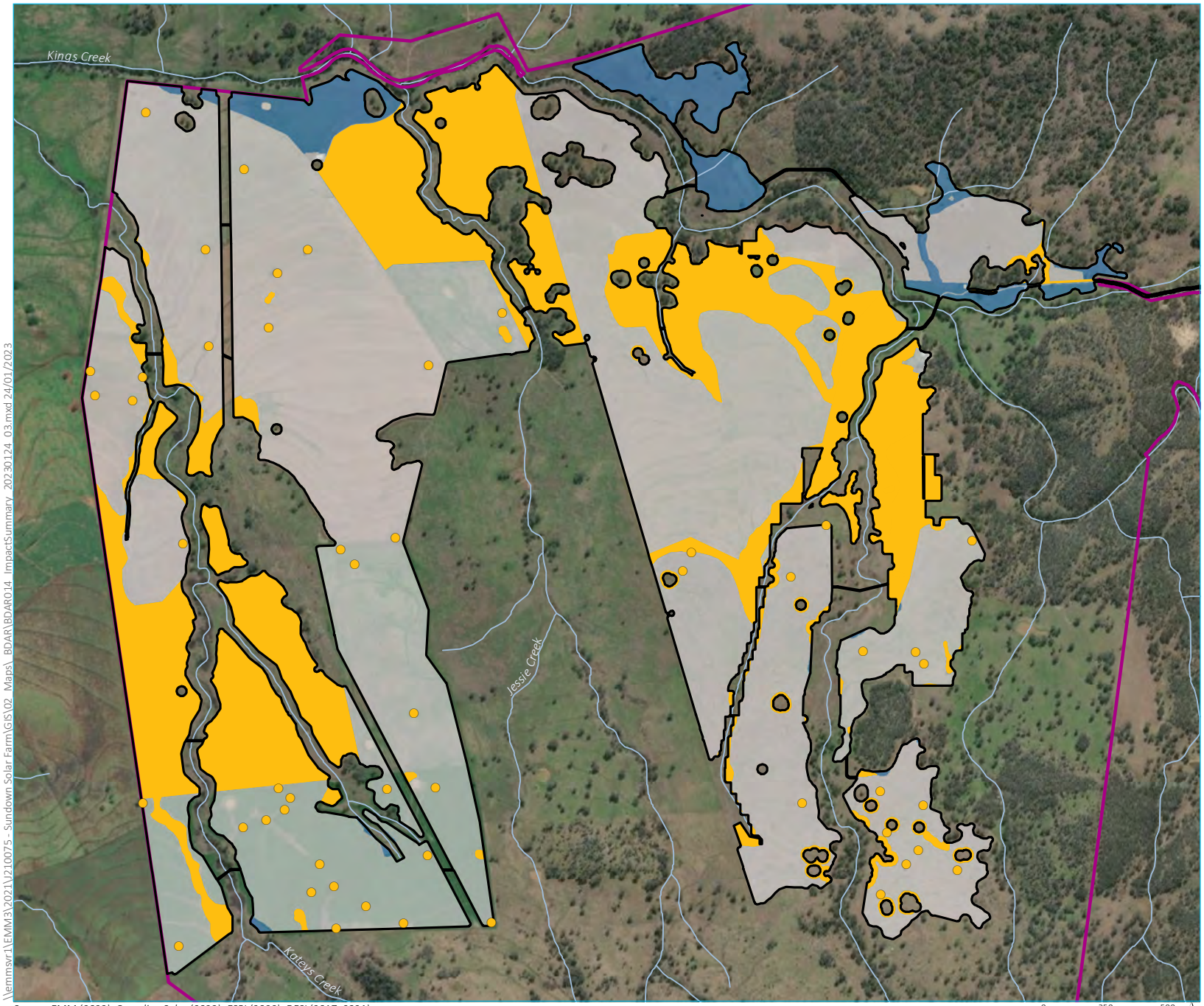
GDA2020 MGA Zone 56

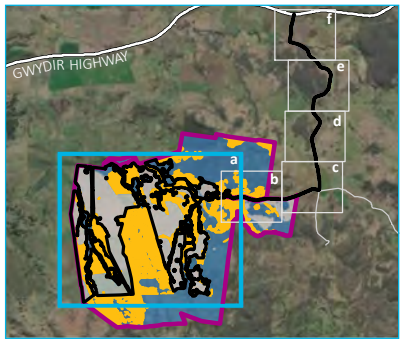
N

Avoidance and minimisation strategy

Sundown Solar Farm
Environmental impact assessment
Figure 6.2g

EMM
creating opportunities





KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road
- Minor road
- Watercourse/drainage line
- Impact not requiring assessment
- Impact not requiring offset

Impacts requiring offset

- Scattered tree
- Vegetation zones that generate credits; species polygons

\\emmsvr1\EMM3\2021\P210075 - Sundown Solar Farm\GIS\02_Maps_BDAR\BDAR014_ImpactSummary_20230124_03.mxd 24/01/2023

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

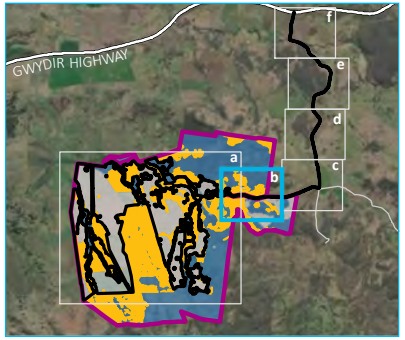
GDA2020 MGA Zone 56

N

Impact summary

Sundown Solar Farm
Environmental impact assessment
Figure 6.3a

EMM
creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road
- Minor road
- Watercourse/drainage line
- Impact not requiring assessment
- Impact not requiring offset

Impacts requiring offset

- Scattered tree
- Vegetation zones that generate credits; species polygons

\\emmsvr1\EMM3\2021\P210075 - Sundown Solar Farm\GIS\02_Maps_BDAR\BDAR014_ImpactSummary_20230124_03.mxd 24/01/2023

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

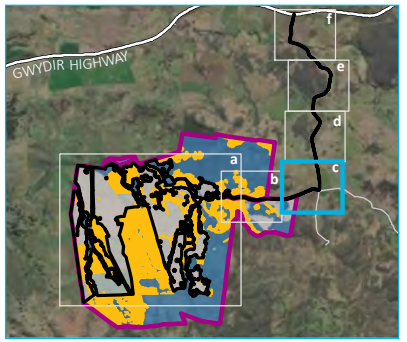
GDA2020 MGA Zone 56

N

Impact summary

Sundown Solar Farm
Environmental impact assessment
Figure 6.3b

EMM
creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road
- Minor road
- Watercourse/drainage line
- Impact not requiring assessment
- Impact not requiring offset

Impacts requiring offset

- Scattered tree
- Vegetation zones that generate credits; species polygons

\\emmsvr1\EMM3\2021\210075 - Sundown Solar Farm\GIS\02_Maps_BDAR\BDAR014_ImpactSummary_20230124_03.mxd 24/01/2023

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

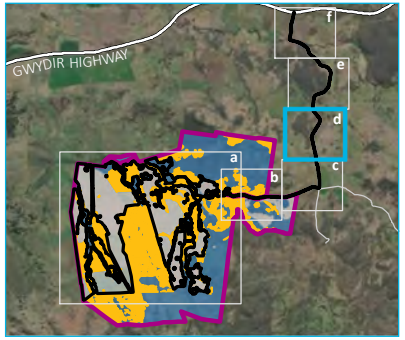
GDA2020 MGA Zone 56

N

Impact summary

Sundown Solar Farm
Environmental impact assessment
Figure 6.3c

EMM
creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road
- Minor road
- Watercourse/drainage line
- Impact not requiring assessment
- Impact not requiring offset

Impacts requiring offset

- Scattered tree
- Vegetation zones that generate credits; species polygons

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

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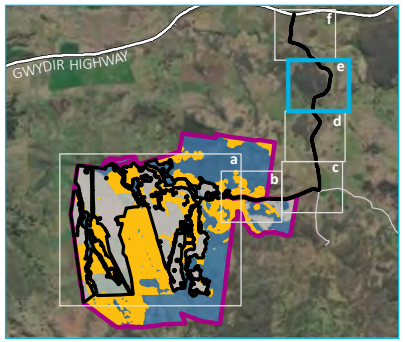
Impact summary

Sundown Solar Farm
Environmental impact assessment
Figure 6.3d

EMM
creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road
- Minor road
- Watercourse/drainage line
- Impact not requiring assessment
- Impact not requiring offset

Impacts requiring offset

- Scattered tree
- Vegetation zones that generate credits; species polygons

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

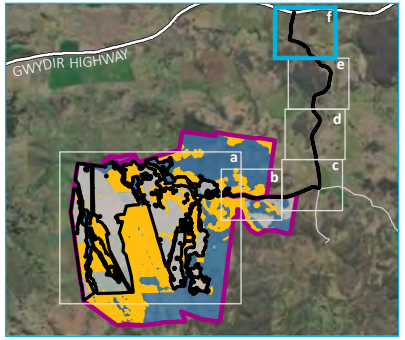
N

\\emmsvr1\EMM3\2021\P210075 - Sundown Solar Farm\GIS\02_Maps\BDAR\BDAR014_ImpactSummary_20230124_03.mxd 24/01/2023

Impact summary

Sundown Solar Farm
Environmental impact assessment
Figure 6.3e

EMM
creating opportunities



KEY

- Proposed Sundown Solar Farm
- Disturbance footprint
- Major road
- Minor road
- Watercourse/drainage line
- Impact not requiring assessment
- Impact not requiring offset

Impacts requiring offset

- Scattered tree
- Vegetation zones that generate credits; species polygons

\\emmsvr1\EMM3\2021\P210075 - Sundown Solar Farm\GIS\02_Maps\BDAR\BDAR014_ImpactSummary_20230124_03.mxd 24/01/2023

Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2021)

0 250 500 m

GDA2020 MGA Zone 56

N

Impact summary

Sundown Solar Farm
Environmental impact assessment
Figure 6.3f

EMM creating opportunities

6.1.4 Potential direct and indirect impacts

i Direct impacts

The direct impacts on biodiversity are summarised below:

- Woodland clearing (2.52 ha) which includes:
  - 2.48 ha of Box Gum Woodland threatened ecological community (TEC) (BC Act).
  - 0.48 ha represents Box Gum Woodland TEC (EPBC Act).
  - 2.52 ha of suitable habitat for Eastern Pygmy-possum for which presence is assumed.
- Derived native grassland clearing (216.49 ha) which:
  - Represents clearing of 216.49 ha of Box Gum Woodland derived grassland (BC Act) of which 29 ha is Box Gum Woodland derived grassland (EPBC Act). Approximately 93% of the derived native grassland clearing is low condition grassland that does not exceed offset thresholds set by the BAM.
  - Includes 182.32 ha of suitable habitat for Bluegrass. The species polygon prepared to measure the area of suitable habitat for Bluegrass is conservative as it exceeds the area of suitable habitat occupied by the species. The species polygon for Bluegrass is also mostly represented by low condition grassland.
  - Includes 186.73 ha of suitable habitat for Austral Toadflax. The species polygon prepared to measure the area of suitable habitat for Austral Toadflax is conservative as it exceeds the area of suitable habitat occupied by the species. The species polygon for Austral Toadflax is also mostly represented by low condition grassland.
- Clearing of 34 of 240 hollow-bearing trees.
- Clearing of 51 scattered trees, of which 18 are hollow-bearing and represent a subset of the above 34 hollow-bearing trees that will be impacted.

A credit requirement was assessed for all of the above impacts and, in relation to vegetation clearing, assumes complete loss of vegetation integrity values.

ii Indirect impacts

Clearing of native vegetation could also result in indirect biodiversity impacts. Indirect impacts that could occur include:

- increased noise, vibration and dust levels resulting in disturbance of fauna species, and consequent abandonment of habitat, or changes in behaviour (including breeding behaviour)
- increase in weeds and pathogens, resulting in degradation of retained native vegetation and habitat
- increase in predatory and pest animal species, resulting in increased predation and competition and a consequent reduction in populations
- potential inadvertent disturbance of retained habitats
- removal of habitat resources for threatened fauna

- displacement of threatened fauna
- runoff, scouring, erosion and sedimentation impacts to retained native vegetation and watercourses.

The disturbance footprint includes a 10 m asset protection zone setback from the edge of infrastructure where indirect impacts to biodiversity may occur. The indirect impact zone has been assessed for ecosystem credits. This is a conservative approach that assumes 100% loss of biodiversity values. In practice, the 10 m setback will be managed for vehicle access and bushfire risks and will not necessitate complete clearance of native vegetation or threatened species habitat. Indirect impacts are unlikely to be significant, as:

- strict controls will be put in place to ensure sediment does not runoff into watercourses
- the project has low potential to facilitate dispersal of weed species. include measures such as weed containment and disposal protocols
- potential noise and dust impacts will be temporary as they will only be evident during vegetation clearing. Dust levels will be monitored and when needed dust suppression implemented such as wetting down dirt roads or reducing vehicle speeds.

iii Aquatic ecology impacts

The disturbance footprint avoids significant disturbance at all mapped waterways. Katey's Creek, Jessie Creek and one unnamed creek are within the study area. These areas were not observed to contain permanent flow; however, they could provide habitat for frogs in wet conditions.

A fourth order stream (King's Creek) runs across the northern edge of the study area. This watercourse contains habitat suitable for frogs, turtles and fish, with a mix of pools and fast flowing areas, and rocky and vegetated banks. It is lined by gallery forest consisting mostly of River Oak, providing habitat for a number of threatened birds, mammals, and reptiles.

The results of the desktop aquatic assessment are summarised in Table 6.7.

Table 6.7 Aquatic assessment

Data source	Jessie Creek (2nd order)	Kateys Creek (3rd order)	Kings Creek (4th order	Swan Brook (4th order)
Freshwater fish community status	Not classified	Not classified	Poor	Poor
Key fish habitat	No	Yes	Yes	Yes
Threatened fish distributions	None	Southern Purple Spotted Gudgeon (*Mogurnda adspersa*)	Southern Purple Spotted Gudgeon (*Mogurnda adspersa*) Murray-Darling Basin population of Eel Tailed Catfish – (*Tandanus tandanus*)	Southern Purple Spotted Gudgeon (*Mogurnda adspersa*) Murray-Darling Basin population of Eel Tailed Catfish – (*Tandanus tandanus*)
Threatened aquatic communities	None	None	None	None

Several new and upgraded watercourse crossings will be required across the project to facilitate vehicle access during construction and operation.

Watercourse crossings will typically be implemented as either bed level or culvert crossings, with crossing upgrades proposed along the Sturmans Road and Spring Mountain Road crossings where there are existing bridges:

- Kings Creek at western extension of Sturmans Road – low level bridge
- Swan Brook at Spring Mountain Road – high level multi-cell box culvert system
- unnamed 2nd order watercourse at Sturmans Road – small box culvert.

The remaining existing watercourse crossings generally comprise bed level crossings.

The location, form and site-specific design of all crossings will be confirmed and developed as part of future detailed design. However, it is noted that the number of required watercourse crossings has been minimised during preliminary design to reduce the potential for watercourse impacts and will be further considered during detailed design.

It is expected that adverse impacts to watercourses and riparian corridors will be avoided and/or minimised because:

- the disturbance footprint preserves the vegetated riparian zone widths recommended by DoI (2018)
- where instream works are proposed (i.e. construction or upgrade of watercourse crossings), these works will be designed and constructed to be consistent with relevant guidelines:
  - *Guidelines for watercourse crossings on waterfront land* (DPE 2022c)
  - *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull *et al.* 2003).

It is noted that consultation between Sundown and DPI Fisheries has occurred in July 2022 with respect to the proposed new crossing over Kings Creek that would replace an existing informal and low-level bridge structure, and that a new box culvert crossing is supported by DPI Fisheries provided appropriate design consideration for fish passage is incorporated in accordance with Fairfull, S. and Witheridge, G. (2003).

As potential habitat for threatened fish occurs in Kings Creek and Swan Brook, assessments of significance have been prepared for Southern Purple Spotted Gudgeon and Eel-tailed Catfish in accordance with Section 220ZZ of the FM Act (Appendix C). These assessments indicate that no significant impact on these species is likely to occur as a result of the project due the marginal value of the aquatic habitats, the limited disturbance works expected in association with construction/upgrade of the crossings and the limited duration of the works.

6.1.5 Serious and Irreversible Impacts

Box Gum Woodland is included in the current list of entities at risk of a Serious and Irreversible Impact (SAII). Additional information regarding the project impacts on Box Gum Woodland has been provided in the BDAR in accordance Section 9.1.1 of the BAM.

Actions to avoid and minimise impacts on Box Gum Woodland was prioritised in concept design and resulted in the exclusion of over 177 ha of derived native grassland and more than 30 ha of woodland from the disturbance footprint.

i Threatened species

Section 9.1.2 of BAM (DPIE 2020a) requires additional information to be provided for threatened species that are also listed as candidate entities for SAII. No threatened species are present that are included in the current list of entities at risk of an SAII and none are likely to be at risk of an SAII in accordance with the four SAII principles of the BC Regulation.

ii Threatened ecological communities

Box Gum Woodland is included in the current list of entities at risk of an SAII and is likely to be impacted by the project. For this reason, additional impact assessment provisions for TECs at risk of an SAII as per Section 9.1.1 of BAM (DPIE 2020a) apply.

iii Actions to avoid and minimise direct and indirect impacts

The conceptual design sought to avoid as much woodland CEEC as practicable. Follow several design iterations it was clear that after woodland, the areas containing the highest values for CEEC were captured by the eastern paddocks on the Newstead property, which contains the better quality derived native grassland compared with adjacent paddocks.

The quality of the derived grassland in the eastern paddocks is affected by grazing and pasture improvement activities but does not appear to have the intense cultivation history of other paddocks, having been maintained largely as native pasture for a long time with periodic burns to control Plains Grass growth.

The eastern paddocks are excluded from the conceptual design, which avoids a large area of CEEC within the study area.

6.1.6 EPBC Act assessment

i Potential impacts to MNES

The impacts which have potential to affect MNES include:

- clearing of 2.52 ha of native woodland vegetation
- clearing of 216.49 ha of derived native grassland
- clearing of 34 hollow-bearing trees recorded in the disturbance footprint
- clearing of 51 scattered trees (with and without hollows).

The sizes of the potential habitats of the identified MNES in the disturbance footprint are summarised in Table 6.8.

Table 6.8 Impacts to habitat of MNES

MNES	Potential habitat in disturbance footprint (ha)	Justification
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	29.48	Vegetation zones within the disturbance footprint that align with the EPBC Act criteria for the Box Gum Woodland CEEC, as shown in Figure 6.1.

Table 6.8 Impacts to habitat of MNES

MNES	Potential habitat in disturbance footprint (ha)	Justification
Bluegrass	182.32	This is the area of the species polygon defined which takes into account species records, PCT associations, habitat quality and connectivity.
Austral Toadflax	186.73	This is the area of the species polygon defined which takes into account species records, PCT associations, habitat quality and connectivity.
Regent Honeyeater	2.52 (Plus 51 scattered trees which do not have an area value.)	All woodland areas within the disturbance footprint.
Swift Parrot	2.52 (Plus 51 scattered trees which do not have an area value.)	All woodland areas within the disturbance footprint. After recent updates to threatened species PCT associations, the Swift Parrot is associated with all PCTs mapped within the disturbance footprint. The BAM-C shows that the species is only associated with PCTs 510 and 590, as per the previous associations for the species. Woodland areas from all PCTs in the disturbance footprint have been conservatively considered as habitat for Swift Parrot, as they would provide potential foraging habitat for the species.
Painted Honeyeater	2.52 (Plus 51 scattered trees which do not have an area value.)	All woodland areas within the disturbance footprint.

The impact assessments are provided in Appendix C, which have concluded that the project has the potential to result in a significant impact to three MNES:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- Bluegrass
- Austral Toadflax.

6.1.7 Proposed avoidance and mitigation measures for MNES

Avoidance and mitigation measures have been applied in the project design. Table 6.9 outlines the avoidance and mitigation measures most relevant to the MNES that will be impacted by the project and addresses the requirements of the supplementary SEARs (Appendix C).

Table 6.9 MNES avoidance and mitigation measures

Avoidance/mitigation measure	Description	Effectiveness for MNES
Avoidance measures		
Avoidance of woodland and derived native grassland areas.	Most areas of woodland and better quality derived native grassland have been avoided by design, with the disturbance footprint placed in cultivated areas and low-quality grassland. Several eastern paddocks on the Newstead property were excluded from the project that included high quality grassland and woodland (Table 6.6).	• Exclusion of eastern paddocks retains 177 ha of DNG (habitat for threatened flora species) and 30 ha of woodland (habitat for threatened fauna species). • Retains a larger area of Box Gum Woodland CEEC.
Avoidance of known records of threatened species.	Disturbance footprint was designed to avoid areas with a high density of threatened species records.	• Retainment of 502 records of Austral Toadflax, representing over 18,700 plants and approximately 94% of all the plants recorded at the site since 2018. • Retainment of 245 records of Bluegrass, representing over 3,700 plants and almost all of the plants recorded since 2018 (99.97%). • Protection of highest quality habitat for threatened flora species.
Avoidance of hollow bearing trees.	By avoiding woodland areas during design, hollow bearing trees are also avoided.	• Retainment of potential breeding habitat for woodland dependent birds and bats. • The project avoids 206 of 240 hollow bearing trees recorded in the study area (approximately 86%).
Access route selection.	The access route option selected uses an existing road requiring fewer upgrades, and supports fewer threatened flora records.	• Retainment of approximately 62 individuals of Bluegrass and 1098 individuals of Austral Toadflax. • Less clearing of potential threatened flora habitat required.
Minimising disturbance to watercourses and riparian corridors.	Disturbance footprint was designed with a buffer distance away from all significant watercourses within the study area. The number of new watercourse crossing has been minimised by selecting routes where existing crossing are in place.	• Protection of aquatic habitat that may support threatened species. • Maintenance of existing water regimes within the site, minimising changes to habitat conditions for threatened species.
Inclusion of a 10 m indirect impact zone.	The disturbance footprint includes a 10 m indirect impact zone from the edge of infrastructure, to accommodate vegetation management, and foot and vehicle traffic.	• Act as a buffer between operational areas and retained vegetation outside the disturbance footprint, reducing impacts to retained vegetation. • Indirect impact zone will be fully offset despite being only partially impacted.
Disturbance set back from woodland patches.	The disturbance footprint is set back from most woodland patches by between 10–20 m. This is in addition to the 10 m indirect impact zone identified.	• Act as a buffer between operational areas and retained woodland vegetation outside the disturbance footprint, reducing impacts to retained woodland habitat.

Table 6.9 MNES avoidance and mitigation measures

Avoidance/mitigation measure	Description	Effectiveness for MNES
PV module installation method.	PV modules will be installed via helical piling methods rather than other construction methods that involve concrete foundations.	• Reduces impact to vegetation within the disturbance footprint as it requires less vegetation clearing. • Allows some grassland habitat to be retained within the PV area, which may continue to be used by threatened species.
Mitigation measures		
Options to further minimise impacts during construction and operation (E.01).	May include: • Minimising removal of hollow bearing trees within the approved disturbance footprint. • Minimising removal of known occurrences of threatened plants, Bluegrass and Austral Toadflax within the approved disturbance footprint. • Minimising removal of tree resources along the Spring Mountain Road/Sturmans Road access route.	• Potential further retainment of hollow bearing trees (habitat for woodland dependent fauna species). • Potential further retainment of occurrences of Bluegrass and Austral Toadflax. • Potential further retainment of trees, representing potential habitat and assisting in maintaining connectivity for the movement of fauna species.
Identification of threatened species occurrences on site plan (E.02 and E.03).	• Site plan will show extent of approved disturbance. • Known records of threatened flora species to be delineated as 'no-go' zones on the site plan. • Threatened flora to be retained will be delineated with high visibility tape or fencing.	• Prevent unnecessary and unapproved damage to occurrences of threatened flora species and their habitat.
Rehabilitation of construction laydown areas (E.04).	The construction laydown areas will be rehabilitated following completion of construction works if they are not required for operational purposes and will include removal of any materials brought into site such as gravel.	• Prevent unnecessary damage or removal of native vegetation, comprising Box Gum Woodland TEC or habitat for threatened species.
Appropriate management of 10 m indirect impact area (E5).	The Construction Environmental Management Plan (CEMP) and any operational management plan will include provisions for the appropriate management of the 10 m indirect impact area, including: • Protocols for bushfire asset management. • Management of weeds and run-off into adjacent off-project areas.	• Minimisation of edge impacts to adjacent retained vegetation, comprising Box Gum Woodland TEC or habitat for threatened species.

Table 6.9 MNES avoidance and mitigation measures

Avoidance/mitigation measure	Description	Effectiveness for MNES
Sediment controls (E6).	Sediment controls to be implemented during construction in accordance with a sediment and erosion control plan, including installation of fencing and sediments traps in any areas where works will occur in proximity to low lying vegetation or streams.	• Preservation of higher quality DNG habitat around waterways – habitat for Bluegrass and Austral Toadflax. • Protection of waterways and aquatic habitats adjacent to the project.
Traffic Management Plan (E7).	The Construction Traffic Management Plan (CTMP) is to include construction speed limits to minimise risk of vehicle strike during construction phase of projects when there is expected to be an increase in traffic movements.	• Reduce risk of vehicle strike on threatened species during construction.
Pre-clearance inspections (E8).	Pre-clearance inspection to be conducted by a suitably qualified ecologist to: • inspect buildings prior to demolition • inspect hollows prior to tree clearing • remove any individuals if found • relocate animals to suitable habitat within the locality • any animals injured during clearing works should be taken to a veterinarian or wildlife clinic.	• Reduce risk of injury to threatened fauna species.
Implementation of a Biodiversity Management Plan (E9).	Implement a Biodiversity Management Plan (BMP) for retained vegetation adjacent to the disturbance footprint that includes (but is not limited to): • Requirements to control and manage weeds that may be exacerbated, spread or otherwise affected by the construction and operation of the project. • Requirements to monitor the vegetation condition and habitat values of any such retained vegetation. • Provisions for corrective actions should a decline in vegetation or habitat condition be detected.	• Protection of retained vegetation and threatened species habitat adjacent to the project. • Protection of areas of Box Gum Woodland CEEC adjacent to the project.
Protection and management of retained Bluegrass and Austral Toadflax (E10).	The Biodiversity Management Plan (BMP) shall include prescriptions for the protection and ongoing management of the habitat of retained occurrences of Bluegrass and Austral Toadflax that are surrounded by the approved disturbance footprint.	• Reduce the impacts of the project on Bluegrass and Austral Toadflax. • Prevent retained plants from being impacted by the project in the long term.

6.1.8 Offset strategy

Sundown Solar will offset the residual impacts on biodiversity by:

- retiring like-for-like credits from an established stewardship site, and/or
- payment directly into the Biodiversity Conservation Trust Fund (BCF).

The project will require ecosystem and species credits to be retired to offset the predicted impacts on biodiversity. The credit obligation includes:

- 260 ecosystem credits to offset impacts to 18.21 ha of native vegetation
- 45 ecosystem credits to offset impacts to 51 scattered trees
- 975 species credits to offset impacts to 182.32 ha of suitable habitat for Bluegrass
- 733 species credits to offset impacts to 186.73 ha of suitable habitat for Austral Toadflax
- 65 species credits to offset impacts to 2.52 ha of suitable habitat for Eastern Pygmy-possum.

Impacts on 207.21 ha of native vegetation do not require offset as the offset thresholds set out in Section 9.2.1 of the BAM are not met.

Sundown Solar's preferred approach to offsetting the residual impacts of the project is to set up stewardship sites to generate like-for-like credits for the project. This option has the potential to provide the best biodiversity outcome if a suitable offset site can be identified near the project.

This approach would deliver a net benefit locally and is likely to return like-for-like credits that are a close match (if not identical) to the credits generated by the project compared with sourcing credits on the credit market or discharging offsetting obligations through the BCF.

Sundown Solar is looking to commence enquiries regarding available like-for-like credits on the credit market to supplement credits that could potentially be generated locally.

A payment to the BCF would only be considered to meet the residual credit requirements if a suitable number and type of biodiversity credits cannot be secured from stewardship sites owned by Sundown Solar and/or other third parties.

Under the assessment bilateral agreement between the Commonwealth and the State of NSW, payment into the NSW Biodiversity Conservation Trust is an accepted offset for MNES provided that the eligibility criteria are met.

Application to apply the 'variation to trading rules' is not preferred and would only be considered after all reasonable steps to seek like-for-like credits are undertaken (OEH 2017) and suitable credits still could not be sourced.

6.1.9 Proposed measures

The mitigation measures detailed in Table 6.10 will be considered to limit the biodiversity impacts of the project.

Table 6.10 Mitigation and management measures

Reference	Mitigation measure	Timing	Responsibility	Intended outcome
E.01	Options to further minimise impacts during construction and operation of the project will be fully explored and implemented where possible. This includes: • minimising removal of hollow-bearing trees within the approved disturbance footprint • minimising removal of known occurrences of threatened plants, Bluegrass and Austral Toadflax within the approved disturbance footprint, especially where proximate to core occurrences along watercourses • minimising removal of tree resources along the Spring Mountain Road/Sturmans Road access route.	Detailed design	Contractor	Biodiversity impact minimisation. Minimise impacts on MNES species including Bluegrass and Austral Toadflax.
E.02	A Site Plan will be included in a Construction Environmental Management Plan (CEMP) and will include: • the extent of approved disturbance • any relevant sensitive areas • stockpile, material laydown areas, and site compounds. This Site Plan is to be placed in an accessible location to be viewed by all site personnel (site office for example).	Pre-construction	Contractor	General protection measure.
E.03	All occurrences of threatened flora will be identified on the Site Plan and delineated in the field as 'no-go' zones. Threatened flora that are to be retained will be flagged with high visibility tape, or the limits of the occurrence clearly demarcated with high visibility tape or fencing. All contractors will be provided with an environmental induction prior to starting work on site, which includes communications about sensitive areas and no-go zones.	Pre-construction	Contractor	Protection of known occurrences of Bluegrass and Austral Toadflax.
E.04	The construction laydown areas will be rehabilitated following completion of construction works if they are not required for operational purposes and will include removal of any materials brought into site such as gravel.	Post-construction	Contractor	Minimisation of long-term impacts on Bluegrass and Austral Toadflax habitat.
E.05	The Construction Environmental Management Plan (CEMP) and any operational management plan will include provisions for the appropriate management of the 10 m indirect impact area, including: • protocols for bushfire asset management • management of weeds and run-off into adjacent off-project areas.	Pre-construction Construction Operation	Contractor Operator	Minimisation of indirect/edge impacts on adjacent retained biodiversity values.

Table 6.10 Mitigation and management measures

Reference	Mitigation measure	Timing	Responsibility	Intended outcome
E.06	Sediment controls to be implemented during construction in accordance with a sediment and erosion control plan, including installation of fencing and sediments traps in any areas where works will occur in proximity to low lying vegetation or streams.	Pre-construction Construction	Contractor	Protection of waterways and aquatic habitats adjacent to the project. Protection of adjacent grassland habitat for Bluegrass and Austral Toadflax.
E.07	The Construction Traffic Management Plan (CTMP) is to include construction speed limits to minimise risk of vehicle strike during construction phase of projects when there is expected to be an increase in traffic movements.	Construction	Contractor	Mitigate risk of prescribed impact (i.e. vehicle strike) on threatened species during construction.
E.08	Pre-clearance inspection to be conducted by a suitably qualified ecologist to: • inspect hollows prior to tree clearing • inspect buildings prior to demolition • remove any individuals if found • relocate animals to suitable habitat in adjacent vegetation outside of the disturbance footprint • any animals injured during clearing works should be taken to a veterinarian or wildlife clinic.	Pre-construction	Contractor Qualified ecologist or wildlife carer	Prescribed impact: • Mitigate risk of prescribed impact (i.e. human-made structures) on threatened species as a result of demolition works. General impact: • Mitigate injury to potential fauna species inhabiting hollows.
E.09	Implement a Biodiversity Management Plan (BMP) for retained vegetation adjacent to the disturbance footprint that includes (but is not limited to): • protocols to control and manage weeds that may be exacerbated, spread or otherwise affected by the construction and operation of the project • protocols to monitor the vegetation condition and habitat values of any such retained vegetation • provisions for corrective actions should a decline in vegetation or habitat condition be detected.	Pre-construction Construction Operation Decommissioning	Contractor Operator Qualified ecologist	Protection of biodiversity values adjacent to the project.

Table 6.10 Mitigation and management measures

Reference	Mitigation measure	Timing	Responsibility	Intended outcome
E.10	The Biodiversity Management Plan (BMP) shall include prescriptions for the protection and ongoing management of the habitat of retained occurrences of Bluegrass and Austral Toadflax that are surrounded by the approved disturbance footprint.	Pre-construction Construction Operation Decommissioning	Operator	Mitigation of project impacts on candidate species Bluegrass and Austral Toadflax. Mitigation of project impacts on MNES Bluegrass and Austral Toadflax.

6.1.10 Conclusion

The BDAR has assessed the potential biodiversity impacts of the project and has assessed the options for avoiding and minimising these impacts as much as is practicable. The disturbance area is currently and has been used historically for cropping and grazing. The conceptual project layout has been designed to use the maximum extent of cropped and grazed land for the development of the project to avoid and minimise biodiversity impacts.

Some of the development footprint contains PCTS which are defined as Box gum woodland and derived native grassland. This native vegetation will require to be cleared for the project, including:

- 2.52 ha of woodland
- 216.49 ha of derived native grassland
- 34 hollow bearing trees
- 51 scattered trees.

A range of avoidance and mitigation measures are proposed to limit the biodiversity impacts of the project.

The project requires 260 ecosystem credits to compensate for impacts to native PCTs and ecosystem credit species, as well as 45 ecosystem credits to compensate for the loss of scattered trees. In addition to ecosystem credits, the project also requires 975 species credits for Bluegrass, 733 species credits for Austral Toadflax, and 65 species credits for the Eastern Pygmy-possum. The Eastern Pygmy-possum has been assumed to be present in woodland areas due to the lack adequate survey specifically targeting this species.

Where possible, Sundown Solar will compensate for the residual impacts through the establishment of stewardship sites near the project and generation of like-for-like credits. Any shortfall in credit obligations after this approach is exhausted will likely be met through a payment directly into the BCF.

The BDAR has assessed the potential for serious and irreversible impacts (SAII) to Box Gum Woodland CEEC, in accordance with Section 9.1.1 of the BAM. The avoidance of impacts to this TEC was a primary focus throughout the design process, resulting in the exclusion of over 177 ha of derived native grassland and 30 ha of woodland from the disturbance footprint. Impacts to the CEEC will be further mitigated through the creation of a biodiversity management plan for areas not included in the final design.

The BDAR has also considered impacts to species and communities listed under the EPBC Act. Significant impact assessments concluded that the project has potential to cause significant impacts to Box Gum Woodland, Bluegrass and Austral Toadflax. The project will be assessed in accordance with the bilateral agreement made between the NSW and the Commonwealth under Section 45 of the EPBC Act.

6.2 Aboriginal heritage

6.2.1 Introduction

An Aboriginal Cultural Heritage Assessment (ACHA) was prepared for the project (Appendix D). The ACHA documents the results of archaeological investigations undertaken to identify the extent and significance of any physical remains and intangible values of past Aboriginal visitation, use and occupation within the project area.

The Aboriginal heritage-related SEARs are outlined in Table 6.11.

Table 6.11 Aboriginal heritage-related SEARs

SEARs requirement	Section addressed
Heritage – including 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 6.2 Appendix D

i Note on ACHA scope

Note, the ACHA considers potential impacts to the onsite project area. It does not consider potential impacts associated with the proposed upgrade of the access road (Spring Mountain Road and Sturmans Road) or the proposed Gwydir Highway/Spring Mountain Road intersection upgrade. At the time of undertaking the onsite investigations, the design and extent of disturbance for the access road and intersection were not known. Nonetheless, the access road was used by the field team, and any information incidentally provided or observed is outlined in this report.

Since the access road is disturbed as a result of its establishment and maintenance, it is considered improbable that significant cultural materials would be present. Similarly, the road verges that have also been subject to past and ongoing maintenance are also considered of low risk to retain significant cultural materials. The ACHA recommendations that these areas be subject to further onsite investigation once detailed design of the access road is finalised, noting that this may be after the submission of the EIS.

6.2.2 Consultation

Consultation for the ACHA was undertaken in accordance with Heritage NSW's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010).

Twenty-six registered Aboriginal parties (RAPs) registered their interest in being consulted. RAP consultation comprised:

- a presentation about the project and the proposed method for the archaeological assessment in June 2021
- review of the proposed ACHA assessment and fieldwork methods
- participation in the four-day archaeological survey in September 2021
- provision of project updates by letter and email
- consultation regarding the need for test excavation in March 2022
- review of the proposed method for the text excavation in August 2022
- participation in the three-day test excavation in June 2022
- participation in an Aboriginal focus group meeting on 5 September 2022
- review of the draft ACHA in August–September 2022.

6.2.3 Existing environment

i Landscape overview

The project area is located within the New England Tablelands Bioregion, which is a stepped plateau of hills and plains with elevations between 600 and 1,500 m on Permian sedimentary rocks, intrusive granites and extensive tertiary basalt flows.

The study area is located in the catchment of the MacIntyre River. The study area landscape is characterised by broad low hills, with creeks and drainage lines running south to north into Kings Creek, (4th order) which runs along the northern boundary, joining the Macintyre River outside the study area to the west. Tributaries to Kings Creek within the study area include Kateys Creek (3rd order) to the west, Jessie Creek (2nd order) in the centre of the study area and a number of first to third order tributaries in the east of the study area.

The geology of the study area is dominated by basalt, and surface outcropping is limited to loose rocks and occasional exposed bedrock in the stream beds.

The access road (Spring Mountain Road and Sturmans Road) crosses a number of streams, including Swan Brook (4th order), Wet Creek (3rd order) and a third order tributary to Kings Creek. High order watercourses and their tributaries were often used by Aboriginal people in the past as suitable areas for camping and food and resource procurement. As such, the potential for archaeological sites and deposits to be found in their vicinity, is generally high, particularly on the lower slopes and level terraces.

ii Vegetation, land use and disturbance

Extensive native vegetation clearing has occurred in the study area as a result of agricultural activities. Remnant vegetation provides insight into past available resources. Native birds, reptiles, mammals, insects and aquatic life would have occupied the landscape, and along with plant resources, would have provided various resources for consumption and use.

Extant areas of woodland and open forest are retained as narrow, disconnected patches along creek lines, as scattered trees across large areas of pasture, and as regenerating woodland in the east. Previous land disturbance has a significant impact to the survivability of cultural materials. There are a number of mature trees that have survived since colonial settlement for use as shade for livestock.

iii Ethno-historical context

The study area falls on the Aboriginal language group boundary of *Nganyaywana (Anaiwan)* and *Ngarabal.*

Ngarabal people were located from Glencoe north to Bolivia then slightly east to the Bundjalung border and west to take in the Beardy plains and the top of the Seven River area. The area around Kingsplains, Wellingrove and Strathbogie stations have also been home to the *Ngarabul*. *Anaiwan* country borders *Ngarabal* country to the south.

Aboriginal people used the landscape as both a natural and cultural resource and there is a strong oral history indicating seasonal movement of Aboriginal people through the rugged gorge system, between the coastal plains and tablelands. The tablelands were more intensively occupied during summer and autumn, with communities moving either to the coast or the western river systems for winter.

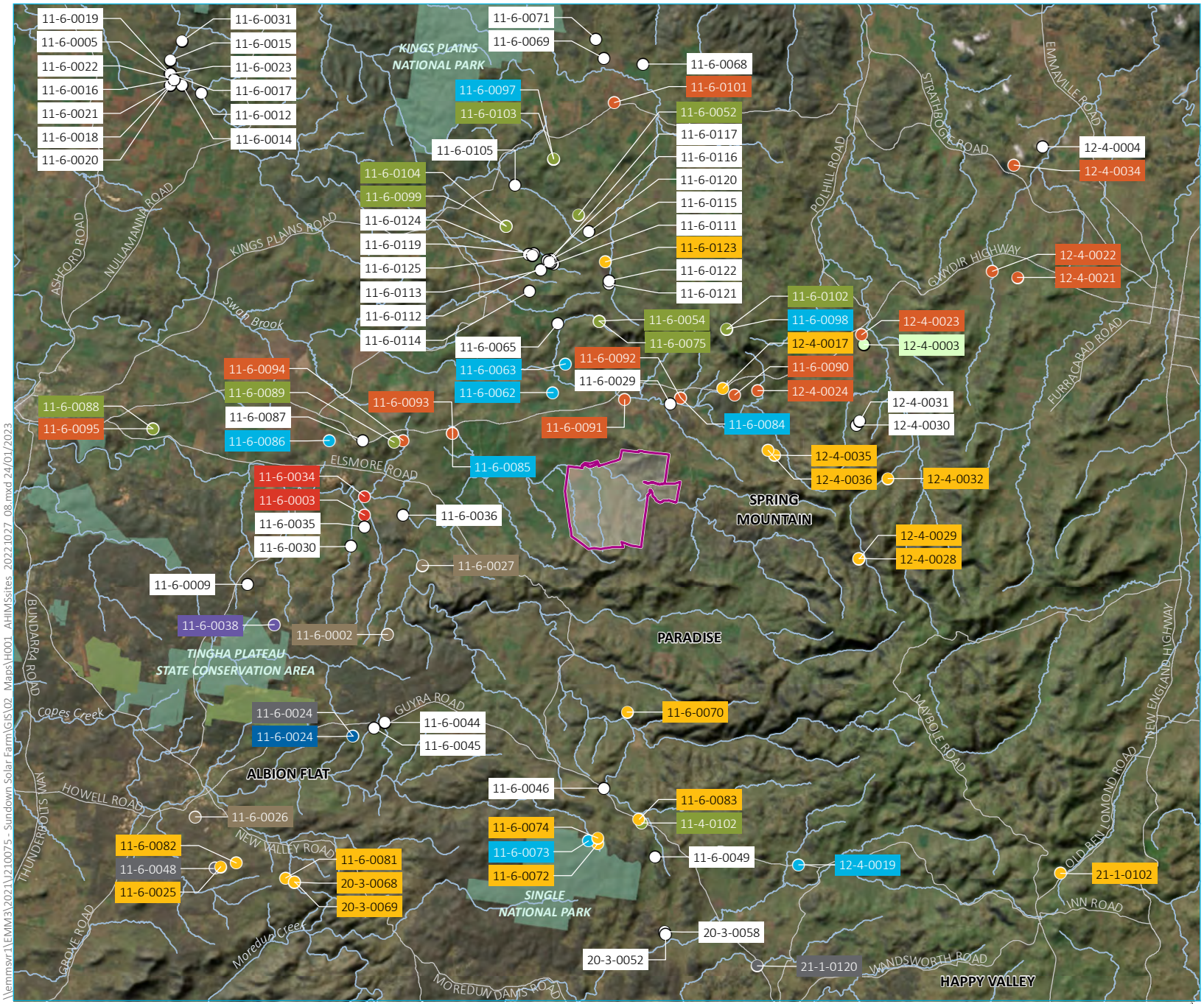
The region is also known for ornately carved trees, ceremonial bora grounds and art sites, indicating an intimate spiritual, as well as a physical, attachment to the sacred landscape the Aboriginal people inhabited.

iv Archaeological context

Archaeological and linguistic evidence suggests that the Tablelands were most intensively occupied from around 4,000 years ago (Beck 2006). This is based on the finds of surface or near-surface artefacts, with very little found at greater depth. The oldest known Aboriginal site (c. 4,300 years old) is near Bendemeer on the southern edge of the Tablelands.

No previous Aboriginal archaeological investigations have been undertaken for the study area. However, in recent years, a number of Aboriginal cultural heritage assessment have been conducted in relation to the development of solar and wind farms in the local area. These studies help to create a predictive model of the range and nature of Aboriginal sites and features near the study area.

A search of the Aboriginal Heritage Information Management System (AHIMS) register on 4 May 2021 identified 105 sites (Figure 6.4), with 62% of sites being artefact sites, 16% being modified trees (16%), and 11% being areas deemed to have potential archaeological deposit (PAD). No sites were recorded within the project area.



KEY

- Proposed Sundown Solar Farm (Project area)
- Major road
- Named watercourse
- NPWS reserve
- State forest

AHIMS (by site type)

- Artefact scatter
- Artefact site (unspecified)
- Axe grinding groove
- Bora/ceremonial
- Burial
- Isolated find
- Modified tree
- Ochre quarry
- PAD
- Rock engraving
- Shelter with art or deposit

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); OEH (2021); DFSI (2017); GA (2011)

0 5 10 km

GDA2020 MGA Zone 56

N

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Aboriginal objects and sites within the AHIMS database

Sundown Solar Farm
Environmental impact assessment
Figure 6.4

EMM creating opportunities

6.2.4 Archaeological survey

i Survey aims and method

EMM conducted a four-day archaeological survey of the survey area with the assistance of RAPs between 20–23 September 2021. The primary objectives of the archaeological survey were to:

- identify Aboriginal archaeological sites and/or Aboriginal places with the assistance of Aboriginal knowledge holders
- characterise the landscape to aid predictions of archaeological potential
- identify sites or areas that would require further investigation if planned for development as part of the project
- identify sites or areas to be avoided by development, where possible
- identify areas with minor or negligible Aboriginal cultural heritage values that are most suitable for development.

The survey was conducted in accordance with Section 2.2 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a). Further details of the assessment methods are provided in the ACHA (Appendix D).

ii Survey results

During the archaeological survey, 36 sites were identified. These sites comprised artefact scatters, isolated finds and scarred trees (Table 6.12 and Figure 6.5).

Table 6.12 Survey results summary

Site type	Frequency	Percentage of total sites
Artefact scatter	13	36
Isolated find	14	39
Modified (scarred) tree	9	25
Total	**36**	**100%**

Artefact sites were predominantly identified on gently sloping landforms close to waterways and are representative of more transitory occupation of the landscape rather than any areas of focused activity. Two artefact sites have been identified as having potential archaeological deposit (PAD) (Figure 6.6 and Plate 6.1).

Seven of the modified trees at the site are living and two are dead. An example scarred tree is shown as Plate 6.3.

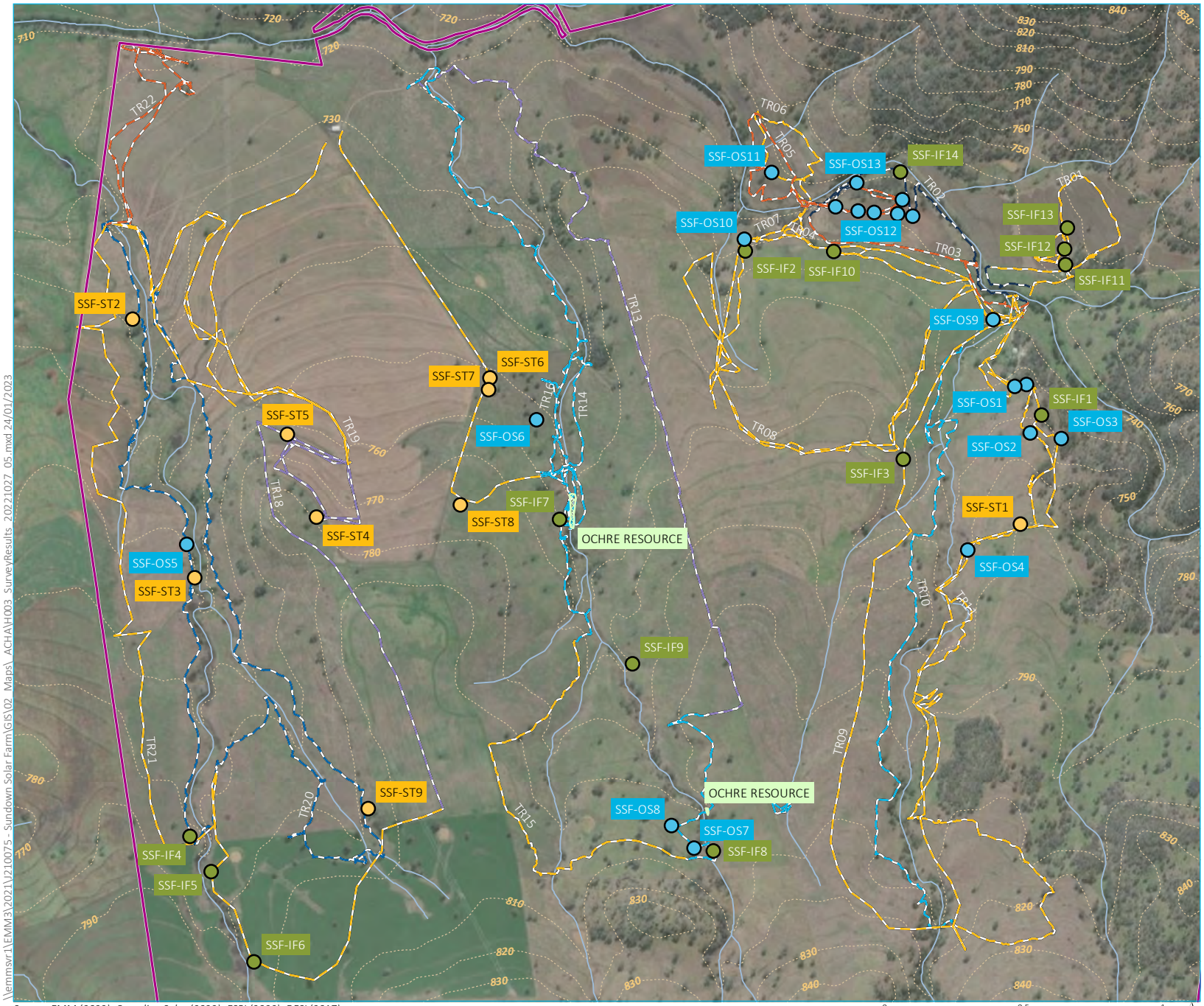
Two ochre resources were observed, one beside Jessie Creek and one on a second order tributary to Jessie Creek further upstream (Plate 6.4 and Figure 6.7).

Plate 6.1 PAD area south of Kings Creek (SSF-OS12)

Plate 6.2 Examples of artefacts found at PAD area south of Kings Creek (SSF-OS12)

Plate 6.3 Example scarred tree (SSF-ST4)

Plate 6.4 Ochre resource on the west bank of Jessie Creek



KEY

- Proposed Sundown Solar Farm (Project area)
- Ochre resource
- Topographic contour (10 m interval)
- Watercourse/drainage line

Archaeological feature

- Artefact scatter (OS)
- Isolated find (IF)
- Culturally modified tree (ST)

Survey transect

- Hill crest
- Hillslope
- Terrace
- Watercourse (Strahler 1 and 2)
- Watercourse (Strahler 3)
- Watercourse (Strahler 4)

0 0.5 1 km

GDA2020 MGA Zone 56

N

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017);

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Aboriginal survey results

Sundown Solar Farm
Environmental impact assessment
Figure 6.5

EMM creating opportunities

6.2.5 Test excavation

i Aims and method

EMM conducted a three-day test excavation of the larger PAD with the assistance of RAPs between 7–9 June 2022. The primary objective of the test excavation was to further characterise the significance and extent of the PAD (a southern terrace of Kings Creek) identified during the archaeological survey (Figure 6.6). No test excavation was undertaken of the smaller PAD as it will not be disturbed.

The test excavation was undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a). Overall, the team excavated 22 individual 50 cm x 50 cm test excavation units. Further details of the assessment methods are provided in the ACHA (Appendix D).

ii Results

The test excavation determined there is a low-density artefact scatter across the area of PAD (Figure 6.6), with eight stone artefacts recovered, comprising flakes, broken flakes, and a core.

The sparse and random distribution of artefacts scatter is evidence of Aboriginal presence in the area, and likely represents partial traces of camping or may be the product of transitory movement by Aboriginal people and temporary camp sites. In either scenario, there is no evidence of an intact campsite in terms of layout or integrity and insufficient information to make further assumptions.

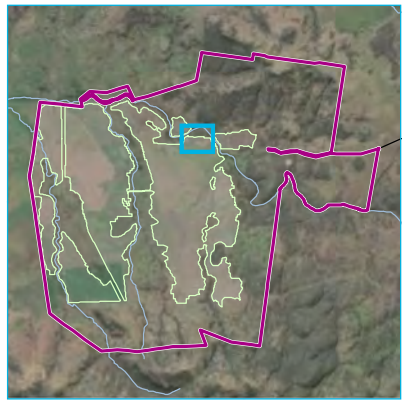
6.2.6 Impact assessment

Avoidance of significant Aboriginal cultural heritage values has been a key aspect of the project layout refinement process. EMM notes that the construction activities associated with the project will represent a similar type of impact to what has already occurred within the development footprint through historical agricultural activities (such as vegetation clearance, cropping, installation of fencing, sculpting of contour banks and installation of access tracks etc).

Thirty-six Aboriginal sites and two ochre resource areas have been identified in proximity to the development footprint. Twenty-six sites will be avoided and 10 sites will be impacted to some degree. All of the sites to be impacted are isolated stone artefacts or low density artefact scatters of low significance. The key mitigation measure for the impacted sites is surface collection prior to development (Figure 6.7).

None of the scarred trees will be impacted, except for the possible relocation of SSF-ST1; a dead, collapsed tree that discussions have indicated can be relocated for interpretive and other opportunities.

The two ochre resource areas will be avoided.



KEY

- Proposed Sundown Solar Farm (Project area)
- Aboriginal cultural heritage assesment and historic heritage survey area
- Named watercourse

Development footprint

- Construction and laydown

Previously identified artefact

- Artefact scatter (OS)
- Isolated find (IF)

Test pit/artefact frequency

- 0
- 1
- 2

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); OEH (2021); DFSI (2017)

0 50 100 m

GDA2020 MGA Zone 56

N

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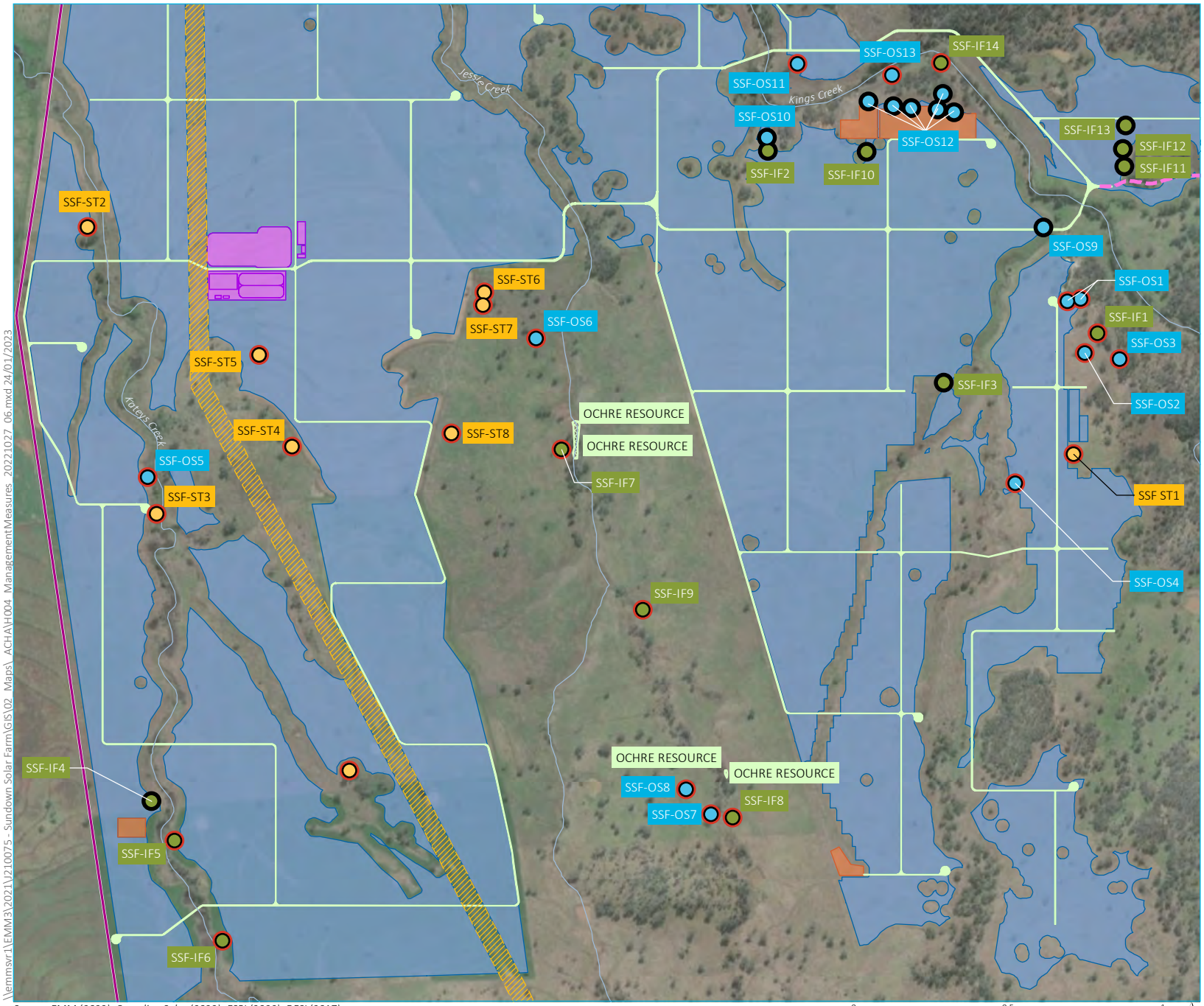
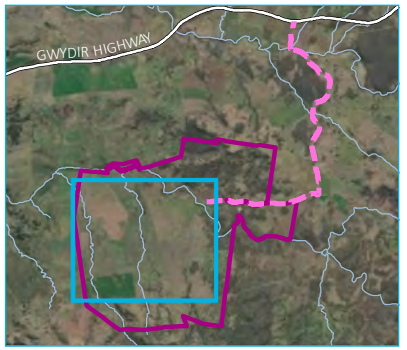
Test excavation results

Sundown Solar Farm
Environmental impact assessment
Figure 6.6

EMM
creating opportunities





KEY

- Proposed Sundown Solar Farm (Project area)
- Named watercourse
- Ochre resource

Archaeological feature

- Artefact scatter (OS)
- Isolated find (IF)
- Culturally modified tree (ST)

Management measure

- Avoidance
- Surface collection

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

0 0.5 1 km

GDA2020 MGA Zone 56

N

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Aboriginal heritage management measures

Sundown Solar Farm
Environmental impact assessment
Figure 6.7

EMM creating opportunities

6.2.7 Mitigation measures

Proposed measures to manage and mitigate potential Aboriginal heritage impacts are outlined in Table 6.13 and are shown in Figure 6.7.

Table 6.13 Aboriginal heritage mitigation measures

Reference	Mitigation measure	Timing
AH1	An Aboriginal Cultural Heritage Management Plan (ACHMP) will be developed in consultation with Heritage NSW, RAPs and DPE. The ACHMP will detail the management of all identified Aboriginal sites. It will also detail the assessment requirements for any proposed changes to the project footprint (for example, the disturbance footprint of the access road and intersection).	Pre-construction
AH2	All verified scarred trees within the development footprint or within 20 m of the development footprint will be avoided with protection during the construction phase to avoid inadvertent impacts, apart from the one dead, fallen tree (SSF-ST1) which may be moved to outside the development footprint (in consultation with RAPs).	Pre-construction Construction
AH3	If any changes to the proposed project layout result in standing trees with cultural scars being situated within the project area, the tree/s must be assessed by a suitably qualified expert in scar tree assessment. Any tree assessed as being of Aboriginal origin, must be avoided as per mitigation measure AH2.	Pre-construction
AH4	All surface artefacts (artefact scatters and isolated finds) impacted by the project will be collected, including sites within 20 m of the development footprint.	Pre-construction
AH5	Following recording and analysis, the recovered Aboriginal objects will either be transferred to a keeping place or reburied in a location outside the development footprint where they will not be harmed. This will be determined in consultation with RAPs.	Pre-construction
AH6	In the event unexpected Aboriginal objects or sites are discovered during any ground disturbance activity, a buffer will be placed around the site and the proponent should determine the subsequent course of action in consultation with a heritage professional and/or the relevant state government agency as appropriate.	Construction
AH7	If suspected human skeletal material is discovered, all works should cease, and the NSW Police and the NSW Coroner's Office should be contacted. Should any material prove to be archaeological Aboriginal remains, Heritage NSW and the Local Aboriginal Land Council will be notified.	Construction
AH8	In consultation with relevant project landholders, Sundown Solar will explore the potential for scheduled RAP access to the ochre resources beside Jesse Creek. The details would be developed in consultation with RAPs as part of the ACHMP.	Pre-construction Construction Operation

6.2.8 Conclusion

Avoidance of significant Aboriginal cultural heritage values has been a key aspect of the project layout refinement process. EMM notes that the construction activities associated with the project will represent a similar type of impact to what has already occurred within the development footprint through historical agricultural activities (such as vegetation clearance, cropping, installation of fencing, sculpting of contour banks and installation of access tracks etc).

Thirty-six Aboriginal sites and two ochre resource areas have been identified in proximity to the development footprint. Twenty-six sites will be avoided and ten sites will be impacted to some degree. All of the sites to be impacted are isolated stone artefacts or low-density artefact scatters of low significance. The key mitigation measure for the impacted sites is surface collection prior to development.

None of the scarred trees will be impacted, except for the possible relocation of one dead scarred tree (SSF-ST1).

While it is acknowledged that the project will result in impacts to these Aboriginal heritage sites, the results of the ACHA, including the test excavation along with the collection and cataloguing of artefacts will contribute to knowledge of artefact types and materials in the local area.

The project offers the opportunity to maintain a cultural connection with the landscape by having continued access to the ochre site on Jessie Creek, which will help to achieve intergenerational equity by allowing retention of cultural materials for the enjoyment and education of future generations.

6.3 Historical heritage

6.3.1 Introduction

A Statement of Heritage Impact was prepared for the project (Appendix E). This section of the EIS summarises the assessment and addresses the SEARs requirements for potential historical heritage impacts. The historical heritage-related SEARs are outlined in Table 6.14.

Table 6.14 Historical heritage-related SEARs

SEARs requirement	Section addressed
Including 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 Appendix E

6.3.2 Existing environment

i Landscape overview

The project area is within the New England Tablelands Bioregion. The New England Tableland Bioregion is a stepped plateau of hills and plains with elevations between 600 and 1,500 m on Permian sedimentary rocks, intrusive granites and extensive tertiary basalt flows.

The landscape of the study area is characterised by broad low hills, with creek and drainage lines running south to north into Kings Creek.

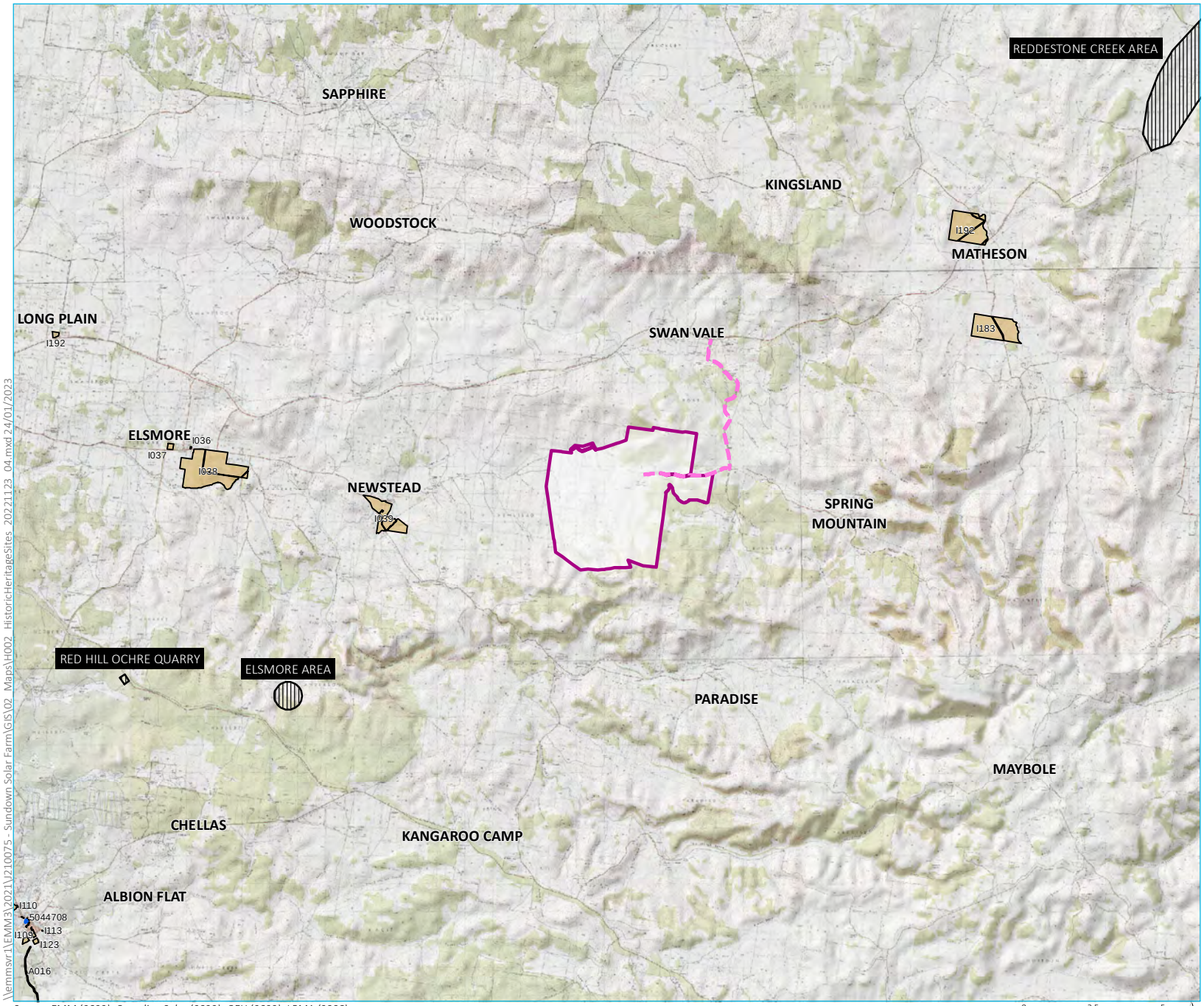
The study area consists of two primary ridges, sloping from south to north, subdivided by Jessie Creek and bordered by Kateys Creek to the west and an unnamed second order stream to the east. These ridges originate in a main ridge, running roughly east to west to the south of the study area at an elevation of over 900 m AHD. Elevation at the southern end of the disturbance footprint is around 840 m AHD sloping to 720 m AHD in proximity to Kings Creek at the northern end of the study area. Slopes are generally gently inclined, ranging from a 2.9% north to south slope on the western ridge and up to 10% beside Jessies Creek in the east and Kateys Creek in the west.

The geology of the project area includes Permian sedimentary rocks and intrusive basalts and granites. This is evident in the project area as the pastures have been raked into piles throughout the years to make agricultural work easier.

The water sources that run through the project area are semi-permanent, except for Kings Creek, which is a 4th order waterway (Strahler System) that runs through the eastern section of the project area.

ii Heritage listings

There are no heritage listings within the project area. The closest listed heritage item to the project footprint is located 5.1 km west and is listed on the Inverell LEP as ‘Newstead Station Group’, item I039 (Figure 6.8).



Source: EMM (2022); Canadian Solar (2022); OEH (2022); LPMA (2006)

Regionally listed historical heritage sites and items

Sundown Solar Farm
Environmental impact assessment
Figure 6.8

EMM
creating opportunities

iii Historical context

The project area and surrounds have been used for farming for the last 180 years or so. The project area is located within the historical boundaries of Newstead station, a large sheep station established in the 1830s.

As is typical with large stations, ownership of Newstead station changed over time and various parcels of land were added on and sold off. Newstead station included several outstations, huts, homesteads and wool sheds, many of which have since been ruined or removed. The portion of Newstead station being proposed to be developed as Sundown Solar Farm, however, has very few structures within it, possibly due to the area historically being used for crops rather than for stock.

Tin mining has historically taken place west of the project area; however, no mining has taken place within the project area.

Further information on the existing environment is provided in Appendix E.

6.3.3 Assessment method

i Archaeological survey

EMM conducted an archaeological survey of the development footprint over a period of three days in September 2021 (Figure 6.9) The survey covered a distance of 48.5 km. Prior to the survey, a desktop assessment of the project area was undertaken to identify potential areas of historical heritage value. The objectives of the archaeological survey were to:

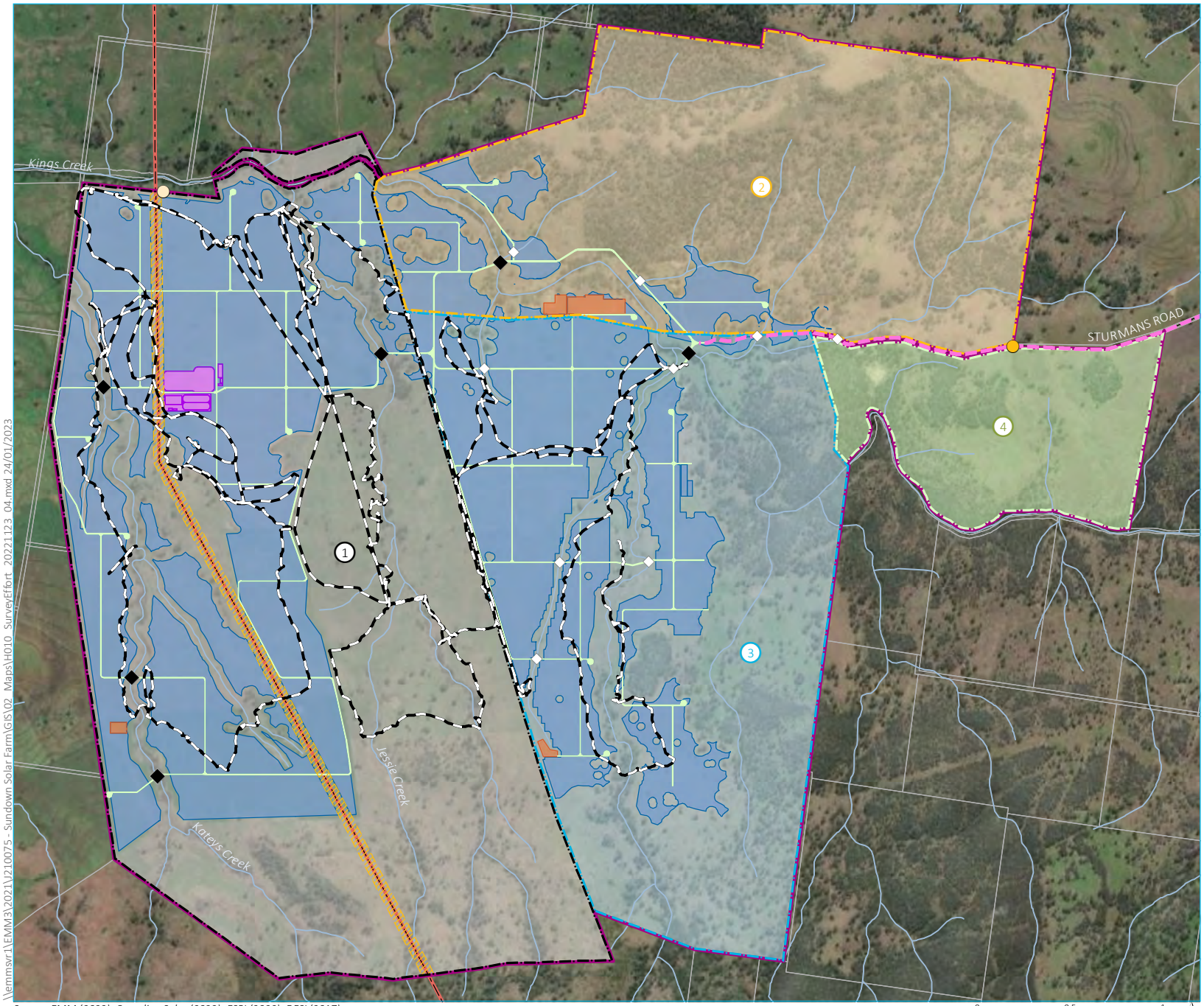
- identify historical sites
- characterise the landscape to aid predictions of archaeological potential
- identify culturally significant landscapes
- identify sites or areas that would require further investigation if planned for development as part of the project
- identify sites or areas to be avoided by development, where possible
- identify areas with minor or negligible historical significance that are most suitable for development.

No subsurface investigations were undertaken. During the survey, information was collected using a handheld global positioning system (GPS) and notebook, digital single-lens reflex (DSLR) Canon camera, and ArcGIS 123 survey forms.

The archaeological survey targeted areas likely to have been used by settlers and shepherds, including sheltered areas and areas near permanent water. The archaeological survey area was divided into four areas (Figure 6.9). The survey effort focussed on Area 1 and Area 3 only, as these areas:

- comprise the majority of the proposed development footprint
- included features considered more likely to have historical importance.

Further detail on the assessment method is provided in Appendix E.



KEY

- Proposed Sundown Solar Farm (Project area)
- Survey track
- Minor road
- Watercourse/drainage line
- Cadastral boundary

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Emergency access/egress point

- Primary
- Secondary

Potential water crossing

- Named watercourse
- Drainage line

Survey area

- 1
- 2
- 3
- 4

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

0 0.5 1 km

GDA2020 MGA Zone 56

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Historical heritage survey effort

Sundown Solar Farm
Environmental impact assessment
Figure 6.9

EMM creating opportunities

6.3.4 Survey results

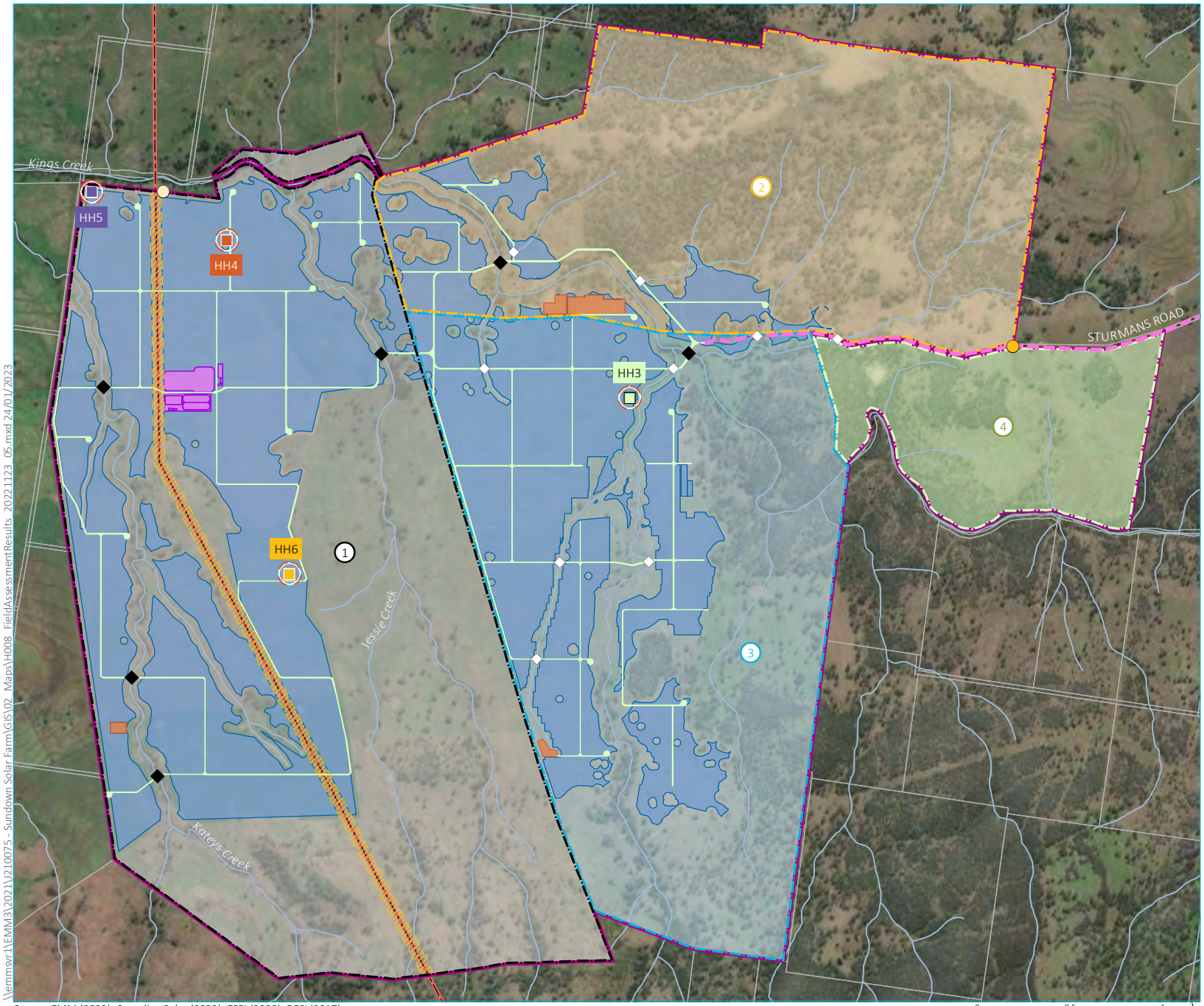
The aerial photographs and the archaeological survey identified the presence of four historical heritage sites within the development footprint:

- a rubbish pit (HH3)
- a shearing shed (HH4)
- a sheep dip and associated yards (HH5)
- an unidentified structure (HH6).

The location of these sites is shown in Figure 6.10. These sites are summarised in Table 6.15 and are shown in Photograph 6.1–Photograph 6.4.

The potential archaeological significance of these sites was assessed in general accordance with the *Burra Charter* (Australian ICOMOS 2013). The assessment concluded that, when assessed individually, none of the four sites meets the threshold for local significance. However, when assessed as part of the broader cultural landscape the sites have the potential to contribute to an understanding of historical land use patterns and therefore have local significance when considered collectively.

Further details of the assessment methods are available in Appendix E.



KEY

- Proposed Sundown Solar Farm (Project area)
- Minor road
- Watercourse/drainage line
- Cadastral boundary
- 20 m impact buffer (*offset for display*)

Historic heritage site

- HH3 - Rubbish pit
- HH4 - Wool shed
- HH5 - Sheep dip and yard
- HH6 - Unidentified structure

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Emergency access/egress point

- Primary
- Secondary

Potential water crossing

- Named watercourse
- Drainage line

Survey area

- 1
- 2
- 3
- 4

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

0 0.5 1 km

GDA2020 MGA Zone 56

N

\\emmsvr1\EMM3\2021\P210075 - Sundown Solar Farm\GIS\02 Maps\H008 FieldAssessmentResults 20221123 05.mxd 24/01/2023

Historical heritage sites

Sundown Solar Farm
Environmental impact assessment
Figure 6.10

EMM
creating opportunities

Table 6.15 Summary of historical heritage survey results

Site	Reference	Level of significance (individually)	Level of significance (collectively)	Description	Within disturbance footprint?	Photograph
Rubbish pit	HH3	None	Local	A rubbish pit, likely dating from the 1960's. Surface relics include glass and metal. There is potential for subsurface relics to also be present.	Yes	Photograph 6.1
Shearing shed	HH4			A shearing shed dating from approximately 1980.	Yes	Photograph 6.2
Sheep dip and yards	HH5			Sheep dip and associated sheds and yards. During the field survey, it was apparent that one of the buildings present in the 1962 aerial photograph has since been removed. There is potential for the presence of subsurface remains of a woolshed, kitchen or other associated buildings.	Yes	Photograph 6.3
Unidentified structure	HH6			The 1962 aerial indicates the presence of a structure, possibly a hut, outstation or shelter. During the field survey, no surface structures remained. It is possible that subsurface structures remain.	Yes	Photograph 6.4

Photograph 6.1 Rubbish pit (HH3) and examples of bottles found in the pit

Photograph 6.2 Shearing shed (HH4)

Photograph 6.3 Sheep dip and yards (HH5)

Photograph 6.4 Likely historical location of unidentified structure (HH6)

6.3.5 Impact assessment

All four sites (HH3, HH4, HH5 and HH6) are located within the disturbance footprint (Figure 6.10) and will therefore result in direct impacts.

6.3.6 Proposed measures

Proposed measures to manage and mitigate potential historical heritage impacts are outlined in Table 6.16.

Table 6.16 Historical heritage mitigation measures

Reference	Mitigation measure	Timing
H1	Prior to construction, prepare a Historical Heritage Management Plan (HHMP). Ensure the HHMP requires: • digital archival recording of: – HH4 (shearing shed)[3] – HH5 (sheep dip and yards) • archaeological investigation (including archaeological excavation) of: – HH3 (rubbish pit) to build an appreciation of life in the region during pastoral operations in early 20th century – HH6 (unidentified structure) to try to determine the function and nature of the structure • protocols for managing unexpected finds.	Pre-construction

6.3.7 Conclusion

A historical heritage impact assessment was undertaken for the project (Appendix E).

The project area was once part of the larger Newstead Station, however very little development appears to have been located within the portion of the station that comprises the proposed development footprint.

There are four historical sites within the development footprint. As it is not practical to avoid these sites, and as none of these sites meet the threshold for local significance, each site will be recorded as per the proposed measures in Table 6.16 and will then be developed as part of the project.

6.4 Land, soil and erosion

6.4.1 Introduction

A land and rehabilitation assessment was prepared for the project (Appendix F). This section of the EIS summarises the assessment and addresses the SEARs requirements for potential land, soil and erosion impacts. The land, soil and erosion-related SEARs are outlined in Table 6.17.

Table 6.17 Land, soil and erosion-related SEARs

SEARs requirement	Section addressed
Land: an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:	
• a consideration of agricultural land (including Biophysical Strategic Agricultural Land), flood prone land and an investigation of the potential for the site to be used for agricultural purposes during operation of the solar farm	BSAL is assessed in Section 6.4. Flood prone land is assessed the surface water report (Appendix J).
• a consideration of agricultural land with other renewable energy projects in the region, including White Rock Wind and Solar Farm, Sapphire Wind and Solar Farm and Glen Innes Wind Farm	Section 6.4.

[3] Prior to construction, HH4 will be relocated to outside of the development footprint. The digital archiving will be completed prior to relocation of HH4.

Table 6.17 Land, soil and erosion-related SEARs

SEARs requirement	Section addressed
• a detailed soil survey to consider the potential for erosion and impacts associated with sodic soils, paying particular attention to the compatibility of the development with the existing land uses on the site and adjacent land (e.g. operating mines, extractive industries including Frazier's Quarry, 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 6.4.
• a decommissioning and rehabilitation plan to return the land to productive agricultural use at closure of the project.	Section 6.4.

6.4.2 Existing environment

i Land use

The project area and surrounds are predominantly used for farming activities. The project area is predominantly mapped as Australian land use and management (ALUM) 3.3.0 ('cropping'). The remainder of the site is mapped as ALUM 3.2.0 ('grazing modified pastures') and to a lesser extent, ALUM 2.1.0 ('grazing native vegetation') (Figure 3.3).

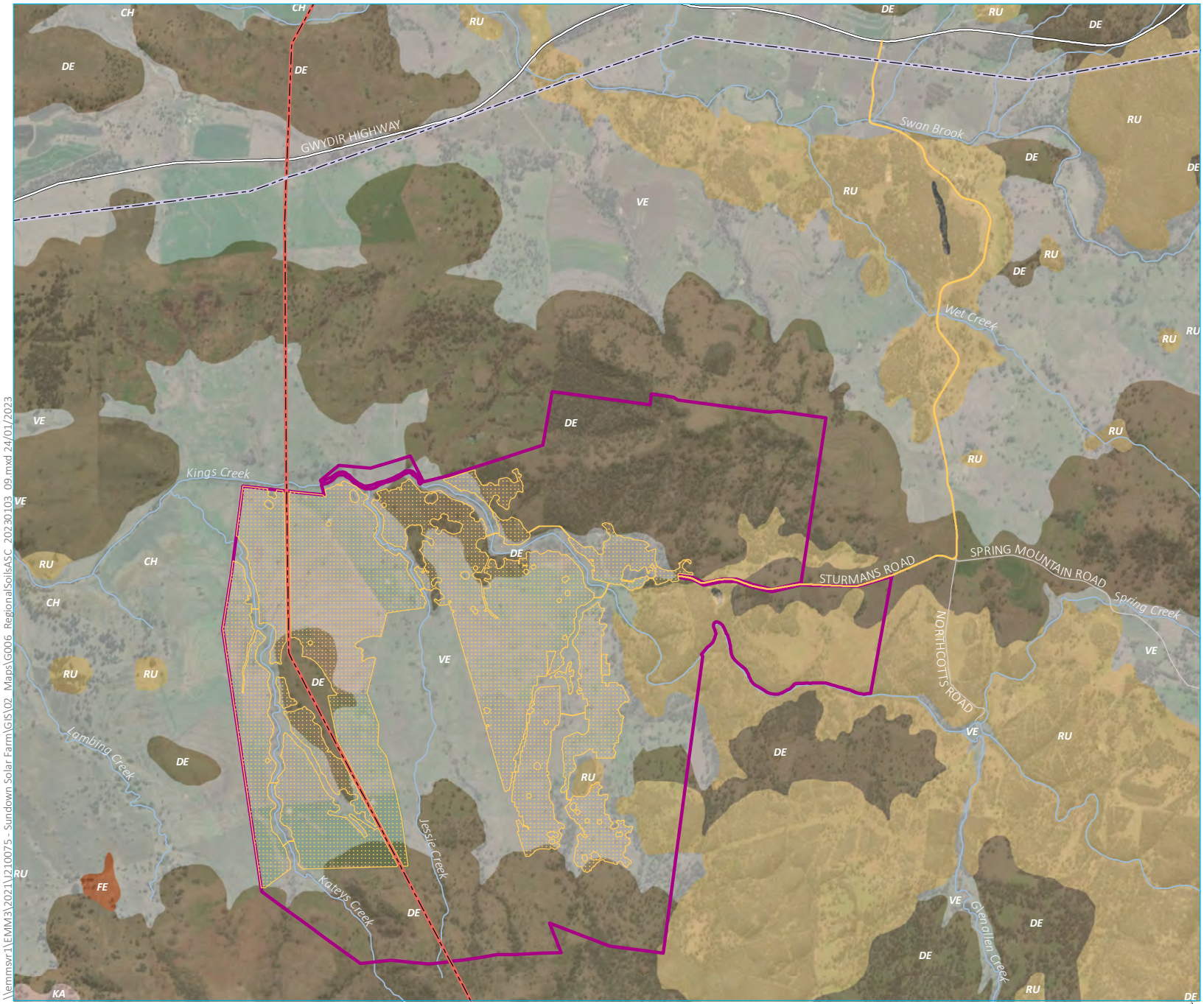
ii Soil type

The predominant soil types in the project area are Vertosols and Dermosols (Figure 6.11). The project area also comprises smaller areas of Rudosols.

Dispersive soil is potentially present on site, associated with Vertosols and Dermosols.

iii Biophysical Strategic Agricultural Land

Portions of the project area are mapped as Biophysical Strategic Agricultural Land (BSAL). A desktop assessment of the site, using the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH 2013) indicates that the site is likely to be considered BSAL. Further detail is provided in Appendix F. Whilst soil verification of BSAL was not completed, verification of LSC revealed a decreased presence of LSC Class 2 and 3 land which, under the regional BSAL mapping process, is identified as BSAL. The reduction of much of this land to LSC Class 4, and the identified limitation of rooting depth, indicates that these areas are unlikely to be BSAL. Remaining areas of LSC Class 2 and 3 are still potentially BSAL.



KEY

- Proposed Sundown Solar Farm (Project area)
- Conceptual disturbance footprint
- Major road
- Minor road
- Named watercourse

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Dominant Australian Soil Classification

- CH | Chromosols
- DE | Dermosols
- FE | Ferrosols
- KA | Kandosols
- RU | Rudosols
- VE | Vertosols

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Source: EMM (2023); Canadian Solar (20221); DPIE (2022); DFSI (2017); OEH (2017); GA (2011)

0 1 2 km

GDA2020 MGA Zone 56

N

Regional soils mapping - Australian soils classification

Sundown Solar Farm
Environmental impact assessment
Figure 6.11

EMM creating opportunities

iv Land and soil capability

The land and soil capability assessment scheme (OEH 2012) ('LSC scheme') uses 'LSC classes' that distinguish between the inherent physical capacity of the land to sustain a range of land uses (and management practices) in the long term without leading to degradation of soil, land, air and water resources.

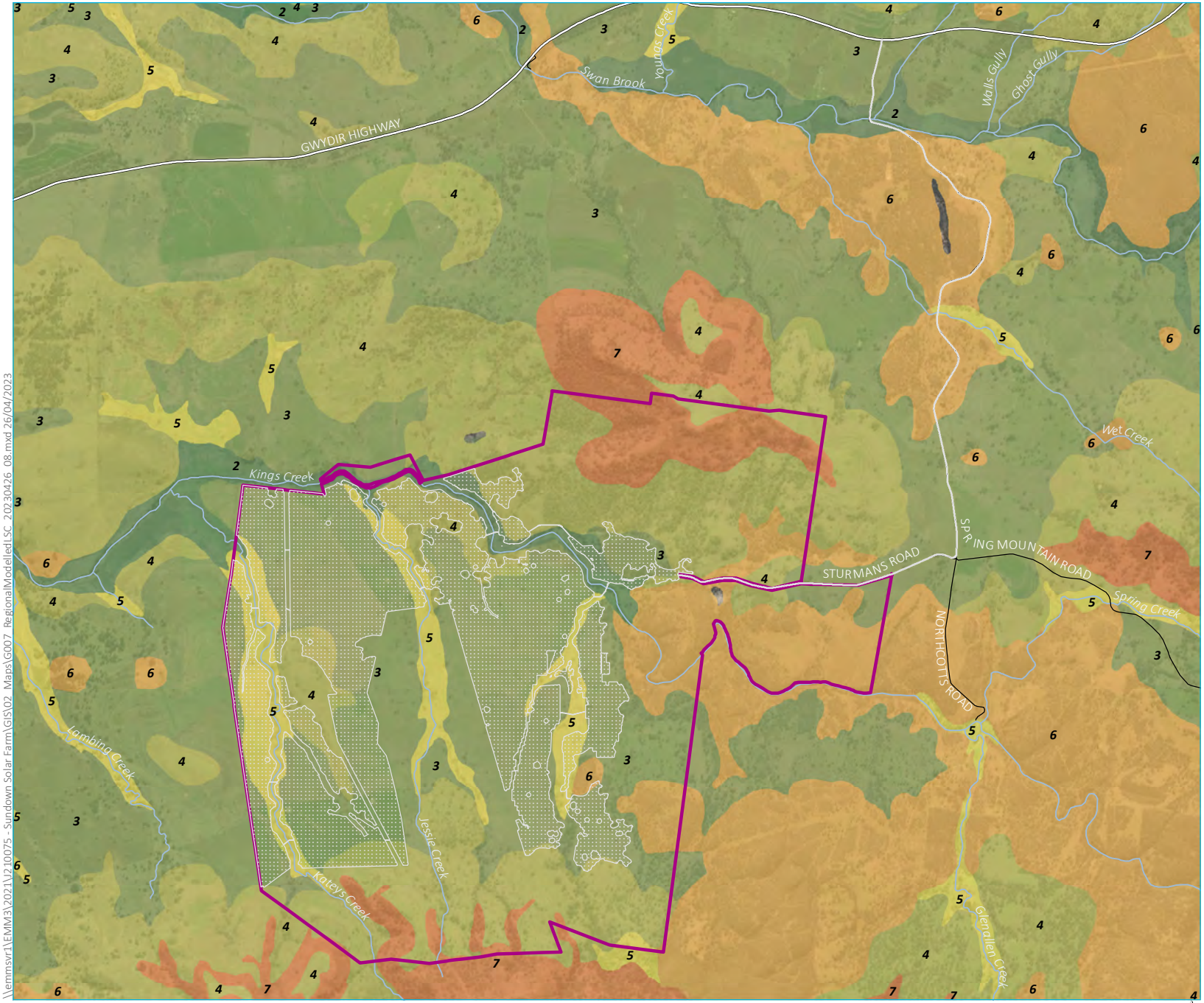
The project area is mapped at the state scale as LSC classes 2–7 (Section 6.12a). These LSC classes represent land with high to very low capability for productive use without resulting in land degradation.

SoilFutures (2023) ground-truthed the LSC classes at the site by undertaking a test sampling program across the development footprint. This assessment verified that there is far less LSC 3 land within the development footprint than is shown in the regional mapping (Figure 6.12b).

Currently, much of the land within the development footprint which is used for the equivalent of continuous cultivation is being used beyond its productive capacity, and although slopes are favourable, depth to bedrock significantly limits water storage. For this reason, much of the LSC class 3 and 4 land that was previously mapped is likely to correspond to Class 4 and 6 land where theoretically, continuous cultivation is not advisable. The project-verified LSC is summarised in Table 6.18.

Table 6.18 Project-verified LSC within development footprint

LSC class	Regionally-mapped extent (ha)	Project-verified extent (ha)	Verified variation (ha)	Project-verified extent (%)
2	11.6	10.9	-0.7	2%
3	494.6	133.0	-361.9	20%
4	79.9	360.0	280.1	55%
5	63.9	0.0	-63.9	0%
6	0.3	146.8	146.5	23%



KEY

- Proposed Sundown Solar Farm (Project area)
- Conceptual disturbance footprint
- Major road
- Minor road
- Named watercourse

LSC Class

- 2 | Slight but significant limitations
- 3 | Moderate limitations
- 4 | Moderate to severe limitations
- 5 | Severe limitations
- 6 | Very severe limitations
- 7 | Extremely severe limitations

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Source: EMM (2023); Canadian Solar (2022); DPE (2022); DFSI (2017)

0 1 2 km

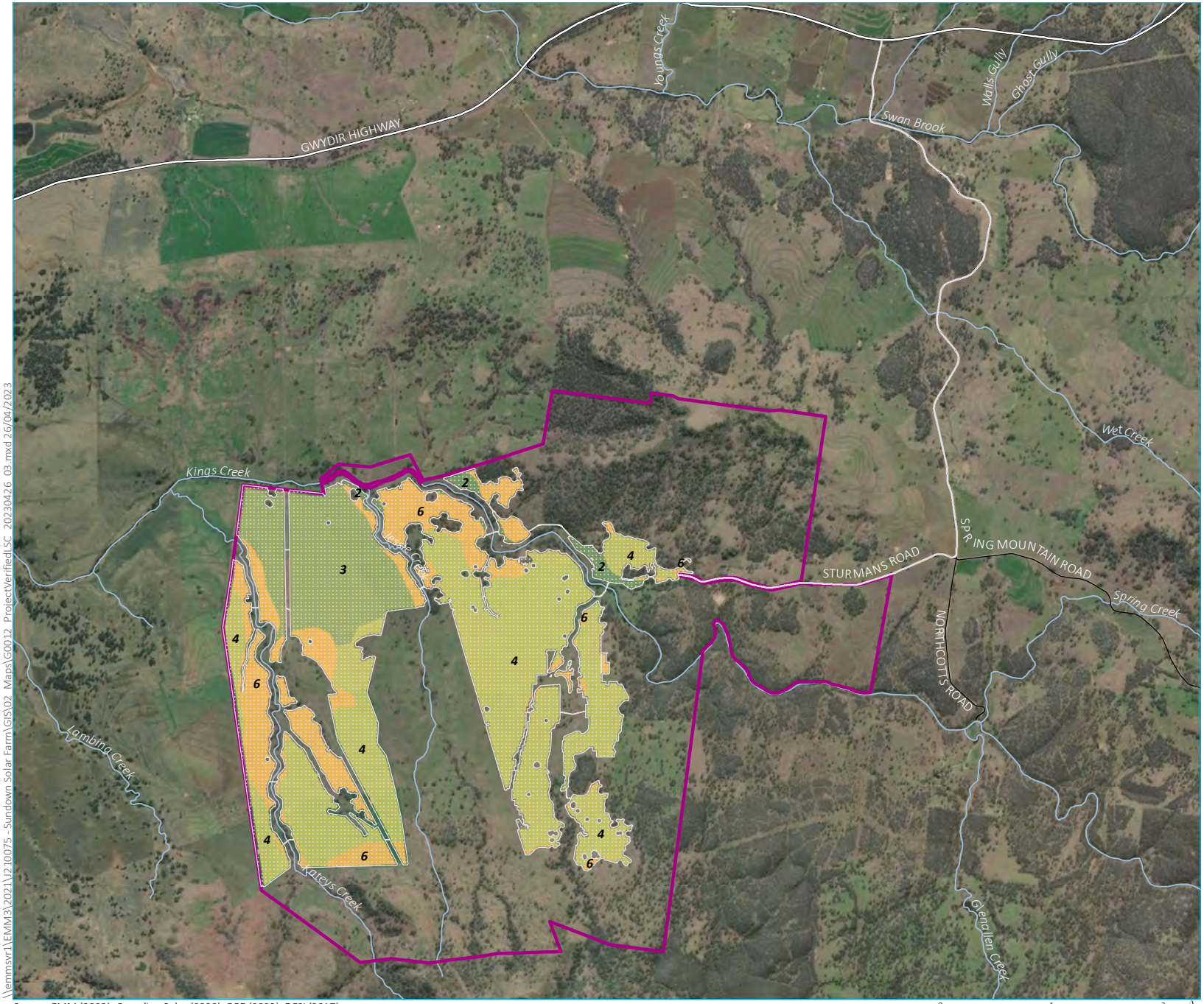
GDA2020 MGA Zone 56

N

LSC - regional mapped

Sundown Solar Farm
Environmental impact assessment
Figure 6.12a

EMM
creating opportunities



\\emmsvr1\EMM3\2021\P10075 - Sundown Solar Farm\GIS\02 Maps\G0012 ProjectVerifiedLSC 20230426 03.mxd 26/04/2023

Source: EMM (2023); Canadian Solar (2022); DPE (2022); DFSI (2017)

LSC - project verified

Sundown Solar Farm
Environmental impact assessment
Figure 6.12b

EMM
creating opportunities

v Acid sulphate soils

No acid sulphate soils are identified within the project area.

vi Erosion hazard

A network of contour banks is present on site and was installed in the 1990's to address erosion risk in some cropping areas.

Erosion potential in the north of the project area is low. This area is flatter and typically comprises vertosols. The erosion potential in the north is <20 t/ha/year up to <500 t/ha/year). Erosion potential in the south of the project area is moderate to high, largely due to the presence of steeper topography. The erosion potential in the south part of the site is 200–<2,000 t/ha/year.

The modelled K-Factors for the project area were determined from the eSpade 2.2 database (DPIE 2020c). The modelled K-Factors range from 0.02–0.07 t ha h $ha^{-1}MJ^{-1}mm^{-1}$ with the general factors per soil type being (from lowest to highest erosion risk):

- Vertosols 0.01–0.03 t ha h ha-1MJ-$1mm^{-1}$
- Dermosols 0.03–0.07 t ha h ha-1MJ-$1mm^{-1}$
- Rudosols and Tenosols 0.05–0.07 t ha h $ha^{-1}MJ^{-1}mm^{-1}$.

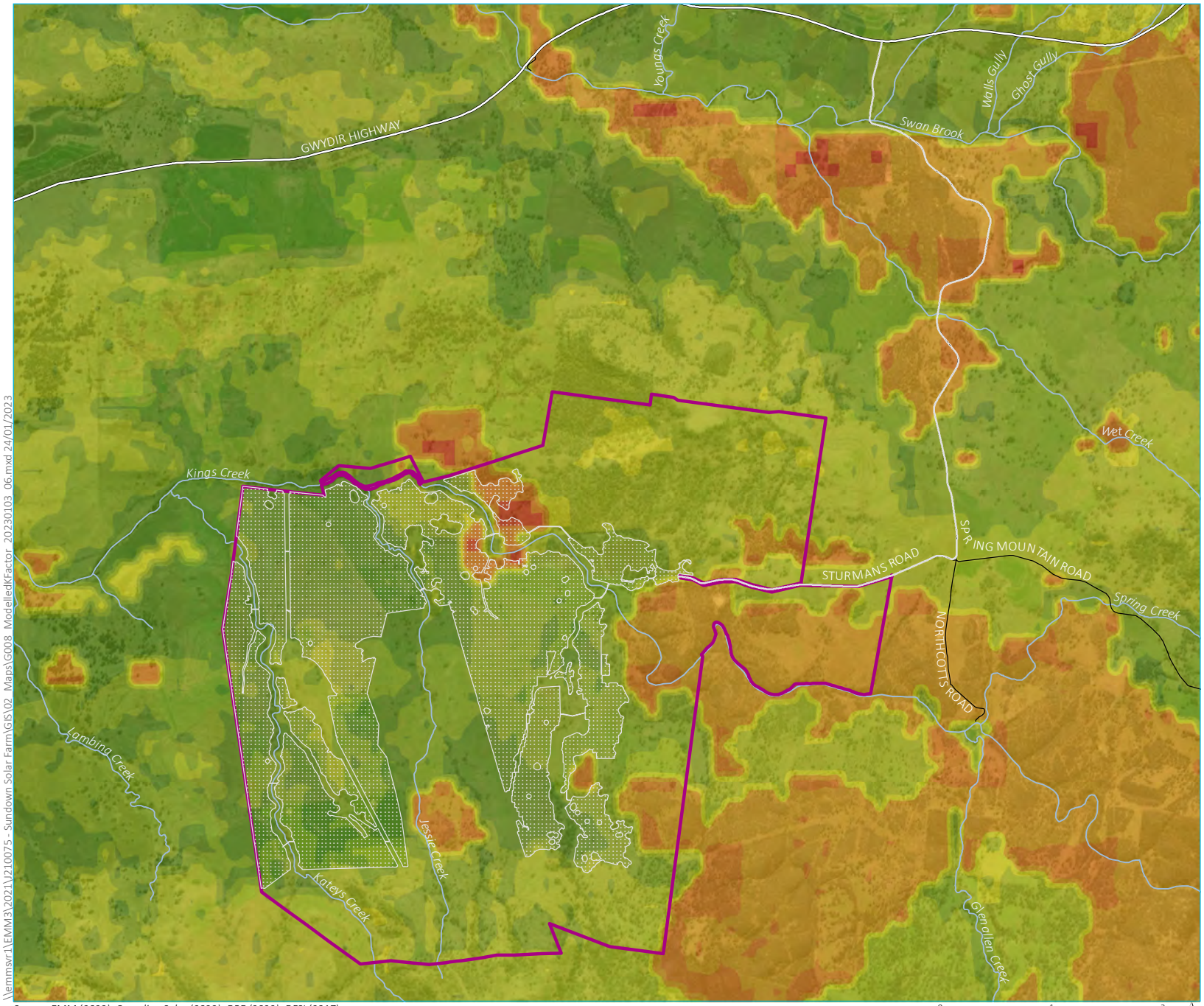
The modelled K-factors are shown in Figure 6.13.

Erosion hazard for the project has been assessed using the Landcom (2004) two-step method that considers rainfall erosivity, slope and soil loss. The majority of the site is considered low erosion risk due to the presence of predominantly low slopes (up to 11.5%). Small areas of the site are considered to be high erosion risk due to the presence of steep slopes (11.5–14% and steeper).

vii Surface water

Watercourses surrounding the project area sit within the headwaters of the Macintyre River catchment. The project area predominantly sits within the Kings Creek catchment, approximately 20 km upstream of its confluence with the Macintyre River, upstream of Inverell. Several ephemeral watercourses traverse the project area draining north to Kings Creek, including Kateys Creek, Jessie Creek and various first and second order watercourses. Kings Creek at the most downstream extent of the project is a fourth order watercourse draining a catchment of approximately 94 km^2.

The proposed site access road crosses several tributaries of Swan Brook, approximately 40 km upstream from its confluence where it joins the Macintyre River to the north of Inverell. The most significant of access road crossings, is where Swan Brook crosses Spring Mountain Road as a fourth order watercourse draining 49.5 km^2 of upstream catchment. Subsequent crossings on Spring Mountain Road and Sturmans Road vary from first to third order and drain less than 3 km^2.



KEY

- Proposed Sundown Solar Farm (Project area)
- Conceptual disturbance footprint
- Major road
- Minor road
- Named watercourse

Soil erodibility (K-factor)

- 0.01 - 0.02
- 0.02 - 0.03
- 0.03 - 0.04
- 0.04 - 0.05
- 0.05 - 0.06
- 0.06 - 0.07
- 0.07 - 0.08

\\emmsvr1\EMM3\2021\P210075 - Sundown Solar Farm\GIS\02 Maps\G008 ModelledKFactor 20230103 06.mxd 24/01/2023

Source: EMM (2023); Canadian Solar (2022); DPE (2022); DFSI (2017)

0 1 2 km

GDA2020 MGA Zone 56

N

Modelled K-factors

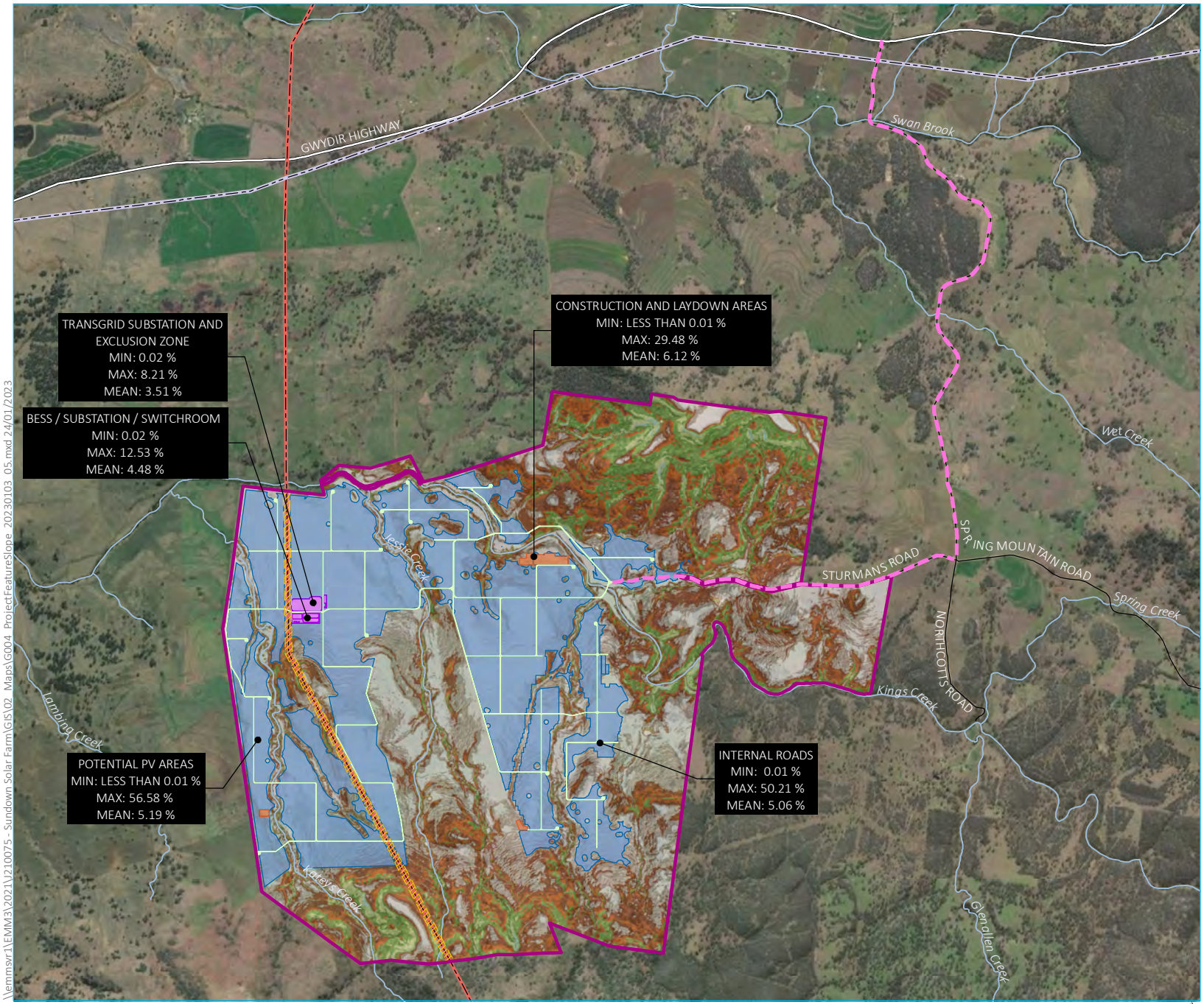
Sundown Solar Farm
Environmental impact assessment
Figure 6.13

EMM creating opportunities

viii Topography

The site consists of two primary ridges, sloping from south to north, subdivided by Jessie Creek and bordered by Kateys Creek to the west and an unnamed first order stream to the east (Figure 6.14). These ridges originate in a main ridge, running roughly east to west to the south of the project area at an elevation of over 900 m AHD. Elevation at the southern end of the project footprint is around 805 m AHD sloping to 720 m AHD in proximity to Kings Creek at the northern end of the project area.

There are minor crests on the western ridge at elevations of 790 m AHD and 800 m AHD. General north to south slope on the western ridge is 2.9%, thought slopes can reach up to 7.5% on the slopes of some of the crests, up to 9% to Jessies Creek in the east and up to 10% slope to Kateys Creek in the west. The eastern ridge has a general north to south slope of 3–3.5%, due to a greater southern extent and subsequent higher elevation of 832 m AHD. The eastern ridge has a wider, flatter crest with slightly lower north–south slopes (around 2.5%) with steeper slopes off the crest, consisting of up to 5–9% to Kings Creek in the north, 16% to Jessies Creek to the west and 11% to the unnamed first order stream to the east. The eastern ridge is split in the north by a first order stream, forming two minor ridges. All elevations and slopes are approximate.



KEY

- Proposed Sundown Solar Farm (Project area)
- Major road
- Minor road
- Named watercourse

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Slope class (%)

- 0-5
- 5-10
- 10-15
- 15-20
- 20-35
- 35-50
- 50-100

Project area slope percentages

Source: EMM (2023); Canadian Solar (2022); DCS (2020); DFSI (2017)

0 1 2 km

GDA2020 MGA Zone 56

N

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Sundown Solar Farm
Environmental impact assessment
Figure 6.14

EMM creating opportunities

6.4.3 Impact assessment

i Soil, BSAL and LSC

Construction activities have potential to impact the quality and/or the quantity of soil due to:

- poor stockpile management
- introduction of contaminants into soil (e.g. pesticides and hydrocarbons)
- exposure to buried contaminants (e.g. pesticides and hydrocarbons)
- inadequate protection from exposure to drainage, wind and/or compaction, and/or
- handling of saturated soil.

Implementation of standard topsoil/subsoil management measures is necessary to maintain the soil's productivity potential. These measures are outlined in Table 6.19 and include, but are not limited to, ensuring that topsoil and subsoil material are stripped and stockpiled separately so that they can be replaced in-situ with as little mixing as practicable. It is also important to protect stockpiles with vegetation cover (or similar) to minimise loss of material, which may result in inadequate material available for rehabilitation.

The development footprint comprises LSC classes 2–6 (Table 6.18). The majority of the land (73%) is LSC classes 4–6 The remaining portion is LSC class 3 (20%) and LSC class 2 (2%).

During the life of the project, the presence of the solar farm will reduce the amount of land available for agricultural purposes onsite. Due to the increase in shade, the option to crop in the immediate vicinity of the panels will be temporarily unavailable during construction and operation, however the option for other agrisolar activities such as grazing and apiculture will be available during operation.

SoilFutures (2023) has assessed the predicted loss of agricultural production (associated with the development of the 651 ha development footprint) to total $89,588 per annum. This is equivalent to less than 0.1% of the annual production of the Inverell LGA.

A transition from cropping to grazing may provide opportunities for landowners to earn additional income by participating in the federal government carbon farming initiative in accordance with the Carbon Credits (Carbon Farming Initiative) Regulations 2011.

Properties adjacent to the project area will be able to continue their agricultural activities unimpeded, during all phases of the project (noting that the issue of allowing stock to safely cross roads during construction will be addressed).

Providing the recommended mitigation measures are implemented, the LSC classes within the project area are not expected to change. Accordingly, agricultural activities can recommence at their current capability, after closure and rehabilitation.

ii Erosion and sediment

It is anticipated that the development footprint will only require minimal site preparation and civil works (such as grading/levelling and compaction). No large areas of reshaping or excavation are anticipated, aside from digging of cable trenches and formation of level pads for the substation, BESS and ancillary infrastructure.

The existing key sediment and erosion risks onsite include the presence of steep areas, the presence of dispersive soils and, on occasion, the presence of exposed soil in between cropping periods. The construction period has potential to create the following additional project-related sediment and erosion risks:

- presence of exposed soil (particularly dispersive soil)
- presence of sloped areas
- poor drainage management (e.g. presence of concentrated flows) resulting in damage to roads/hardstand areas, loss of soil, ponding, gullying etc
- disturbance to watercourses due to increased impervious areas upstream and/or construction of water crossings
- turbid runoff into watercourses
- poor design of water crossings
- reduction in LSC due to sediment deposition on downstream agricultural lands
- loss of soil structure and water holding capacity due to mechanical compaction
- inadequate maintenance of sediment and erosion control infrastructure and procedures.

During operation, the risk of sediment and erosion risk is low. Assuming the site runoff is designed and maintained as per the recommendations in Table 6.19, erosion risks during operation will be limited to runoff from the panel drip lines.

Steep areas within the project area (11.5–14% and steeper) are considered to present a high erosion risk. These areas will require increased erosion and sediment control requirements.

iii Dust

During construction, the presence of unsealed roads and hardstand areas, the presence of exposed soil and the movement of construction vehicles has potential to generate dust emissions.

During operation, the risk of dust is almost negligible as the key source of dust will be two to three operational vehicles per day travelling along unsealed access roads.

During decommissioning, the presence of exposed soil has potential to generate dust, however it is anticipated that the extent of exposed soil will be considerably less than during construction, and the duration of the exposed soil will also be shorter.

iv Regional land use

The Sundown Solar Farm footprint is comparatively insignificant in comparison to the footprints of nearby renewable energy projects (Figure 1.1). Accordingly, the development of Sundown Solar Farm is not anticipated to have a significant impact on the removal of regional land available for agricultural use.

The compatibility of Sundown Solar Farm with adjacent land-uses (e.g. agriculture, renewable energy farms, extractive industries including Frazier's Quarry etc) during operation is expected to be good, particularly as the development comprises the upgrade of the Gwydir Highway/Spring Mountain Road intersection and the access road.

After decommissioning, the project area will be rehabilitated to agricultural land use (Section 6.4.3iv). Accordingly, there are no anticipated land use conflicts associated with this stage.

v Rehabilitation

At the end of the 35-year project life, the site will be rehabilitated to a condition as near as practicable to the condition that existed prior to construction of the solar farm and in consultation with the landowners.

Rehabilitation will involve the removal of all project-related infrastructure with the exception of any infrastructure the landowners request to remain e.g. road upgrades, water crossings, internal access roads and hard stand areas etc. The upgrades to the access road and to the Gwydir Highway/Spring Mountain Road will also remain.

Implementation of the mitigation measures outlined in Table 6.19 will mean that the LSC classes within the development footprint are unlikely to change from their current capability and that land, soil and erosion risks are adequately managed and impacts to agriculture are minimised.

6.4.4 Proposed measures

Proposed measures to manage and mitigate potential land, soil and erosion impacts are outlined in Table 6.19.

Table 6.19 Land, soil and erosion mitigation measures

Reference	Mitigation measure	Timing
Soil quality		
L1	Prepare and implement a soil stripping and management plan (SSMP) that includes an inventory of soils to be stripped and stockpiled, including soil types, stripping areas, depths and volumes, and includes a topsoil and subsoil stripping and stockpiling procedure.	Pre-construction Construction Closure/decommissioning
L2	Preserve as much topsoil and subsoil as practicable for in-situ replacement post-disturbance.	Construction Closure/decommissioning
L3	Segregate topsoil and subsoil as much as practicable.	Construction
L4	Segregate soil types as much as practicable.	Construction
L5	Protect stockpiles from erosion using polymers or cover crops etc.	Construction
L6	Where soil requires amelioration, apply the ameliorant prior to and during stripping. This will maximise mixing of the ameliorants.	Construction
L7	Address any amelioration requirements in stockpiled subsoil and topsoil prior to reinstatement.	Construction
L8	Implement weed and biosecurity management practices as outlined in the construction environmental management plan (CEMP).	Construction Closure/decommissioning
L9	If opting for lower carbon farming, ensure any fertilizer applied during revegetation is non-water soluble, mineral based and biologically inoculated.	Construction Closure/decommissioning
L10	Minimise the extent and duration of disturbed soil. Stabilise exposed soil with polymers, vegetation, gravel or similar as soon as practicable.	Construction Closure/decommissioning
L11	Avoid unnecessary soil compaction as much as practicable.	Construction Closure/decommissioning
L12	If potentially contaminated soil is identified, ensure the soil is segregated and is managed in accordance with applicable guidelines.	Construction

Table 6.19 Land, soil and erosion mitigation measures

Reference	Mitigation measure	Timing
Dust		
L14	To minimise dust during construction, use water trucks as required and minimise vehicle speeds and movements where possible. Stabilise pavements with polymer or cement wherever practicable.	Construction
Sediment and erosion		
L15	Level and revegetate the existing contour banks to re-establish sheet-flow conditions.	Construction
L16	Avoid disturbance of dispersive soils wherever practicable. Where this is not practicable, treat dispersive soil with ameliorants at a suitable rate.	Construction Closure/decommissioning
L17	Ensure drainage is designed to: • maintain sheet flow conditions • maintain flow velocity at approximately 0.3 m/s • avoid ponding • avoid concentrated flows • minimise slope gradient and slope length.	Construction
L18	Ensure access roads have a crowned profile, where appropriate, with minimum cross fall of 4% either side of the crown to minimise the formation of corrugations.	Construction
L19	Use outfall drainage, where appropriate, to convey upslope drainage across roads and tracks instead of infall drainage and table drains. Infall drainage and table drains should be used where the slope and height of the outer fill present an erosion risk.	Construction
L20	Install Type A or B sediment basins to capture and treat turbid runoff. Ensure sediment basins have a flow-activated flocculant system installed.	Construction
L21	If there are catchments where the calculated soil loss exceeds 150 t/ha/yr but it is not possible to construct a sediment basin due to boundary or flood height limitations, install Type 2 and Type 3 sediment control measures and increase the intensity of erosion control to compensate for the inability to install sediment basins.	Construction
L22	Divert clean runoff away from areas of ground disturbance wherever practicable.	Construction
L23	In areas of high erosion risk, such as drains, trenches or areas of dispersive soil, install rock matrices and/or apply ameliorant as applicable.	Construction
L24	Install energy dissipaters at drain outlets to ensure flow velocities are maintained within acceptable limits for the soil type. Stilling pond and roughness type dissipators are recommended.	Construction
L25	Revegetate exposed areas. For areas steeper than 1:4, use hydraulically applied (i.e. sprayed) seeded hydro-mulch.	Construction
L26	Maintain groundcover (vegetation, gravel, etc) around solar panels during operation, particularly on panel drip lines.	Operation
L27	Schedule earthworks (including watercourse disturbance) to avoid high rainfall periods wherever practical. Where this is not practicable, apply polymers or physical covers to exposed soil to achieve C-Factors of 0.01.	Construction
L28	Avoid handling saturated soil wherever practicable (e.g. after rain).	Construction Closure/decommissioning

Table 6.19 Land, soil and erosion mitigation measures

Reference	Mitigation measure	Timing
L29	Implement a water movement permit system during construction to minimise the potential for accidental turbid water discharge during pumping and dewatering activities, as applicable.	Construction
L30	Ensure that the effectiveness of sediment and erosion control infrastructure and procedures are regularly monitored by a suitably trained person.	Construction
Water crossings		
L31	Install water crossings as early as possible in the construction program.	Construction
L32	Design water crossings as per the recommendations in the water report (Appendix J).	Construction

6.4.5 Conclusion

Potential land, soil and erosion impacts associated with the proposal were assessed (Appendix F).

The project area comprises predominantly moderate capability land (LSC class 4) with some good quality (LSC class 3) and some constrained low capability land (LSC class 6) and any BSAL is likely to be limited to within remaining LSC Class 2 to 3 land. The project will result in a temporary and reversible change in land use for land within the development footprint, noting there is potential for dual land use, as grazing or apiculture will be possible across much of the development footprint during operation.

Properties adjacent to the project area will be able to continue agricultural activities unimpeded during all phases of the project.

At the end of the project life, project infrastructure will be removed [4] from the development footprint and the site will be rehabilitated and returned to agricultural activity. Implementation of the mitigation measures outlined in Table 6.19 will ensure that the LSC within the development footprint is unlikely to change from its current capability and that land, soil and erosion risks are adequately managed and impacts to agriculture are minimised.

6.5 Visual

6.5.1 Introduction

A visual impact assessment was prepared for the project (Appendix G). This section of the EIS summarises the assessment and addresses the SEARs requirements for potential visual impacts. The visual-related SEARs are outlined in Table 6.20.

[4] Some infrastructure may remain, such as the access roads, sheds, water crossings and hard stand areas. This will be decided in consultation with landowners.

Table 6.20 Visual-related SEARs

SEARs requirement	Section addressed
A detailed assessment of the likely visual impacts and cumulative impacts of the development (including any glare, reflectivity and nightlighting) 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.	Section 6.5 A draft landscaping plan is not required.

6.5.2 Existing environment

i The site

The site is privately-owned land, used for farming (cropping and grazing). The site is zoned RU1 – Primary Production under the *Inverell Local Environmental Plan 2012* (Inverell LEP).

ii Surrounding area

Land surrounding the site is used for farming. Generation of renewable energy also exists in the broader region; including the Sapphire Wind Farm (MP09_0093), Sapphire Solar Farm (SSD-8643), White Rock Wind Farm (MP10_0160), White Rock Solar Farm (SSD-7487) and Glen Innes Wind Farm (MP07_0036) (Figure 1.1).

Newstead Station Group, an item of local heritage significance listed on the Inverell LEP, is approximately 4 km west of the development footprint. Newstead Station is a pastoral property on the north side of Elsmore Road and consists of Newstead Homestead, a shearing shed, church ruins and a cemetery, originally within an open rural landscape.

No listed scenic or significant vistas within proximity of the project area have been identified.

Single National Park is approximately 16 km south of the site and Kings Plains National Park is approximately 18 km north of the site. Mount Topper State Forest and Tingha Plateau State Conservation Area are approximately 16 km south-west of the site.

The site is not within a sensitive land use designation or within a potentially sensitive land use zone. The nearest sensitive land use zone is approximately 6 km north-west of the site and is zoned RU5 Village under the Inverell LEP.

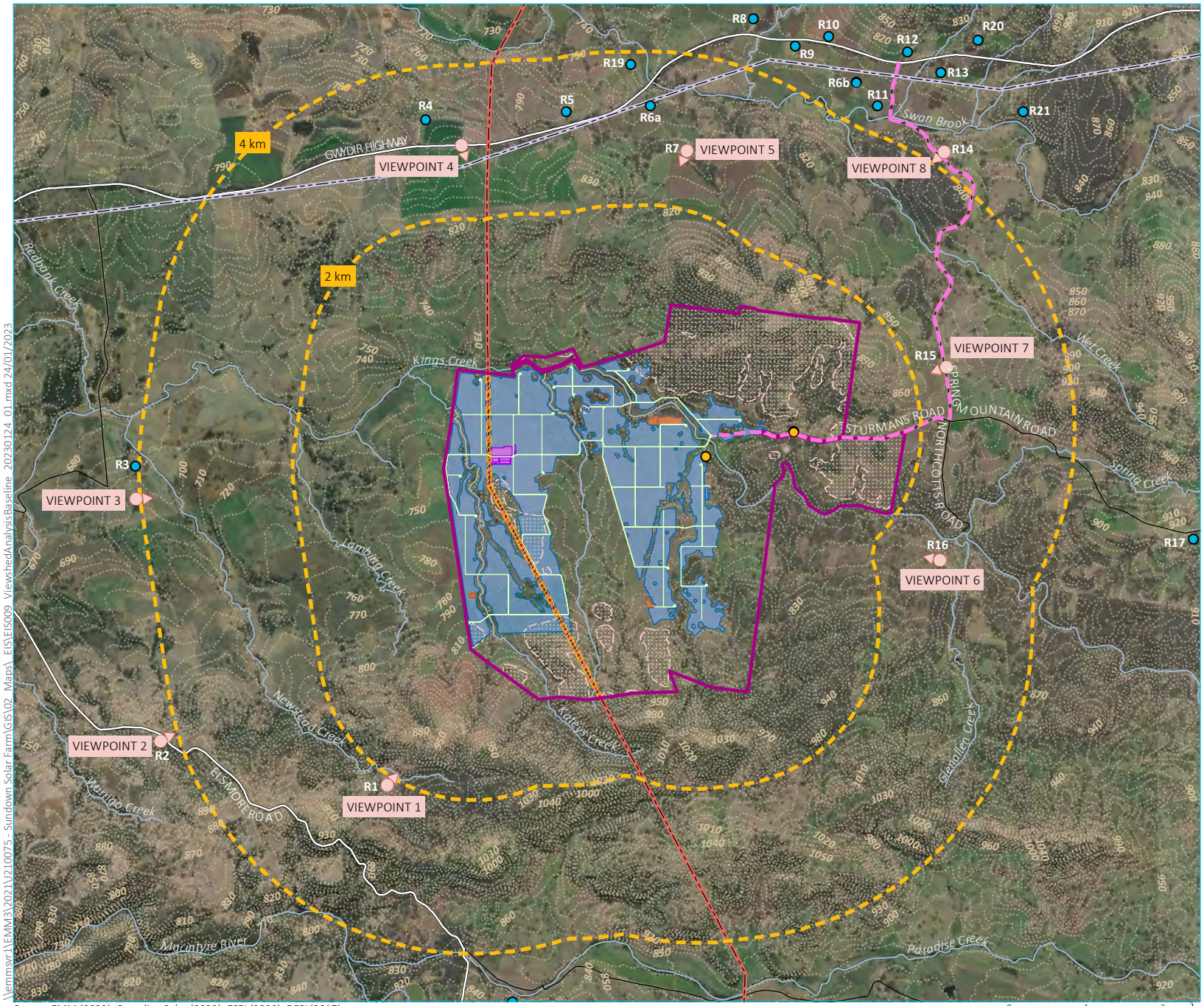
Electricity transmission line infrastructure traverses the project area and includes:

- Transgrid's existing 330 kV transmission line between Armidale and Dumaresq, which passes through the site
- a local 132 kV network that runs north of the site between the Inverell and Glen Innes substations.

iii Rural dwellings

Only a very small portion of the proposed development footprint is currently visible from the eight viewpoints (Figure 6.15).

There are 11 non-associated properties within a 4 km buffer of the development footprint (Figure 6.16). The closest non-project related property to the development footprint is R1, approximately 2.1 km south-west of the development footprint.



Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017)

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Viewshed analysis - baseline

Sundown Solar Farm
Environmental impact assessment
Figure 6.15

EMM
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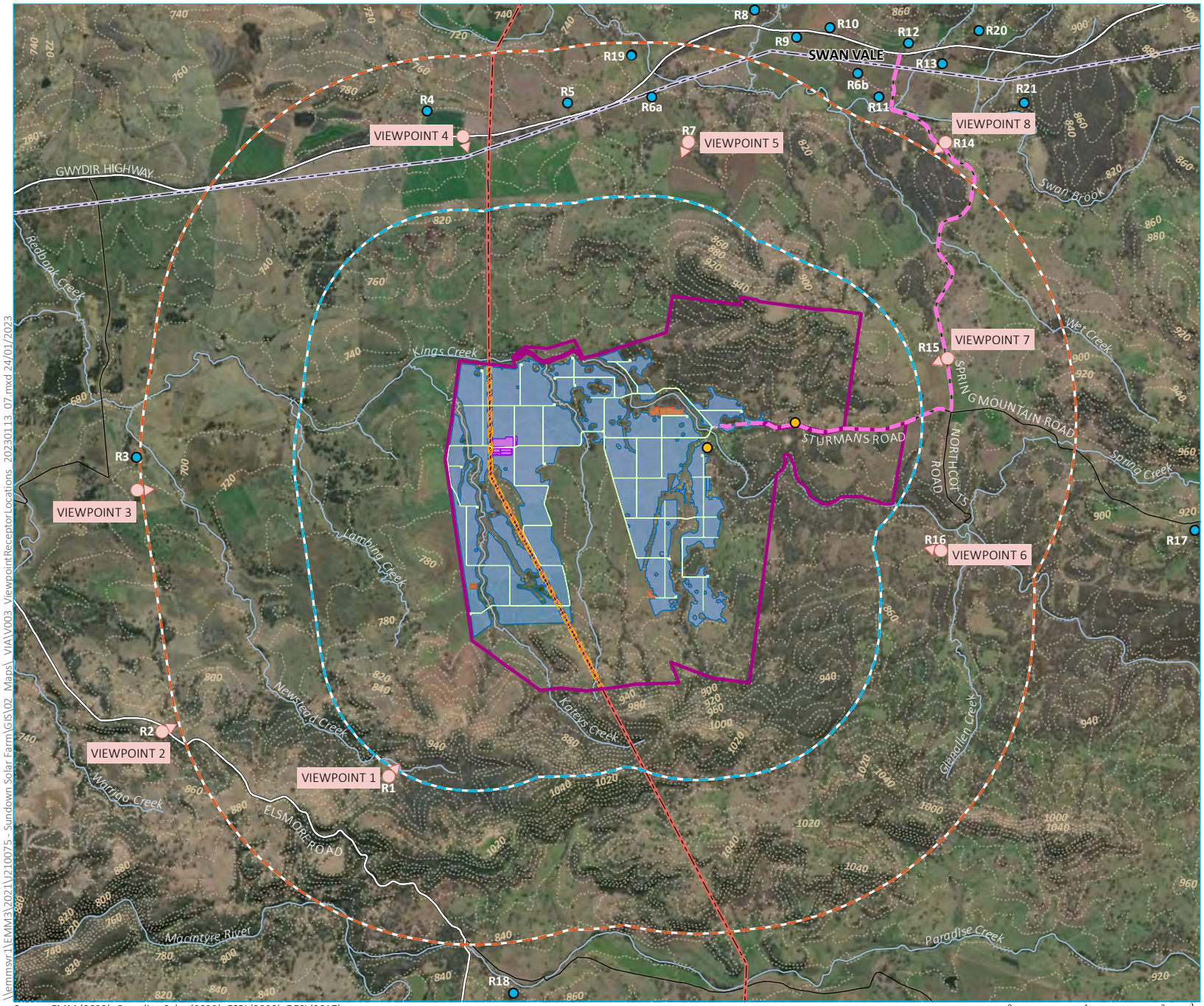

KEY

- Proposed Sundown Solar Farm (Project area)
- Development footprint buffer (2 km)
- Development footprint buffer (4 km)
- Viewpoint location
- Associated property
- Non-associated property
- Major road
- Minor road
- Named watercourse
- Topographic contour (20 m)

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Source: EMM (2023); Canadian Solar (2022); ESRI (2023); DFSI (2017)

0 1 2 km

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Location of viewpoints and receptors

Sundown Solar Farm
Environmental impact assessment
Figure 6.16

EMM
creating opportunities

iv Settlements and townships

Inverell is the largest township in the Inverell Shire LGA, with a population of approximately 16,500.

v Air traffic

Armidale Airport is the closest major airport to the development footprint and is approximately 80 km south-east of the development footprint. Inverell and Glen Innes airports are significantly closer to the development footprint at approximately 26 km south-west and 26 km north-east, respectively.

vi Night lighting

Existing sources of night lighting in the immediate vicinity of the site are minimal due to its rural setting. The main sources of lighting would be from rural residential dwellings, farm machinery and vehicles on roads.

vii Other developments

Based on a review of NSW Department of Planning and Environment's (DPE's) Major Projects register, it is understood that there are a number of other projects already constructed or likely to be constructed within close proximity of the project (Figure 1.1). These include:

- White Rock Wind Farm (MP 10_0160) – approximately 4 km east of the site at its closest point. Stage one of White Rock Wind Farm, which consists of 70 turbines is operational. Stage two will include an additional 48 turbine. Stage two is approved but construction has not commenced, and it is unclear when this will occur.
- White Rock Solar Farm (SSD-7487) – approximately 10 km east of the site at its closest point. Construction of the White Rock Solar Farm was completed in 2018 and this project is fully operational.
- Sapphire Wind Farm (MP09_0093) – approximately 3 km north of the site at its closest point. Construction of the Sapphire Wind Farm was completed in 2018 and this project is fully operational, with 75 turbines spread out across 22 different properties.
- Sapphire Solar Farm (SSD-8643) – approximately 15 km north of the site at its closest point. Construction of the 180 MW solar farm has not commenced, and it is unclear when this will occur.
- Glen Innes Wind Farm (MP07_0036) – approximately 13 km north-east of the project at its closest point. Construction of the Glen Innes Wind Farm has not commenced, and it is unclear when this will occur.

6.5.3 Assessment method

i General

The VIA was prepared in general accordance with:

- *Guidelines for Landscape and Visual Impact Assessment* (3rd ed.) (2013) (the GLVIA), prepared by the Landscape Institute and Institute of Environmental Management and Assessment
- *Wind Energy: Visual Assessment Bulletin AB 01 for State Significant Wind Energy Development* (2016) prepared by DPIE (the VA Bulletin).

The *Large-Scale Solar Energy Guideline* (DPE 2022) was released in August 2022 and provides the community, industry, applicants and regulators with guidance on the planning framework for the assessment and approval of large-scale solar energy development proposals under the EP&A Act. It is acknowledged that the guideline is supported by a technical supplement for landscape and visual impact assessment which provides additional guidance and tools for assessing, evaluating, and mitigating visual and landscape impacts. As this assessment was prepared prior to the release of the guideline, it has not been completed in strict accordance with the requirements of the guideline or the methodology prescribed by the technical supplement. However, it is noted that this assessment has sought to identify all viewpoints with potential to experience significant visual impacts.

Cumulative visual amenity impacts from other energy developments (proposed, approved and operating) have been considered in accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE 2021b).

The assessment involved seven key stages:

- Stage 1: assessment of the existing landscape, noting its character and complexity.
- Stage 2: determination of the project's zone of visual influence, using computer-generated zones of theoretical visibility (based on topographical data) and fieldwork analysis.
- Stage 3: selection of viewpoints.
- Stage 4: assessment of the magnitude of visual change arising from the project.
- Stage 5: determine the capacity of the landscape to absorb change without a loss of quality (i.e. assess its visual sensitivity).
- Stage 6: determine the significance of visual change in the landscape.
- Stage 7: determine any management measures required to mitigate against visual impacts.

Further detail about the methodology is provided in Appendix G.

ii Viewshed analysis

A viewshed analysis was generated using a digital elevation model (DEM) which covers the development footprint, the eight viewpoints and their immediate surrounds. The DEM was built using publicly available ELVIS spatial data from the Foundation Spatial Data Framework. This data was captured in 2011. The DEM is representative of the bare earth surface and only considers the topography of the landscape.

A digital surface model (DSM) was not developed due to the negligible potential for views of the development footprint. A DSM is representative of the actual surface of the earth and takes into account a variety of different features in the landscape, including vegetation and built structures (e.g. rural dwellings, farm sheds and agricultural infrastructure).

A viewshed analysis based on a DSM alone could not be used to identify the potential visual impacts of the project as it would not provide a true representation of the ability of certain features to shield views of project infrastructure from a given location. For example, in the case of vegetation, a viewshed analysis based only on a DSM may exaggerate the shielding potential of this feature. In reality, depending on the nature of the vegetation (e.g. canopy cover only), views of project infrastructure through vegetation may still be possible.

Accordingly, the reader should consider the total area identified as 'visible project infrastructure – bare earth surface' as representative of the worst-case scenario for each viewpoint (i.e. the maximum visible extent of project infrastructure from the selected viewpoint).

The viewshed analysis only considers the height of the dominant project infrastructure, namely the PV panels. The panels were conservatively assumed to be 4.4 m. This is representative of the height of the PV panels at their maximum tilt angle (i.e. 4 m) and allows site-specific clearance of up to 40 cm, should it be required to avoid flooding risk or to improve access for sheep to graze underneath the PV panels. Other project infrastructure including inverters, BESS and management hub facilities were not considered as part of the viewshed analysis. The exact location of this infrastructure within the development footprint will be determined during the detailed design stage of the project. For example, the location of the inverters will be dependent on the model chosen. The proposed footprints for the substation and BESS have been positioned within the development footprint with a view to minimising or avoiding visual amenity impacts on nearby residences wherever possible.

A Transgrid-owned 330 kV transmission line traverses the project area. Local supply lines enter the eastern portion of the project area. Due to the presence of existing overhead wiring within the landscape, the project's potential transmission alignments have not been considered as part of the viewshed analysis.

When considering the bare earth surface (i.e. topography) within the development footprint and surrounds, the results of the viewshed analysis indicate that project infrastructure may be visible from one of the eight viewpoints assessed as part of this VIA. As identified by the contours shown in Figure 6.15, the landform pattern within and surrounding the development footprint can be described as undulating with the terrain rising to the south, north and east of the development footprint. At the majority of selected viewpoints, undulation within the landscape limits the extent of the visual landscape affected by project infrastructure.

iii Viewpoints

A total of 11 non-associated properties are identified within a 4 km radius of the development footprint. Of these receptors, a total of eight viewpoints were selected as part of this assessment (Table 6.21 and Figure 6.15). The viewpoints were selected based on the following criteria:

- proximity to the project area boundary
- the location of receptors (i.e. dwellings)
- the positioning of regional and local roads and potential impacts on passing motorists
- local topography.

The rationale for the selection of viewpoints is provided in Table 6.21.

Table 6.21 Assessed viewpoints, receptors and rationale for selection

Assessment location	Viewpoint type(s)	Representative receptors	Rationale for selection
Viewpoint 1	Dwelling	R1	Views are representative of a receptor (i.e. dwelling) on Cooks Road, R1. At its closest point, the development footprint is approximately 2.1 km from R1.
Viewpoint 2	Dwelling	R2	Views are representative of a receptor (i.e. dwelling) on Elsmore Road, R2. At its closest point, the development footprint is approximately 4.2 km from R2. The existing view from viewpoint 2 is shown in Photograph 6.5.
Viewpoint 3	Dwelling Local heritage item	R3	Views are representative of a receptor (i.e. dwelling) with access from Gwydir Highway and Newstead South Road, R3. At its closest point, the development footprint is approximately 4 km from R3. A review of aerial imagery indicates there is more than one dwelling at this property. R3 was selected as the focus of Viewpoint 3 as it was considered to have the highest likelihood of a line of sight to the project area (based on distance, elevation and vegetation). Views are also representative of Newstead Station Group, an item of local heritage significance listed on the Inverell LEP, approximately 4 km west of the development footprint.
Viewpoint 4	Motorists	-	Views are representative of those experienced by motorists travelling along Gwydir Highway (Photograph 6.6).
Viewpoint 5	Dwelling	R7	Views are representative of a receptor (i.e. dwelling) on Inverness Road, R7. At its closest point, the development footprint is approximately 2.8 km from R7. The view existing from viewpoint 5 is shown in Photograph 6.7.
Viewpoint 6	Dwelling	R16	Views are representative of a receptor (i.e. dwelling) on Northcotts Road, R16. At its closest point, the development footprint is approximately 2.8 km from R16.
Viewpoint 7	Dwelling	R15	Views are representative of a receptor (i.e. dwelling) on Spring Mountain Road, R15. At its closest point, the development footprint is approximately 2.5 km from R15.
Viewpoint 8	Dwelling	R14	Views are representative of a receptor (i.e. dwelling) on Spring Mountain Road, R14. At its closest point, the development footprint is approximately 4.2 km from R14.

Photograph 6.5 **Viewpoint 2 – View from Elsmore Road looking north-east towards development footprint**

Photograph 6.6 **Viewpoint 4 – View from Gwydir Highway looking south towards development footprint**

Photograph 6.7 **Viewpoint 5 – Entrance to R7 looking east away from development footprint**

6.5.4 Impact assessment

i Construction

The assessment determined that none of the viewpoints will experience significant visual impacts during the 21 month construction period. This is largely due to the presence of vegetation and to variances in local topography that will serve to shield the development footprint from surrounding receptors.

Motorists travelling along the Gwydir Highway may experience distant views of the development footprint during construction (and operation); however, it is assumed the focus of these motorists will be in line with their direction of travel along the Gwydir Highway.

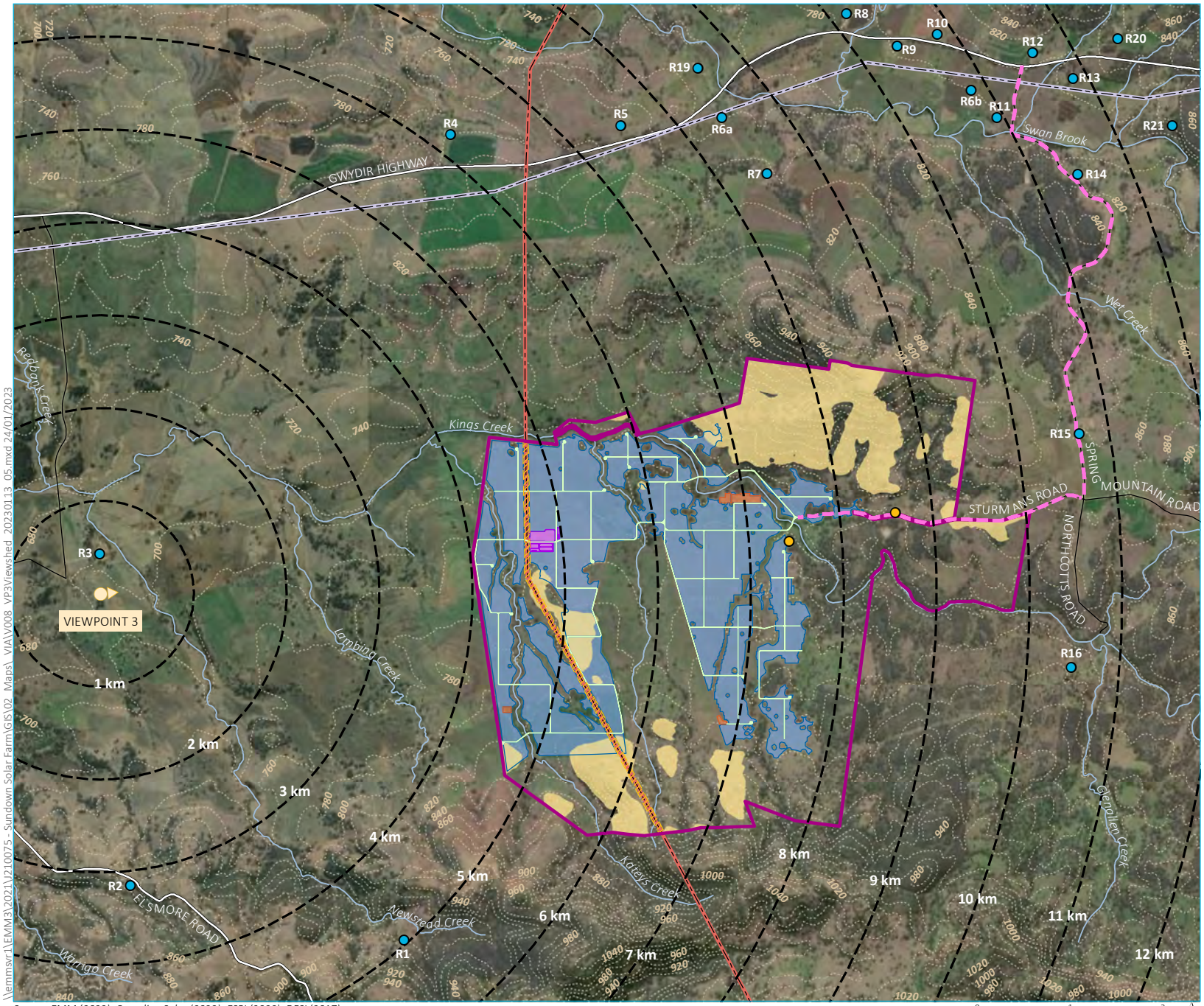
ii Operation

During operations, the most significant visual contribution will be the PV panels, conservatively estimated to have a height of 4.4 m. However, due to the presence of the undulating landscape and vegetation, the PV panels are predicted to be visible from only one of the eight viewpoints, namely viewpoint 3. Viewpoint 3 is predicted to experience a slight/moderate visual impact[5]. It is noted that as viewpoint 3 is approximately 4 km from the development footprint, the views, if experienced, will be distant views. Further details about viewpoint 3 are provided in Appendix G.

The potential extent of the development footprint that may be visible from viewpoint 3 is shown in Figure 6.17.

The predicted visual impact at each viewpoint is summarised in Table 6.22.

[5] If the focus of this viewpoint were Newstead Station Group, the visual sensitivity would be nominated as 'high' due to the presence of a local heritage item listed on Schedule 5 of the Inverell LEP; however, as R3 and the other dwellings are closer to the development footprint and considered more likely to experience views of project infrastructure, the visual sensitivity has been rated based on the presence of rural dwellings only.



KEY

- Proposed Sundown Solar Farm (Project area)
- Associated property
- Non-associated property
- Major road
- Minor road
- Named watercourse
- Topographic contour (20 m)

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Viewshed analysis

- Viewpoint 3
- Viewpoint buffer
- Visible project infrastructure (assumed 4.4 m height) - bare earth surface

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

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Viewshed analysis - Viewpoint 3

Sundown Solar Farm
Environmental impact assessment
Figure 6.17

EMM
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Table 6.22 Predicted visual impacts at each viewpoint

Viewpoint	Distance to development footprint	Representative receptors	Residential or public	Project infrastructure visible based on viewshed analysis	Magnitude of change	Visual sensitivity	Evaluation of significance	Significant impact	Additional mitigation proposed	Potential cumulative impact
Viewpoint 1	2.1 km	R1	Residential	No	Negligible	Moderate	Slight	No	No	No
Viewpoint 2	4.2 km	R2	Residential	No	Negligible	Moderate	Slight	No	No	No
Viewpoint 3	4.1 km	R3	Residential	Yes	Low	Moderate	Slight/ moderate	No	No	Yes
Viewpoint 4	3 km	-	Public	No	Negligible	Low	Negligible	No	No	No
Viewpoint 5	2.8 km	R7	Residential	No	Negligible	Moderate	Slight	No	No	No
Viewpoint 6	2.8 km	R16	Residential	No	Negligible	Moderate	Slight	No	No	No
Viewpoint 7	2.5 km	R15	Residential	No	Negligible	Moderate	Slight	No	No	No
Viewpoint 8	4.2 km	R14	Residential	No	Negligible	Moderate	Slight	No	No	No

iii Reflectivity and glare

a Impact on residential dwellings

The single axis tracking configuration of the PV panels will allow the PV panels to rotate from east to west during the day to track 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 west of the development footprint will only have potential to be impacted by glint and glare during the afternoon tracking period. However, as little as 2% of the light received is typically reflected by PV 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 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 panels within the development footprint. Nonetheless, glint and glare may result from the project and may have an impact on receptors and motorists travelling along the local and regional road network. However, the presence of an undulating topography and vegetation in the landscape will reduce the duration and location from which reflection from the PV panels may be visible.

Glint and glare may also occur as a result of the PV panel mounting framework, perimeter fencing, BESS housing, management hub infrastructure, inverters and transformer units. This infrastructure will be more sparsely dispersed within the development footprint and is therefore unlikely to create noticeable glint or glare when compared with existing structures such as agricultural sheds and wire fencing.

As part of the preliminary design process, the substation and BESS footprints within the development footprint have been positioned as far from the closest receptors as possible.

b Impact to aircraft

Armidale Airport is the closest major airport to the development footprint and is approximately 80 km south-east of the development footprint. Due to the distance between Armidale 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.

Inverell and Glen Innes airports are significantly closer to the development footprint at approximately 26 km south-west and 26 km north-east, respectively. Due to the distance between these airports 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.

c Impact to motorists

The potential for low angled reflected sunlight to cause a distraction to drivers travelling along the local and regional road network has been considered. Due to the low level of reflectivity of PV panels, as well as the possibility of other features becoming more common in modern PV panel designs, such as anti-reflective coatings, the PV panels are not expected to cause a distraction to motorists travelling along the local and regional road network.

Where undulation in the landscape, favourable topography, screening in the form of existing remnant vegetation and/or landscaping completely removes or disrupts views towards the development footprint, potential impacts from glint or glare will be limited.

iv Cumulative impacts

The closest developments to the project are the White Rock wind and solar farm and the Sapphire wind and solar farm, which are approximately 4 km east and 3 km north of the project, respectively (Figure 6.18).

It is anticipated that views of project infrastructure from each of these projects from a single location will be limited as a result of:

- the distance between the projects
- variable elevation within the landscape
- the presence of significant transport infrastructure, namely Gwydir Highway
- the presence of vegetation within the landscape.

Due to the distance between the project's development footprint and the Glen Innes Wind Farm (Figure 1.1), an assessment of potential cumulative visual impacts was not warranted.

v Cumulative impacts during construction

During construction, the landscape within the development footprint will change as a result of the introduction of project infrastructure. Views of the project and other renewable energy generation projects during construction may be possible for motorists travelling along the Gwydir Highway; however, based on separation distances, it is anticipated that these views will be of only one project at any given time. Further, it is assumed the focus of these motorists will be in line with their direction of travel along this major road corridor.

Based on the results of the viewshed analysis, concurrent views of the project and other renewable energy generation projects during construction from neighbouring residences are considered unlikely.

vi Cumulative impacts during operation

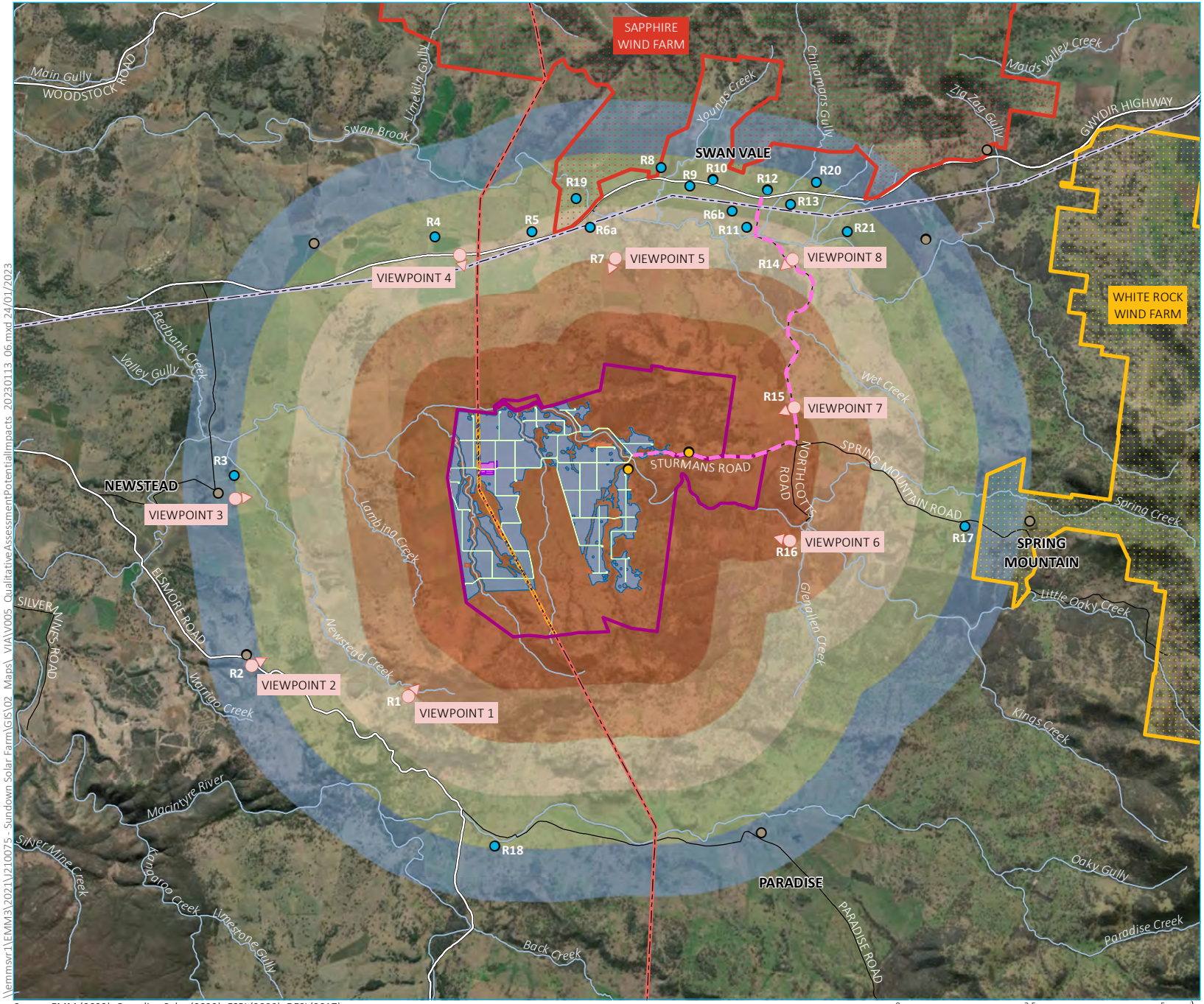
Project infrastructure from multiple renewable energy generation projects may be visible to motorists travelling along the Gwydir Highway; however, based on separation distances, it is anticipated that these views will be of only one project at any given time, with the exception of shared views of turbines from both the White Rock Wind Farm and Sapphire Wind Farm.

Due to the low level of reflectivity of PV panels, the project is not expected to cause a distraction to motorists travelling along the Gwydir Highway.

The following factors will limit potential for cumulative visual impacts to occur:

- spatial separation between the development footprint for the project and neighbouring renewable energy generation projects (both operational and proposed)
- variable elevation and undulation within the landscape between these projects
- the presence of significant stands of remnant vegetation in the landscape between these projects.

Nonetheless, the visual impact assessment identified the potential for viewpoint 3 to have concurrent views of Sundown Solar Farm (once constructed) and White Rock wind and solar farm (Figure 6.20). Although partial views of project infrastructure are predicted from viewpoint 3, the presence of remnant vegetation in the landscape has the potential to significantly screen the extent of project infrastructure visible from this viewpoint.



KEY

- Proposed Sundown Solar Farm (Project area)
- Sapphire Wind and Solar Farm
- White Rock Wind and Solar Farm
- Viewpoint location
- Associated property
- Non-associated property
- Non-associated property (>4 km from Project area)
- Major road
- Minor road
- Named watercourse

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Project area buffer

- 1 km
- 2 km
- 3 km
- 4 km
- 5 km

Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

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Qualitative assessment of potential cumulative impacts

Sundown Solar Farm
Environmental impact assessment
Figure 6.18

EMM creating opportunities

6.5.5 Proposed measures

Based on the calculated magnitude of change and evaluations of significance assigned to each of the eight viewpoints, no specific visual mitigation measures (for example landscaping) are warranted.

Proposed measures to manage potential visual impacts are outlined in Table 6.23.

Table 6.23 Visual mitigation measures

Reference	Mitigation measure	Timing
V1	Where possible, select suitable colours for project infrastructure to minimise visual impacts, including in particular the management hub buildings/facilities and the BESS housing. These buildings and materials will be designed to blend in with the local rural/farming landscape and will be similar to existing farm sheds and agricultural infrastructure in the area surrounding the site.	Pre-construction Construction
V2	Manage lighting to minimise impacts on surrounding areas, for example ensure that all external lighting is installed as low intensity lighting (except where required for safety or emergency purposes) and complies with Australian Standard AS/NZS 4282:2019 – *Control of the Obtrusive Effects of Outdoor Lighting*. Similarly, ensure that external lighting does not shine above the horizontal.	Operation

6.5.6 Conclusion

Due to variances in local topography and the presence of mature vegetation, the assessment determined that the project will not result in significant visual impacts to any of the 8 viewpoints. The assessment determined that the project may result in slight/moderate visual impacts to viewpoint 3 (Newstead Station Group, an item of local heritage significance listed on the Inverell LEP). However, based on the calculated magnitude of change and evaluations of significance assigned to each of the eight viewpoints, no landscaping is warranted in association with any of the viewpoints.

Motorists travelling along the Gwydir Highway may experience transitory and distant views of project infrastructure. However, as it is assumed that the focus of these motorists will be in line with their direction of travel, any potential views are considered insignificant.

Similarly, based on the height of the PV panels, the presence of the undulating landscape, the presence of mature vegetation and the separation distances between the project and other renewable energy projects in the area, there is limited potential for combined views of the project and other renewable energy developments.

The project will not have any significant adverse visual impacts on the locality.

6.6 Noise and vibration

6.6.1 Introduction

A noise and vibration impact assessment was prepared for the project (Appendix H). This section of the EIS summarises the assessment and addresses the SEARs requirements for potential noise and vibration impacts. The noise and vibration-related SEARs are outlined in Table 6.24.

Table 6.24 Noise and vibration-related SEARs

SEARs requirement	Section addressed
An assessment of the construction noise impacts and cumulative noise 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* (NPfI) and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria.	Section 6.6

6.6.2 Existing environment

i Setting

The site is in a rural area where the primary land-use is agriculture (Figure 3.3). There are three operational renewable energy farms within a 15 km radius of the site (Figure 1.1).

Therefore, given the rural setting, the ambient noise levels are at or below the minimum levels provided in the *Noise Policy for Industry* (EPA 2017) (NPfI), of 35 decibels (dB) for daytime and 30 dB for evening.

ii Potentially sensitive receptors

There are 21 potentially sensitive receptors (residential properties) within 4 km of the project area boundary, excluding the landowners onsite (namely the associated properties), namely R1–R21 (Table 6.25 and Figure 6.19). In relation to the noise assessment, the potentially sensitive receptors are referred to as noise assessment locations. There are no schools, child-care centres, hospitals, or similar land-uses within a 2 km radius of the project area.

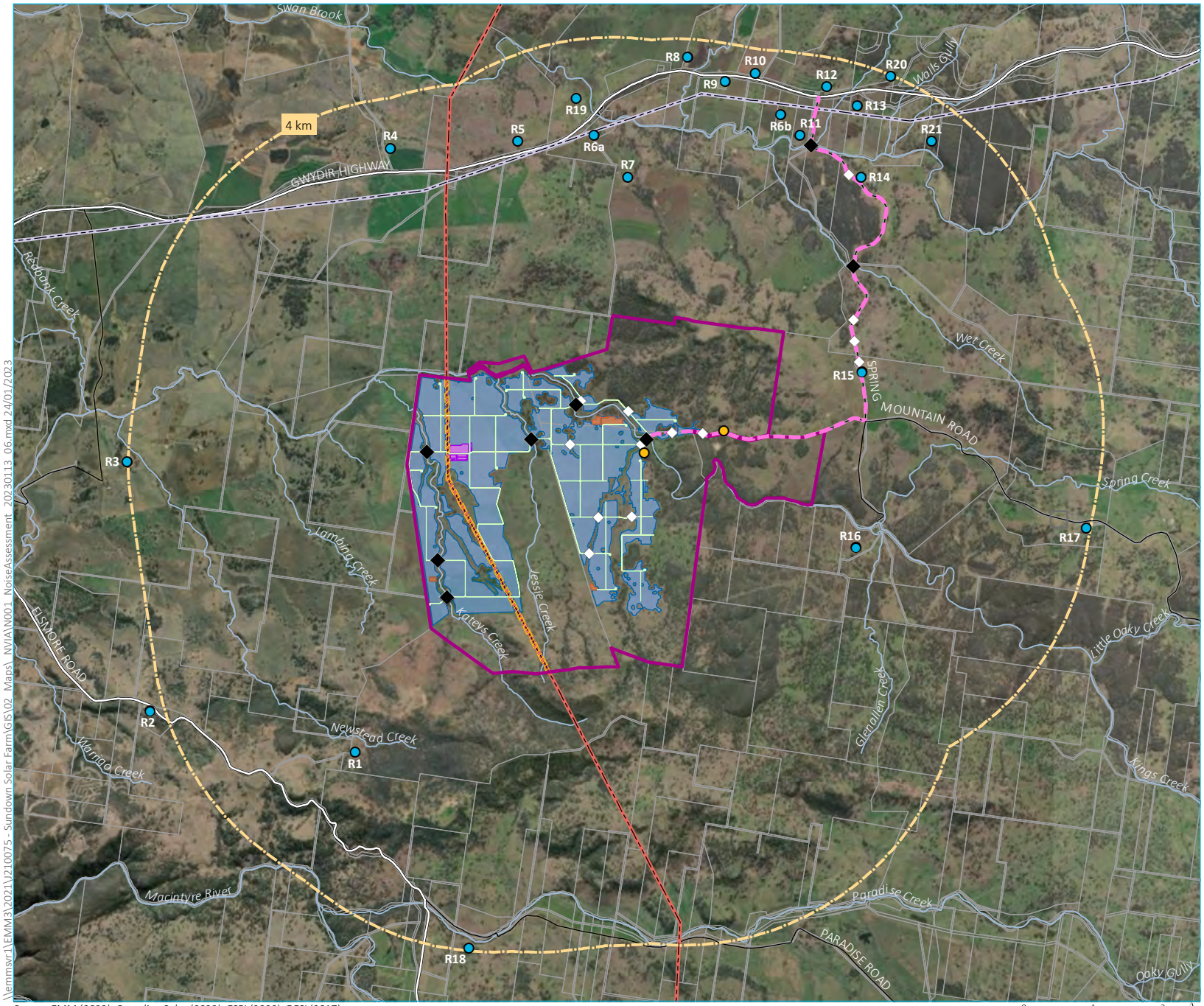
Table 6.25 Noise assessment locations

ID	Address	Classification	Easting	Northing
R1	Lachlana, 122 Cooks Rd, Newstead NSW 2360	Residential	345292	6696323
R2	St Lawrence, 2312 Elsmore Rd, Newstead NSW 2360	Residential	342345	6696911
R3	4157 Gwydir Hwy, Newstead NSW 2360	Residential	342016	6700484
R4	3692 Gwdir Hwy, Swan Vale NSW 2370	Residential	345796	6704993
R5	3598 Gwydir Hwy, Swan Vale NSW 2370	Residential	347626	6705096
R6a[6]	3382 Gwydir Hwy, Swan Vale NSW 2370	Residential	348719	6705178
R6b	3382 Gwydir Hwy, Swan Vale NSW 2370	Residential	351401	6705475
R7	77 Inverness Rd, Swan Vale NSW 2370	Residential	349204	6704581
R8	3236 Gwydir Hwy, Swan Vale NSW 2370	Residential	350061	6706299
R9	3163 Gwydir Hwy, Swan Vale NSW 2370	Residential	350603	6705951
R10	3112 Gwydir Hwy, Swan Vale NSW 2370	Residential	351037	6706073
R11	32 Spring Mountain Rd, Swan Vale NSW 2370	Residential	351677	6705176

[6] R6a and R6b share the same postal address but the property has two separate residential properties, approximately 2–3 km apart from each other.

Table 6.25 Noise assessment locations

ID	Address	Classification	Easting	Northing
R12	3018 Gwydir Hwy, Swan Vale NSW 2370	Residential	352063	6705874
R13	2963 Gwydir Hwy, Swan Vale NSW 2370	Residential	352499	6705604
R14	155 Spring Mountain Rd, Swan Vale NSW 2370	Residential	352552	6704570
R15	489 Spring Mountain Rd, Swan Vale NSW 2370	Residential	352567	6701774
R16	170 Northcotts Rd, Spring Mountain NSW 2360	Residential	352480	6699255
R17	Kokoda, 934 Spring Mountain Road, Spring Mountain NSW 2360	Residential	355787	6699536Sc
R18	2929 Elsmore Road, Paradise NSW 2360	Residential	346924	6693507
R19	Yarrawa Park, 3382 Gwydir Hwy, Swan Vale NSW 2370	Residential	348460	6705714
R20	Alkoomie, 2962 Gwydir Hwy, Swan Vale NSW 2370	Residential	352981	6706030
R21	Pieta, 2861 Gwydir Hwy, Swan Vale NSW 2370	Residential	353570	6705097



KEY

- Proposed Sundown Solar Farm (Project area)
- Proposed Sundown Solar Farm (Project area) - 4 km buffer
- Noise assessment location
- Associated property
- Major road
- Minor road
- Named watercourse
- Cadastral boundary

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Potential water crossing

- Named watercourse
- Drainage line

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Source: EMM (2023); Canadian Solar (2022); ESRI (2023); DFSI (2017)

Noise assessment locations

Sundown Solar Farm
Environmental impact assessment
Figure 6.19

EMM
creating opportunities

6.6.3 Impact assessment

i Construction noise

Construction of the project would be undertaken in three distinct stages over a period of approximately 21 months:

- Stage 1: site establishment (approximately 3 months).
- Stage 2: civil, mechanical and electrical works and deliveries (approximately 14 months).
- Stage 3: commissioning and testing (approximately 4 months).

Construction noise was assessed in accordance with the *Interim Construction Noise Guideline* (DECC 2009) (ICNG). Further details are provided in the noise and vibration impact assessment (Appendix H).

Construction noise levels are predicted to exceed NMLs at up to 11 assessment locations, namely R6b, R9–R16 (inclusive), R20 and R21, during standard day construction hours [7] (Table 6.26). The predicted noise exceedances are due to the works proposed to upgrade of the access road (these assessment locations are in close proximity to the intersection and the access road), and not due to the construction of the solar farm and BESS infrastructure.

Therefore, the predicted ICNG noise affected level exceedance at each residence will be temporary in nature and only occurring when the road upgrade is undertaken nearest the residence. However, the highly noise affected level of 75 dB(A) will not be exceeded. The exceedance can be mitigated by verification of the prediction and notification of the construction schedule with the relevant landowner. It is also noteworthy that the construction noise assessment is a worst case assessment on the basis that all construction equipment is operating at the same time, which is unlikely to occur for any period of time near the residences.

The predicted construction noise level at all other assessment locations satisfy the NMLs. All assessment locations are predicted to comply with the EPA's highly noise affected level of 75 dB(A).

The predictions for each assessment location represent the energy-average noise level over a 15 minute period and assumes all plant operating concurrently.

Table 6.26 Predicted construction noise levels

Assessment location	Classification	Period	Noise affected NML, dB	Highly noise affected NML, dB	Predicted construction noise level, dB $L_{Aeq,15min}$ Stage 1/Stage 2	Compliance with NML Stage 1/Stage 2
R1	Residential	Standard	45	75	39/41	Yes/yes
R2	Residential	Standard	45	75	36/38	Yes/yes
R3	Residential	Standard	45	75	38/39	Yes/yes
R4	Residential	Standard	45	75	39/40	Yes/yes
R5	Residential	Standard	45	75	40/42	Yes/yes
R6a	Residential	Standard	45	75	41/43	Yes/yes
R6b	Residential	Standard	45	75	51/53	No/no (+6/+8)

[7] 7:00 am to 6:00 pm Monday to Friday, 8:00 am to 1:00 pm Saturday and no work on Sunday or public holidays.

Table 6.26 Predicted construction noise levels

Assessment location	Classification	Period	Noise affected NML, dB	Highly noise affected NML, dB	Predicted construction noise level, dB $L_{Aeq,15min}$ Stage 1/Stage 2	Compliance with NML Stage 1/Stage 2
R7	Residential	Standard	45	75	42/44	Yes/yes
R8	Residential	Standard	45	75	41/43	Yes/yes
R9	Residential	Standard	45	75	45/47	Yes/no (+2)
R10	Residential	Standard	45	75	44/46	Yes/no (/+1)
R11	Residential	Standard	45	75	57/59	No/no (+12/+14)
R12	Residential	Standard	45	75	53/55	No/no (+8/+10)
R13	Residential	Standard	45	75	52/53	No/no (+7/+8)
R14	Residential	Standard	45	75	61/63	No/no (+16/+18)
R15	Residential	Standard	45	75	66/67	No/no (+21/+22)
R16	Residential	Standard	45	75	45/46	Yes/no (/+1)
R17	Residential	Standard	45	75	39/40	Yes/yes
R18	Residential	Standard	45	75	34/35	Yes/yes
R19	Residential	Standard	45	75	40/42	Yes/yes
R20	Residential	Standard	45	75	45/46	Yes/no (/+1)
R21	Residential	Standard	45	75	47/49	No/no (+2/+4)

ii Road traffic noise during construction

Road traffic noise was assessed in accordance with the *Road Noise Policy* (DECCW 2011) (RNP). Further details are provided in the noise and vibration impact assessment (Appendix H).

Road traffic noise level predictions for construction traffic during the day are provided in Table 6.27. For residences on Gwydir Highway, the EPA's RNP criterion is 60 dB $L_{Aeq,15hour}$ applies. For all other residential locations (local roads) the EPA's RNP criterion of 55 dB $L_{Aeq,1hour}$ applies. Traffic volumes were collected by EMM between 2–4 June 2021. The assessment assumes peak period of light vehicles (LV) and heavy vehicles (HV) associated with the busiest construction stage (PV installation) of the project.

Assessment of day traffic predictions demonstrate that all road segments likely to be used by vehicles associated with construction of the project comply with the relevant absolute or relative increase criterion.

As the existing traffic volumes on Gwydir Highway were found to be above the RNP's absolute criterion of 60 dBA, additional traffic volumes were assessed against the relative increase in traffic noise generated by the project. The relative traffic increase on Gwydir Highway was found to be negligible (0 dB) and as such the ≤2 dB allowance criterion is met for both road segments likely to be used by vehicles associated with construction of the project.

Table 6.27 Road traffic noise calculations (construction), day (7.00 am to 10.00 pm)

Road name	Approximate distance from nearest carriageway	Road segments	Existing movements[1]			Existing plus project movements			Noise level increase due to the Project, $L_{Aeq,15hour}$, dB
			Total	%HV	Calculated level, $L_{Aeq,15hour}$, dB	Total	%HV	Predicted level, $L_{Aeq,15hour}$	Total
Gwydir Highway	30 m	State road between Inverell (west) and Spring Mountain Road	1,346	15	62	1,774	12	16	0
	170 m	State road between Glen Innes (east) and Spring Mountain Road							
Spring Mountain Road	60 m	-	<50	<10	39	460	17	50	11
Sturmans Road	1,720 m	-	<50	<10	20	460	17	30	10

Notes: 1. Existing movements are based on 2018/2019 long-term road traffic counts. Refer TIA (Appendix I) for detail.

Traffic associated with operations is negligible compared to construction traffic and accordingly also meet the RNP criterion.

iii Construction vibration

a Project area

The assessment shows that construction vibration levels associated with work within the project area are highly unlikely to impact any of the potentially sensitive receptors. The nearest residence (R16) to the project area is approximately 1 km from the project area boundary. R16 is beyond the safe working distances for human comfort and cosmetic damage for all listed plant.

b Access road

The nearest residences to the access road (R14 and R15) are located approximately 50 m and 45 m respectively to the closest proposed access road upgrade activities. During stage 1 of construction, vibration levels at these assessment locations may exceed the levels for human comfort if the size of the vibratory roller used to construct the access road is greater than 6 tonnes. The construction contractor will therefore need to select its plant and equipment for the road upgrade to minimise vibration impacts and will notify the relevant landowner of the construction schedule.

All assessment locations are outside of the safe working distances for cosmetic damage.

iv Operational noise

Operational noise levels are predicted to comply with the *NSW Noise Policy for Industry (NPfI*) assessment criteria at all the noise assessment locations (Table 6.28) for day and evening/night periods. The levels presented for each assessment location represents the energy-average noise level over a 15 minute period and assumes all plant operating concurrently under ISO9613-2 noise enhancing conditions.

Table 6.28 Predicted operational noise levels

Assessment location	Classification	Period	PNTL, dB	Predicted noise level, dB $L_{Aeq,15min}$
R1–R21	Residential	Day	40	<30
		Evening/night	35	

v Decommissioning noise

Decommissioning activities are expected to be limited to removal of plant and equipment during standard day hours in accordance with the ICNG. Noise from these activities would be less than levels predicted for construction activities and are therefore not anticipated to result in any adverse noise impacts at the identified assessment locations.

Vehicle movements associated with decommissioning activities would be significantly lower than that generated by the project construction and will therefore satisfy RNP requirements.

6.6.4 Proposed measures

Proposed measures to manage potential noise and vibration impacts are outlined in Table 6.29.

Table 6.29 Noise and vibration mitigation measures

Reference	Mitigation measure	Responsibility	When
Universal work practices			
N1	Ensure the importance of minimising noise and vibration is reinforced at toolbox meetings.	Construction contractors	Construction
N2	Minimise unnecessary metal-on-metal contact.	Construction contractors	Construction
N3	Minimise the need for vehicle reversing for example, by arranging for one-way site traffic routes where possible.	All staff	At all times
N4	Ensure access road is maintained.	All staff	At all times
Plant and equipment			
N5	Ensure potentially noisy plant and equipment is maintained in accordance with manufacturer specifications.	All staff	At all times
N6	Where practical, use quieter plant and equipment.	All staff	At all times
N7	Minimise unnecessary movement of equipment/material/plant.	All staff	At all times
N8	Operate plant and equipment in the quietest and most efficient manner.	All staff	At all times

Table 6.29 Noise and vibration mitigation measures

Reference	Mitigation measure	Responsibility	When
N9	Undertake regular inspections/maintenance of plant and equipment to ensure that all noise reduction devices are operating effectively.	All staff	At all times
Work scheduling			
N10	Construction work to be limited to standard construction hours (i.e. 7:00 am–6:00 pm Monday to Friday and 8:00 am–1:00 pm on Saturdays), including delivery of plant and equipment. Exceptions to these hours may be required on limited occasions. Regulatory authorities (including the Inverell Shire Council) and surrounding landholders will be notified of any exceptions prior to any works being undertaken.	Construction contractors	Construction
Specific assessment locations (noise)			
N11	Ensure the following mitigation measures are undertaken for R6b, R11, R12, R14 and R15: • verification • notification. See Section 7.2 of the NVIA (Appendix H) for further details.	Construction contractor	Pre-construction Construction
Vibration			
N12	Wherever practicable, ensure that vibration intensive activities are undertaken outside of the safe working distances. Where this is not practicable: • use less vibration intensive methods of construction or equipment where practicable • limit vibration intensive works to the least sensitive times of the day, in consultation with the relevant sensitive receivers • undertake vibration monitoring to ensure compliance with DIN-4150 criteria.	Construction contractor	Construction
N13	If ongoing works are required[1], and where monitoring has confirmed actual vibration levels are nearing the DIN-4150 criteria, consider installation of a monitoring system to warn operators when vibration levels are approaching the cosmetic damage criteria (e.g. flashing light, audible alarm etc).	Construction contractor	Construction
N14	Ensure the following mitigation measures are undertaken for R14 and R15: • verification • notification • respite offer. See Section 7.3 of the NVIA (Appendix H) for further details.	Construction contractor	Pre-construction Construction

6.6.5 Conclusion

Construction noise levels are predicted to exceed NMLs at up to 11 assessment locations. These exceedances are in relation to the upgrade of the site access road and the intersection. No exceedances are predicted in relation to the construction of the solar farm/BESS infrastructure. No exceedance of the 'Highly Noise Affected' level of 75 dB(A) is expected.

Construction vibration levels are predicted to exceed acceptable human comfort thresholds at two assessment locations, depending on the size of vibratory rollers used during the upgrade of the site access road.

Operational noise is predicted to satisfy the NPfI PNTLs for all assessment locations.

During peak construction, increases in road traffic noise will occur along the Gwydir Highway, Spring Mountain Road and Sturmans Road. Assessed road traffic noise levels indicate that predicted levels will remain below the thresholds provided in the RNP (DECCW 2011).

Decommissioning phase noise and vibration are expected to satisfy all applicable criteria.

By applying the proposed mitigation measures outlined in Table 6.29, the project is not anticipated to generate significant noise or vibration impacts.

6.7 Traffic and transport

6.7.1 Introduction

A traffic impact assessment was prepared for the project (Appendix I). This section of the EIS summarises the assessment and addresses the SEARs requirements for potential traffic and transport impacts. The traffic and transport-related SEARs are outlined in Table 6.30.

Table 6.30 Traffic and transport-related SEARs

SEARs requirement	Section addressed
• an assessment of the construction, operational and decommissioning traffic impacts of the development	Section 6.7.3
• an assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation	Section 6.7.3
• an assessment of the likely transport impacts to the site access route (including Gwydir Highway and Spring Mountain Road), site access point, any Crown land, particularly in relation to the capacity and condition of the roads, road safety and intersection performance	Section 6.7.3 Crown land is discussed in Section 3.2.1 and is shown in Figure 3.4
• a cumulative impact assessment of traffic from nearby developments	Section 6.7.3
• provide details of measures to mitigate and/or manage potential impacts including a schedule of all required road upgrades (including resulting from heavy vehicle and over mass/over dimensional traffic haulage routes), road maintenance contributions, any other traffic control measures, developed in consultation with the relevant road authority; and a demonstration of consultation about potential cost sharing with the White Rock Wind Farm project (if required).	Section 6.7.4

6.7.2 Existing environment

i Summary of site access route

The site is in a rural area and is accessed from the Gwydir Highway, via Spring Mountain Road and Sturmans Road (Figure 3.1). The access route from the highway to the site is approximately 9 km long. The first portion of the access route is Spring Mountain Road (approximately 6.6 km long), and the second portion comprises a further 2.4 km along Sturmans Road to the site entrance. The speed limit of the entire access route is 100 kilometres per hour (km/h), which is the default speed of regional roads in NSW.

a Gwydir Highway

Gwydir Highway is a sealed, single-lane State road that spans approximately 568 km and connects Collarenebri, Moree, Warialda, Inverell and Glen Innes. The carriage width is approximately 9 m with a 3.5 m lane each way and 1 m shoulder on each side (Photograph 6.8). The posted speed limit is 100 km/h.

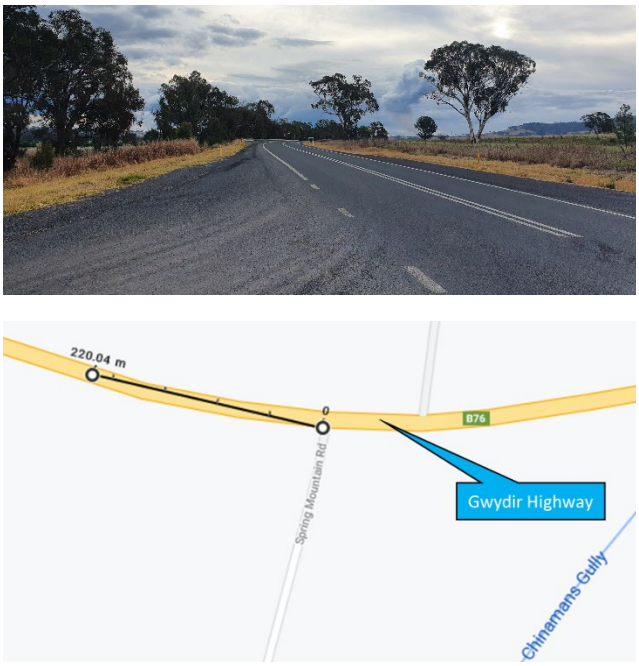
Photograph 6.8 Gwydir Highway, facing west, at the Spring Mountain Road intersection

The Gwydir Highway/Spring Mountain Road is a T-junction intersection (Figure 6.20) and the key features are summarised in Table 6.31.

Table 6.31 Gwydir Highway/Spring Mountain Road intersection – key features

Aspect	Description
Location from the site	Approximately 5 km north-east of the site.
Intersection control	Priority control (no signals).
Major road	Gwydir Highway.
East approach	One lane on approach and one lane on departure. No turning lane.
West approach	One lane on approach and one lane on departure. No turning lane.
South approach	One lane on approach and one lane on departure (no line markings).
Pedestrian connectivity	No pedestrian connectivity on any approach.
Traffic function	Predominantly carries regional and local traffic.
Sight distance from Spring Mountain Road looking west	220 m (Figure 6.21)
Sight distance from Spring Mountain Road looking west	650 m (Figure 6.21)
Public transport	The intersection is used as a school bus pick-up and drop-off during school days (however there is no signage or other physical infrastructure to indicate the presence of a bus stop).

Figure 6.20 Gwydir Highway/Spring Mountain Road intersection



Sight distance to the west (220 m approximate)

Sight distance to the east (650 m)

Figure 6.21 Site distance at Gwydir Highway/Spring Mountain Road intersection

b Spring Mountain Road

Spring Mountain Road is a single carriageway, local road with no lane markings. The first 30 m or so is sealed with bitumen and the remainder is unsealed (Figure 6.20). The carriageway width is approximately 4 m, narrowing to approximately 3.5–4 m towards Sturmans Road. The road is winding in parts and the terrain is slightly undulating (Photograph 6.9).

There are five water crossings along the route, including a bridge over Swan Creek (Photograph 6.10). There are also several cattle grids across the road (Photograph 6.11).

Photograph 6.9 Bends and gradients along Spring Mountain Road

Photograph 6.10 Bridge over Swan Creek on Spring Mountain Road

Photograph 6.11 Example of a cattle grid on Spring Mountain Road

c Sturmans Road

Sturmans Road is a single carriageway, local, unsealed road with no lane markings. The carriageway width is approximately 3.5–4 m/ The road is winding with gently undulating gradients (Photograph 6.12). There are three water crossings on Sturmans Road, including two culverts and a bridge over Kings Creek (Photograph 6.13 and Photograph 6.14). A cattle grid also crosses the road (Photograph 6.15).

Photograph 6.12 Bends along Sturmans Road

Photograph 6.13 Culvert on Sturmans Road

Photograph 6.14 Bridge over Kings Creek on Sturmans Road

Photograph 6.15 Example of a cattle grid on Sturmans Road

ii Existing traffic volumes

The existing traffic volumes at Gwydir Highway, Spring Mountain Road and Sturmans Road are outlined in Table 6.32.

Table 6.32 Existing traffic volumes

Road	Description of road	Daily traffic volume (approximate)	Road width (approximate)	Sealed?	Required width for daily traffic volume (Austroads Guide to Road Design)	Currently meets Austroads design standard?
Gwydir Highway	State road between Grafton (east) and Castlereagh Highway (west) near Walgett	1,346[1]	9.0 m	Yes	Minimum 9 m wide seal	Yes
Spring Mountain Road	Local road between Gwydir Highway (north) and site (south)	Less than 50 vehicles	4.0 m	No	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No
Sturmans Road	Local road between site (west) and Spring Mountain Road (east)	Less than 50 vehicles	3.5–4.0 m	No	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No

Note: [1] This is the average traffic volume for 2021 from two RMS permanent classifier stations.

Spring Mountain Road and Sturmans Road provide access to rural residential and agricultural properties only. The daily traffic volumes are quite low, and the existing road widths and geometry are generally adequate for these purposes.

Intersection traffic surveys were undertaken between 2 to 4 June 2021 at Gwydir Highway/Spring Mountain Road. The intersections were surveyed between 7:00 am and 9:00 am (AM peak hours), as well as between 4:00 pm and 6:00 pm (PM peak hours). The AM peak hour was 7:30 am to 8:30 am and the PM peak hour was 4:00 pm to 5:00 pm (Figure 6.22).

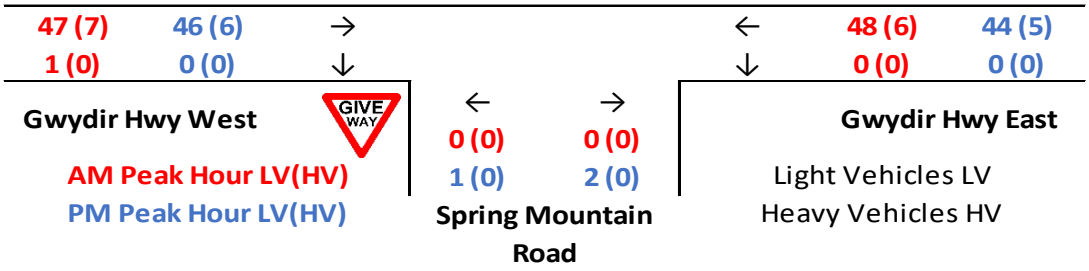


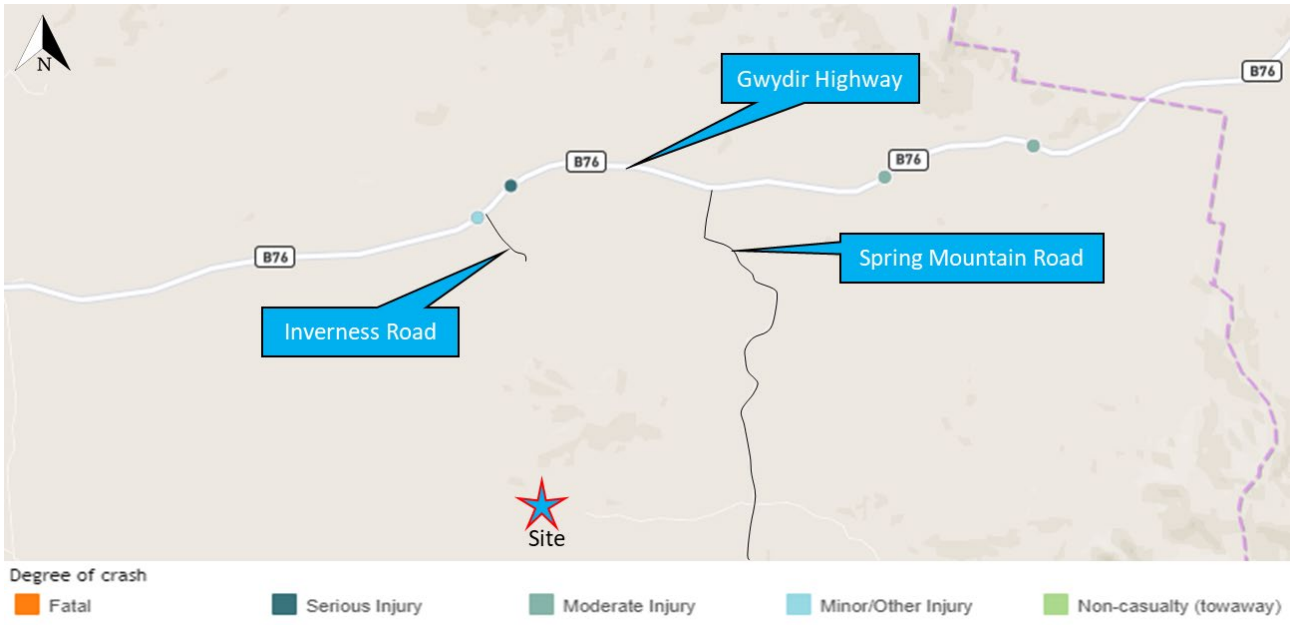
Figure 6.22 Existing traffic volumes at Gwydir Highway/Spring Mountain Road intersection

iii Crash data

The TfNSW Centre for Road Safety interactive history database indicates four non-fatal crashes within approximately 10 km of the Gwydir Highway/Spring Mountain Road intersection for the last five years between 2015 and 2019 (Figure 6.23):

- one minor/other injury
- two moderate injuries
- one serious injury.

Each crash was an off-road type of crash, involving collision with an object. This crash rate is considered low.



Source: TfNSW Centre for Road Safety

Figure 6.23 Baseline crash data

iv Public transport

Public transport in the region is limited to a privately operated bus service that comprises the following routes along the Gwydir Highway:

- Route 141 – Grafton to Moree Town
- Route 142 – Moree Town to Grafton
- Route 312 – Inverell to Tamworth
- Route 338 – Inverell to Armidale
- Route 141 – Glen Innes to Inverell via Swan Vale, Elsmore and Long Plain.

There are school bus routes operating along Gwydir Highway for schools in Glen Innes and Inverell. School bus pick-up and drop-off takes place at the Gwydir Highway/Spring Mountain Road intersection during school periods.

6.7.3 Impact assessment

i Construction traffic

a Construction duration and hours

Construction of the project would be undertaken in three distinct stages over a period of approximately 21 months:

- Stage 1: site establishment (approximately 3 months).
- Stage 2: civil, mechanical and electrical works and deliveries (approximately 14 months).
- Stage 3: commissioning and testing (approximately 4 months).

Construction activities will be undertaken during the standard daytime construction hours of:

- 7:00 am–6:00 pm Monday to Friday
- 8:00 am–1:00 pm Saturday.

In general, no construction activities will occur on Sundays or public holidays. Exceptions to these hours may be required on limited occasions. Regulatory authorities (including the Inverell Shire Council) and surrounding landholders will be notified of any exceptions prior to any works being undertaken.

b Construction workforce

The average construction workforce throughout the 21-month construction period will average 100 people, increasing to approximately 400 during the peak construction period.

Inverell and Glen Innes are the major towns in the vicinity from where the construction workforce is expected to be sourced. It is expected that the 50% of the construction traffic will be from Inverell and 50% from Glen Innes (Figure 6.24). Construction workers will travel to site via the Gwydir highway via shuttle bus or via light vehicle (cars, utes).

c Construction plant and equipment

Site establishment works and preparation for construction will include:

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

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
- water trucks for dust suppression, as required.

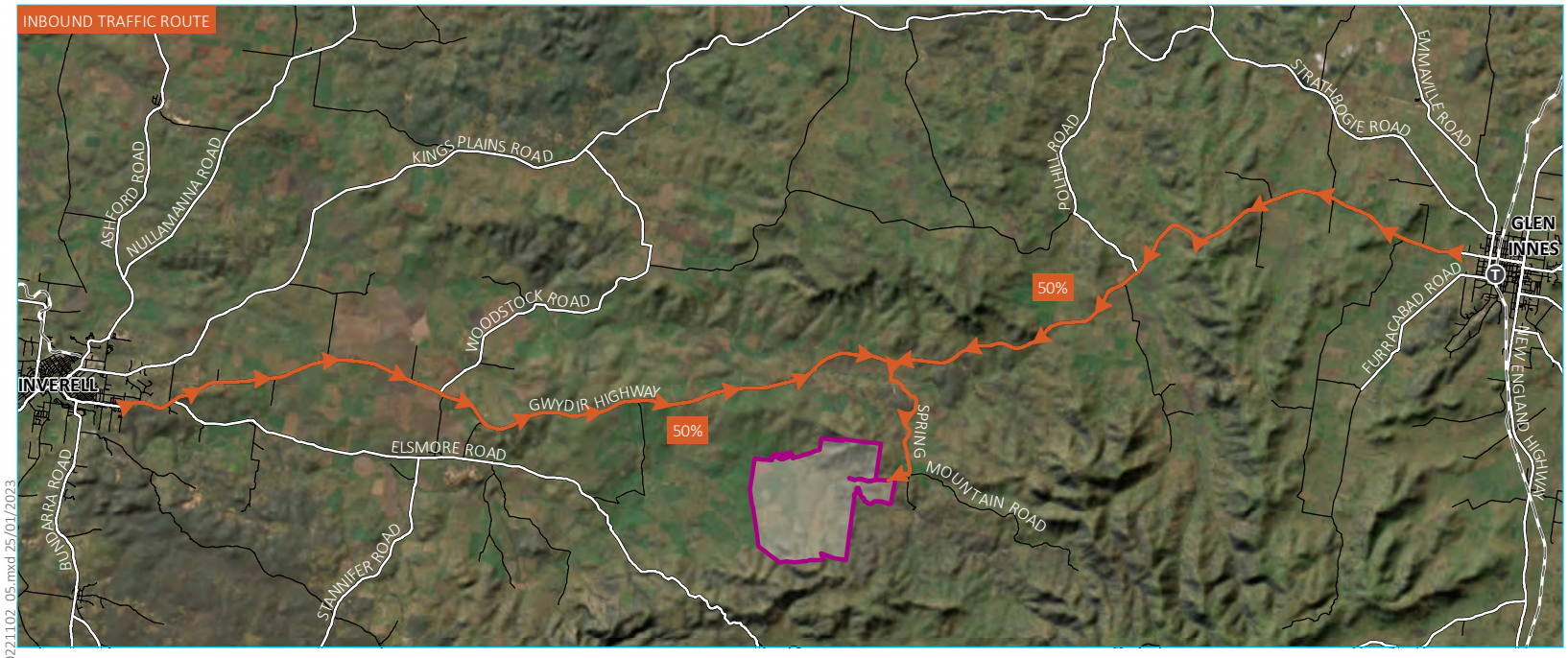
d Delivery of construction materials and infrastructure

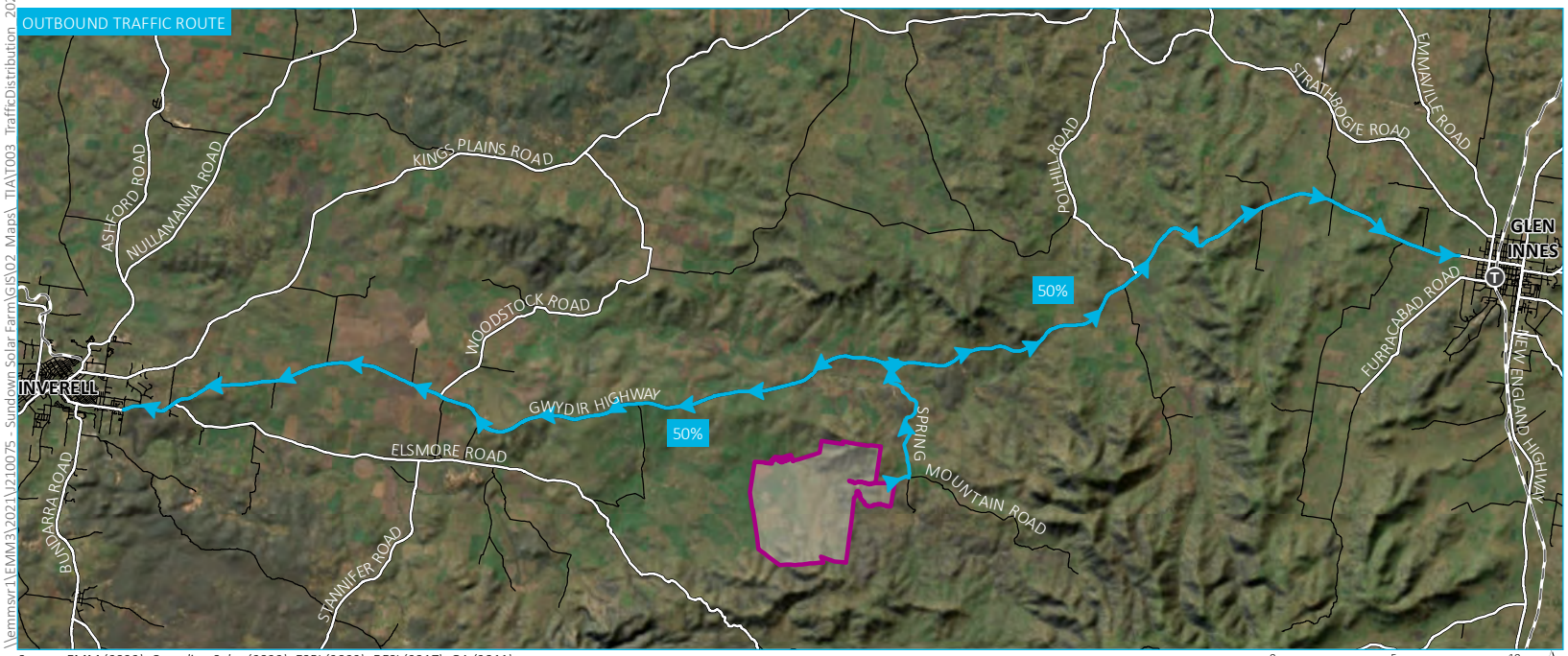
Construction materials and infrastructure will be transported to the site via the Gwydir Highway. Approval will be sought to allow B-doubles up to 26 m in length to access the site during the construction phase.

Construction materials and infrastructure delivered to the site will include:

- PV solar panels
- piles, mounting structures and frameworks
- electrical equipment and infrastructure including cabling, inverters, switchgear, the onsite substation and the high voltage (transformer)
- construction and permanent buildings and associated infrastructure
- earthworks and lifting machinery and equipment.

Oversize over mass (OSOM) vehicles will be required for the delivery of the substation.





KEY

- Proposed Sundown Solar Farm (Project area)
- Train station
- Rail line
- Major road
- Minor road
- Inbound traffic route
- Outbound traffic route

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Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017); GA (2011)

0 5 10 km

GDA2020 MGA Zone 56

N

Construction traffic distribution

Sundown Solar Farm
Environmental impact assessment
Figure 6.24

EMM creating opportunities

e Traffic volumes

During peak construction, daily construction traffic would comprise up to 100 light vehicle trips, 14 shuttle bus trips and 100 heavy vehicles trips (Table 6.33).

Approximately 50% of the construction workforce will travel from Inverell and 50% will travel from Glen Innes. There would be up to 214 peak daily and 102 peak hourly construction vehicle trips. The trip estimates assume deliveries will be made using 19 m semi-trailers.

It is assumed that 100% of the shuttle bus trips and 80% of the light vehicle trips would occur in the peak hour. The remaining 20% light vehicle trips would occur during the off-peak hours. It is also assumed that the shuttle buses will carry 20 passengers per trip and each light vehicle will carry 1.25 people per trip.

Table 6.33 Vehicle trips during peak construction

Peak construction stage	Daily		Peak hour	
	Trips	Movements	Trips	Movements
Light vehicles	100	200	80	80
Shuttle buses	14	28	14	14
Heavy vehicles	100	200	8	16
Total	**214**	**428**	**102**	**110**

Note: A 'vehicle trip' is defined as a vehicle entering the site once (1 movement) and a vehicle exiting the site once (1 movement).

The figures in Table 6.33 are based on a worst-case scenario where a permit for 26 m B-double vehicles is not approved and 19 m semi-trailers are used instead. In the best case scenario, where 26 m B-doubles are used, heavy vehicle numbers would be commensurately lower. Table 6.33 shows that light and shuttle bus movement will occur in one direction during the peak hour whereas heavy vehicles will have one inbound and one outbound movement during the peak hours.

OSOM vehicles will be required for the delivery of the substation.

The construction traffic volumes are presented in Figure 6.25. The combined existing plus construction traffic volumes are presented in Figure 6.26.

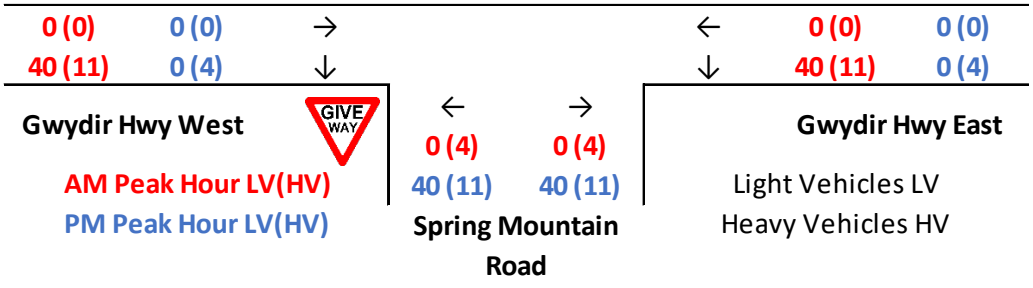


Figure 6.25 Construction traffic volumes (daily)

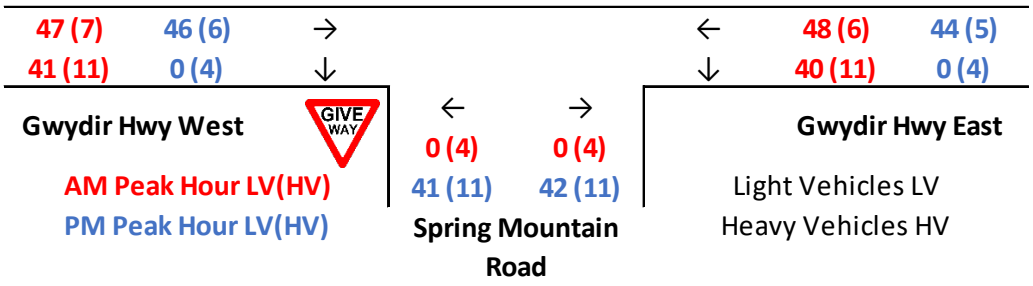


Figure 6.26 Existing and construction traffic volumes combined (daily)

f Intersection performance

The Gwydir Highway/Spring Mountain Road intersection performance was modelled with SIDRA Intersection 9.0 software. SIDRA provides the following performance indicators:

- Degree of saturation (DOS) – the total usage of the intersection expressed as a factor of 1 with 1 representing 100% use/saturation (e.g. 0.8 = 80% saturation).
- Average delay (DEL) – the average delay in seconds encountered by all vehicles passing through the intersection. It is often important to review the average delay of each approach as a side road could have a long delay time, while the large free flowing major traffic will provide an overall low average delay.
- Level of service (LOS) – this is a categorisation of average delay, intended for simple reference.
- 95% queue lengths (Q95) – is defined to be the queue length in metres that has only a 5% probability of being exceeded during the analysed time period. It transforms the average delay into measurable distance units.

The LOS is a good indicator of overall performance for individual intersections, with each level summarised in Table 6.34.

Table 6.34 Intersection LOS standards

Level of service	Average delay (seconds per vehicle)	Traffic signals, roundabout	Priority intersection ('Stop' and 'Give Way')
A	<14	Good operation.	Good operations.
B	15 to 28	Good with acceptable delays and spare capacity.	Acceptable delays and spare capacity.
C	29 to 42	Satisfactory.	Satisfactory, but accident study required.
D	43 to 56	Operating near capacity.	Near capacity and accident study required.
E	57 to 70	At capacity. At traffic signals, incidents will cause extensive delays. Roundabouts require other control mode.	At capacity; required other control mode.
F	>71	Unsatisfactory with excessive queuing.	Unsatisfactory with excessive queuing; required other control mode.

Source: *RTA Guide to Traffic Generating Developments* (RTA 2002)

SIDRA modelling for the Gwydir Highway/Spring Mountain Road intersection was conducted for the following scenarios:

- baseline (i.e. existing traffic volumes)
- baseline and construction traffic volumes.

The intersection performance results indicate that the intersection will perform satisfactorily and within capacity with LOS A and DoS <0.2 for both scenarios. The results also show that the intersection has capacity to accommodate traffic generated by the proposed development (Table 6.35).

Table 6.35 SIDRA modelling results for Gwydir Highway/Spring Mountain Road

	AM peak					PM peak				
	Intersection volume	DEL(s)	LOS	DOS	Max Q in m (approach)	Intersection volume	DEL(s)	LOS	DOS	Max Q (approach)
Baseline	112	7.9	A	0.042	0.1 (Gwydir Highway west)	106	7.9	A	0.041	0.1 (Gwydir Highway west)
Baseline and construction	221	8.7	A	0.071	2.5 (Gwydir Highway west)	214	10.9	A	0.079	2.4 (Spring Mountain Road south)

g Sight distance at intersection

Gwydir Highway has a speed limit of 100 km/h near the Spring Mountain intersection. In accordance with *Austroads Guide to Road Design Part 4A (Unsignalised and Signalised Intersections)* (Austroads, 2017), for a road with design speed of 110 km/h (design speed is generally 10 km/h higher than the speed limit), the minimum safe intersection sight distance (SISD) required for a general minimum 2 second driver reaction time is 285 m.

Sight distances on Gwydir Highway at Spring Mountain Road have been estimated based on the line of sight (Figure 6.21). Based on the 100 km/h speed limit, the safe intersection sight distance (SISD) to the east is 650 m and therefore meets the minimum requirement. The SISD to the west, however, is 220 m and therefore does not meet the minimum requirement for traffic turning westward onto Gwydir Highway from Spring Mountain Road.

h Turning lanes at intersection

TfNSW recommends that intersections are designed for a travel speed 10 km/h greater than the posted speed limit. As Gwydir Highway has a posted speed limit of 100 km/h, the intersection Gwydir Highway/Spring Mountain Road intersection should be designed to accommodate speeds of up to 110 km/h.

The current configuration of the Gwydir Highway/Spring Mountain Road intersection is 110 km/h design speed T-junction with no intersection turn treatment.

The need for a turning lane/s at the intersection was assessed by considering the peak hourly turning traffic volumes for the baseline plus the construction scenario (Table 6.36). The results indicate the following turn treatments will be required to accommodate the construction traffic:

- a channelised right turn (short) treatment (Austroads Type CHR(S)) will be required for right turning traffic on the Gwydir Highway eastbound approach

- a basic left turn treatment (Austroads Type BAL) will be required for left turning traffic on the Gwydir Highway westbound approach (if the BAL has not already been installed by Goldwind Australia (noting this is a requirement of the White Rock Wind Farm development consent)).

Table 6.36 Intersection turn treatment warrant for Gwydir Highway/Spring Mountain Road

Movement	Peak hour	Major road traffic volume	Turning traffic volume	Turn treatment required
Left turn from major road (Gwydir Highway)	AM	54	51	Basic left turn (BAL)
	PM	49	4	Basic left turn (BAL)
Right turn from major road (Gwydir Highway)	AM	159	52	Channelised short right turn (CHR(S))
	PM	105	4	Basic left turn (BAL)

i Warrant for rural road upgrades

According to *Austroads Guide to Road Design Part 3: Geometric Design* (Austroads 2016), the existing width of Spring Mountain Road and Sturmans Road is not adequate to accommodate the predicted increase in traffic associated with the construction stage (Table 6.37). Accordingly, these roads will be widened to 8.7 m to safely accommodate construction stage traffic.

Table 6.37 Baseline and construction daily traffic volumes and corresponding design standards

Road	Description of road	Approximate daily baseline + development traffic volume	Existing road width (approximate)	Austroads Guide to Road Design standard in accordance with daily traffic volume	Provision	Will meet Austroads design standard?
Gwydir Highway	State road between Grafton (east) and Castlereagh Highway (west) near Walgett	1,774 vehicles	9.0 m sealed	Minimum 9 m wide seal	No change, except the intersection upgrade	Yes
Spring Mountain Road	Local road between Gwydir Highway (north) and internal site area (south)	478 vehicles	4.0 m unsealed	Minimum 7.2 m wide seal	8.7 m unseal	Acceptable to Council as a temporary construction stage road
Sturmans Road	Local road between solar farm site area (west) and Spring Mountain Road (east)	478 vehicles	3.5–4.0 m unsealed	Minimum 7.2 wide seal	8.7 m unseal	Acceptable to Council as a temporary construction stage road

The rural road width capacity assessment shown in Table 6.37 shows current non-compliances for Spring Mountain Road and Sturmans Road. However, the road will have sufficient width to cater two-way movements during construction stage.

The construction traffic volume will be the primary traffic usage of these roads during the construction period and other traffic usage will be minimal. The project generated traffic volumes will significantly reduce after construction of the solar farm is completed.

j On-site parking

The laydown areas within the development footprint will comprise a gravel hardstand area for parking for approximately 100 light vehicles and 14 shuttle buses, or as determined in detailed design.

k Cumulative traffic

Renewable energy projects

As shown in Figure 1.1 there are several operational and approved-but-not-yet-constructed renewable energy developments in the region. None of these developments use or propose to use Spring Mountain Road or Sturmans Road as their access route.

However, Goldwind Australia has approval to construct White Rock Wind Farm Stage 2. Part of the proposed White Rock Wind Farm Stage 2 (namely the construction of the alternative transmission line) will involve generation of construction traffic at the Gwydir Highway/Spring Mountain Road intersection and on Spring Mountain Road.

Approximately 20% of the construction traffic for the alternative transmission line will use the Gwydir Highway/Spring Mountain Road intersection and on Spring Mountain Road. It is noted that Goldwind Australia has approval to construct White Rock Wind Farm Stage 2 on the condition (MP 10_0160 granted in December 2016) that the Gwydir Highway/Spring Mountain Road intersection is upgraded to include a Basic Right Turn (BAR) treatment and a Basic Left Turn (BAL) treatment. This upgrade has not yet been undertaken.

Consultation with Goldwind Australia shows that the Sundown Solar Farm is likely to be constructed before commencement of construction of the White Rock Wind Stage 2 alternative transmission line. If this is the case, no cumulative traffic impacts are expected. Notwithstanding, Sundown Solar has liaised with Goldwind Australia regarding its requirement to upgrade the intersection and will continue to consult with Goldwind Australia (and TfNSW and Inverell Shire Council) to manage scheduling of construction works and to avoid/minimise associated cumulative traffic impacts.

Extractive industry

Frazier's quarry is located off Sturmans Road. The quarry is currently not operational and is approved to haul up to 40 laden trucks of quarry products per day, with an average of 12 laden trucks a day during peak operation. The proposed commencement of operations is not known at this stage.

It is not anticipated that Frazier's Quarry will be operational during the Sundown Solar Farm construction period. However, if the quarry is operational during the Sundown Solar Farm construction period, the cumulative traffic impacts will be minimal as the quarry, at peak operation, will generate an average of 12 trucks per day. Notwithstanding, Sundown Solar will continue to consult with the operator of Frazier's Quarry (an associated landowner) to manage scheduling and to avoid/minimise potential cumulative traffic impacts. It is noted that the proposed intersection and road upgrades for the Sundown Solar Farm will improve road safety for any quarry traffic.

I Swept path assessment

A swept path assessment has been undertaken to inform the concept design of the Gwydir Highway/Spring Mountain Road intersection upgrade. The swept path assessment assumes that 26 m B-double vehicles will be used during construction (accordingly, the intersection has been conceptually designed to accommodate 26 m B-double trucks).

The road width at the site access on Sturmans Road can also accommodate 26 m B-double vehicles. All vehicles accessing/egressing the site will access Sturmans Road in a forward direction.

ii Operational traffic

No material traffic impacts are expected during the operations phase, given the very limited amount of traffic that will be generated (i.e. three light vehicles per day) and the proposed road upgrades will remain in place for the life of the project. Accordingly, no specific mitigation measures are proposed to manage traffic impacts for the operation phase.

iii Decommissioning traffic

Traffic impacts during the decommissioning phase will be significantly lower than the construction phase as the upgraded road infrastructure will be in place to accommodate decommissioning traffic.

Sundown Solar will consult with Council and neighbouring landowners prior to and during the decommissioning to determine the most appropriate ways to manage traffic impacts during this stage.

6.7.4 Proposed measures

Proposed measures to manage and mitigate potential traffic and transport impacts are outlined in Table 6.38.

Note, no material traffic impacts are expected during the operations or closure and decommissioning phase. Accordingly, proposed mitigation measures are mostly aimed at mitigating the pre-construction and construction phases impacts.

Table 6.38 Traffic and transport impact mitigation measures

Reference	Mitigation measure	Timing
T1	Ensure the upgrade to the Gwydir Highway/Spring Mountain Road intersection complies with Austroads rural roads design standards, including but not limited to: • installation of a right turn traffic lane (type (CHR(S)) at the eastbound approach • installation of a Basic Left Turn (BAL) treatment (if the BAL has not already been installed by White Rock Wind Farm (noting this is a requirement of their development consent)) • installation of warning sign at sign no. t2–25 on Gwydir Highway to warn that trucks will be entering/leaving the intersection.	Pre-construction Construction
T2	Ensure upgrade of the access road (Spring Mountain Road/Sturmans Road) complies with Austroads rural roads design standards, including but not limited to: • increase carriage width to 8.7 m (unsealed).	Pre-construction Construction
T3	Ensure upgrades of the access road (Spring Mountain Road/Sturmans Road) include: • replacement of cattle grids • installation of water crossings in accordance with applicable standards (as outlined in the water assessment report (Appendix J)).	Pre-construction Construction

Table 6.38 Traffic and transport impact mitigation measures

Reference	Mitigation measure	Timing
T4	Implement a construction traffic management plan (CTMP), approved by Inverell Shire Council and TfNSW, as applicable. CTMP to include (but not limited to): • driver code of conduct • requirement to reinstate property accesses along the access road route • requirement to implement traffic controls to ensure residents can continue to access their properties • requirement to implement standard dust control measures, including but limited to use of a water cart as required • generally limit construction traffic to standard construction hours. Exceptions to these hours may be required on limited occasions. Regulatory authorities (including the Inverell Shire Council) and surrounding landholders will be notified of any exceptions prior to any works being undertaken • safety initiatives in relation to pedestrians, livestock and school bus routes (include a requirement for heavy vehicles to avoid operating during school run periods i.e. typically 8:00 am to 9:30 am and 2:30 pm to 4:00 pm during school days) • induction process for vehicle operators • a complaint resolution procedure • any community consultation measures for peak construction periods.	Pre-construction Construction
T5	Obtain a permit from National Heavy Vehicle Regulator (NHVR) to allow any OSOM vehicles required for construction to use the road network.	Pre-construction
T6	Provide onsite parking for up to 100 light vehicles and 14 shuttle buses on a dedicated, gravelled hardstand area.	Pre-construction Construction
T7	Provide a daily shuttle bus service for transport of workers to/from Inverell/Glen Innes.	Construction
T8	Liaise with the operator of Frazier's Quarry to ensure the trucking schedules are managed with minimal impacts.	At all times

6.7.5 Consultation

Sundown Solar consulted with Inverell Shire Council in relation to the proposed road upgrades, and with TfNSW in relation to the proposed intersection upgrades. Inverell Shire Council has provided in-principle support for the proposed road upgrades. TfNSW has provided comments on the intersection concept – considered.

Details of the consultation are provided in Table 5.3.

6.7.6 Conclusion

No material traffic impacts are expected during the operations or decommissioning phase. The increase in traffic volumes using the Gwydir Highway, Spring Mountain Road, Sturmans Road, and the Gwydir Highway/Spring Mountain Road intersection during the 21 month construction phase will be safely and adequately managed by implementing the proposed measures in Table 6.38. With the implementation of these measures, the proposed Sundown Solar development is not expected to significantly impact regional or local traffic or road networks.

6.8 Water

6.8.1 Introduction

EMM has prepared a water assessment for the project (Appendix J). This section of the EIS summarises the assessment and addresses the SEARs requirements for potential water impacts. The water-related SEARs are outlined in Table 6.39.

Table 6.39 Water-related SEARs

SEARs requirement	Section addressed
An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, andmeasures proposed to monitor, reduce and mitigate these impacts.	Section 6.8.3
Details of water requirements and supply arrangements for construction and operation.	Section 6.8.3
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 6.8.4 Specific erosion and sediment control measures are described in the LRA (Appendix F).

6.8.2 Existing environment

i Climate

Details on the existing climate are provided in Section 2.7.5.

ii Topography

The site consists of two primary ridges, sloping from south to north, subdivided by Jessie Creek and bordered by Kateys Creek to the west and an unnamed first order stream to the east. These ridges originate in a main ridge, running roughly east to west to the south of the project area at an elevation of over 900 m AHD. Elevation at the southern end of the project footprint is around 805 m AHD sloping to 720 m AHD in proximity to Kings Creek at the northern end of the project area.

Locally, the presence of low contour banks across much of the site to control local runoff, reduce overland flow velocities and minimise soil erosion is evidence of is past and current agricultural use.

iii Hydrology

a Catchment and watercourses

The project is located in the southern headwaters of the Border Rivers catchment in northern NSW, which forms part of the greater Murray-Darling Basin.

Several ephemeral watercourses traverse the development footprint and drain generally from south to north. These include Kateys Creek (3rd order) and Jessie Creek (2nd order), as well as several unnamed 1st and 2nd order watercourses, all of which drain to Kings Creek. Kings Creek is a 4th order watercourse flowing generally to the west and joins the Macintyre River east of Inverell. The Macintyre River continues generally to the north-west beyond Inverell, ultimately forming part of the Barwon-Darling River system.

Contributing catchment extents and associated areas for named watercourses and selected larger unnamed watercourses (named Watercourse A, B, C and D) are shown on Figure 6.27.

Several small farm dams are located within the development footprint both on and adjacent to watercourses. These dams would have supported past agricultural use.

The proposed site access route follows Sturmans Road and Spring Mountain Road. Sturmans Road also drains generally to Kings Creek and is crossed by two unnamed watercourses (2nd and 3rd order). Spring Mountain Road crosses Swan Brook (4th order) as well as several unnamed 1st and 2nd order tributaries. Swan Brook is a tributary of the Macintyre River and joins this river downstream (north) of Inverell.

Existing watercourse crossings generally comprise bed level crossings with the exception of the following three locations:

- Kings Creek at western extension of Sturmans Road – low level bridge
- Swan Brook at Spring Mountain Road – high level multi-cell box culvert system
- unnamed 2nd order watercourse at Sturmans Road – small box culvert.

b Streamflow monitoring

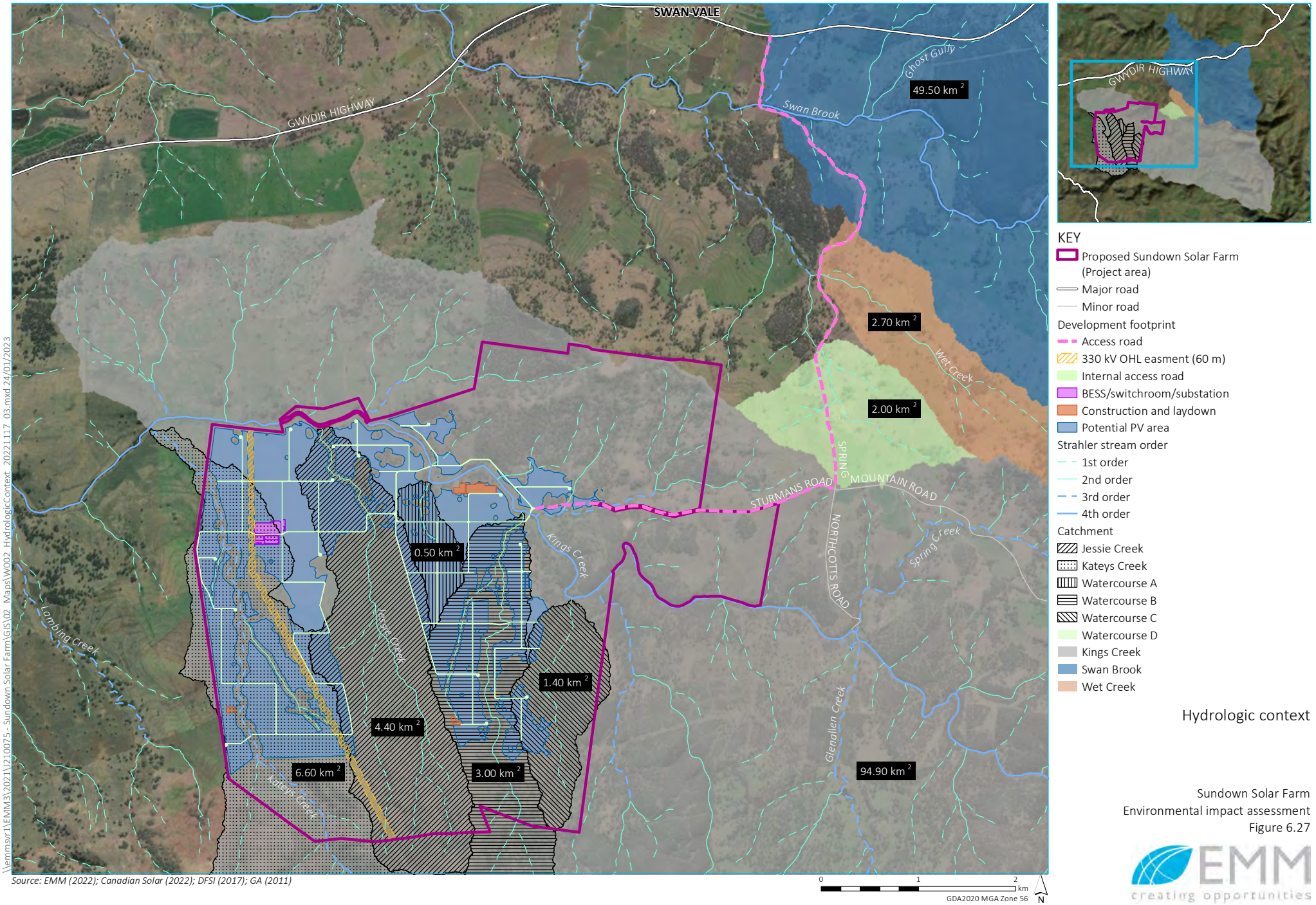
There are two stream gauges located on Kings Creek, including one in close proximity to the project near the confluence with Jessie Creek (Station 416059 – Kings Creek at Gred). However, both gauges have insufficient ratings to support reliable streamflow estimates.

c Water quality

No known water quality monitoring data was available for the watercourses in proximity to the site, nor for downstream sites that are likely to be representative of these watercourses. It is expected that Kings Creek and its major tributaries are likely to be of relatively good water quality to support agricultural and environmental needs, although they are degraded to some extent by past farming and land management practices in the surrounding area and upstream catchment.

Water quality monitoring undertaken for the Macintyre River at Inverell, reported in *Water Quality Technical Report for the Border Rivers Surface Water Resource Plan Area (SW16)* (DPIE 2020d) provides some insight to regional water quality issues in the upper Border Rivers catchment. This report suggests that water quality in the Macintyre River at Inverell for the most recent assessment period of 2010–2015 was poor when assessed against an index considering a suite of parameters including nutrients, turbidity and total suspended solids, electrical conductivity, dissolved oxygen and pH. Whilst generally low in turbidity and total suspended solids, several water quality issues were noted in terms of elevated nutrients, salinity and pH.

While these results are dated and are not directly relatable to the site due to the very large additional catchment between the site and Inverell, the results provide an appreciation for regional water quality issues and pressures in this part of the upper Border Rivers catchment.



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Source: EMM (2022); Canadian Solar (2022); DFSI (2017); GA (2011)

Hydrologic context

Sundown Solar Farm
Environmental impact assessment
Figure 6.27

EMM
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d Geomorphology

The NSW River Styles Database (DPIE 2020e) provides an overview of geomorphic watercourse character, behaviour, condition and recovery potential targeting third and higher order watercourses throughout NSW. Geomorphic characterisation is based on the River Styles Framework, developed by Macquarie University, which classifies watercourses based on measurable geomorphic attributes and qualities that include river type, fragility, sensitivity to disturbance, condition, rarity and recovery potential.

Limited information is available for Kings Creek, Kateys Creek and Swan Brook which is summarised below. Whilst dated with assessments completed in 2008, it provides relevant context for understanding the nature and condition of these watercourses.

Kings Creek where it runs through and adjacent to the development footprint is generally characterised as a partly confined, bedrock controlled, discontinuous floodplain watercourse with fine-grained bed material. It is mapped as being in generally poor condition with low recovery potential.

Kateys Creek where it runs through the development footprint is characterised as bedrock controlled, partly confined with fine-grained bed material, and is in poor condition with low recovery potential.

Swan Brook where it crosses Spring Mountain Road is characterised as partly confined, planform controlled, discontinuous floodplain watercourse with gravel bed material, and is in poor condition with low recovery potential.

iv Soils

The existing soils environment is outlined in Section 6.4.2.

v Hydrogeology

a Groundwater resources and consumptive use

The geology of the site is mapped primarily as Maybole Volcanics and Emmaville Volcanics, with overlying Quaternary alluvium following generally along watercourses as valley and higher terrace deposits.

The New England Fold Belt is a fractured rock aquifer system with groundwater characterised as either shallow, unconfined aquifers within weathered and fractured rock, or deeper, confined system connected though jointing and fracturing of the rock (DPIE 2019b). The New England Fold Belt typically shows low bore yields, thought to infer a relatively low fracture permeability. Groundwater-surface water connection in this geological unit depends on the extent of fracturing between surface features and the underlying aquifers. The relatively low permeability of the New England Fold Belt means there is not likely to be significant connection between surface water and groundwater sources (DPIE 2019b).

Water access licenses held by groundwater users in the New England Fold Belt are primarily for stock and domestic, or irrigation purposes, which is typical for rural/agricultural areas.

There are 29 registered bores within 5 km of the site. The locations of these bores are presented in Figure 6.28. A review of drilling records for the 12 bores drilled in the last 20 years indicates the water bearing zone in the region typically ranges between 11 and 62 m below ground level (mbgl). Drilling logs indicate water bearing zones are characterised as fractured or weathered basalt, consistent with the overall resource description. Standing water levels at the time of drilling range between 1.5 and 24 mbgl and bore yields range between 0.3 and 9 L/s, with higher yields typically occurring at depth.

Registered groundwater bore GW971316 is within the disturbance footprint towards the south-western boundary (Figure 6.28). Bore records show water bearing zones from 23–24 mbgl in weathered basalt and 30–32 mbgl in fractured basalt. Lithology records show 1 m of topsoil overlying 17 m of clay, and then basalt to 34 m.

The New England Fold Belt has variable geology and hence the water quality of groundwater is also variable. It Is likely that the shallower unconfined aquifers in weathered basalts will have lower salinity, and deeper aquifers will be more variable, depending on the residence time (DPIE 2019b).

b Potential groundwater dependent ecosystems

A range of terrestrial groundwater dependent ecosystems (GDEs) are mapped within and adjacent to the disturbance footprint based on the *Groundwater Dependant Ecosystems Atlas* (BoM 2020) (Figure 6.28). These comprise high, moderate and low potential GDEs and typically follow larger watercourses and their associated riparian corridors including Kateys Creek, Jessie Creek and Kings Creek. Associated plant communities include ribbon gum, riparian tea tree, river oak, Blakeley's Red Gum and White Box woodlands found on Inverell basalts.

No aquatic GDEs are mapped in the vicinity of the project.

vi Water licencing

a Surface water

During construction stormwater from roof areas will be captured in rainwater tanks for re-use. Some surface water will also be captured in sediment basins and will be reused, as required.

These forms of water extraction (or water take) are defined as 'excluded works' under the *Water Management (General) Regulation 2018* (WM Regulation) and therefore licensing is not required.

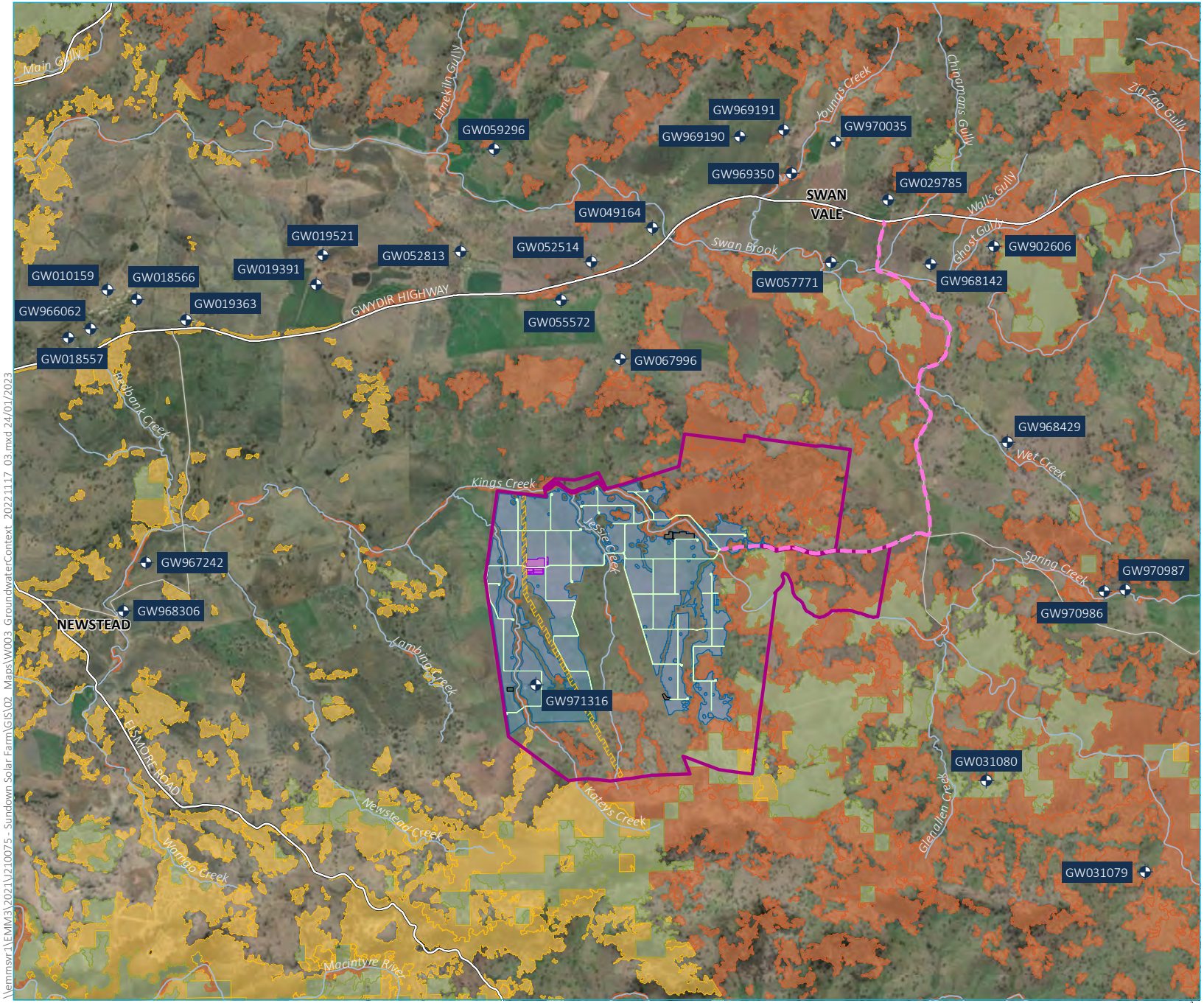
To further minimise demand for imported water, it is also proposed to source water opportunistically during construction and operation from existing landholder dams in accordance with harvestable rights. Licensing of water will not be required provided the total volume of dams used for such purposes is within the maximum harvestable right dam capacity (MHRDC), and otherwise complies with the applicable harvestable rights order.

No other surface water take is proposed. Accordingly, the project is not expected to have any requirements for surface water licensing.

b Groundwater

An exemption under the *Water Management (General) Regulation 2018* (WM Regulation) applies to the need for licensing of incidental groundwater take of 3 megalitres (ML) or less per year in any water source. This would apply to any groundwater entering excavations during construction. However, as excavations will be limited to a few metres in depth and existing groundwater levels are estimated to be at least 11 mbgl, groundwater is not expected to be intercepted and licencing is unlikely to be required.

Nonetheless, any groundwater observed to seep into the excavations will be recorded and reported in accordance with WM Regulation requirements and a water access licence (WAL) and appropriate entitlement will be obtained in advance within the water year, should the 3 ML per year threshold be exceeded.



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Source: EMM (2022); Canadian Solar (2022); BOM (2022); DRNSW (2022); DFSI (2017)

Groundwater context

Sundown Solar Farm
Environmental impact assessment
Figure 6.28

EMM creating opportunities

6.8.3 Impact assessment

i Preliminary design

The development footprint has been designed to minimise impacts to water, including the following design elements:

- minimising disturbance of existing watercourses and associated riparian corridors
- minimising the number of new watercourse crossings required
- minimising development in flood prone areas
- locating sensitive infrastructure (e.g. substation, BESS) in suitable areas compatible with flood risk
- avoiding disturbance of existing registered groundwater bores
- minimising disturbance of mapped groundwater dependent ecosystems (GDEs).

This approach is described in further detail in Table 6.40 and will also apply to future design refinement through the detailed design process.

ii Water demand and source during construction

The primary source of construction water will be from a commercial water supplier, trucked to site. To minimise the need for imported water, water will also be opportunistically sourced from:

- existing landholder dams (where harvestable rights apply)
- onsite sediment basins
- onsite rainwater tanks collecting runoff from building roofs.

The estimated water demand is 75 ML over the 21 month construction period. This water will mainly be used for dust suppression, and will also be used for site amenities, fire protection and washing of equipment and plant.

Sundown Solar is also progressing investigation of alternative water supplies to support the construction phase. This includes investigating the potential to utilise existing infrastructure in the local area (e.g. groundwater bores) in agreement with existing licence holders, as well as the feasibility of establishing a new bore to access groundwater.

No significant impacts are anticipated in relation to water demand for the construction period.

iii Water demand and source during operation

As with the construction phase water supply, the primary source of operations water will be from a commercial water supplier, trucked to site. To minimise the need for imported water, water will also be opportunistically sourced from rainwater tanks collecting runoff from building roofs. Water may also be sourced opportunistically from existing landholder dams (where harvestable rights apply).

The estimated water demand during operations is 475 kL/year, over 35 years. This water will mainly be used for washing of PV panels, and will also be used for site amenities, fire protection and washing of equipment and plant.

As operations water will be sourced from a commercial supplier (and to a lesser extent from existing landholder dams (where harvestable rights apply)) no water take licences will be required.

No significant impacts are anticipated in relation to water demand for the operation period.

iv Surface water quality

Construction and operation activities have potential to impact surface water quality as a result of:

- soil erosion and transport of sediment into receiving watercourses
- accidental spillage of fuel or other hazardous materials used to support construction activities
- discharge of stormwater contaminated with hydrocarbons from the substation site
- poor or ineffective wastewater management practices
- entrainment of construction plant and/or materials in floodwaters.

No material impacts to water quality objectives are anticipated. The water quality of runoff leaving the development footprint is expected to be similar to the water quality of the receiving environment.

v Increased runoff

Construction activities such as vegetation clearing, soil compaction and installation of impervious surfaces have potential to temporarily increase site runoff. This may result in additional runoff leaving the project area and impacting downstream properties and receptors.

The presence of PV modules and new impervious surfaces during the operation phase has limited potential to increase site runoff. PV modules will shed runoff directly to the ground, which will be stabilised and vegetated to promote retention and infiltration similar to existing conditions. The quantum increase of impervious surfaces is not sufficient to result in significant increases in site runoff.

Potential impacts to the quantity of surface water runoff are considered negligible/minor and are manageable through the implementation of the mitigation measures outlined in Table 6.40.

vi Flooding

The development footprint has been refined to generally lie outside of the 1% AEP flood extent area (Figure 6.29). Minor encroachments of the development footprint into the 1% AEP flood extent occur in several isolated locations, however flooding is typically shallow (in the order of 0.1 m) and low hazard (H1) in these locations for events up to the 1% AEP.

Existing flood extents generally align with the presence of watercourses and their immediate overbank area for events up to 1% AEP, with only limited floodplain inundation. For the Probable Maximum Flood (PMF) event, flooding is more extensive and affects larger areas of the floodplain.

Depths of flooding across the study area are highly variable depending on local hydraulic conditions.

Flood hazard across the study area is also highly variable. Flooding within watercourses typically reaches a threshold that is unsafe for people and vehicles (H4) for the 20% AEP event, with hazard increasing further for larger events.

In addition to flooding along mapped watercourses, flood modelling also identified that a concentration of runoff generated from overland flows is likely to occur roughly midway between Kateys Creek and Jessie Creek, flowing generally to the north and discharging into Kings Creek. This flow path is shown to overtop several contour banks, as would be expected for large flood events, that have been constructed in the past to control local runoff, minimise flow velocities and resulting soil erosion. Flood hazard in this area is shown to be relatively low (H1) for all events up to and including PMF.

On this basis there is low potential for adverse flooding impacts either within or downstream of the development footprint for events up to 1% AEP.

vii Watercourses and riparian corridors

The primary project-related risk to watercourses and associated corridors relates to direct physical disturbance during the construction and operation of water crossings. The project will potentially include the construction of several new or upgraded watercourse crossings (Figure 3.1), namely:

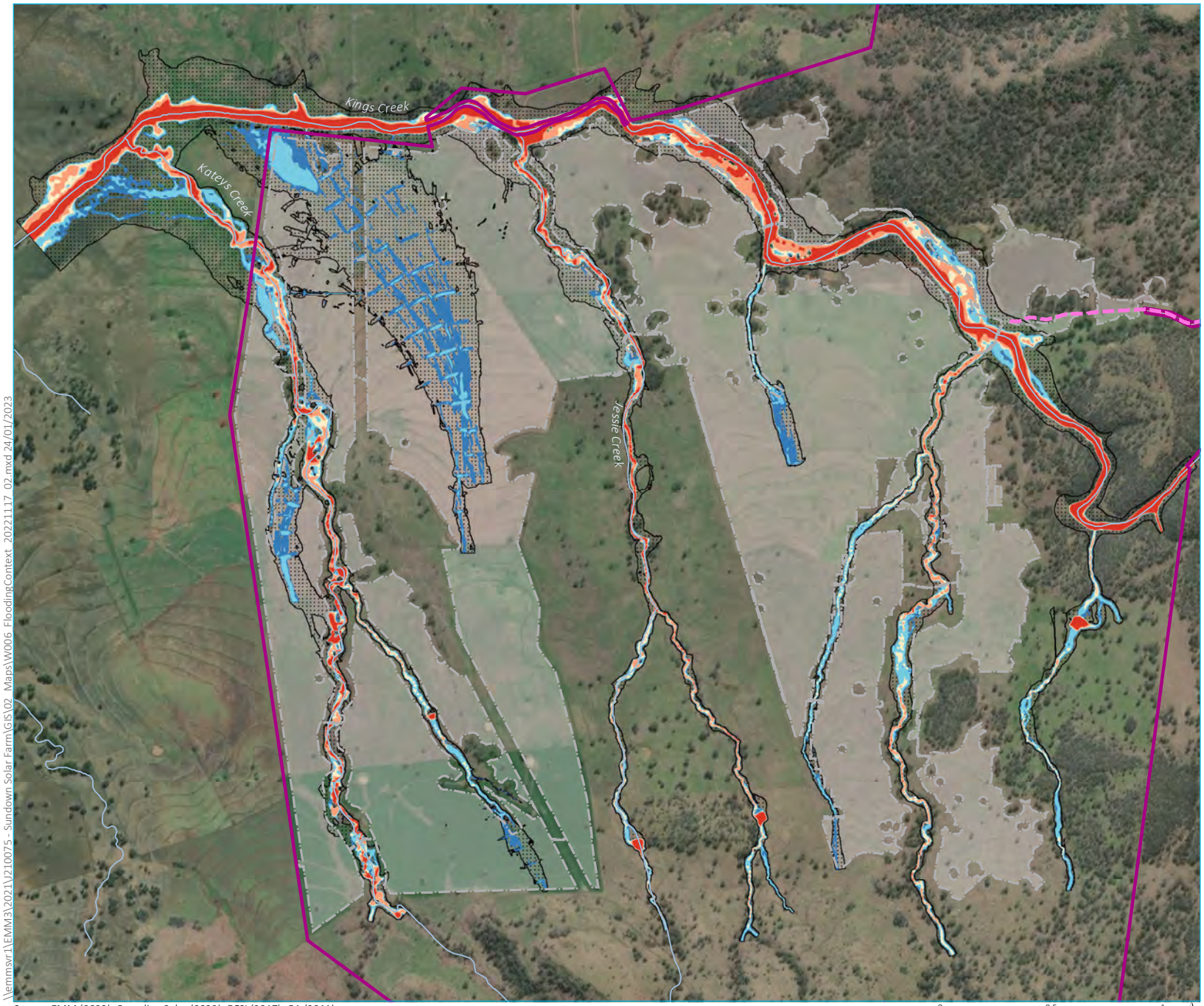
- 8 crossings on the access road
- 13 crossings on internal access roads.

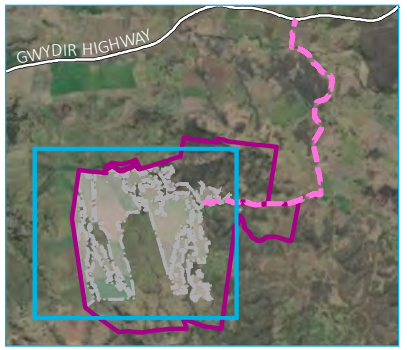
The type of watercourse crossings will typically be bed level crossings or culvert crossings. The number of watercourse crossings has been minimised during preliminary design to reduce the potential for watercourse impacts. This approach will also apply during detailed design.

The outcomes of a detailed mapping exercise to assess the extent of waterfront land and associated vegetated riparian zones (VRZs) for all mapped watercourses within the development footprint is presented in Figure 6.30. This was determined in accordance with DoI (2018) and included assessment of top of bank levels and channel widths based on available light detection and ranging (LiDAR) survey and supported by site observations.

It is expected that adverse impacts to watercourses and riparian corridors will be avoided because:

- the development footprint preserves VRZ widths recommended in DoI (2018)
- where instream works are proposed (i.e. construction or upgrade of watercourse crossings), these works will be designed and constructed to consider local hydraulic conditions, minimise local flooding impacts, and consistent with relevant guidelines.





KEY

- Proposed Sundown Solar Farm (Project area)
- Access road
- Development footprint
- Major road (refer to inset)
- Minor road
- Named watercourse
- PMF flood extent

1% AEP flood depth (m)

- 0.05 - 0.1
- 0.1 - 0.3
- 0.3 - 0.5
- 0.5 - 1
- > 1

Source: EMM (2022); Canadian Solar (2022); DFSI (2017); GA (2011)

0 0.5 1 km

GDA2020 MGA Zone 56

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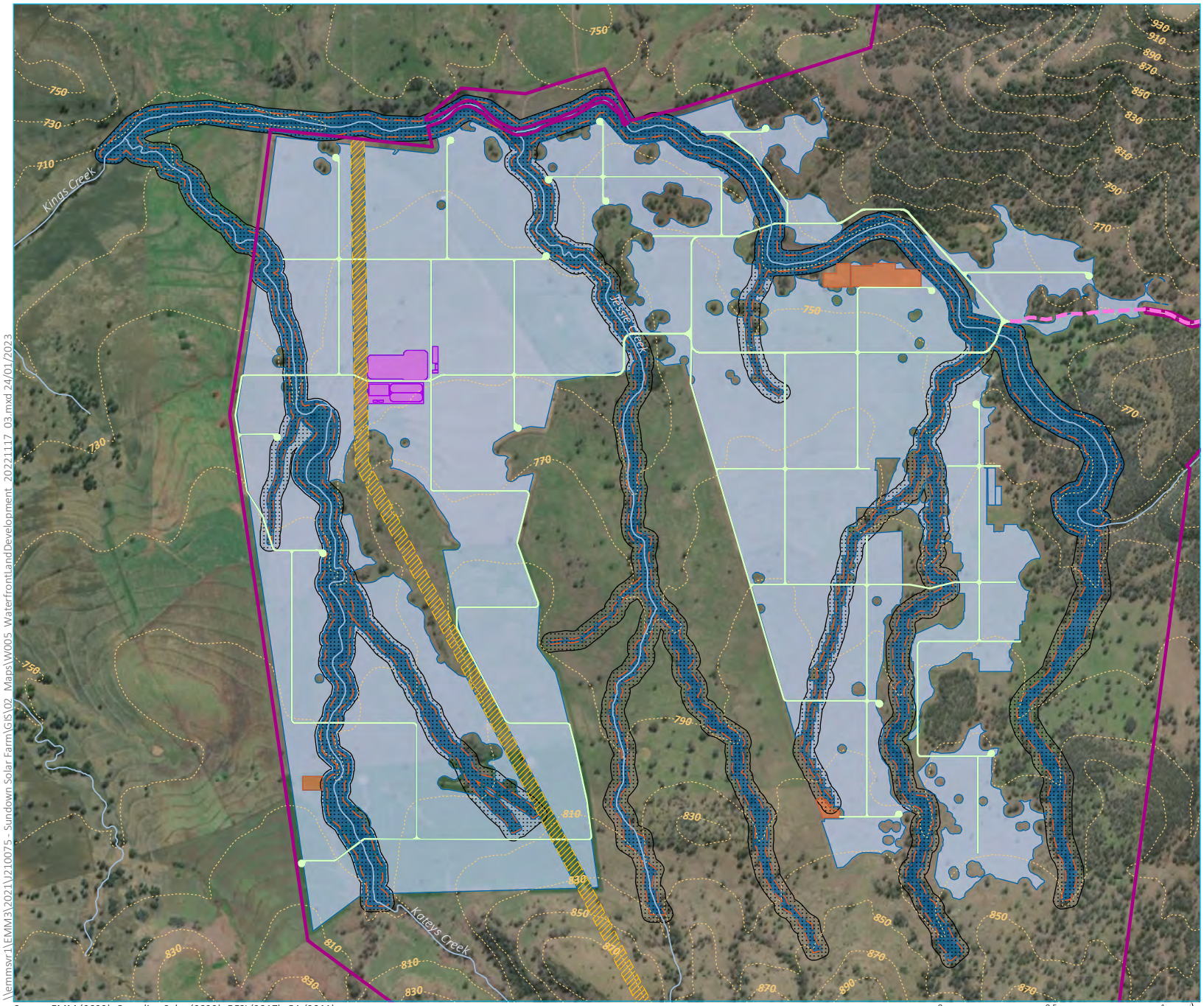
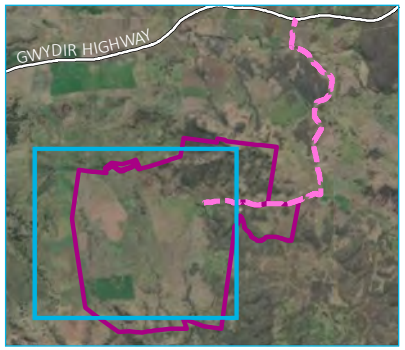
Flooding context

Sundown Solar Farm
Environmental impact assessment
Figure 6.29

EMM
creating opportunities





KEY

- Proposed Sundown Solar Farm (Project area)
- Major road (refer to inset)
- Minor road
- Named watercourse
- Topographic contour (20 m)
- Vegetated riparian zone (VRZ)
- Inner 50% of VRZ
- Waterfront land

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

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Source: EMM (2022); Canadian Solar (2022); DFSI (2017); GA (2011)

0 0.5 1 km

GDA2020 MGA Zone 56

N

Waterfront land and riparian corridors

Sundown Solar Farm
Environmental impact assessment
Figure 6.30

EMM
creating opportunities

viii Groundwater levels

During construction the project will require excavation below existing surface levels to establish suitable foundation conditions for infrastructure, and for the installation of underground services. However, as excavations will be limited to a few m in depth and existing groundwater levels are estimated to be at least 11 mbgl, groundwater is not expected to be intercepted. Nonetheless, any groundwater is observed to seep into the excavations will be recorded, managed and reused on site or discharged as appropriate.

Groundwater take via bores for construction use is not currently proposed but is being investigated. If viable, further assessment of groundwater impacts will be undertaken, including the necessary applications. Further detail is provided in Appendix J.

During operation the introduction of impervious surfaces for selected site infrastructure will lead to a very small reduction in the infiltration of stormwater runoff to the underlying soils and recharge of groundwater. However, this will have negligible impact on groundwater levels or availability to existing users (including GDEs) owing to the very small quantum of impacted area compared to the overall recharge area.

No groundwater take is expected to occur during the operation phase.

ix Groundwater quality

Construction and operation activities have limited potential to impact groundwater quality as a result of accidental spillage of wastewater, fuel or other hazardous materials used to support site activities that may infiltrate through soils to groundwater.

Potential impacts to groundwater are considered minor and manageable through the implementation of the mitigation measures outlined in Table 6.40.

x Impacts to existing groundwater users

There is one registered bore (GW971316) located within the development footprint. This bore will not be used as part of the project. Accordingly, impacts to consumptive users accessing groundwater via existing registered bores are not anticipated.

Similarly, the development of the project is assessed as unlikely to impact availability of groundwater to terrestrial GDEs mapped in the vicinity of the project, including high priority GDEs under the Groundwater WSP.

6.8.4 Proposed measures

Proposed measures to manage and mitigate potential water impacts are outlined in Table 6.40.

Table 6.40 Water mitigation measures

Reference	Mitigation measure	Timing
Stormwater management		
W1	Develop a Soil and Water Management Plan (SWMP) to address temporary and site-specific risks to surface water and groundwater during the construction phase. Key stormwater management principles will include: • appropriate siting of proposed infrastructure within the development footprint, which will minimise (and avoid where possible) disturbance to existing drainage lines and overland flow paths • grading to minimise earthworks and consistent with the existing prevailing grade and landforms and to fall to existing drainage lines, to minimise changes to existing flow paths • provision of surface drainage infrastructure comprising: – diversion of upslope runoff around infrastructure (excluding PV modules) – surface drainage measures as required to control runoff generated within the site, minimise soil erosion potential and direct runoff towards receiving drainage lines. Sheet flow conditions will be maximised, and construction of diversion drains, channels and table drains to be minimised to the extent practicable – suitable treatments, including rock rip rap where appropriate, will be used to armour earthwork batters and site drainage as needed for scour protection and to achieve stable waterways where flow concentrations cannot be avoided – maintain existing flow paths where possible and minimise catchment diversions, with the objective of minimising changes to flow regimes in receiving watercourses • prompt stabilisation of disturbed areas and progressive rehabilitation as early as practicable • maintaining drainage, erosion and sediment control measures • monitoring and adjustment protocols for drainage, erosion and sediment control practices to achieve the desired performance standard • drainage, erosion and sediment control personnel competence • stormwater runoff from buildings will be captured in rainwater tanks for use on site, to minimise demand for imported water • implement procedures for hazardous material storage and spill management as defined in applicable guidelines • maintain spill kits onsite at all times during construction and operation • consider weather preparedness and response planning • identify requirements for monitoring and maintenance of water management and drainage systems.	Pre-construction
W2	Specific stormwater management measures for the substation area will include: • diversion of clean runoff away from potentially oil-contaminated areas • bunding of potentially oil-contaminated areas • provision of stormwater treatment device(s) to remove oil/grease, hydrocarbons and sediment from runoff prior to discharge to the downstream drainage system.	Pre-construction
W3	Update SWMP to apply to operations phase, including but not limited to: • rehabilitation of temporary works and construction disturbance areas not utilised for operations • continuation and maintenance of stabilised and vegetated surfaces, drainage and sediment and erosion control measures that will be retained for operations.	Operation

Table 6.40 Water mitigation measures

Reference	Mitigation measure	Timing
Erosion and sediment control		
W4	Implementation of erosion and sediment control measures and site rehabilitation and revegetation in accordance with best practice comprising *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom 2004) and *Best Practice Erosion and Sediment Control* (IECA 2008). The LRA (Appendix F) describes a range of proposed measures for adoption. Proposed measures will be considered further and formalised as part of detailed design and will form part of the SWMP.	Pre-construction
W5	Progressive Erosion and Sediment Control Plan (PESCPs) will be implemented for all discrete disturbance areas.	Pre-construction
Flood risk management		
W6	Develop and implement a Flood Management Plan (FMP) to describe required site management and protocols in the event of flood events that could impact construction sites or access, including: • suitable early warning/prediction measures and communication protocols • site preparedness activities and procedures • triggers for closure, evacuation and recovery • emergency response and support.	Pre-construction
W7	Construction site planning at detailed design stage to: • consider flood risk and adopt appropriate placement of temporary works, plant, materials and workforce facilities, that gives due consideration to overland flow paths and mainstream flood risk • ensure that temporary works minimise offsite flooding impacts as far as practical.	Pre-construction Construction
W8	Design and construction of permanent works to: • locate sensitive infrastructure (e.g. substation, BESS) on high ground above 1% AEP flood levels (or other suitable level of flood immunity as may be determined during detailed design), and avoid or otherwise divert local overland flow paths around infrastructure • ensure finished ground levels are constructed at-grade and not materially higher than existing levels in areas subject to existing mainstream flooding, in order to minimise potential offsite flooding impacts as far as practical.	Pre-construction Construction
W9	• Update FMP to describe required site management and protocols in the event of flood events that could impact ongoing operation of the site.	Operation
Watercourse crossings		
W10	Watercourse crossings to be designed and constructed to: • consider the appropriate level of serviceability and flood immunity required for the project • consider local hydraulic conditions and minimise scour potential • minimise local flooding impacts • be consistent with relevant guidance comprising Guidelines for watercourse crossings on waterfront land (DoPI 2012) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull, S. and Witheridge, G. 2003).	Construction

6.8.5 Conclusion

Potential water related impacts associated with the proposed Sundown Solar Farm were assessed, including impacts to:

- surface water quality, quantity, flooding and impacts to watercourses and riparian corridors
- groundwater levels, quality and impacts to existing users.

Overall, potential surface water and groundwater impacts during construction and operation are considered minor and can be adequately managed through the implementation of the mitigation measures outlined in Table 6.40.

6.9 Hazards and risk

6.9.1 Introduction

A hazard and risk assessment was prepared for the project (Appendix K). This section of the EIS summarises the assessment and addresses the SEARs requirements for hazard impacts. The hazards-related SEARs are outlined in Table 6.41.

Table 6.41 Hazards-related SEARs

SEARs requirement	Section addressed
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 Hazardous Industry Planning Advisory Paper No. 6 – *Guidelines for Hazard Analysis* (HIPAP) (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011).	Section 6.9 (hazards)
An assessment of all potential hazards and risks including but not limited to bushfire risks of the development against the RFS *Planning for Bushfire Protection 2019*, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Field.	Section 6.9 (hazards) Section 6.10 (bushfire)

In addition to the SEARs requirements outlined in Table 6.41, DPE requested a PHA for the BESS. To meet this request, a PHA was undertaken in accordance with recent hazards-related SEARs for projects proposing to develop a BESS with a capacity exceeding 30 MW. These SEARs typically require:

> A Preliminary Hazard Analysis (PHA) must be prepared in accordance with the Hazardous Industry Planning Advisory Paper No. 6 – Guideline for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011). The PHA must consider all recent standards and codes and verify separation distances to on-site and off-site receptors to prevent fire propagation and compliance with Hazardous Industry Advisory Paper No. 4, 'Risk Criteria for Land Use Safety Planning (DoP, 2011).

6.9.2 Existing environment

i Setting

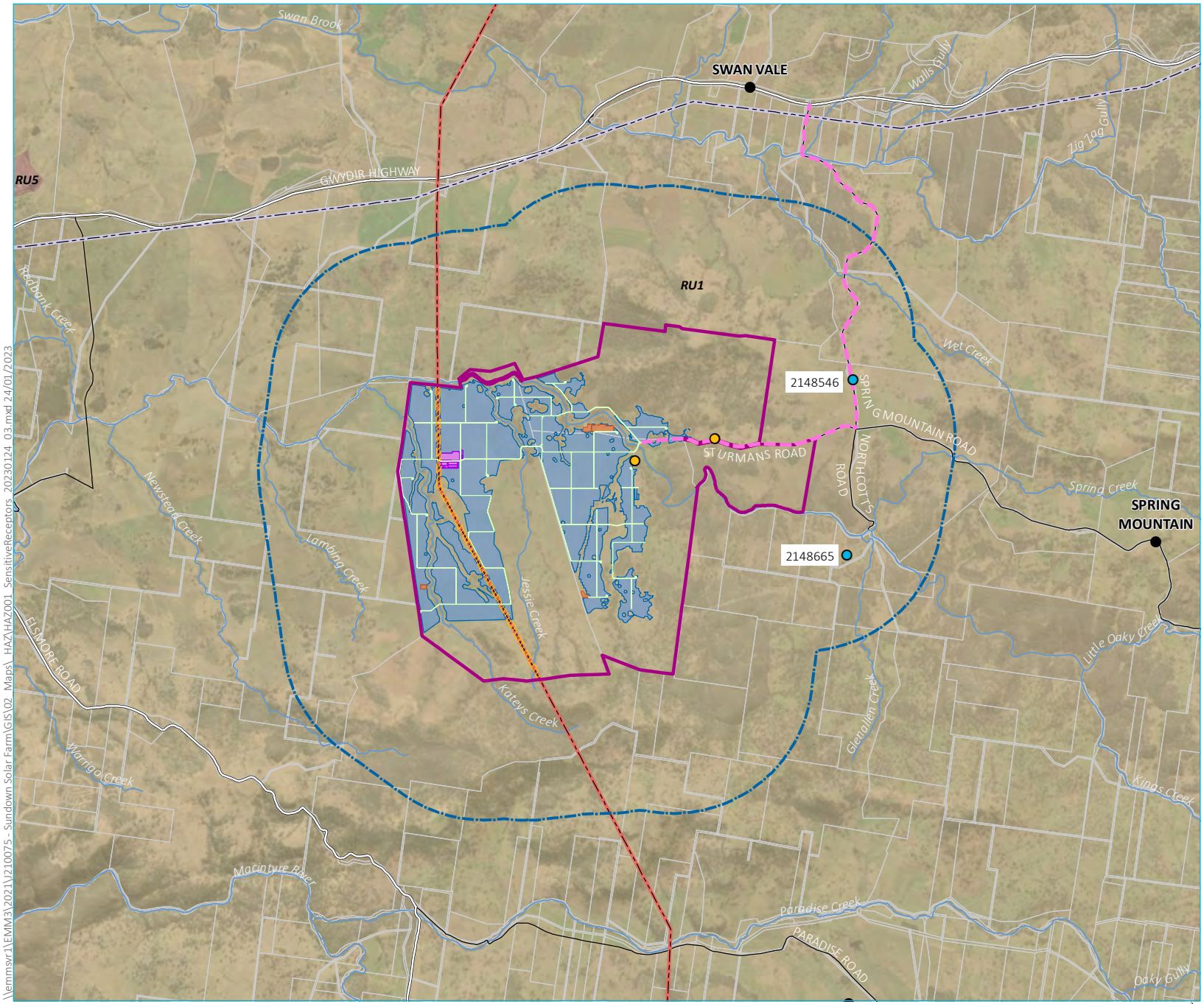
The site is privately owned by three different parties, in a rural area where the primary land-use is farming. The surrounding land is used for farming and generation of renewable energy, including Sapphire Wind Farm and Sapphire Solar Farm, White Rock Wind Farm and White Rock Solar Farm and the Glen Innes Wind Farm. These solar/wind farms fall within a 15 km radius of the site (Figure 1.1).

The site is zoned RU1 – Primary Production under the *Inverell Shire Local Environmental Plan 2012*.

The site is located on Sturmans Road, Spring Mountain, approximately 30 km east of Inverell and approximately 38 km west of Glen Innes. The site is accessed from the along Gwydir Highway (Figure 1.1).

ii Potentially sensitive receptors

There are two project-related dwellings within the project site and two non-project related dwellings within a 2 km radius from the project area boundary. These two non-project related dwellings are potentially sensitive receptors (Figure 6.31).



KEY

- Proposed Sundown Solar Farm (Project area)
- Proposed Sundown Solar Farm (Project area) - 2 km buffer
- Associated property
- Non-associated property
- Major road
- Minor road
- Named watercourse
- Cadastral boundary

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

Development footprint

- Access road
- 330 kV OHL easment (60 m)
- Internal access road
- BESS/switchroom/substation
- Construction and laydown
- Potential PV area

Inverell Local Environmental Plan 2012

Land zoning

- RU1 | Primary Production
- RU5 Village

Potentially sensitive receptors within a 2 km radius

Sundown Solar Farm
Environmental impact assessment
Figure 6.31

Source: EMM (2023); DPIE (2022); Canadian Solar (2023); ESRI (2023); DFSI (2017, 2020)

0 2.5 5 km

GDA2020 MGA Zone 56

N

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EMM creating opportunities

6.9.3 Impact assessment

i SEPP (Hazards and Resilience) risk screening and PHA

A risk screening was undertaken in accordance with the Hazards and Resilience SEPP to determine whether the project is considered to the potentially hazardous. The Hazards and Resilience SEPP defines potentially hazardous industry as follows:

> a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:
>
> - to human health, life or property; or
> - to the biophysical environment; and
> - includes a hazardous industry and a hazardous storage establishment.

Development proposals that are classified as potentially hazardous industry must undergo a PHA as per the requirements set in HIPAP No. 6 *Guidelines for Hazard Analysis* to determine the risk to people, property and the environment. If the residual risk exceeds the acceptability criteria, the development is considered as a hazardous industry and may not be permissible within NSW.

The risk screening considered the type and quantity of hazardous materials to be stored on site, distance of the storage area to the nearest project area boundary, and the expected number of transport movements. Additional details of the risk screening method are provided in the hazard impact assessment (Appendix K).

The risk screening results for the proposed Sundown Solar Farm indicated:

- the storage and transport of hazardous materials for the project will not exceed the relevant risk screening threshold
- there are no other risk factors identified that could result in significant offsite impacts.

Accordingly, the project is not considered to be potentially hazardous within the meaning of the Hazards and Resilience SEPP and does not require a PHA. Notwithstanding the SEPP 33 risk screening outcome, a PHA for the BESS was completed using the methodology outlined in HIPAP No. 6 *Guidelines for Hazard Analysis,* which focuses on offsite impacts (further detail on the PHA method is provided in Appendix K). The review of BESS separation distances found that:

- The proposed BESS has been tested to UL 9540A (Test Method) and the results indicate:
  - While cell-to-cell propagation occurred during the test, module-to-module propagation was not observed, indicating an adequate thermal barrier between modules.
  - The Unit level results show a resiliency of the Unit to thermal runaway propagation and fire hazard in a single failure event.
- The designated land area can accommodate the proposed BESS units to meet the proposed capacity.

- There is a considerable separation distance between the proposed BESS and the O&M building area (i.e. 65 m). In the event of thermal runaway and/or fire, propagation is not expected to affect other onsite receptors (e.g. substation and switchyard) based on the propagation characteristics determined from the UL 9540A test. Currently, the O&M building is sited within the BESS fenced area. As it will be staffed by onsite personnel, it is recommended that the location of the O&M building be revisited during detailed design in consideration of access and egress from the building in the event of an emergency.
- No offsite impact is expected as the BESS will be located in a rural area and there is a large separation distance to the nearest sensitive receptor (approximately 3.6 km).

ii Hazards and risk assessment

To address the 'hazards and electromagnetic interference' assessment requirement of the SEARs, an assessment of hazards and risks was undertaken. The assessment objective was to identify and assess all reasonably foreseeable hazards and risk events associated with the project infrastructure and operations.

The assessment was undertaken in accordance with HIPAP No. 6 *Guidelines for Hazard Analysis* (DoP 2011a) and focussed on assessing the potential for offsite impacts. The development footprint boundary was used to define and determine offsite impact (i.e. impact extending outside of the development footprint boundary). The following factors were considered to identify the hazards:

- project infrastructure and type of equipment
- types, quantities and locations of hazardous materials present
- proposed operation and maintenance activities
- external factors such as unauthorised access, flood, lightning storm etc.

The assessment identified several potential hazards, typical to generation of renewable energy (Table 6.42).

Each potential hazard was assessed for its potential to cause significant offsite impacts. The assessment determined that all hazards are rated as a very low residual risk, except for 'asset damage caused by unauthorised access' which is rated as having a medium residual risk. This particular hazard had a severity rating of 'major' to account for the trespasser potentially injuring themselves and others in the act. The assessment noted that the controls for this hazard are well understood, and the likelihood was rated unlikely.

The assessment identified no events with potential for significant offsite impact based on the following considerations:

- proposed mitigations measures would be implemented
- the project will be situated in a rural area
- the distance between the nearest non-associated residential dwelling and the development footprint is approximately 3.6 km.

Further detail about the PHA methodology is provided in Appendix K.

Table 6.42 Potential hazards

Hazard	Potential cause	Potential consequence	Risk analysis (offsite and public impact)		
			Severity	Likelihood	Risk
Fire in equipment (BESS, substation, transformer, etc)	• Equipment faulty, overheating, overcharged, short circuited or experiencing arc flash etc. • Encroachment of offsite bushfire. • Arson. • System failure.	• Release of toxic emissions. • Explosion risk. • Escalation to adjacent infrastructure. • Injury and/or fatality to onsite personnel.	Insignificant	Unlikely	Very low
Exposure to voltage	• Electrical faults. • Human error during installation/maintenance. • System failure.	• Injury and/or fatality (electrocution). • Fire.	Insignificant	Unlikely	Very low
Exposure to arc flash	• Electrical faults. • Human error during installation/maintenance. • System failure. • Faulty equipment (e.g. corroded conductors). • Insufficient isolation/insulation for voltage level. • Vibration.	• Injury and/or fatality (electrocution, burns, exposure to intense light/noise/pressure). • Fire.	Insignificant	Unlikely	Very low
Loss of containment of chemicals/fuels	• Inappropriate storage and handling (human error and/or inappropriate equipment). • Physical damage to storage/handling equipment (e.g. puncture in bund). • Ineffective maintenance. • System failure.	• Soil contamination. • Fire, if ignited. • Injury and/or fatality to onsite personnel from exposure.	Insignificant	Unlikely	Very low
Release of electrolyte from BESS battery cell	• Physical damage to BESS (e.g. puncture, crush etc). • Abnormal heating to BESS (e.g. thermal runaway or exposure to fire). • System failure.	• Release of toxic emissions. • Explosion risk. • Fire, if ignited. • Injury and/or fatality to onsite personnel.	Insignificant	Unlikely	Very low

Table 6.42 Potential hazards

Hazard	Potential cause	Potential consequence	Risk analysis (offsite and public impact)		
			Severity	Likelihood	Risk
Thermal runaway in battery (i.e. an increase in battery temperature that releases thermal energy and further increases battery temperature)	• Physical damage (e.g. puncture, crush etc). • Abnormal heating (e.g. thermal runaway or exposure to fire). • Inadequate ventilation. • Electrical failure. • System failure.	• Release of toxic emissions. • Explosion risk. • Fire, if ignited. • Injury and/or fatality to onsite personnel.	Insignificant	Unlikely	Very low
Coolant or chiller unit leak from BESS	• Physical damage to BESS (e.g. puncture, crush etc). • Ineffective maintenance. • System failure.	• Irritation/injury to onsite personnel from exposure. • Ingress of coolant to electrical components resulting in short circuit and fire, resulting in injury and/or fatality to onsite personnel.	Insignificant	Unlikely	Very low
Generation of explosive gas	• Thermal runaway. • Encroachment of onsite fire or offsite bushfire.	• Release of toxic emissions. • Explosion risk. • Fire, if ignited. • Injury and/or fatality to onsite personnel.	Insignificant	Unlikely	Very low
Exposure to electro-magnetic fields (EMF)	• Operation of power generation/storage/transmission equipment.	• Injury/health risk to onsite personnel.	Insignificant	Rare	Very low
Asset damage caused by unauthorised access	• Vandalism caused by unauthorised access.	• Fire. • Explosion risk. • Injury and/or fatality to trespasser/onsite personnel.	Major	Unlikely	Medium

Table 6.42 Potential hazards

Hazard	Potential cause	Potential consequence	Risk analysis (offsite and public impact)		
			Severity	Likelihood	Risk
Asset damage caused by severe weather event	• Severe weather (flood, storms, lightning strike, strong wind, etc).[8]	• Physical damage to plant/equipment. • Electrical fault. • Fire, if ignited. • Injury and/or fatality (electrocution, burns, exposure to projectile object).	Insignificant	Unlikely	Very low

[8] Note, bushfire risks are outlined separately in Section 6.10.

iii Electro-magnetic fields

The potential for project-related electro-magnetic field (EMF) impacts was assessed in accordance with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Field.* The assessment considered all project infrastructure with potential to generate EMF:

- photovoltaic panels, solar arrays and power conversion systems
- underground cables
- substation and grid connection
- transmission lines
- BESS.

The study also considered the proposed control measures that would be implemented to limit exposure to EMF. The assessment concluded that EMF created from the project will not exceed the ICNIRP levels for occupational exposure or for general public exposure levels.

6.9.4 Proposed measures

Proposed measures to manage and mitigate hazards are outlined in Table 6.43. These measures will be applied over the life of the project. Note that the proposed measures for bushfire risks are provided separately in the bushfire chapter of this EIS (Section 6.10).

Table 6.43 Hazard mitigation measures

Reference	Mitigation measure	Timing
H1	Design, install, operate and maintain all plant and equipment in compliance with relevant international and/or Australian standards and guidelines, including but not limited to AS 5139.	Pre-construction Construction Operation
H2	Prepare a Fire Management Plan in consultation with the local NSW RFS district office (outlining measures for the construction, operation and decommissioning phases). Ensure the Fire Management Plan is prepared by a suitably qualified consultant.	Pre-construction
H3	Ensure all plant and equipment is operated and maintained in accordance with manufacturer specifications.	Construction Operation
H4	Ensure warning signs are displayed in accordance with relevant international and/or Australian standards and guidelines.	Construction Operation
H5	Ensure storage and handling of chemicals and fuel complies with AS 1940.	Construction Operation
H6	Prepare and implement an Emergency Response Plan, in accordance Australian Standard AS3745 2010 *Planning for Emergencies in Facilities.* Consult with Fire and Rescue NSW and local NSW RFS district office during preparation of Emergency Response Plan.	Construction Operation
H7	Install security fencing around site to prevent unauthorised access.	Construction Operation

Table 6.43 Hazard mitigation measures

Reference	Mitigation measure	Timing
H8	Prepare and implement safety procedures including, but not limited to, use of appropriate personal protection equipment (PPE).	Construction Operation
H9	Ensure mitigation measures outlined in the bushfire chapter of this EIS are also implemented (Table 6.45).	As applicable.
H10	Currently, the O&M building is sited within the BESS fenced area. As it will be staffed by onsite personnel, it is recommended that the location of the O&M building be revisited during detailed design in consideration of access and egress from the building in the event of an emergency.	Pre-construction
H11	Consider and/or implement the recommendations in the Technical Due Diligence Report (DNV 2022) for the BESS.	Pre-construction Construction Operation
H12	Review the investigation reports on the Victorian Big Battery Fire (occurred on 31 July 2021) and implement relevant findings for the project.	Pre-construction Construction Operation
H13	Consult with Fire and Rescue NSW to ensure that the relevant aspects of fire protection measures have been included in the design. These may include: • type of firefighting or control medium • demand, storage and containment measures for the medium. The above aspects will form an input to the Fire Safety Study (as applicable).	Pre-construction Construction

6.9.5 Conclusion

The SEPP 33 risk screening outcome determined that the project is not classed as potentially offensive or potentially hazardous development. Notwithstanding the SEPP 33 risk screening outcome, a PHA was prepared for the project (Appendix K). This assessment summarises potential hazards and risks associated with the project and details management measures to reduce these hazards and risks to acceptable levels. The assessment considered all hazards and risks associated with the project including, BESS separation distances, electrical connection and conversion systems (e.g. inverters and transformers), the onsite substation and ancillary infrastructure.

For all identified events associated with the project, the resulting consequences are not expected to have significant offsite impacts. The assessment identified numerous scenarios/events with potential for off-site impacts, which were subject to qualitative risk analysis in accordance with the *Multi-level Risk Assessment Guideline* (DoP 2011b). Of the 17 events identified, all were rated as “very low” risks except for one “medium” risk event. This event is related to an unauthorised person accessing the proposed BESS/development footprint, resulting in vandalism/asset damage to the infrastructure with the potential for self-injury during the act. To adequately manage this risk, security fencing, cameras, and warning signs will be installed, and onsite security protocols implemented to deter trespassers and minimise unauthorised person access.

Based on the study risk acceptance criteria, the risk profile for the project is considered to be tolerable. The analysis found that the project is compliant with the *Hazardous Industry Planning Advisory Paper* (HIPAP) 4 (DoP 2011c) qualitative risk criteria.

The PHA concluded that the project:

- is not considered to be potentially hazardous within the meaning of the Hazards and Resilience SEPP
- is located in a suitable area (i.e. a rural area) with considerable separation distance to sensitive receptors and in an area without any other hazardous developments in the vicinity of the project site
- is not expected to have significant offsite hazard impacts
- is not expected to generate EMF levels that exceed ICNIRP levels for occupational exposure or for general public exposure levels
- meets the HIPAP No.4 qualitative risk criteria.

Assuming the mitigation measures outlined in Table 6.43 are implemented, the project is not expected to result in any significant hazards or risks.

6.10 Bushfire

6.10.1 Introduction

A portion of the project area and its surrounds is mapped as bushfire prone land. Accordingly, an assessment of the potential project-related bushfire risks was undertaken for the project (Appendix L). This meets the bushfire-related requirements of the SEARs (Table 6.44).

Table 6.44 Bushfire-related SEARs

SEARs requirement	Section addressed
An assessment of all potential hazards and risks including but not limited to bushfire risks of the development against the RFS *Planning for Bushfire Protection 2019*, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Field.	Section 6.9 (hazards) Section 6.10 (bushfire)

The bushfire assessment was prepared in accordance with the *Planning for Bush Fire Protection* (PBP) (RFS 2019) guideline. The PBP guideline aims to protect life and protect property from the threat of bushfire. All development on bushfire prone land in NSW is required to satisfy the aims and objectives of this guideline.

The bushfire assessment was also prepared in the context of the *Rural Fires Act 1997*, which aims to prevent, mitigate and suppress bushfires and other fires in rural fire districts across NSW.

The bushfire assessment is presented as Appendix L and is summarised below.

6.10.2 Existing environment

i General

As described in Chapter 3, the entire site is zoned RU1 – Primary Production under the Inverell LEP and is currently and has historically been used for farming (cropping and grazing).

Land surrounding the site is characterised by rolling pastoral hills, open flat valleys, and ridgelines with scattered vegetation. The hill slopes are generally gentle in gradient and predominantly mixed areas of cleared open grasslands and remnant woodland/forest vegetation on steeper terrain, near rocky outcrops and between saddles (Figure 6.33 and Figure 6.34). The site is located on Sturmans Road, Spring Mountain, approximately 30 km east of Inverell and approximately 38 km west of Glen Innes (Figure 1.1).

ii Bushfire prone land

A portion of the project area is mapped as bushfire prone land (Figure 6.32). Some land adjacent to the project area is also mapped as bushfire prone land. However, only a very small portion of the development footprint is mapped as bushfire prone land.

iii Fire season and weather

The site is located within the Northern Tablelands Bushfire Management Committee region and is covered by the *Northern Tablelands Bush Fire Risk Management Plan 2020*.

The region has a temperate climate and the bushfire season generally runs from August to March. Prevailing winds associated with the bushfire season are north-westerly winds accompanied by high daytime temperatures and low humidity. Dry lightning storms occur frequently during the fire season.

The Inverell LGA falls within the North-Eastern NSW RFS Fire Weather District and has a fire danger rating (FDR) classification of:

- Forest FDR = 80
- Grassland FDR = 110.

While historically the region has experienced an average of 170 bushfires per year with an average of five major fires per year, a review of the most recent fires in the region (SEED, geo.seed.nsw.gov.au) indicates that the project area and its immediate surrounds have experienced a considerably lower frequency of bushfires than the surrounding region. The closest bushfires have been over 30 km from the project area:

- 2002–2003 Strathmore fire (over 30 km west from the site)
- 2002–2003 Rockwood fire (over 30 km north from the site)
- 2019–2020 fire (over 50 km east from the site).

The predominant sources of bushfire ignition in the area are:

- dry lightning strikes
- escape from legal burns
- ignition caused by farm equipment (e.g. harvester, bailer etc).

iv Vegetation

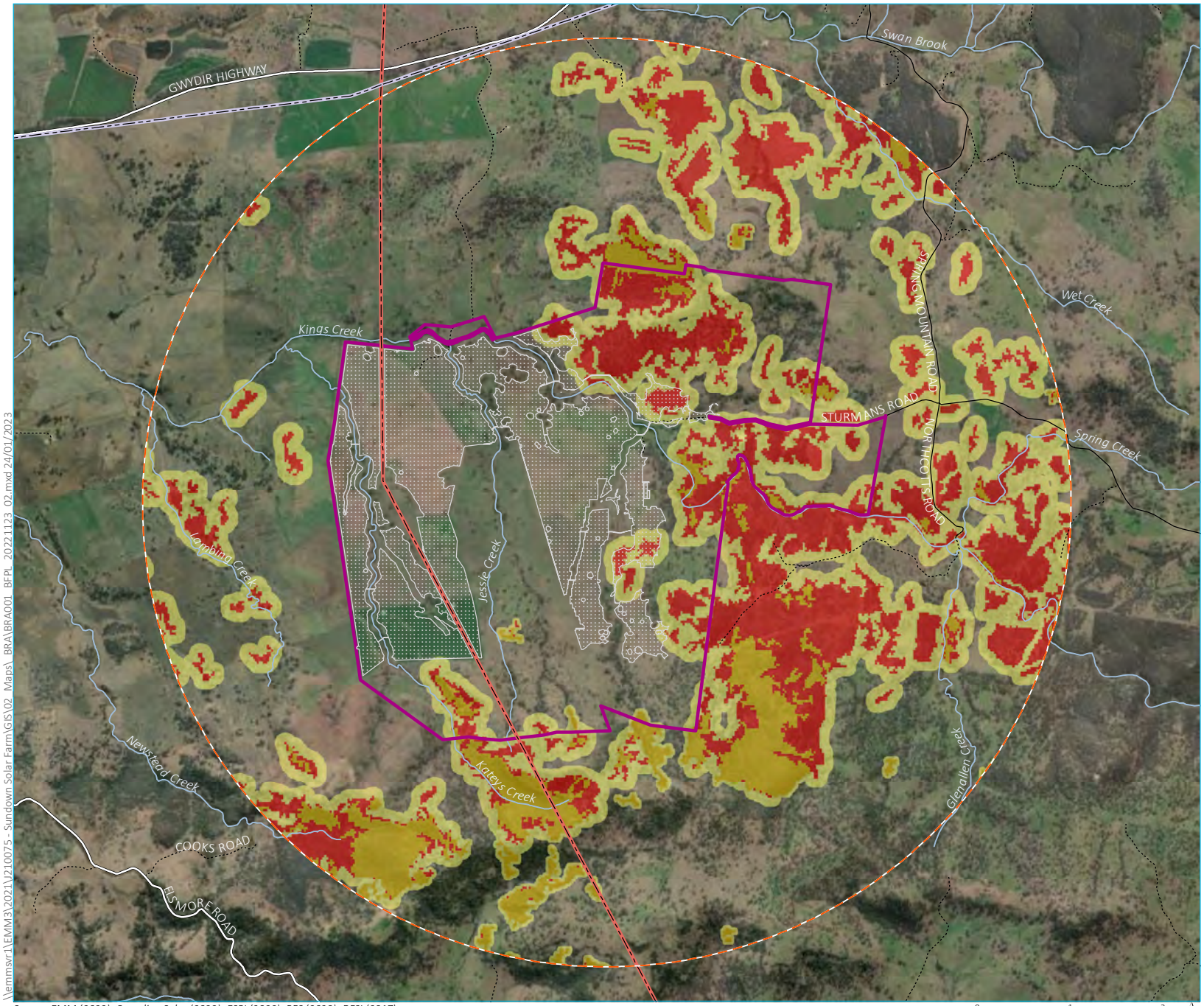
Vegetation mapping for the site and surrounding land is shown in Figure 6.33 and broadly comprises:

- managed agricultural and rural enterprise on the valley flats and lower slopes (non-native vegetation)
- derived native grasslands and grassy woodland remnants on lower slopes (Western Slopes/New England Grassy Woodlands and derived native grasslands)
- forest (and woodland) vegetation on steeper upper slopes (e.g. Northern Tableland Dry Sclerophyll Forests).

v Topography and slopes

The topography of the site comprises flat areas and gentle to steep slopes, ranging from 500–750 m above sea level.

The topography of the proposed development footprint is predominantly on slopes 0–5 and 5–10 but less than 15 degrees. The slopes within the project area and surrounding area are shown in Figure 6.34.



KEY

- Proposed Sundown Solar Farm (Project area)
- 5 km buffer (off Project area centroid)
- Development footprint
- Major road
- Minor road
- Vehicular track
- Named watercourse

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

NSW bush fire prone land category

- Vegetation Category 1
- Vegetation Category 2
- Vegetation Buffer

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Source: EMM (2022); Canadian Solar (2022); ESRI (2022); RFS (2020); DFSI (2017)

0 1 2 km

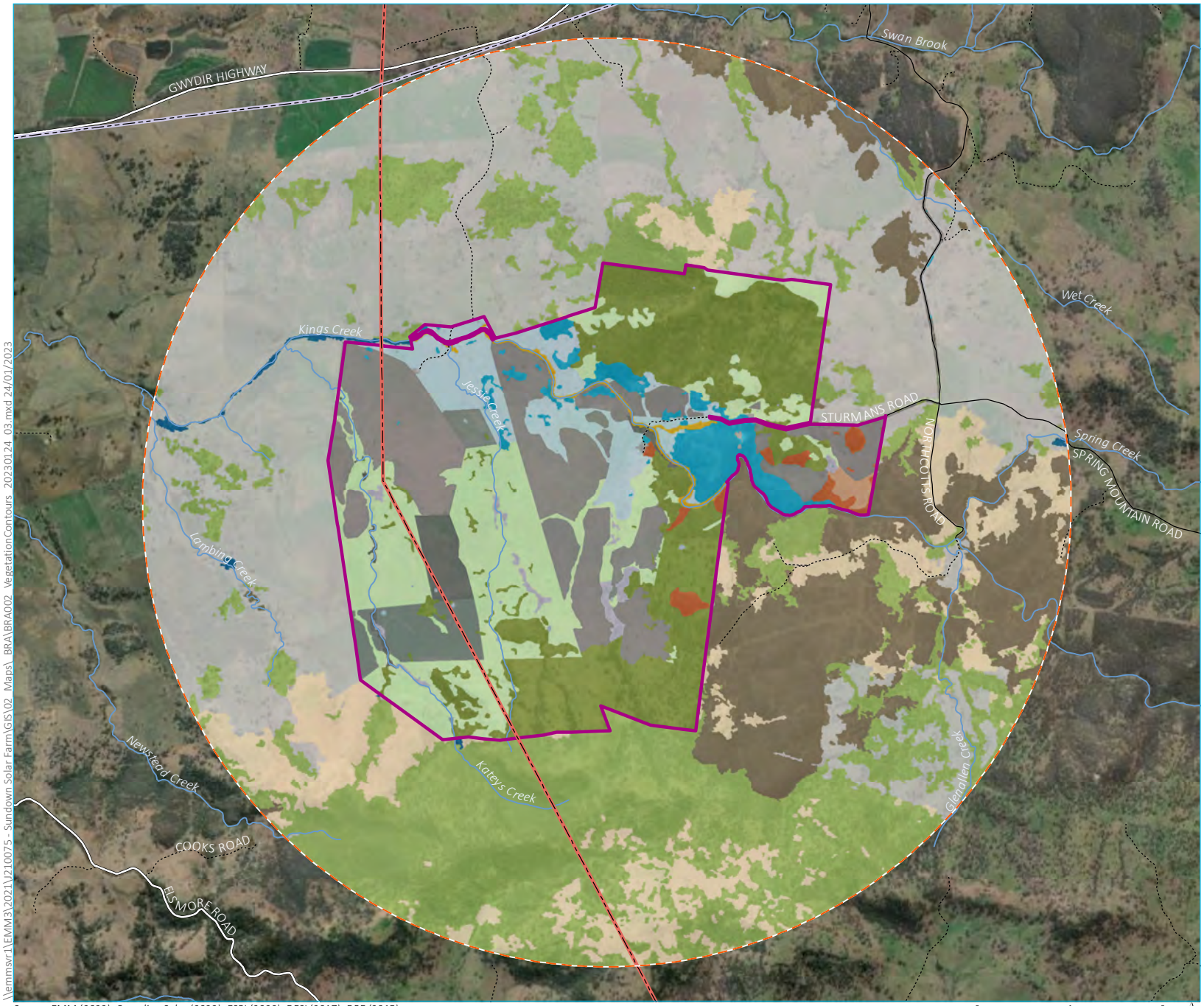
GDA2020 MGA Zone 56

N

Bushfire prone land

Sundown Solar Farm
Environmental impact assessment
Figure 6.32

EMM creating opportunities



KEY

- Proposed Sundown Solar Farm (Project area)
- 5 km buffer (off Project area centroid)
- Major road
- Minor road
- Vehicular track
- Named watercourse

Existing overhead transmission line

- Armidale to Dumaresq (330 kV)
- Glen Innes to Inverell (132 kV)

PCT and formation (EMM, 2022)

- PCT 084 | woodland
- PCT 508 | woodland
- PCT 508 | derived native grassland
- PCT 510 | woodland
- PCT 510 | derived native grassland
- PCT 571 | woodland
- PCT 590 | woodland
- PCT 590 | derived native grassland
- Cleared
- Cultivation
- Exotic
- Waterbody

Regional vegetation (VIS 4467)

- Not Native
- Candidate native grasslands
- Dry sclerophyll forests (shrubby sub-formation)
- Forested wetlands
- Grassy woodlands

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Source: EMM (2023); Canadian Solar (2023); ESRI (2023); DFSI (2017); DPE (2015)

0 1 2 km

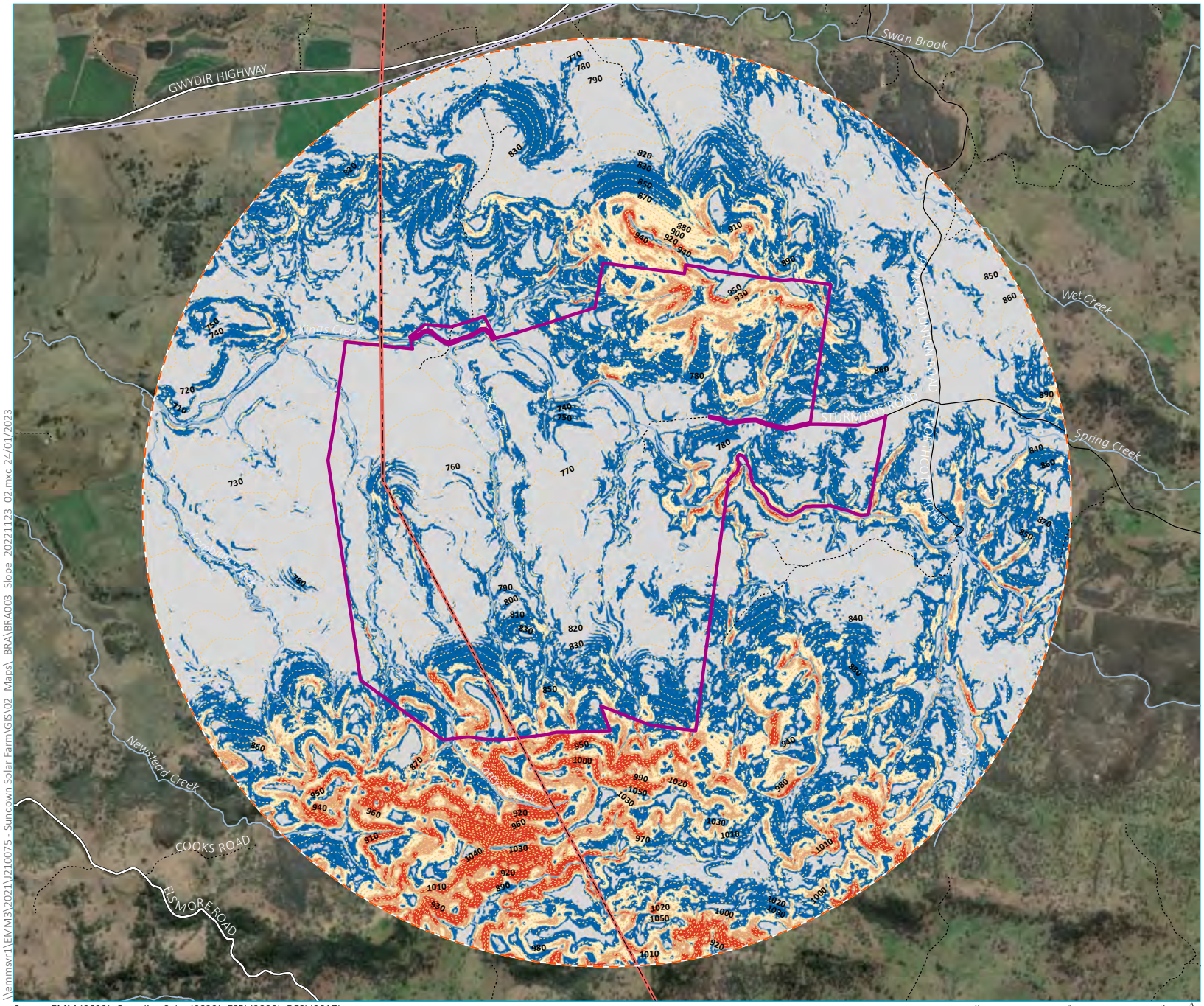
GDA2020 MGA Zone 56

N

Vegetation and water courses

Sundown Solar Farm
Environmental impact assessment
Figure 6.33

EMM creating opportunities



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Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

Slopes

Sundown Solar Farm
Environmental impact assessment
Figure 6.34

EMM
creating opportunities

6.10.3 Predicted impacts

An unplanned fire (either impacting upon or emanating from the project site) has potential to cause risk to:

- human life, e.g. employees, contractors, visitors and nearby neighbours
- project infrastructure, e.g. solar panels, BESS, substation etc
- surrounding infrastructure e.g. houses, farms, public amenities etc
- the environment e.g. crops, livestock, native flora and fauna etc.

Potential sources of fuel and ignition for unplanned fires during the life of the project include:

- movement of vehicles or equipment over long, dry grass
- human error such as non-compliance with hot works procedures (and associated generation of sparks) or incorrect disposal of cigarette butts
- storage and handling of flammable liquids (e.g. diesel etc)
- arcing/sparking of plant or equipment
- migration of an offsite bushfire into the project area
- lightning strike
- arson
- arcing, sagging or damage to the nearby transmission line.

Over the next 30–40 years (i.e. the expected lifespan of the project), the region is predicted to experience more frequent days of high fire danger than previously experienced (Douglas 2017). Planning for long term infrastructure will therefore include consideration of the potential for increased fire danger and potentially higher fire frequencies.

6.10.4 Proposed measures

Proposed measures to manage and mitigate bushfire risks are outlined Table 6.45. These measures comply with the PBP (RFS 2019) and will be applied over the life of the project applicable to the stage of the project.

Table 6.45 Bushfire mitigation measures

Reference	Mitigation measure	Timing
B1	Establish an asset protection zone (APZ) of at least 10 m around the solar farm development footprint perimeter (Figure 6.35).	Pre-construction Construction
B2	Prepare and implement a Bushfire Management Plan in consultation with the local NSW RFS district office (outlining measures for the construction, operation and decommissioning phases). Ensure the Bushfire Management Plan is prepared by a suitably qualified consultant and is updated annually to capture legislative changes and to ensure the risk analysis and mitigation actions are relevant to the project and environment.	At all times

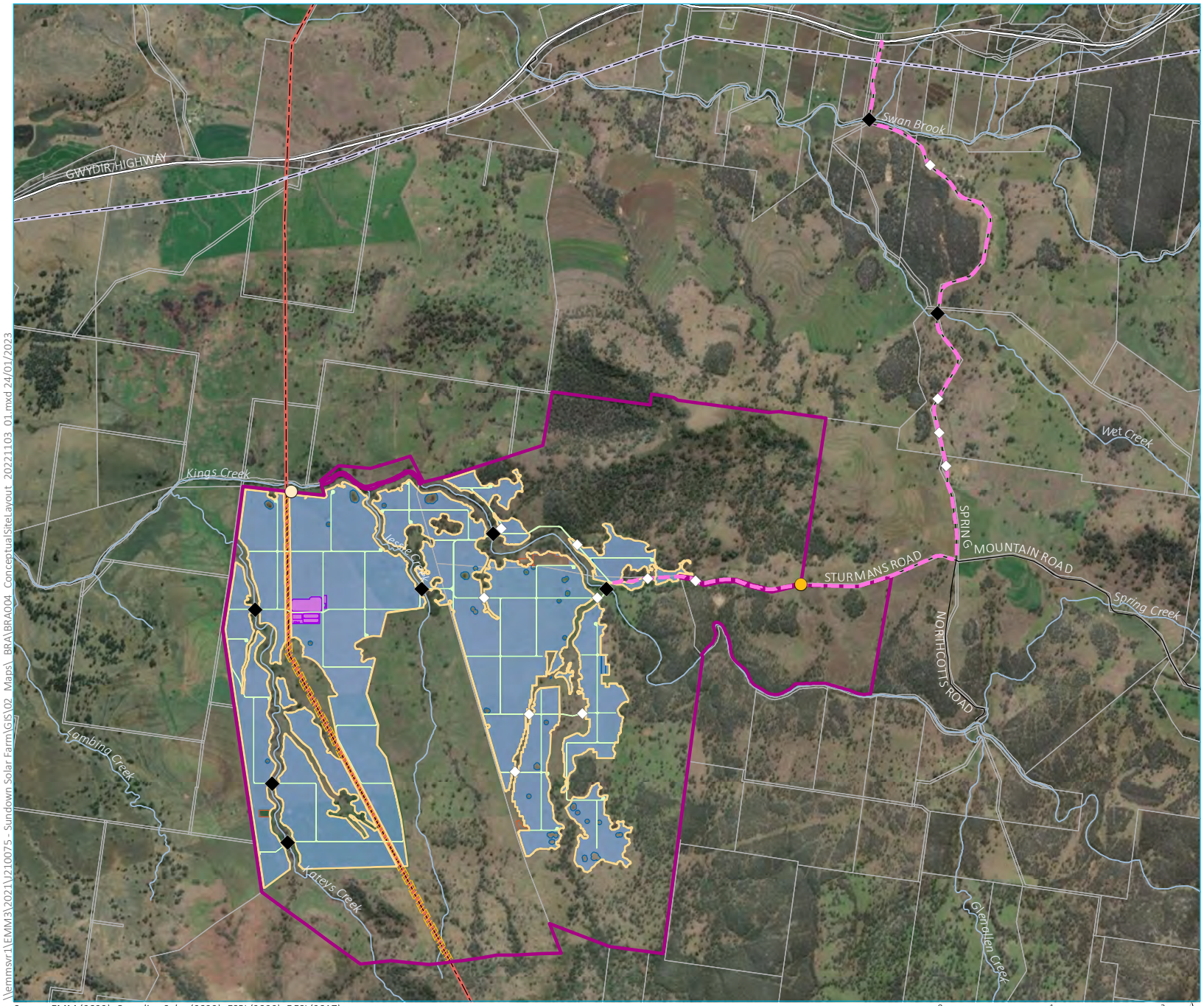
Table 6.45 Bushfire mitigation measures

Reference	Mitigation measure	Timing
B3	Ensure the Bushfire Management Plan includes a requirement to: • maintain APZ (and all areas within the APZs) to the standard of an Inner Protection Area (IPA) in accordance with Appendix 4 of PBP and the NSW RFS document *Standards for Asset Protection Zones,* for the life of the project • monitor fuel loads of the APZ (and the areas within the APZ) annually in August (i.e. before the fire season) • maintain fuel loads in accordance with the PBD (e.g. ensure APZ and all areas within the APZs comprise sand, gravel, or grass that is maintained at a height of less than 10 cm)[9] • avoid any tree canopy in the APZ • minimise vehicle movements off access roads and through long grass • comply with construction procedures, particularly hot works procedures • comply with cigarette butt disposal procedures • ensure flammable liquids are stored and handled in accordance with Australian Standard AS 1940:2017 • prohibit prescribed burning onsite • prohibit combustible fencing within 10 m of any structure • ensure fuel loads below individual photovoltaic modules are kept to a minimum • locate onsite electricity supply and distribution infrastructure underground, wherever possible • prohibit hot works on total fire ban days, or when local authorities or the site manager deems weather conditions too dangerous • include 24-hour emergency contact details including alternative contact details • ensure fire-fighting infrastructure and systems are regularly tested and maintained • identify location of hazards (physical, chemical, electrical) • include any other requirements requested by NSW RFS district office.	At all times
B4	Ensure all buildings (including the BESS, substation and the management hub) are designed and constructed to reduce the reduce the risk of ignition from a bushfire, in accordance with bushfire attack level (BAL) 12.5 construction standards detailed in AS3959-2018, Section 3 and Section 5.2–5.8.	Pre-construction Construction
B5	Ensure site infrastructure includes a dedicated, static, water storage tank for fire-fighting purposes. The tank location should be determined in consultation with NSW RFS. The tank should include the following specifications: • made of steel • capacity of at least 50–80 kilolitres • fast-fill water connections (65 mm Storz fittings) • easily accessible fill points • be located on a hardstand area able to support the weight of the tank and a 23 tonne fire truck (e.g. fully loaded category 1 firefighting vehicle) • be located on a hardstand area able to allow adequate turning room for a 23 tonne fire truck.	Pre-construction Construction

[9] Including any areas proposed to be used for grazing within the development footprint.

Table 6.45 Bushfire mitigation measures

Reference	Mitigation measure	Timing
B6	Ensure Bushfire Management Plan includes a requirement to maintain the following areas to provide for safe and unobstructed passage by a category 1 firefighting vehicle: • access road • internal roads • main access/egress point. Ensure these areas have: • a trafficable surface with a minimum width of 4 m • an overhead clearance height of at least 4 m • curves inner radius 6 m • crossfall less than 6 degrees • surfaces and crossing structures capable of carrying vehicles with a gross vehicle mass of 23 tonnes • turnaround provisions of 22 m diameter or T junction at the termination of each access track and in position of the dedicated water supply tanks • drainage and wet areas crossing are trafficable (where possible) or avoided.	Pre-construction Construction Operation
B7	Ensure the construction induction process highlights the bushfire risks and the requirements of the Bushfire Management Plan.	Pre-construction Construction
B8	Prepare and implement a bushfire emergency response plan, in accordance with *Development Planning – a Guide to Developing a Bush Fire Emergency Management and Evacuation Plan* (RFS 2014) and Australian Standard AS3745 2010 *Planning for Emergencies in Facilities.* Display the bushfire emergency response plan in a prominent location.	Pre-construction Construction Operation
B9	It is recommended that the site layout includes an alternate access point for emergency situations.	Pre-construction Construction Operation



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Source: EMM (2022); Canadian Solar (2022); ESRI (2022); DFSI (2017)

Conceptual site layout with APZ

Sundown Solar Farm
Environmental impact assessment
Figure 6.35

EMM
creating opportunities

6.10.5 Conclusion

The potential for project-related bushfire impacts was assessed in accordance with the PBP guideline and a number of mitigation measures have been proposed to manage these risks (Table 6.45). The proposed mitigation measures also comply with the PBP guideline.

6.11 Social

6.11.1 Introduction

A social impact assessment (SIA) was prepared for the project (Appendix M). The SIA addresses the potential social impacts and benefits of the project to the local area, the region and to NSW and considers whether the project increases the demand for community infrastructure and services.

This section of the EIS summarises the assessment and addresses the SEARs requirements for potential social impacts. The social-related SEARs are outlined in Table 6.46.

Table 6.46 Social-related SEARs

SEARs requirement	Section addressed
Including an assessment of the likely impacts on the local community and consideration of the construction workforce accommodation including assessment of cumulative impacts with other renewable energy projects in the area.	Section 6.11

The SIA was prepared in accordance with:

- the *Social Impact Assessment Guideline for State Significant Projects* (SIA Guideline 2021) (DPIE 2021d)
- the *Technical Supplement: Social Impact Assessment Guideline for State Significant Projects* (SIA Technical Supplement 2021) (DPIE 2021e).

An overview of the SIA methodology is provided as Figure 6.36. Further detail is provided in Appendix M.

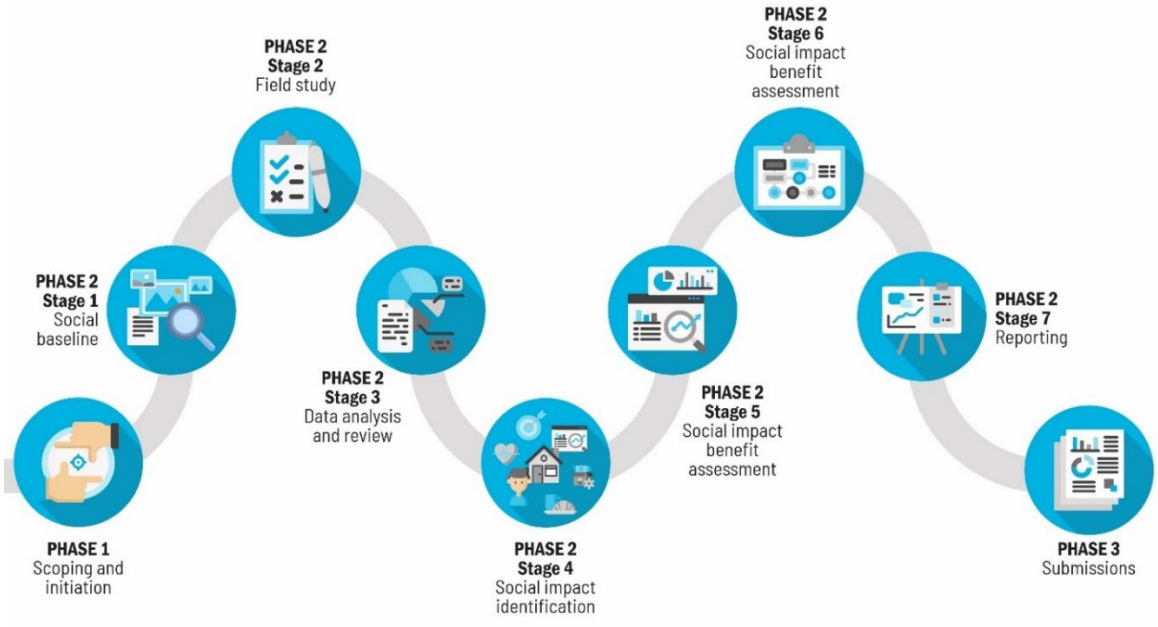


Figure 6.36 Overview of SIA methodology

6.11.2 Existing environment

i Potentially affected communities

The project has two key study areas: a local study area and a regional study area. The potentially affected communities have been mapped to the ABS categories used for data collection and the local and regional study areas (herein referred to as local area or regional area), illustrated in Figure 6.37.

The Project is located within the state suburbs census (SSC) of Spring Mountain and Newstead and is directly adjacent to Swan Vale SSC. The Project may directly impact landowners, residents, and businesses within the vicinity of the project and along the primary transport route. Accordingly, Spring Mountain SSC, Newstead SSC, Swan Vale SSC, Inverell SSC, and Glen Innes SSC comprise the local area for the Project. The communities within this area have the potential to benefit and/or be impacted as a consequence of the Project.

The project is likely to have a broader reach due to use of infrastructure, supply chains, haulage routes, transportation of goods, materials and equipment, and the movement of its workforce, some of which may require drive-in-drive-out and/or fly-in-fly-out arrangements. These factors require the study area to include regional areas likely to be impacted by the Project. Accordingly, Inverell local government area (LGA) and Glen Innes Severn LGA comprise the regional area for the Project.

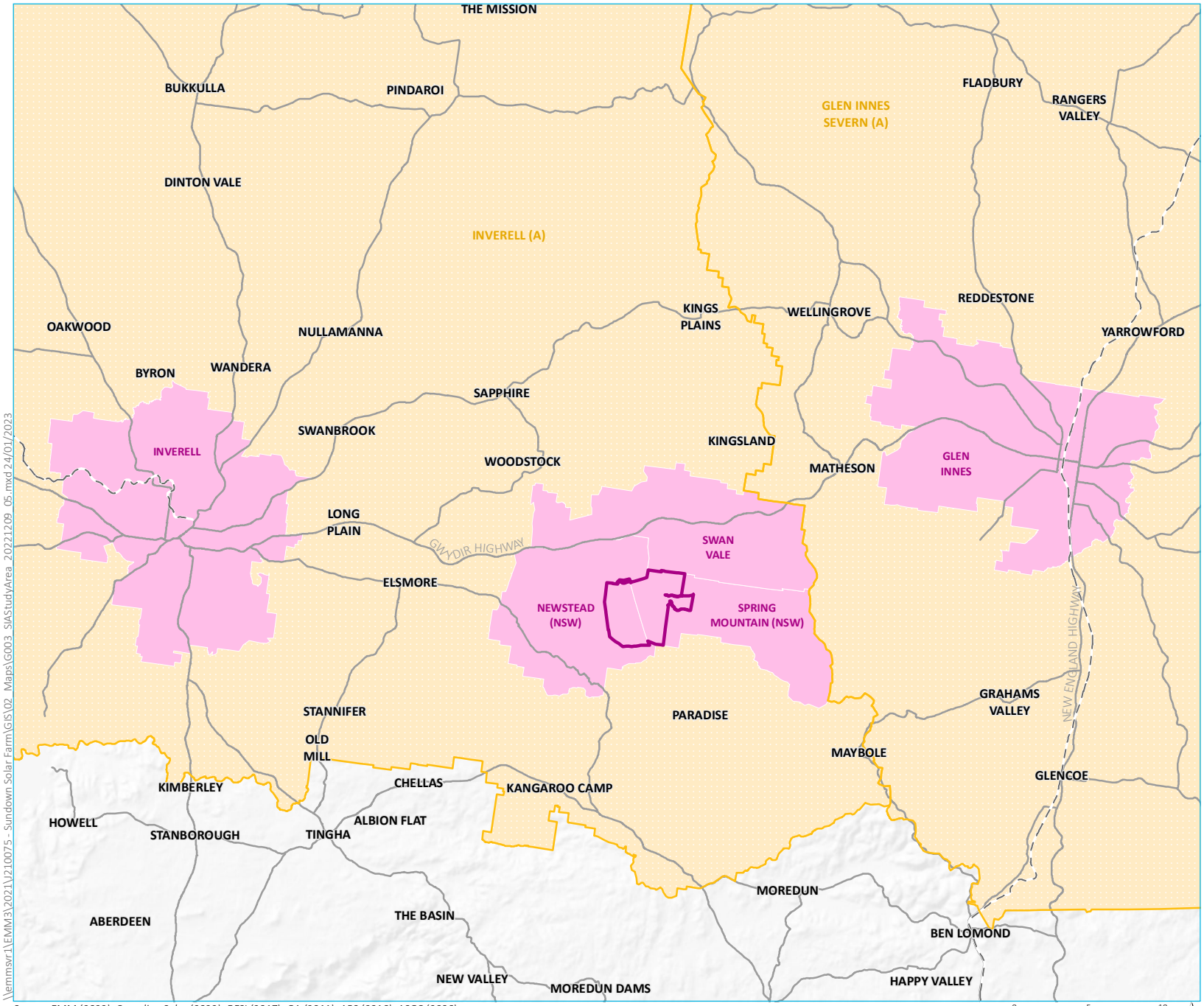
ii Demographics

According to the 2016 Census, the local area had a total population of 17,835 people, comprising a population of 20 in Spring Mountain SSC, 23 in Newstead SSC, 42 in Swan Vale SSC, 11,660 in Inverell SSC, and 6,155 in Glen Innes SSC.

The projected population of the regional area is estimated to decrease by 8.5% from 25,746 persons in 2016 to 23,551 persons by 2041. The population of Inverell LGA is expected to increase by 0.9% from 16,812 to 16,955 persons between 2016–2041. The population of Glen Innes Severn LGA is expected to decrease by 26.2% from 8,934 to 6,596 persons between 2016–2041.

These projections reflect rural to urban migration for education, employment, community, social and health services. (AIHW 2005; Hugo, & Harris 2011; D'Alessandro & Bassu 2015).

The population of the local area is concentrated in the younger and older age ranges, with only 26.4% of the population in the middle age range between 20–44 years. There is a higher concentration of children aged 0–14 years in the local area, regional area, and area of reference in comparison to NSW. Additionally, the population in the Local area is ageing, with 23.5% of the population aged 65 years and older compared to 16.3% of the population aged 65 years and older in NSW. The median ages for the LGAs within the Regional area vary, with 47 years for Glen Innes Severn LGA and 42 years for Inverell LGA, compared to the median age of 38 in NSW.



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Source: EMM (2022); Canadian Solar (2022); DFSI (2017); GA (2011); ABS (2016); ASGC (2006)

Sundown Solar Farm
Environmental impact assessment
Figure 6.37

EMM creating opportunities

iii Qualifications and workforce

The local and regional areas have a significantly smaller proportion of persons who have completed Year 12 or equivalent compared to the area of reference and NSW.

The unemployment rate in the local area is 7.8%, which is higher than the regional area (7.6%), area of reference (6.4%) and NSW (6.3%) (ABS 2016a). There is also a slightly higher rate of youth unemployment in the local area (14.4%) and regional area (14.6%) compared to the area of reference (13.9%) and NSW (13.6%).

In the local area, the top three occupations are labourers (15.9%), professionals (15.0%), and technicians and trades workers (14.3%). Healthcare and social assistance is the top industry of employment in the local area (14.1%), followed by retail trade (12.8%), and manufacturing (10.1%) (ABS 2016a). Health care and social assistance occupations reflect the work available in the local area, as a central business hub which provides services to the rest of regional area. While most healthcare and social assistance jobs require a bachelor degree qualification, the other prominent industries of retail trade and manufacturing reflects the nature of the work available in the area, consisting of jobs that may require a certificate level qualification or no tertiary qualification.

iv Local housing and rental market

Vacancy rates for the local area have remained below the 3% benchmark since September 2019, indicating an undersupply of rental units and housing (SQM Research 2021). As at November 2022, there were 239 properties for sale and 39 properties listed for rent across the Inverell and Glen Innes areas. There were 0 properties available for rent or sale in Spring Mountain SSC, Newstead SSC, and Swan Vale SSC. There are a total of 38 identified tourist accommodation providers in the local area – all of which are located in Inverell SSC and Glen Innes SSC.

A range of short-term accommodation options are available in Inverell and Glen Innes, including motels, farm stays, caravan parks and serviced apartments. The ABS has surveyed tourism accommodation providers (hotels, motels and serviced apartments with 15 rooms or more) until June 2016 to provide an overview of supply, demand and revenue of tourist accommodation. In the year to June 2016, there were 11 tourism accommodation establishments surveyed within the regional area providing a total of 247 rooms, of which less than half were occupied.

v Social infrastructure and services

Social infrastructure refers to community facilities, services, and networks that help individuals, families, groups and communities meet their social needs, maximise their potential for development and enhance community wellbeing. This includes (amongst others) childcare, schools, hospitals and aged care services. Social infrastructure and services in the local area are mainly concentrated in Inverell SSC and Glen Innes SSC.

vi Socioeconomic advantage and disadvantage

Despite only a slightly higher level of unemployment in the region, and adequate provision of social infrastructure and social services, there are relatively more households with low income and fewer people in high-skill occupations compared to the rest of NSW, suggesting higher rates of socioeconomic disadvantage.

According to the 2016 SEIFA, most of the local area is in the bottom 20% of communities in NSW in terms of disadvantage, except for Swan Vale SSC in all areas, and Spring Mountain SSC and Newstead SSC which fall in the bottom 40% of communities relative to Index of Education and Occupation, recognising the percentage of people with qualifications and in highly skilled occupations.

The regional area (Inverell LGA and Glen Innes Severn LGA) also exhibits higher levels of disadvantage according to the 2016 SIEFA, with all rankings in the regional area in the bottom 20% of communities, except for IEO in Glen Innes Severn LGA, which is among the bottom 30% of communities in NSW.

vii Vulnerable groups

According to the 2016 Census estimations on homelessness, rates of homelessness in the regional area are lower than NSW rates, with a rate of 25.5 homeless persons per 10,000 persons in Inverell LGA, and a rate of 34.0 homeless persons per 10,000 persons in Glen Innes Severn LGA, compared to a rate of 50.4 homeless persons per 10,000 persons in NSW. The rate of homelessness is also less compared to NSW within the area of reference (42.7 per 10,000 persons).

viii Community culture and values

Inverell LGA is a dynamic and vibrant community with progressive and inclusive residents, in area endowed in natural resources. Inverell Shire Council's Community Strategic Plan expresses a vision for 'a community for everyone', with the mission 'to work with the community in providing and facilitating the provision of services that enhance the quality of life for all residents' (Inverell Shire Council 2017). The community's values are leadership, knowledge, partnerships, participation, and planning.

Glen Innes Severn LGA is recognised for its unique landscape and rural character, with the vision to have 'a vibrant, confident and inclusive community supported by a sustainable and prosperous economy underpinned by a well-maintained road network' (Glen Innes Severn Council 2017). The region has a community that is diverse and inclusive of both rural and urban residents. Locals value the sense of community, affordability, physical beauty, rural lifestyle, climate, and convenience.

6.11.3 Assessment method

The assessment of social impacts uses eight categories to identify social impacts:

- way of life: how people live, work, play and interact
- community: its composition, cohesion, character, how it operates and sense of place
- accessibility: how infrastructure provided by public, private or not for profit organisations, including services and facilities is accessed and used
- culture: shared beliefs, customs, values and stories, and connection to Country, land, places, waterways and buildings, both Aboriginal and non-Aboriginal
- health and wellbeing: physical and mental health
- surroundings: access to and use of ecosystem, public safety and security, access to and use of natural and built environment, aesthetic value and/or amenity
- livelihoods: how people sustain themselves through employment or business, their capacity to do so and whether disadvantage is experienced
- decision-making systems: extent community can have a say in decisions that affect their lives, access to complaint, remedy and grievance mechanisms.

Potential social impacts have been assessed. These include benefits (i.e. positive social impacts) and negative social impacts.

Potential negative social impacts have been assessed in the absence of any social mitigation measures and then have been assessed based on the successful implementation of the proposed social mitigation measures.

Similarly, potential social benefits have been assessed in the absence of any additional social enhancement measures and then have been assessed based on the successful implementation of the proposed social enhancement measures.

6.11.4 Impact assessment

i Way of life impacts

Increased traffic throughout the construction period was identified by key stakeholders in in-depth interviews as having a potential negative impact on the local community. An increase in traffic, including heavy vehicle traffic, has the potential to increase congestion and travel time for local road users, including private coaches and school busses, which can reduce local connectivity for residents, freight and tourists.

The project will lead to a temporary increase in traffic on the Gwydir Highway between Inverell and Glen Innes, during the construction phase. This is expected to have a moderate negative impact on local connectivity. Following application of mitigation and management measures as outlined in Chapter 7, the temporary reduction in local connectivity is assessed as being of a low level of significance.

ii Community impacts

Engagement undertaken for the development of the Glen Innes Severn Council Community Strategic Plan 2022–2032 identified that residents valued the 'community feel' the most (Glen Innes Severn Council 2022).

Based on their experiences with other renewables projects in the area, key stakeholders and service providers identified the potential for a community benefits fund or investments in community infrastructure as an opportunity to distribute benefits to the broader community and enhance community cohesion. Sundown Solar has committed to establishing a community benefits fund, with a specified amount of funding to be allocated to the fund annually.

iii Accessibility impacts

Accessibility impacts include:

- Reduced access to short-stay and rental accommodation due to presence of construction workforce increasing demand for accommodation.
- Reduced access to local health care services due to presence of construction workforce increasing demand for services.
- Increased service demand on Local Government services, specifically waste management.

For the construction phase Sundown Solar will encourage contractors to adopt a preferential hiring approach to prioritise the employment of workers with relevant skills from the local area, then the regional area, followed by hiring outside of these areas (where feasible and practical). However, potential skills shortages in the local and regional area may pose barriers for local hiring.

If the local rental market is inundated due to demand from the Project-related construction workforce, there is potential that rental housing scarcity will increase, and rental affordability will decrease.

Unmitigated, the project will increase demand for short-stay and rental accommodation in Inverell and Glen Innes, which is expected to generate a negative impact of high significance. Following application of mitigation and management measures outlined in Table 6.47, the impact is expected to be of medium significance.

However, it is anticipated that a small proportion of construction workers in Stage 2 (400 FTE workers at peak) may be sourced from outside of the regional area. These workers are likely to temporarily relocate to Inverell or Glen Innes and seek short-stay or rental accommodation. This temporary, short-term population influx will be perceived by local residents and stakeholders to increase demand for local health care services.

Unmitigated, the temporary increased demand for local health care services by the project construction workforce is expected to have a negative impact of medium significance. Following application of mitigation and management measures, the impact is expected to be of low significance.

The increase in service demand on Inverell Shire Council's waste management services may lead to the service being unable to meet demand due to funding and staffing constraints. This also has the potential to lead to a reduced capacity for Inverell Shire Council to service the residential population. As such, Inverell Shire Council may be required to rearrange internal priorities, resources and funding arrangements in order to accommodate increased demand within the waste management services.

iv Surroundings impacts

Impacts to surroundings include:

- reduced rural amenity due to construction noise and dust, including from project construction traffic
- increased risk to public safety due to project construction traffic.

The rural amenity associated with a quiet rural lifestyle may be impacted due to an increase in construction related activities. Stakeholders identified the 'rural lifestyle' and the current 'quiet' amenity of the local area as notable values of the local community. Noise and dust were raised by stakeholders in interviews in particular.

The noise assessment shows that impacts can be managed by noise verification and consultation with neighbours. Dust generation will be mitigated using standard construction techniques such as the use of water carts and screens.

During operation, the risk of dust is almost negligible as the key source of dust will be two to three operational vehicles per day travelling along unsealed access roads.

During decommissioning, the presence of exposed soil has potential to generate dust, however it is anticipated that the extent of exposed soil will be considerably less than during construction, and the duration of the exposed soil will also be shorter.

Unmitigated, the potential reduction in rural amenity as a result of construction activity is expected to generate a negative impact of medium significance. Following application of mitigation and management measures, the impact is expected to be of low significance.

To address public safety concerns, the intersection at Gwydir Highway and Spring Mountain Road will be upgraded, and Spring Mountain Road and Sturmans Road will have localised road widening and sealing. These upgrades will make the intersection and roads safer to travel on, and assist in mitigating public safety risk.

In the absence of these measures, the increased risk to public safety due to project construction traffic is expected to generate a negative impact of high significance. Following application of mitigation and management measures, the impact is expected to be of medium significance.

v Livelihood impacts

Impacts to livelihoods include:

- reduced unemployment due to increase in opportunities relating to employment and training
- increased economic prosperity for local businesses due to increase in local supply opportunities.

Sundown Solar will encourage its construction contractors to adopt a preferential hiring approach to prioritise the employment of workers with relevant skills from the local area, then the regional area, followed by hiring outside of these areas.

The regional area has a higher rate of unemployment (6.3%) compared to NSW (4.6%) as a whole. Council states that there are difficulties associated with filling positions as much of the work is becoming 'casualised', with work available for semi-skilled people but not many permanent positions available. Therefore, the increase in employment and training opportunities for residents in the local and regional study areas is expected to generate a positive impact of high significance. Following application of enhancement measures the benefit is expected to be of very high significance.

To maximise local procurement benefits derived from the Project Sundown Solar will engage with local businesses services and the Inverell and Glen Innes Chambers of Commerce to establish relationships between the project and businesses within the community. It is recommended that Sundown Solar encourages the project workforce, particularly during the construction phase, to support and contribute to the local and regional community through local spending.

The increase in supply and procurement opportunities for local and regional businesses is expected to generate a positive impact of high significance. Following application of mitigation measures, the benefit is expected to be of very high significance.

vi Cumulative impacts

There are 10 renewable energy projects identified within a 75 km radius of the project. Four are operational, and six are yet to be developed. The operational projects do not affect cumulative impacts to the passive nature of their operations. The construction timelines of the yet-to-be-developed projects are considered unlikely to align with the construction of the project, and therefore cumulative social impacts are also considered unlikely.

6.11.5 Proposed measures

Proposed measures to manage and mitigate potential social impacts are outlined in Table 6.47.

Table 6.47 Social impact mitigation measures

Reference	Mitigation measure	Timing
S1	Implement a CTMP, approved by Inverell Shire Council and TfNSW, as applicable. CTMP to include (but not limited to): • driver code of conduct • requirement to reinstate property accesses along the access road route • requirement to implement traffic controls to ensure residents can continue to access their properties • requirement to implement standard dust control measures, including but not limited to use of a water cart as required • generally limit construction traffic to standard construction hours. Exceptions to these hours may be required on limited occasions. Regulatory authorities (including the Inverell Shire Council) and surrounding landholders will be notified of any exceptions prior to any works being undertaken • safety initiatives in relation to pedestrians, livestock and school bus routes (include a requirement for heavy vehicles to avoid operating during school run periods i.e. typically 8:00 am to 9:30 am and 2:30 pm to 4:00 pm during school days) • induction process for vehicle operators • a complaint resolution procedure • any community consultation measures for peak construction periods.	Pre-construction Construction

Table 6.47 Social impact mitigation measures

Reference	Mitigation measure	Timing
S2	Provision of a daily shuttle bus service for transport of workers to/from Inverell/Glen Innes.	Construction
S3	Establish and maintain a project grievance mechanism (i.e. a project phone number and project email) as well as maintain a community complaints register to: • provide the opportunity for stakeholders to raise complaints, grievances, and provide feedback • record and address any issues raised by stakeholders and community members	Pre-construction
S4	Establish a community benefits fund, with a specified amount of funding to be allocated each year. The community benefits fund will be facilities by a community liaison committee, to help guide the most effective and meaningful way to determine how the funding is allocated to local community programming and projects to address community needs. Sundown Solar will communicate the establishment of the community benefits fund, the application process, and the decision-making process to the local community through ongoing engagement and consultation.	Construction Operation
S5	Establish a local employment policy which specifies a preferential hiring approach to prioritise the employment of workers with relevant skills from the local area, then the regional area, followed by hiring outside of these areas (where feasible and practical).	Pre-construction
S6	Provide advance notice to health care services in Inverell and Glen Innes regarding ramping up of construction activities and likely influx of construction workers.	Pre-construction Construction
S7	Develop workforce housing strategy prior to construction that assesses the housing and accommodation environment and identify and addresses potential accommodation and rental market pressures in the local and regional area.	Pre-construction
S8	Liaise with the Inverell Chamber of Commerce and the Glen Innes Chamber of Commerce to communicate project accommodation needs so that local accommodation businesses can be notified in advance to allow capacity building.	Pre-construction Construction
S9	Liaise with Inverell Shire Council Waste Manager prior to commencement of construction to establish an effective waste management strategy.	Pre-construction
S10	Engage with Councils outside of Inverell Shire Council where feasible and practical to assess the potential for recycling of materials that are not able to be processed by Inverell Shire Council, as applicable.	Pre-construction
S11	An ACHMP will be developed in consultation with Heritage NSW, RAPs and DPE. The AHMP will detail the management and mitigation of all identified Aboriginal sites along with special procedures and training and reporting protocols.	Pre-construction
S12	Liaise with Inverell Shire Council to develop safety protocols at the school bus zone on the Gwydir Highway/Spring Mountain intersection when construction traffic (both heavy vehicles and workforce vehicles) are driving through these zones.	Pre-construction
S13	Liaise with local and regional employment and training services to identify pathways for apprenticeship and training opportunities with the project.	Pre-construction
S14	Establish a local procurement policy which includes a target percentage of local spend in the project budget.	At all times
S15	Develop a register (e.g. online) where local contractors and suppliers can sign up for updates on upcoming contract opportunities.	At all times
S16	Liaise with Inverell Chamber of Commerce and Glen Innes Chamber of Commerce to provide information on upcoming contract opportunities.	At all times

6.11.6 Conclusion

A social impact assessment was undertaken for the project (Appendix M). The assessment concluded that the project will not significantly affect the local housing/accommodation or other local services. The project will result in a range of socioeconomic benefits in the local region including employment opportunities, the establishment of a community benefits fund and the provision of clean energy.

With the implementation of the mitigation measures outlined in Table 6.47, the project is not expected to result in any significant negative socioeconomic impacts.

6.12 Waste management

6.12.1 Overview

As part of the preparation of the EIS, consideration has been made as to how the project's waste will be managed in accordance with the relevant governmental assessment requirements, guidelines and policies, and in consultation with Inverell Shire Council.

This meets the requirements of the SEARs to:

- identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.

The project will produce a number of waste streams during the 21 month construction period. Minor quantities of waste will also continue to be generated by the day-to-day operation of the project. Waste will also be generated as part of decommissioning at the end of the project's operational life.

6.12.2 Existing environment

The site is currently used for farming purposes and therefore generates farming-related waste streams.

6.12.3 Waste during construction

Waste streams likely to be generated during the construction of the project will include:

- cardboard packaging
- wood pallets
- plastic wrapping and ties
- timber offcuts (e.g. wood separators to prevent damage to PV modules)
- excess building materials (e.g. scrap metal, plastic, masonry, gravel/sand etc)
- domestic-type waste from construction staff (e.g. food wrapping, putrescible waste etc)
- domestic-type recyclable waste from construction staff (e.g. drink containers etc)
- cleared vegetation
- waste oils and lubricants (including rags, filters and drums)
- electrical waste (e.g. power drills or nail guns)

- waste from onsite toilets.

Of each of the project phases, the construction period will generate the greatest volume of waste. Nonetheless, the overall volumes of construction waste will be low, short-term (approximately 21 months) and manageable.

6.12.4 Waste during operation

Waste streams likely to be generated during the operation stage will be typically associated with maintenance activities and the presence of staff. Waste streams are likely to comprise:

- domestic-type waste from operations staff (e.g. food wrapping, putrescible waste etc)
- domestic-type recyclable waste from operations staff (e.g. drink containers etc)
- general waste from the operations and maintenance buildings
- waste oils and lubricants (including rags, filters and drums)
- waste air filters
- waste from onsite toilets
- damaged or faulty components that have been replaced
- waste batteries.

6.12.5 Waste during decommissioning

Waste streams likely to be generated during the decommission and closure stage are likely to include:

- project infrastructure, such as solar panels, mounting system, BESS, transformer etc
- metal from posts, fencing, cabling etc.

6.12.6 Potential impacts

Potential impacts from poor management of waste include:

- contamination of land and water
- unnecessary resource depletion
- unsanitary conditions potentially resulting in issues with pest animals.

6.12.7 Proposed measures

Proposed measures to manage and mitigate potential waste impacts are outlined in Table 6.48.

Table 6.48 Waste mitigation measures

Reference	Mitigation measure	Timing
WM1	Manage all waste in accordance with the NSW *Protection of the Environment Operations Act 1997* (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 • dispose of waste appropriately.	At all times
WM2	Manage waste to ensure that: • the generation of waste is kept to a minimum • no waste is received or disposed of onsite • waste is stored, handled and disposed in accordance with the EPA's Waste Classification Guidelines 2014 (or its latest version) • waste is removed from site as soon as practicable • waste is reused, recycled or sent to an appropriately licensed waste facility for disposal.	At all times

Examples of proposed waste management measures include (but are not limited to):

- Skip bins will be available onsite to encourage waste separation for recycling/re-use. General waste bins/skips will be provided for disposal of materials that cannot be cost-effectively recycled/re-used.
- During construction, cardboard and scrap metal will be segregated for recycling, wherever practicable.
- During construction, wood pallets will be reused if in good condition, returned to the supplier if practicable, sold for wood chip if damaged or can be recycled at Inverell waste depot.
- Hazardous waste (e.g. waste oil, septic wastewater, etc.) will be collected by a licenced waste contractor for disposal at a licenced facility.
- Electric waste can be taken to Inverell waste depot (or other local licenced provider) for recycling.
- During operation, damaged PV modules will be collected by a specialised recycler for recycling.
- Power conversion units and transformers will typically be containerised or pre-assembled on a skid or concrete mounted platform and will therefore generate limited waste materials.
- Preference will be given to the use of dry transformers where practicable, as these don't require oil and therefore don't generate waste oil.
- As the decommissioning is not scheduled for 35 years after commissioning, options for using a specialised solar farm recycling service will be investigated toward the end of the project life. It is expected that solar panel recycling technology will have advanced by this time.
- During decommissioning, metal components such as steel piles and copper in conductors will be segregated for recycling, wherever practicable. Structures and equipment that cannot be recycled will be disposed of at an appropriately licensed waste management facility.

In September 2022 Sundown Solar reached out to Inverell waste depot, the closest waste facility to the site. Inverell waste depot confirmed it has capacity during the construction and operation phases to accept the proposed project-related waste streams and volumes (including waste oil and electric waste but excluding septic waste).

6.12.8 Conclusion

The project will produce a number of waste streams during construction, operation and decommissioning. Assuming the proposed waste management measures (Section 6.12.7) are implemented, there will be no material impact in relation to the management of waste.

6.13 Cumulative impacts

Cumulative impacts are discussed in Section 2.9.

6.14 Summary of mitigation measures

A summary of the proposed mitigation measures for the project is presented in Appendix N. These measures will be incorporated into the environmental management strategy and relevant management plans and protocols.

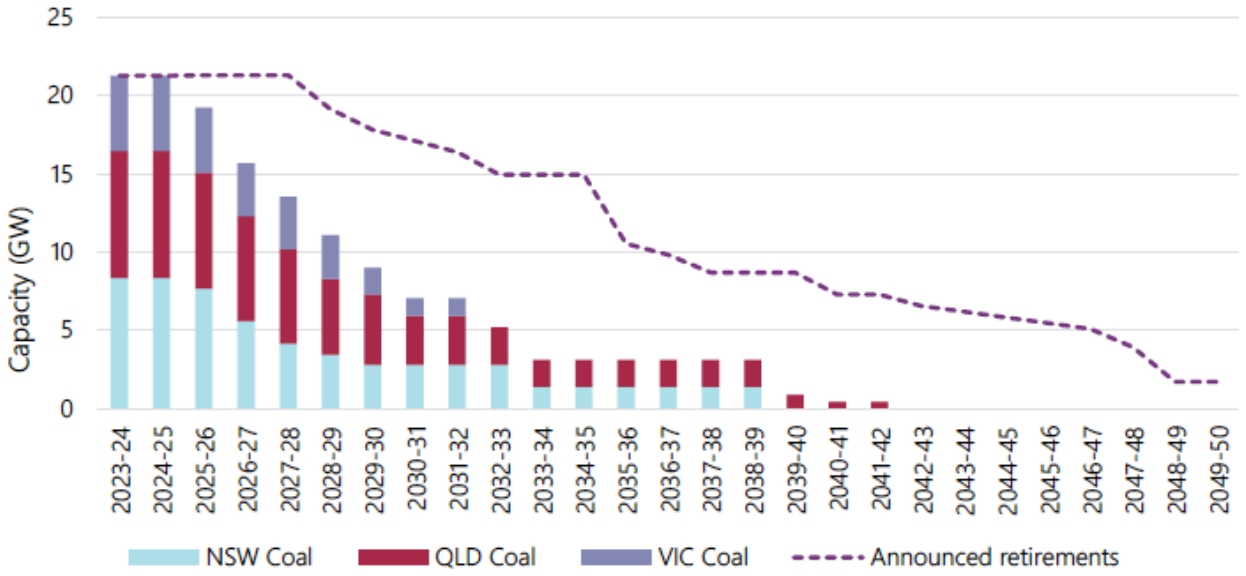
7 Justification

This chapter provides a justification and evaluation of the project, having regard to the economic, environmental, and social impacts and benefits of the project and the principles of ecologically sustainable development (ESD).

7.1 Project need and objectives

7.1.1 Security of supply

The project will deliver 360 MW of much needed energy supply into the National Electricity Market. This aligns with the base case (step change) scenario described in the *2022 Integrated System Plan* (2022 ISP) (AEMO 2021), with the Australian Energy Market Operator (AEMO) expecting that all NSW coal fired generation capacity (approximately 8,000 MW) will be retired by 2040 and mostly replaced with energy generated by renewable sources. AEMO also notes that coal fired energy generation is being retired 2–3 times faster than previously anticipated (Figure 7.1).



Source: Reproduced from Infrastructure Investment Objectives Report (AEMO 2021).

Figure 7.1 Forecast coal retirements under step change scenario

Announced retirements include Liddell Power Station in 2023 and Eraring Power Station in 2026, which will close seven years ahead of the originally forecast schedule (NSW Government 2022b). Vales Point Power Station is anticipated to close in 2028, Bayswater Power Station in the mid-2030s and Mount Piper Power Station is expected to close in 2042 or earlier.

Notwithstanding, if the NSW Government is to foster a secure and reliable energy supply to its residential customers and industry, as well as meet its climate change objectives (i.e. its target of reducing greenhouse gas emissions from 2005 levels by 50% by 2030) it is critical that large renewable projects, such as the Sundown Solar Farm, can be developed at the earliest opportunity.

The project is consistent with the NSW Government's electricity infrastructure objectives set out in the *Electricity Infrastructure Investment Act 2020*, including:

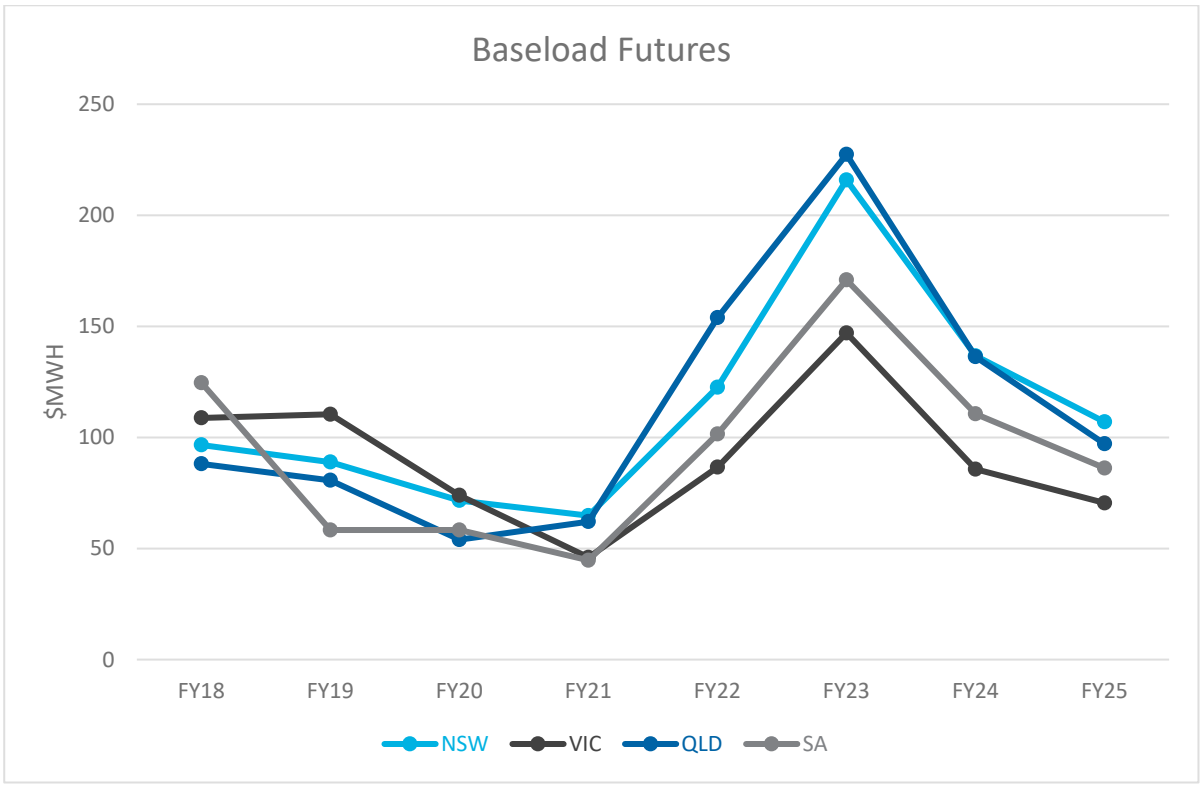
- construction of specified amounts of renewable energy infrastructure
- construction of additional infrastructure necessary to minimise costs to NSW electricity customers and meet the NSW energy security target and reliability standard.

The *Infrastructure Investment Objectives Report* (AEMO 2021) proposes a 20 year development plan for renewable energy and storage infrastructure to deliver on these objectives.

AEMO expects that given the scale of the coal plant retirements, and the relatively lower capacity factors of wind and solar compared with existing coal, approximately nine times (122 GW) more grid scale renewables and triple the amount of current firm capacity (some 45 GW) are needed across the National Electricity Market (NEM) to replace retiring coal fired capacity (AEMO 2021).

Given that renewable energy generation needs to be developed in advance of the retirement of coal-fired plants, there is an urgent need for large-scale solar development in the next 5–10 years. Factors including ageing coal generators and restricted coal supply, the Russia-Ukraine conflict affecting gas prices, and La Nina weather systems have caused a major uplift in the forward electricity prices in NSW (along with other NEM states, such as Queensland) (Figure 7.2).

Forward prices have more than doubled in response to these factors and have increased the potential for a supply squeeze and load shedding. This highlights the need for investment in large scale renewables capacity and storage in the NEM in the short term. The Sundown Solar Farm can therefore assist in balancing wholesale electricity prices.



(Source: Renew economy, 2022)

Figure 7.2 National Electricity Market states wholesale futures prices

7.2 Summary

The development and operation of the project, in conjunction with other large-scale renewable energy projects, has potential to fill the need for replacement power as ageing coal-fired generators face closure. The project is consistent with relevant Commonwealth, State, regional and local strategic plans and polices, in particular the *NSW Electricity Infrastructure Roadmap*, which sets out the plan to deliver REZs in NSW. The project will contribute to the energy generation and storage targets for the New England REZ, with an indicative capacity of around 360 MW (AC) and up to 150 MW (AC) four-hour energy storage.

In addition to its location within the New England REZ, the site is suitable for the construction and operation of a large-scale solar and battery project due to the available solar resource, the favourable physical conditions and large areas of predominantly cleared land which has limited biodiversity value, and relatively few residences within close proximity of the site. The project's proximity to an existing 330 kV transmission line means that there will be infrastructure within the immediate area with the capacity to export the electricity generated by the project to the grid.

If this project was not developed, its benefits, which include contributions to the generation of renewable energy and increased energy security, and job creation in the region, will not be realised.

The project is suitably located within the New England REZ with easy access to transmission infrastructure. The critical need to establish renewable energy generation and storage projects in NSW means that not proceeding with the project in its current location may encourage development in a less favourable location, resulting in greater requirements for grid connection infrastructure and greater environmental and social impacts.

The project will result in environmental impacts and social benefits to the surrounding natural and built environments. The impacts have been comprehensively assessed, are not predicted to be significant and can be adequately managed through appropriate design, mitigation and management during construction and operation. On balance, it is therefore considered that the project is in the public interest.

7.3 Design development

During the preparation of this EIS, the development footprint has been refined based on environmental constraints identification, stakeholder engagement, community consultation and design of project infrastructure with the objective of developing an efficient project that avoids and minimises environmental and social impacts.

Throughout the project refinement process (Chapter 2), Sundown Solar has made considerable effort to avoid potential environmental impacts where possible. Where impacts cannot be avoided, design principles have sought to minimise disturbance and/or implement mitigation measures to manage the extent and severity of any residual impacts. The proposed mitigation measures that will be implemented for each of the key environmental matters assessed in this EIS are summarised in Section 6.14.

The development footprint reflects the most appropriate area for the project infrastructure based on inputs provided during the environmental assessments and through consultation activities with regulatory and community stakeholders and the functional requirements of project infrastructure. The irregular shape of the development footprint is a direct result of avoiding identified constraints and reducing impacts.

During detailed design and prior to the commencement of construction, it is anticipated that the placement of infrastructure and extent of construction activities will be further refined to ensure avoidance and minimisation objectives are met.

7.4 Strategic context

The project is supported by Commonwealth and State energy policies and State, regional and local strategic planning frameworks and plans (Chapter 2). The project will support the Commonwealth and State governments to achieve their respective renewable energy and greenhouse gas emission reduction targets. The project will also contribute to the continued growth of renewable energy generation and storage capacity in the New England REZ.

7.5 Objects of the EP&A Act

The objects of the EP&A Act are set out in Clause 1.3 of the Act. An assessment of the consistency of the project with the objects of the EP&A Act is provided in Table 7.1.

Table 7.1 Consistency with the objects of the EP&A Act

Object	Consistency with the project
To promote the social and economic welfare of the community and better environment by the proper management, development and conservation of the State's natural and other resources.	Resources within the study area and, more specifically, the development footprint, include land that is being used for agricultural production and land which has biodiversity and Aboriginal cultural heritage values. This constitutes the 'natural resources', which must be properly managed, developed or conserved. It is acknowledged that the development of the project will reduce the utilisation of the land within the development footprint for agricultural production; however, this impact will be mitigated by a number of factors including: • the use of single axis tracking PV modules involves a typical row spacing of 8–12 m, which would leave a significant area of land that could still be used for agrisolar activity such as sheep grazing or apiculture during operations • site selection – the development footprint has been strategically designed so that primary production can continue within the immediate surrounds and to reduce potential impacts on the use of neighbouring farmland for primary production purposes • return to agricultural land – the development footprint can be returned to agricultural land use at the completion of the project's operations. Land management practices will avoid or minimise potential impacts to neighbouring agricultural operations that have been identified during engagement with the local community. Through design, the project will have minimal impact on biodiversity values and Aboriginal cultural heritage resources. The existing agricultural use of the development footprint means that biodiversity impacts will be minimal, and largely associated with the road upgrade corridor; the footprint of which has been minimised in consultation with Council engineers. The residual impact to biodiversity values will be offset. The impact of the project on Aboriginal cultural heritage will be limited, and a range of mitigation and management measures will be implemented, including salvage of artefacts.
To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	This EIS describes the economic, environmental and social context of the project and the potential impacts of it to allow informed consideration of these aspects in determining the development application. The project will contribute to the continued growth of renewable energy generation and storage capacity, as well as providing energy security and reliability. On balance, the economic and social benefits are weighed against the limited environmental impacts and decisions can be made about this land-use.

Table 7.1 Consistency with the objects of the EP&A Act

Object	Consistency with the project
To promote the orderly and economic use and development of land.	The orderly and economic use of land is best served by development that is permissible under the relevant planning regime and predominately in accordance with the prevailing planning controls. The project is permissible with consent, is consistent with statutory and strategic planning controls and will connect to the 330 kV transmission line. As detailed in this EIS, the project will result in positive socioeconomic impacts, with appropriate mitigation measures and management strategies being proposed to reduce any adverse environmental and social impacts.
To promote the delivery and maintenance of affordable housing.	Not directly applicable to the project.
To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	Measures to avoid and minimise impacts to native vegetation and threatened species habitat were considered during the initial design stages of the project, resulting in avoidance of significant biodiversity values and minimisation of impacts on other areas of native vegetation. Further, the road upgrade corridor utilises existing roads, tracks and maintained road shoulders to the extent practicable to minimise the amount of vegetation clearing required. Unavoidable impacts will be offset in accordance with NSW Government policy. This will ensure no net loss of biodiversity values in the long-term.
To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	Avoidance of Aboriginal cultural heritage values has been a key aspect of the project refinement process. Subsequently, only sites with limited significance will be affected and artefacts will be salvaged prior to construction. The project will unavoidably affect potential historical heritage sites, however the wider landscape values will not be affected.
To promote good design and amenity of the built environment.	The project has been designed to suit the site and to avoid the constraints identified where possible and to limit the potential visual, noise and air quality impacts on sensitive receptors (including residences).
To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Over the life of the project, infrastructure will be maintained, or upgraded, to ensure safe and efficient operations. All construction associated with the project will be compliant with the Building Code of Australia and all other relevant statutory requirements.
To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	This is a matter for the different levels of government in the State. As summarised in Chapter 5, a wide range of government agencies have been consulted regarding the project, including Inverell Shire Council, BCD and DPE.
To provide increased opportunity for community participation in environmental planning and assessment.	There have been a range of engagement activities to inform the community about the project and to seek community (and other stakeholder) feedback. This EIS provides information regarding the project and its potential impacts. It will be placed on public exhibition by DPE, and community members will be able to make formal submissions. Sundown Solar will prepare a report responding to these submissions following the exhibition of the EIS.

7.6 Consideration of community views

Feedback from the community included mostly positive and neutral views. Some stakeholders recognised the benefits of the project. In particular, stakeholders acknowledged the project as a source of local employment, particularly during construction. Stakeholders were also interested in understanding how the benefits of the project could be shared within the community.

Comments have been made by community stakeholders regarding how the project will change the landscape, and the local benefits that would accrue from the project. The community are generally accepting of the project and no significant concerns have been raised to date.

Detail of community views and responses are included in Chapter 5 and were identified as part of targeted engagement and the SIA field study.

7.7 Summary of project impacts

This EIS has considered the potential impacts associated with the project, as well as the need for the project and alternative development options. This section summarises the potential impacts and provides a justification for the project on environmental, economic and social grounds.

7.7.1 Environmental impacts

This EIS has assessed potential impacts to the environment (Table 7.2).

Table 7.2 Assessment summary

Aspect	Assessment summary
Biodiversity	• The project has been designed to avoid and minimise impacts to biodiversity, resulting in the avoidance of areas of high biodiversity value as much as possible. • Much of the development footprint is land which has historically (and is currently) been used for cropping and grazing and does not require to be offset for the development. • However, the project will result in residual impacts to 2.52 of Box gum woodland and 216.49 of derived native grassland which will require to be offset in accordance with the BC Act. • The project is not expected to result in significant impacts to MNES as a range of avoidance and mitigation measures have been incorporated into the project design to limit impacts to MNES. • To compensate for unavoidable disturbance of native vegetation and threatened species habitat, a staged offset strategy is proposed.
Aboriginal cultural heritage	• Avoidance of Aboriginal cultural heritage values have been a key aspect of the project refinement process. Subsequently, only limited culturally significant sites will be impacted by the project, and artefacts will be collected prior to commencement of construction. Management of onsite heritage sites will be managed in consultation with RAPs as the project is developed.
Historical heritage	• The project will result in impacts to four potential historical heritage sites, none of which are listed on any heritage registers. These sites which will be archivally recorded prior to being disturbed.
Land, soil and erosion	• The project will result in a temporary and reversible change of land use for land within the development footprint. Land management will include consideration of the viability of agrisolar activities such as sheep grazing or apiculture throughout the operation phase. • Land management practices will minimise or avoid potential impacts across the project area and to neighbouring agricultural operations and ensure that the development footprint is not precluded from being returned to a productive agricultural use at the end of operations.
Visual	• Due to the topography and the presence of mature vegetation, project infrastructure may be visible from one of the eight viewpoints. This viewpoint (viewpoint 3) has potential for a slight/moderate visual impact. Based on the calculated magnitude of change and evaluations of significance assigned to each of the eight viewpoints, no landscaping is warranted.

Table 7.2 Assessment summary

Aspect	Assessment summary
Noise and vibration	• Construction noise levels are predicted to exceed NMLs at up to nine assessment locations. These exceedances are in relation to the upgrade of the site access road and the intersection. No exceedances are predicted in relation to the construction of the solar farm/BESS infrastructure. No exceedance of the 'Highly Noise Affected' level of 75 dB(A) is expected. • Construction vibration levels are predicted to exceed acceptable human comfort thresholds at two assessment locations, depending on the size of vibratory rollers used during the upgrade of the site access road. • Operational noise is predicted to satisfy the NPfI PNTLs for all assessment locations. • During peak construction, increases in road traffic noise will occur along the Gwydir Highway, Spring Mountain Road and Sturmans Road. Assessed road traffic noise levels indicate that predicted levels will remain below the thresholds provided in the Road Noise Policy (RNP) (DECCW 2011). • Decommissioning phase noise and vibration are expected to satisfy all applicable criteria. • By applying the proposed mitigation measures outlined in Table 6.29, the project is not anticipated to generate significant noise or vibration impacts.
Traffic and transport	• During the construction and operation phases, Gwydir Highway will be the main transport route. The site will be accessed via the Spring Mountain Road and Sturmans Road. • The existing level of service (LOS) for Gwydir Highway/Spring Mountain Road intersection is LOS A (i.e. good operation) and is predicted to remain at LOS A during construction and operation of the project. • The available sight distance on Gwydir Highway at the Gwydir Highway/Spring Mountain Road intersection to the right meets the minimum requirements but does not meet the minimum requirements to the left. This will be managed via the installation of applicable warning signs. • To accommodate the temporary increase in construction traffic, the intersection will be upgraded to include a right turn traffic lane (type (CHR(S)) at the eastbound approach, as well as a Basic Right Turn (BAR) treatment and a Basic Left Turn (BAL) (if the BAL has not already been installed by White Rock Wind Farm (noting this is a requirement of their development consent). Due to the narrow carriageway width of less than 4.0 m, the site access road, will be widened to 8.7 m width for the entire route. • A CTMP will be developed by the construction contractor in consultation with Inverell Shire Council and Transport for NSW (TfNSW) prior to the commencement of works.
Water	• The project is not expected to have a significant impact on water resources in the local or regional area. All infrastructure areas are designed to avoid higher order watercourses and drainage lines. • The development footprint has been designed to avoid areas of extreme flood hazard. • All water crossings will comply with the *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI 2003) and *Guidelines for Watercourse Crossings on Waterfront Land* (DPI 2012).
Bushfire	• Bushfire risks are low at the site. • Applicable fire protection infrastructure will be installed including (and not limited to) asset protection zones, fire-fighting water tanks and an access/egress point suitable for emergency services use. Similarly, applicable fire protection procedures will be implemented.
Hazards and risk	The PHA concluded the project: • is not considered to be potentially hazardous within the meaning of the Hazards and Resilience SEPP • is located in a suitable area (i.e. a rural area) with considerable separation distance to sensitive receptors and in an area without any other hazardous developments in the vicinity of the project site • is not expected to have significant offsite hazard impacts • is not expected to generate EMF levels that exceed ICNIRP levels for occupational exposure or for general public exposure levels • meets the HIPAP No.4 qualitative risk criteria.

Table 7.2 Assessment summary

Aspect	Assessment summary
Social	• The project will not significantly affect the provision of local housing/accommodation or other local services. The project will result in a range of socioeconomic benefits in the local region including employment opportunities, the establishment of a community benefits fund and the provision of clean energy. • With the implementation of the mitigation measures outlined in Table 6.47, the project is not expected to result in any significant negative socioeconomic impacts.
Waste	• The project will produce a number of waste streams during construction, operation and decommissioning. Assuming the proposed waste management measures (Section 6.12.7) are implemented, there will be no material impact in relation to the management of waste. • Sundown Solar has engaged with Inverell waste depot, the closest waste facility to the site. Inverell waste depot confirmed it has capacity during the construction and operation phases to accept the proposed project-related waste streams and volumes (including waste oil and electric waste but excluding septic waste).

7.7.2 Economic benefits

The project will provide economic stimulus to the local region. The average construction workforce throughout the 21-month construction period will be approximately 200 FTE jobs. The project will directly employ a further two to three people FTE during the operation phase and will provide ongoing economic benefits for both the local economy within the Inverell LGA and more broadly, the regional economy within the New England REZ.

Sundown Solar will work in partnership with Inverell Shire Council and the local community to ensure that, as far as possible, the benefits of the projected economic growth in the region are maximised and impacts minimised.

7.7.3 Social impacts

The social impacts of the project are assessed in Section 6.11. The project is justified on social grounds for three principal reasons:

- the main issues raised by the local community have been addressed and mitigated
- it will provide direct benefits to the local and regional economy
- it will provide indirect benefits through the use of services and facilities both locally and regionally.

The project will generate energy from a renewable source, contributing to filling the need for replacement power as ageing coal-fired power stations progressively close.

Whilst the project will result in clearing of native vegetation and also the temporary loss of agricultural land, it is considered that these impacts can be managed to appreciably low levels through the suite of mitigation and offsetting measures proposed. The impacts are considered to be far outweighed by the project's benefits. Mitigation and management strategies have been proposed for each of the identified potential social impacts to minimise negative consequences and to maximise social benefits for the local community.

Public safety risks, including bushfire, hazards and risks associated with project infrastructure, will be mitigated through design of buildings, construction areas and other assets to include appropriate bushfire protection measures, and emergency access and evacuation protocols, which will be developed as part of the emergency response plan.

7.7.4 Cumulative impacts

The project has potential for cumulative impacts with nearby development and future projects. Cumulative impacts are addressed in Chapter 2.

7.8 Ecologically sustainable development

The principles of ESD are outlined in Part 8, Division 5, Section 193 of the EP&A Regulation and are addressed in Table 7.3.

Table 7.3 Consideration of ESD principles

Principle	ESD principle	Evaluation of project impact against principle
Precautionary principle	The precautionary principle, 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.	During the project planning phase and preparation of this EIS, experts in a range of fields have carefully considered environmental impacts, effects and consequences through the preparation of quantitative technical assessments. This has resulted in a high degree of certainty around the impacts that may arise from the project. The findings of the technical assessments are provided in Chapter 6. Taking into consideration the results of these assessments, the project has been designed with regard to the precautionary principle and in response to applicable legislation, Government policies, and relevant guidelines. Management measures have been proposed for all potential environmental impacts. Taking these measures into account, it is considered that there would be no threat of serious or irreversible damage to the environment. Therefore, the project is consistent with the precautionary principle.
Social equity including inter-generational equity	Inter-generational equity, 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.	A range of mitigation measures are proposed that will minimise the impacts of the project during construction and operation. The project will contribute to the sustainable transition of electricity generation to a more reliable, more affordable and cleaner energy future and contribute to a net reduction in greenhouse gas emissions. Once decommissioned, the land within the development footprint can be rehabilitated to its current use if required by the landowners, thereby allowing for either continuation of renewable energy generation or a return to agricultural production, both of which would provide benefits for future generations. Further, the project will enable the generation of electricity from a renewable energy source. Given the above, it is considered that the project supports inter-generational equity.

Table 7.3 Consideration of ESD principles

Principle	ESD principle	Evaluation of project impact against principle
Conservation of biological diversity and maintenance of ecological integrity	Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.	The conservation of biological diversity and ecological integrity was a fundamental consideration in the development of the project. The location of the project on land with a long history of agricultural use means that biodiversity values are minimal in the study area. In addition, the project has been sited within the study area to minimise impacts to biodiversity values where possible. Specifically, the development footprint was refined to avoid areas of high biodiversity value once these areas were identified by the biodiversity assessment carried out for the project, namely the two areas on the north-east side, and the small area of derived native grassland in the south-east corner of the study area. The BDAR was prepared to assess the project's potential biodiversity impacts and it includes offset calculations as necessary to ensure no net loss of biodiversity values as a result of the project. Management and mitigation measure have been prescribed to minimise, manage and offset residual impacts on biodiversity.
Improved valuation and pricing of environmental resources	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, and iii) established environmental goals 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.	Project benefits are considered to outweigh the costs. The project will generate up to 400 FTE jobs during peak construction and two to three FTE jobs throughout operations and will provide economic benefits to the local community. The project also supports the transition away from fossil fuel energy generation, thereby contributing to a net reduction in greenhouse gas emissions. Sundown Solar accepts the financial costs associated with all the measures required for the project to avoid, minimise, mitigate and manage potential environmental and social impacts.

7.9 How compliance will be ensured

A monitoring and management framework will be developed to enable the potential positive and negative impacts to be monitored over time. The monitoring and management framework will be prepared in accordance with the proposed mitigation and management measures as well as the development consent conditions. the requirements of the development consent granted for the project, if approved. The monitoring and management framework will:

- outline all mitigation and management measures
- outline key performance indicators, targets and outcomes
- assess actual project impacts against predicted impacts

- outline reporting requirements
- identify responsible parties
- identify requirements for review of the framework.

7.10 Key uncertainties and proposed measures

Sundown Solar's parent company (Canadian Solar) is developing and operating solar and battery projects domestically and internationally and has vast experience in the construction and operation of facilities using best available technologies to meet relevant standards.

A competitive bid process will select an engineering, procurement and construction contractor with a demonstrated ability to build the project in a manner that is consistent with the proposed mitigation and management measures outlined in Appendix N.

There are no key uncertainties that cannot be mitigated using the measures outlined in Appendix N.

7.11 Conclusion

The Sundown Solar Farm involves the development and operation of a large-scale solar PV generation facility, BESS and associated infrastructure. The project is within the New England REZ and will play an important part in achieving the objectives of the New England REZ. It will also provide significant economic stimulus to the region through construction jobs and associated flow-on benefits.

This EIS has comprehensively considered the potential environmental impacts of the project in accordance with relevant legislation, policies and guidelines. The assessments undertaken and the conclusions reached clearly demonstrate that this project can be developed and operated within acceptable limits. The residual environmental and social impacts identified throughout this EIS will be managed through the mitigation and management measures described throughout (Appendix N), such that the project will not result in significant impacts on the environment or the local community.

In terms of benefits, project will achieve the following overall benefits:

- contributions to energy security and reliability in NSW by diversifying the State's energy mix and helping to prepare for the retirement of large-scale coal-fired power generation
- providing economic benefits for both the local economy within the Inverell Shire LGA and the and more broadly, the regional economy within the New England REZ
- providing significant employment opportunities and local economic stimulus during the 21 month construction period.

It is considered that the environmental, social and economic benefits for the local, region and NSW communities far outweigh the temporary impacts that would result from the development and operation of the project and that the project should be approved.

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Abbreviations

Abbreviation	Definition
ABS	Australian Bureau of Statistics
AC	alternating current
ACHA	Aboriginal cultural heritage assessment
ACHMP	Aboriginal Cultural Heritage Management Plan
AEMO	Australian Energy Market Operator
AGL	above ground level
AHD	Australian height datum
AHIMS	Aboriginal Heritage Information Management System
ALERP	Australia's Long-Term Emissions Reduction Plan
ALUM	Australian land use and management
APZ	asset protection zone
BAL	basic left turn
BAL	bushfire attack level
BAM	biodiversity assessment method
BCD	Biodiversity Conservation Division
BCF	Biodiversity Conservation Trust Fund
BDAR	biodiversity development assessment report
BESS	battery energy storage system
BoM	Bureau of Meteorology
BOS	Biodiversity offset scheme
BSAL	Biophysical Strategic Agricultural Land
CEEC	critically endangered ecological community
CEMP	construction environmental management plan
CHR	channelised right turn
CHR(S)	channelised right turn (short)
COAG	Council of Australian Governments
CTMP	construction traffic management plan
CWP	CWP Renewables Pty Ltd
dB	decibels (dB)
DC	direct current
DCCEEW	Department of Climate Change, Energy, the Environment and Water

Abbreviation	Definition
DEM	digital elevation model
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment (note name changed to DPE in 2022)
DSLR	digital single-lens reflex
EEC	endangered ecological community
EIS	environmental impact statement
EMF	electro-magnetic field
EMM	EMM Consulting Pty Limited
EPA	Environment Protection Authority
FDR	fire danger rating
FTE	full time equivalent
GDE	groundwater dependent ecosystem
GPS	global positioning system
GW	gigawatts
ha	hectares
HIPAP No. 6	Hazardous Industry Planning Advisory Paper No. 6 – *Guidelines for Hazard Analysis*
HV	high voltage
HV	heavy vehicle
IBRA	Interim Biogeographic Regionalisation for Australia
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IPC	Independent Planning Commission
ISP	Integrated System Plan
KL	kiloliters
km	kilometres
kV	kilovolt
LEP	Local Environmental Plan
LGA	Local government area
LSC	land and soil capability
LV	light vehicle
M	metres
mbgl	metres below ground level

Abbreviation	Definition
MHRDC	maximum harvestable right dam capacity
MNES	matters of national environmental significance
MV	medium voltage
MW	megawatts
MW (AC)	megawatts (alternating current)
MW (DC)	megawatts (direct current)
NEM	National Electricity Market
NHVR	National Heavy Vehicle Regulator
NML	noise management level
NSW	New South Wales
OSOM	over size over mass
PAD	potential archaeological deposit
PCT	plant community type
PEA	Preliminary Environmental Assessment
PHA	preliminary hazard assessment
PMST	Commonwealth Protected Matters Search Tool
PV	pPhotovoltaic
RAP	Registered Aboriginal party
REZ	Renewable Energy Zone
RFS	Rural Fire Service
SAII	serious and irreversible impacts
SAT	single axis tracker
SCADA	supervisory control and data acquisition
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SISD	safe intersection sight distance
SSC	State Suburbs Census
SSD	State significant development
Sundown Solar	Sundown Solar Pty Ltd
TBDC	Threatened Biodiversity Data Collection
TEC	threatened ecological community
TfNSW	Transport for NSW
VI	vegetation integrity

Abbreviation	Definition
WAL	water access licence

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