Edify Energy

Darlington Point Solar Farm

Environmental Impact Statement

Final | 16 April 2018

Job number 254766

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Terminology

Abbreviation	Description
ABS	Australian Bureau of Statistics
AC	Alternating current
AHIP	Aboriginal Heritage Impact Permit
AHIMS	Aboriginal Heritage Information Management System
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ARI	Average Recurrence Interval
AUL	Auxiliary Left-turn
AUR	Auxiliary Right-turn
AWS	Automatic Weather Station
BAL	Basic left-turn
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016*
BESS	Battery Energy Storage System
BOM	Bureau of Meteorology
BOS	Biodiversity Offset Strategy
BSAL	Biophysical Strategic Agricultural Land
CEEC	Critical Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CHAR	Cultural Heritage Assessment Report
CIA	Coleambally Irrigation Area
Cwth	Commonwealth
CLM Act	*Contaminated Land Management Act 1997*
Crown Lands Act	*Crown Lands Act 1989*
CSU	Charles Sturt University
DPI	Department of Primary Industries
DPSF	Darlington Point Solar Farm
DP&E	Department of Planning and Environment
DoEE	Department of the Environment and Energy
DOS	Degree of Saturation

Abbreviation	Description
DER	Distributed Energy Resources
Edify Energy	Edify Energy Pty Ltd
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPC	Engineering, Procurement and Construction
FBA	Framework for Biodiversity Assessment
GDE	Groundwater Dependent Ecosystem
GMA	Groundwater Management Area
GWh	Gigawatt hours
ha	Hectares
HCM	Highway Capacity Manual
Heritage Act	*Heritage Act 1977* (NSW)
HV	High voltage
IAP2	International Association for Public Participation
ICNG	Interim Construction Noise Guidelines
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ISEPP	State Environmental Planning Policy (Infrastructure) 2007 (NSW)
km	kilometres
KTP	Key Threatening Process
kV	kilovolt
LEP	Local Environment Plan
LGA	Local Government Area
LOS	Level of Service
LUCRA	Land Use Conflict Risk Assessment
LV	Low voltage
m	Metres
MIA	Murrumbidgee Irrigation Area
MNES	Matters of National Environmental Significance

Abbreviation	Description
MVA	Mega volt amps
MW	Megawatts
Murrumbidgee LEP	Murrumbidgee Local Environmental Plan 2013
NEM	National Electricity Market
NESA	National Energy Security Assessment
NPW Act	*National Parks And Wildlife Act 1974* (NSW)
Native Vegetation Act	*Native Vegetation Act 2003*
O&M	Operations and Maintenance
OEH	Office of Environment and Heritage
OEMP	Operational Environmental Management Plan
PCT	Plant Community Type
PEA	Preliminary Environmental Assessment
POEO Act	*Protection of the Environment Operations Act 1997*
PPA	Power purchase agreement
PV	Photovoltaic
RET	Renewable Energy Target
RFS	Rural Fire Service
RMS	Roads and Maritime Services
Roads Act	*Roads Act 1993*
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SHR	State Heritage Register
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SSD	State Significant Development
SSI	State Significant Infrastructure
TMP	Traffic Management Plan
TSC Act	*Threatened Species Conservation Act 1995*
VIS	Vegetation Information System
Vph	Vehicles per hour

Abbreviation	Description
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
WM Act	*Water Management Act 2000*
WONS	Weeds of National Significance

Certification

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

<table>
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<tr><th colspan="2">Proposed development</th></tr>
<tr><td colspan="2">Darlington Point Solar Farm
Refer to Chapter 2 of this EIS for a description of the proposed development.</td></tr>
<tr><th colspan="2">Land to be developed</th></tr>
<tr><td colspan="2">Land to the east of Donald Ross Drive, approximately 10 km south of the town of Darlington Point, the DPSF project area comprises the existing TransGrid Darlington Point Substation and the proposed DPSF site, which includes:
• Lot 160 of DP 821551 (referred to as ‘Anderson property’).
• Lots 41, 42 and 64 of DP 750903, Lot 2 of DP 542215 and Lots 18, 35 and 36 of DP 750903 (referred to as ‘Tubbo Station’).
• Lot 2 of DP 628785 (being the TransGrid substation site to which DPSF will connect, which is included within the DA in accordance with TransGrid’s connection policy to facilitate any substation augmentation works that may be necessary as part of the development).</td></tr>
<tr><th colspan="2">Certification</th></tr>
<tr><td colspan="2">We certify that we have prepared this EIS in accordance with Schedule 2 of the Environmental Planning and Assessment Regulation 2000 and the Secretary’s Environmental Assessment Requirements (SEARs) issued for the Darlington Point Solar Farm on 9 May 2017. To the best of our knowledge, it contains all available information that is relevant to the environmental assessment of the development to which the statement relates. The information contained in this EIS is neither false nor misleading.</td></tr>
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16 April 2018</td><td>Kellie Charlesworth
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Executive Summary

This Environmental Impact Statement (EIS) identifies and assesses the environment and social issues associated with the construction, operation and decommissioning of a proposed large-scale solar farm and associated battery energy storage system (BESS) approximately 10 kilometres south of the township of Darlington Point, within the Murrumbidgee Local Government Area (LGA) in Western NSW. The proposed solar farm, the Darlington Point Solar Farm (DPSF), is to accommodate 275 megawatts (MW) alternating current (AC) of solar photo-voltaic generated electricity, and 100MW BESS battery storage system storage for resupply during peak demand. The DPSF project will connect in to TransGrid's 330kV Darlington Point substation at Donald Ross Drive, which supplies power to the National Electricity Market (NEM).

Arup has prepared the EIS on behalf of the proponent, Edify Energy. This EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP& Act) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs) provided by NSW Department of Planning and Environment (DP&E) on 9 May 2017.

A referral to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to recommend a Not a Controlled Action Particular Matter will be submitted to the Department of Environment and Energy in the coming weeks.

The proposal

The DPSF project area comprises the TransGrid Darlington Point Substation and the proposed DPSF site, which is approximately 1,042 hectares (ha) in size. Approximately 710 ha is proposed to be developed for the solar farm (e.g. solar panels, site infrastructure, access roads, firebreaks etc) while augmentation works, as needed would be undertaken within the existing TransGrid Darlington Point substation which covers an area of 26.6 ha. Existing transmission easements cover approximately 59.9 ha of the site, while 245.2 ha is to be retained as Vegetation and Heritage Protection Exclusion Zones.

The DPSF site and surrounding lands are zoned as RU1 – Primary Production under the Murrumbidgee Local Environmental Plan 2013 (Murrumbidgee LEP), with adjacent properties accommodating farming, agribusiness, poultry farms and a small number of private residences. The DPSF site is used for livestock grazing. A 330 kV and two 132 kV TransGrid overhead transmission lines cross the site from west to east, and a 33 kV Essential Energy overhead transmission line runs north-south near the eastern boundary of the site.

Key development and infrastructure components of the DPSF is proposed to include:

- Photovoltaic (PV) solar panels

- Steel mounting frames with piled foundations
- A single-axis tracking system
- Direct current (DC) / alternating current (AC) inverter stations
- Medium voltage (33kV) electrical reticulation network
- A 33/132kV switchyard, including an internal 33kV switch-room
- Internal access tracks for operational maintenance and housekeeping, to be largely located in bushfire set-back zones
- Security perimeter fencing
- Staff car park and small amenities building
- Battery energy storage system facility.

The DPSF has an estimated capital investment value of $407 million, consisting of $353 million for the solar farm and $54 million for the BESS.

Proposal need and justification

Australia has committed to reducing its greenhouse gas (GHG) emissions to 26-28% below 2005 levels by 2030. The use of renewable energy helps to reduce emissions of GHGs associated with electricity generation. The Australian Government's large-scale Renewable Energy Target (RET) commenced in 2001 to ensure that at least 20% of Australia's electricity consumption comes from renewable sources by 2020. Following review, the RET was confirmed in early 2015 as 33,000 gigawatt hours (GWh) by 2020. To meet the RET, around 6,700 GW of new renewable energy capacity is needed between 2015 and 2020.

Notwithstanding the RET, solar PV is also one of the lowest cost forms of generation.

The NSW Government's Renewable Energy Action Plan was released in 2013 in support of the Australian Government's RET and to guide renewable energy development in NSW to achieve maximum benefits to the State. The Plan positions NSW to increase energy from renewable sources by attracting investment, building community support, and grow expertise in renewable energy.

Construction and operation of the DPSF would provide the following benefits:

- Contribution of approximately 275 MW AC producing some 577,000 MWh to the Australian RET
- Provision of a clean energy source, with enough power to supply around 130,000 homes each year for 30 years through the NEM (based on typical NSW household electricity consumption specified by Origin Energy in 2016)
- Assisting the RET and Paris Agreement obligations, as well as NSW's own transition to net zero emissions and accelerate advanced energy technology, including battery storage to firm otherwise intermittent renewable energy generation.

- Provision of around 300 jobs during peak construction and about five full-time jobs during operation, with an emphasis on local content amounting to circa 42% of capital deployed.
- Direct and indirect investment into the Murrumbidgee Shire during construction.
- Edify Energy's development intent is to maximise direct benefits to the local community. Opportunities for additional community benefits would be further explored throughout the planning and development process and ongoing through operations.
- Unlocks available connection capacity in TransGrid's Darlington Point node, which is identified by TransGrid as a robust node with large capacity for additional connections (TransGrid, 2016). As outlined below, there are no alternative brownfield sites (without native vegetation) within reasonable proximity to the TransGrid substation. Therefore, the proposed DPSF site is considered the optimal location for renewable energy generation at the Darlington Point node and meets the primary key criteria for large scale solar site selection (NSW Government, 2017).

It is considered that proceeding with the DPSF project would result in a balanced outcome with significant economic and social benefits, alignment with climate change and energy policy objectives for renewable energy development, and with manageable environmental impacts, which are described throughout this EIS.

The consequences of not undertaking the DPSF project would include the loss of significant economic and social benefits to the Darlington Point region. This would be a lost opportunity for large scale renewable electricity generation feeding into the NEM at Darlington Point, given the lack of other alternative, suitable, and available sites at this key node.

Options and alternatives considered

A 'do nothing' option was considered early on in the project development process, but was discounted as it would not assist in the achievement of the Australian and NSW governments' strategic goals and targets for renewable energy, climate change and emissions.

Various technology options were considered for the DPSF project. Polycrystalline silicon solar panels were determined to be the preferred technology for the DPSF project. Single axis tracking mounting systems were preferred to take advantage of the good solar resource and maximise output energy over a longer period each day. A battery energy storage system (BESS) is proposed for the DPSF site and would consist of numerous individual fire-rated battery cubicle modules or a containerised system mounted on concrete plinths or skid-mounted. However, a final decision on these technology options would be confirmed during the detailed design phase of the project.

Darlington Point has been identified by TransGrid as a robust node with large capacity for additional connections and the region has favourable solar resource (TransGrid, 2016). Being adjacent to the substation, the proposed DPSF site is considered to be the optimum site for electricity generation to connect to the Darlington Point node and meets the primary key criteria for large scale solar site selection (NSW Government, 2017). The proposed DPSF site was selected due to:

- Proximity to the Darlington Point substation, eliminating the need for additional transmission line easements and replication of costly infrastructure
- Access to large areas of flat, open terrain historically used for grazing, reducing the need for vegetation clearing, major earthworks and site preparations
- Favourable solar resource with an annual average of 7.8 hours' sunshine a day
- Excellent road access to the site off Donald Ross Drive, via the Sturt Highway and/or Kidman Way/Newell Highway, which allows easy supply of plant and equipment during construction
- Positive support from landowners, neighbours and the Murrumbidgee Shire Council
- Lack of alternative brownfield or cropping sites available within close proximity, and a genuine desire by Edify Energy to avoid high-value irrigated farmland.

Whilst the DPSF site meets the primary key criteria for large scale solar site selection (NSW Government, 2017) as outlined above, the development of the site would have some limited impacts on the native grassland vegetation of the site (refer to Section 7.1). A number of properties in close proximity to the existing Darlington Point substation were investigated for their suitability and availability as alternative sites for the DPSF. As the proposed DPSF is located on grazing land with native grassland coverage, the basis of the alternative site investigation was to identify any available alternative sites devoid of native vegetation, such as arable cropping land or other brownfield developments.

Edify Energy undertook discussions with adjacent landowners during the site selection and feasibility phase and did not identify any arable or brownfield land within a feasible radius of the Darlington Point substation as being available, commercially or otherwise, for lease or purchase.

Notwithstanding the above and albeit with limited land alternatives proximate to the Darlington Point substation, Edify Energy has intentionally overlooked areas of high-value agricultural production within the Murrumbidgee and Coleambally Irrigation Areas, as it is considered counter-intuitive to displace material food crops with renewable energy facilities. Not least, such an approach would be highly likely to attract significant community concerns as has been evident at other proposed solar farm projects on productive arable lands in North Queensland and the Murray River region.

Edify Energy will be the long-term equity participant and asset manager of DPSF and retaining community support is vital to the success of the project. The DPSF site enjoys local landowner support, good neighbourly relations (including with nearby food producers), and the unanimous desire of the Murrumbidgee Shire Council and local Member of NSW Parliament to see the project approved and implemented.

Therefore, in selecting the DPSF site and progressing with the development of the project, Edify Energy has sought to achieve a balanced outcome, considering the limited but manageable impacts on the Riverine Plains Grasslands in parallel with the strong community support and significant social and economic benefits the project will bring to the Darlington Point community.

Statutory planning framework

The EIS provides a review of the DPSF project in the context of the applicable statutory planning frameworks. Under the EP&A Act, the DSPF project is considered State Significant Development (SSD 8392) and is subject to approval under Part 5.1 of the EP&A Act. An assessment of the DPSF project in relation to the relevant State Environmental Planning Policies (SEPPs), other NSW environmental legislation, and the Murrumbidgee LEP has informed the development of the project and indicated potential approvals and licences.

Community and stakeholder consultation

Edify Energy has implemented a Stakeholder and Community Engagement Program throughout the development of the DPSF project. The objectives of the engagement program include:

- Consulting with decision makers to ensure their requirements are met
- Consulting with key stakeholders during preparation of the EIS so their issues and opportunities are considered
- Informing the broader community about the project and provide opportunities for their questions to be answered and their issues and opportunities to be considered
- Positioning Edify Energy as a ‘good neighbour’ and progressive and reputable large scale solar farm developer and operator.

A range of consultation tools have been utilised by the project including the development of a briefing pack, project fact sheet, project webpage, community information session and letters to State and Local ministers.

Consultation has been carried out with a range of government agencies and key stakeholders including:

- Murrumbidgee Shire Council
- TransGrid
- NSW Department of Planning and Environment
- NSW Office of Environment and Heritage
- NSW Renewable Energy Advocate
- Rural Fire Service
- NSW Department of Industry – Lands.

Ongoing community consultation has also been carried out with the proposed DPSF site landowners and farm managers, who are strong supporters of the proposal. In early April 2017, consultation was also carried out with the immediate neighbours and adjacent land users and community members who expressed interest. A local community drop-in session was held in December 2017 to provide an additional opportunity for community members to learn about the project, ask questions and provide feedback.

Edify Energy will continue to keep the community and key stakeholders informed about the progress of the DPSF. The Stakeholder and Community Engagement Plan will continue to be a live document that will be reviewed and updated by Edify Energy in responses to feedback received and any conditions required by the DP&E.

Environmental impacts and management

This EIS provides a detailed investigation of risks and impacts of the construction, operation and decommissioning phases of the proposed DPSF. A preliminary environmental assessment (PEA) prepared for the project (April 2017) assisted in the identification of key environmental matters that were identified as having a potential impact on the environment without mitigation measures and therefore required a more detailed assessment.

Key environmental assessment issues

The assessment of the key environmental matters has been guided by the SEARs for the project. Detailed investigations of key environmental matters were undertaken for the following areas:

- Biodiversity
- Traffic and access
- Flooding and hydrology
- Aboriginal heritage
- Land compatibility

Biodiversity

A Biodiversity Assessment Report (BAR) was prepared for the proposed DPSF site in accordance with SEARs. The Office of Environment and Heritage (OEH) Framework for Biodiversity Assessment methodology (FBA) was used to assess both the direct and indirect impacts to biodiversity due to the DPSF project and to determine the biodiversity offset requirements under the FBA.

The DPSF project area (710ha) has been designed to avoid or minimise significant impacts to biodiversity. The Vegetation and Heritage Protection Exclusion Zones amount to 245.2 ha (23.5% of the DPSF site area), which has constrained the technical and economic options available for the development of the site. The site is dominated by Riverine Plains Grassland with fragmented areas of EPBC Act and *Threatened Species Conservation Act 1995* (TSC Act) listed grassy woodland

and open forest. The majority of wooded areas are not listed as threatened under any legislation. Site photographs are provided in **Appendix A**.

No threatened flora species were recorded within the DPSF site. Two species of threatened fauna were recorded during the field surveys:

- Superb Parrot (EPBC Act, TSC Act);
- Grey-crowned Babbler (TSC Act).

The vast majority of the higher habitat value woodland areas have been avoided by the solar farm footprint and incorporated into Vegetation and Heritage Protection Exclusion Zones on the DPSF project site; only a small number of isolated paddock trees are impacted. The direct impact to native vegetation (associated with internal access roads, firebreaks, site buildings/infrastructure, battery facility etc) amount to only 46ha (6.48%) of the project area and includes:

- 8.14 ha direct impact to Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (PCT 16) moderate to good - moderate;
- 0.16 ha direct impact to Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South Western Slopes Bioregions (PCT 75) moderate to good - moderate;
- 37.7 ha direct impact to Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45) moderate to good - moderate.

It was recognised in discussions with DP&E and OEH that the FBA methodology does not allow for consideration of indirect or partial impacts such as would result from the operation of solar panels on the plains grassland.

There are no known specific project examples in Australia which have sought to quantify the indirect impacts of solar farm operation with a specific focus on Riverine Plains Grasslands or indeed native grasslands in general. However, there is plenty of anecdotal evidence to demonstrate grasslands in general continue to thrive in, under and around solar panels.

The Riverine Plains Grasslands, such as at the DPSF site, have a long history of supporting the livestock grazing industry and as such there is a depth of agricultural industry knowledge and scientific assessment available to understand and optimise grassland growth and management. Due to their expertise in the agricultural management of Riverine plains grassland, Charles Sturt University (CSU) were engaged to provide specialist advice of the potential impacts on grassland diversity, persistence and structure and optimal management regime for retaining and enhancing these values.

The study determined that the grassland diversity and persistence would not be significantly impacted by the construction and operation of the solar farm under the proposed biodiversity management regime, including weed management. The proposed construction methodology is expected to have minimal impact on the persistence of existing grassland species. The grassland growth varies throughout the year and from season to season depending on growing conditions (e.g. rainfall and temperature etc). Photographs showing the condition of the grassland in April, July and December 2017 are shown in **Appendix A.** The panel area will not be permanently mown or grazed, only as recommended in the management regime as outlined by CSU (usually in winter, mid September – October and if required in summer when dry matter exceeds 5t/ha for bushfire management). The biodiversity management regime, including for bushfire management, is expected to be detrimental to the exotic flora species at the DPSF site, to the benefit of native grasses and forbs later in the season.

This management regime will predominantly impact the under-panel areas dominated by Plains Grassland (56%) of which individual stems can grow up to 2m. The other areas of the native grassland only normally grow to about 50cm and will not require substantial management intervention to keep the fuel load down under the proposed management regime. CSU states that the between-panel area should not significantly change once it is recovered from construction. No permanent impacts to the between-panel area is anticipated and as such offsets are not proposed for this component.

The CSU study estimates that under the proposed biodiversity management regime, the average structure of the Plains Grassland dominated area would be reduced by a maximum of 20%. Therefore the indirect impact to biodiversity of the DPSF project site is estimated to be:

- 21.06 ha net impact to grassland as calculated from CSU study inputs (see Appendix D).

With respect to Commonwealth Matters of National Environmental Significance (MNES), one threatened fauna species, Superb Parrot, and one endangered ecological community, Weeping Myall Woodland, listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), have been recorded within the project area. Protection of habitat areas for this species and ecological community was prioritised. A further two birds, two species of plant and one bat species have potential habitat within the project area.

No significant impacts to MNES are anticipated with the implementation of the DPSF biodiversity management regime. A referral to the Commonwealth under the EPBC Act to recommended a Not a Controlled Action Particular Matter will be submitted to the Department of Environment and Energy (DoEE) in the coming weeks. The referral will conclude that the project is unlikely to result in a Controlled Action (consistent with the BAR conclusions) and further assessment by DoEE is considered unlikely to be required.

Mitigation measures for the project include pre-construction, construction and operation measures. A strong focus on biodiversity management within a Biodiversity Management Plan, ongoing grassland monitoring in association with CSU, and a biodiversity offsets package (BOP) is proposed for the project.

Traffic and access

A traffic impact assessment was undertaken for the DPSF site and considered the existing road network and the likely construction and operational traffic generation and impacts associated with the development of the DPSF site. Trip generation analysis noted that up to 249 vehicles per hour during the morning and evening peak hour periods during construction could be expected; however Edify Energy is actively progressing opportunities for a ‘park-and-ride’ scheme to substantially reduce the volume of personal vehicles on Donald Ross Drive. Once operational, the DPSF site is expected to generate a total of five vehicles per day.

During the peak construction period, it is not expected that the proposed DPSF would impact significantly on the operation of the surrounding road network. An intersection analysis indicated that all intersections would function within the acceptable limits of operation in both the AM and PM peak periods during the peak construction period.

The operational traffic impact due to the project is deemed to be insignificant, as the additional levels will be less than 5% of existing daily traffic levels and therefore has an insignificant impact on the Sturt Highway. The traffic generation for the decommissioning phase of the project is expected to be similar or less than for the construction phase, with vehicles utilising the same routes.

Flooding and hydrology

The flood assessment consisted of a desktop hydraulic analysis based on historical flood evidence sourced from the Murrumbidgee River Flood Atlas and existing ground survey of the site to estimate flood levels and velocities. The flood depth across the site for a 90-year Average Recurrence Interval (ARI) flood event based on the 1974 flood event found that the flood depth across the DPSF site for the existing case was generally less than 0.25 metres, with the maximum depth noted to the south of the site reaching 0.75 metres.

The flood modelling for the post-development scenario indicated that the predicted changes in flood levels due to the DPSF project are less than 0.001m and are therefore considered minor.

Aboriginal heritage

An Aboriginal Cultural Heritage Assessment Report (CHAR) has been prepared for the DPSF project to provide an assessment of the Aboriginal cultural values associated with the DPSF site and to assess the cultural and scientific significance of any Aboriginal heritage sites recorded. Consultation with Aboriginal stakeholders was undertaken.

The DPSF site lies in a landscape considered the province of peoples of the Wiradjuri language group. The study area is situated on the flat and open depression landforms which form a large plain adjacent to the Murrumbidgee River. The landscape of the DPSF site has been modified by modern land use practices.

Review of background information, Aboriginal community consultation and an archaeological survey has resulted in the identification of ten (10) Aboriginal archaeological sites within the DPSF project boundary. The DPSF project area has been designed to avoid nine of the ten Aboriginal archaeological sites by the implementation of a Vegetation and Heritage Protection Exclusion Zone at the

DPSF site. One surface artefact scatter will be directly affected by the DPSF project area, however, mitigation measures to remove the scatter prior to the commencement of construction have been developed in consultation and agreement with the Griffith Local Aboriginal Land Council.

Land compatibility

A review of historic and current land uses, attributes and capabilities of the DPSF site was undertaken and assessed using the Land Use Conflict Risk Assessment (LUCRA) tool. Historically the western portion of the DPSF site has been used for cattle grazing, however, the property owner has recently instigated the retirement of the land from this use, by significantly reducing live stocking. The eastern portion of the DPSF site is currently used for sheep grazing, as part of a large broadacre commercial operation.

The DPSF site is surrounded by production facilities accommodating farming, poultry farms, agribusiness and private residences. From a review of publicly available registers, no current or historic mining or exploration licences or new mineral or energy titles are located within or in close proximity to the DPSF site. However, one metallic and industrial deposit (Tubbo Sand Pit) is located approximately 2 kilometres to the east of the DPSF site, however, consultation with Murrumbidgee Council has indicated that the DPSF project would not impact on its operation.

Potential impacts to surrounding land uses may include potential impacts to weed spraying activities, bushfire risk and traffic, dust and noise generation. However, with the application of mitigation measures it is considered that any potential risks are manageable.

Lower risk environmental issues

The following lower risk issues identified were assessed for the DPSF in accordance with the SEARs including:

- Non-Aboriginal heritage
- Noise and vibration
- Visual amenity
- Soils and geology
- Air quality
- Water quality
- Resource use and waste
- Socio-economic
- Hazardous materials and development
- Electro and magnetic fields
- Bushfire risk
- Cumulative impacts.

No significant impact for any of these aspects is expected from the development of the DPSF. Any impacts are considered minor and/or manageable with the application of mitigation measures.

Impact management

The design of the proposed DPSF has been developed to avoid key environmental impacts. Vegetation and Heritage Protection 'Exclusion' Zones have been implemented across the DPSF site to avoid direct impacts to significant vegetation and known archaeological sites. A range of management and mitigation measures have been developed to minimise any residual impacts. Management plans and policies have been developed to minimise impacts and manage any identified risks.

Justification and conclusion

The DPSF project represents a contribution to help achieve the strategic goals and targets centred on renewable energy, climate change and emissions set by the Australian and NSW government. The design of the proposed DPSF site has been developed in order to minimise environmental, biophysical, economic and social impacts while optimising both electricity output through renewable energy and direct benefits to the local community.

The key environmental risks have been assessed through specialist investigations:

- Biodiversity impacts were assessed through the Biodiversity Assessment Report, which concluded that there were potential residual impacts to biodiversity of the site that would require a biodiversity offset under the NSW legislation. A referral to the Commonwealth under the EPBC Act will be undertaken due to the presence of 2 MNES recorded on-site, however as impacts are not expected to be significant to these species, the referral will recommend a Not a Controlled Action determination.
- Traffic and access impacts were determined to be minimal with the additional construction and operational-related traffic unlikely to impact on the existing road network.
- Flooding impacts were assessed to be insignificant at less than 0.001m potential impact for the defined flooding event.
- Aboriginal heritage impacts – the Aboriginal archaeological survey assessment identified 10 sites within the DPSF site, however, only one artefact scatter site would be directly impacted. As agreed with the local Aboriginal stakeholders, removal of the scatter will be undertaken prior to the commencement of construction with a representative of the local Aboriginal Land Council present.
- Land use impacts – while there proposed change of land use has the potential to result in some loss of agricultural grazing land, this will be somewhat mitigated by the potential for ongoing grazing on the solar farm site. Edify Energy is in ongoing dialogue with the land owners to implement an ongoing sheep grazing regime within the solar farm boundary. Notwithstanding, the DPSF project provides an opportunity for the diversification of rural

economies and alternative employment and income streams within the region and is generally compatible with surrounding land uses. The DPSF project is reversible and upon decommissioning returned to its existing capacity.

A range of mitigation measures have been developed to address the environmental impacts and risks of the DPSF site. The impacts identified are considered to be manageable with the effective implementation of the mitigation measures detailed in this EIS. Impacts are therefore considered acceptable, and the DPSF project is considered to achieve a reasonably balanced outcome between maximising the use of the site's solar resources and robust network connection, generating millions of dollars in direct investment to the local community and minimising the potential impacts on the environment.

1 Introduction

1.1 Project Overview

Edify Energy Pty Ltd (Edify Energy) is proposing to develop, construct and operate a large-scale solar farm approximately 10 km south of Darlington Point within the Murrumbidgee Local Government Area (LGA) in Western NSW. The proposed DPSF site is proposed to accommodate 275 megawatts (MW) alternating current (AC) of solar generated electricity, including the provision for battery technology for energy storage and resupply during peak demand. The DPSF would connect to the adjacent TransGrid Darlington Point 330 kV substation (the Darlington Point substation) and supply power to the National Electricity Market (NEM).

The DPSF is to be located wholly on private land historically used for grazing. Long term option agreements for use of this land have already been negotiated with the landowners. The DPSF has an estimated capital investment value of $407 million, comprising $353 million for the DPSF 275MW solar farm, including TransGrid connection, and $54 million for the Darlington Point Battery Energy Storage System (BESS), as independently determined by iCubed Consulting to support this planning application.

1.2 The proponent

Edify Energy is an Australian renewable energy and energy storage development and investment company. Edify Energy specialises in large-scale renewable energy, particularly solar projects, across their entire life-cycle including development, financing, construction management and asset management. To date, Edify Energy has five committed large-scale solar photovoltaic (PV) projects in Australia; four in far north Queensland and one in central Victoria, amounting to 440MWp.

1.3 Purpose of this Environmental Impact Statement

This Environmental Impact Statement (EIS) has been prepared by Arup on behalf of Edify Energy, with specialist input from Environment Property Services and Charles Sturt University for ecological assessment and land management planning; and Kelleher Nightingale Consulting for cultural heritage assessment. The purpose of the EIS is to describe the proposal, document the likely impacts of the proposal on the environment and community, and detail any protective measures to be implemented during construction, operation and decommissioning.

The EIS has been prepared in accordance with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and the Secretary's Environmental Assessment Requirements (SEARs) for the proposal.

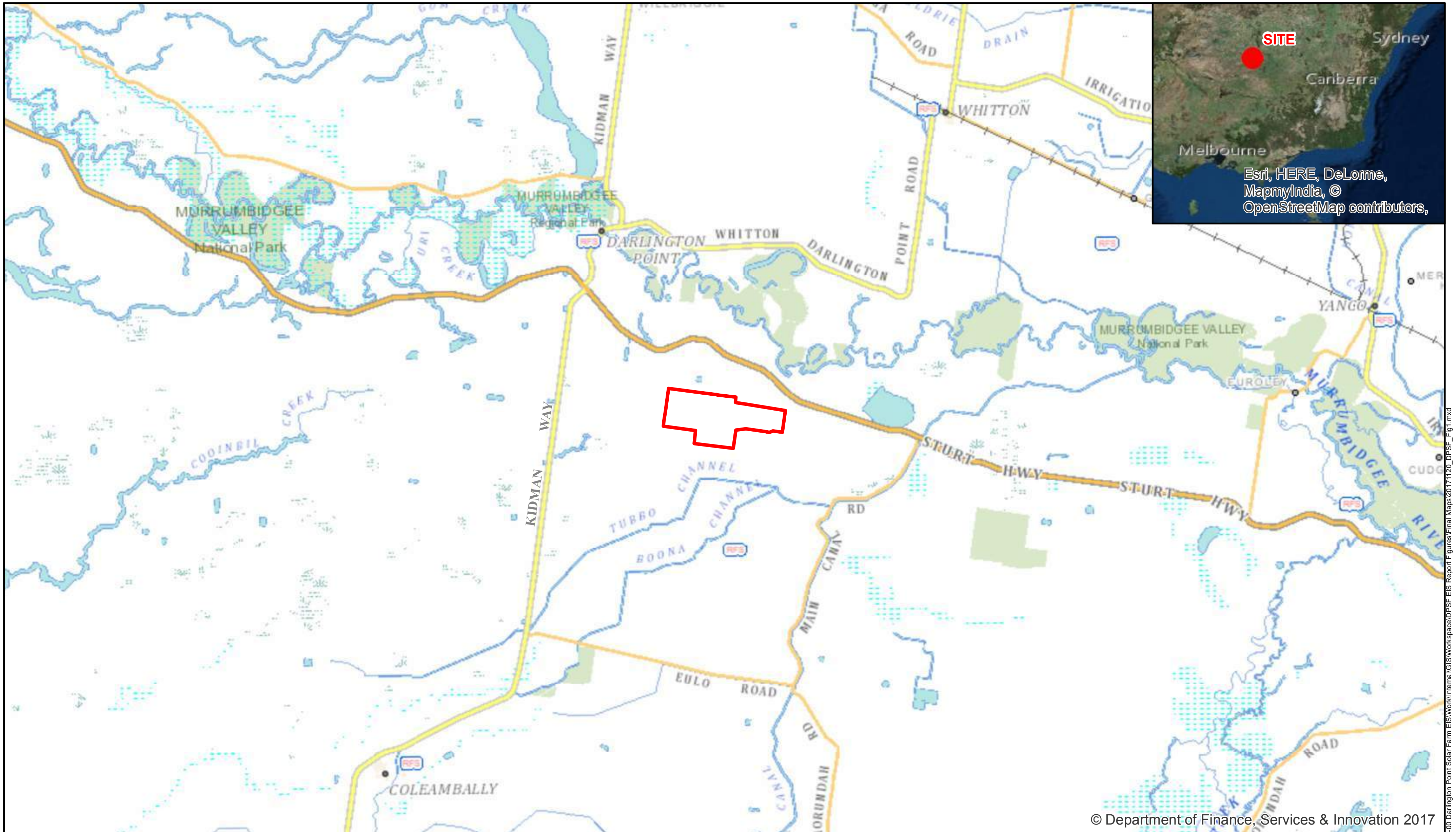
1.4 Local context

The proposed DPSF is located within the Murrumbidgee Council area in the Riverina area of western New South Wales, approximately 10km south of Darlington Point and 15km north-east of Coleambally, as shown in **Figure 1**. The site is situated on land adjacent to TransGrid's 330 kV Darlington Point substation at Donald Ross Drive, which supplies power to the National Electricity Market.

Darlington Point is a township comprised of around 1,162 people (ABS, 2017) situated in the Murrumbidgee Shire. Darlington Point is located on the Murrumbidgee River, approximately 30 km south of Griffith and 140 km west of Wagga Wagga.

Darlington Point was first established as a river crossing town of the Murrumbidgee River with pastoral leases. Irrigation from the River has enabled the development of intensive fruit, vegetable, grain and rice production within the region. The DPSF site is located adjacent to but not within the Murrumbidgee Irrigation Area (MIA) and the Coleambally Irrigation Area (CIA).

The DPSF site is located on Donald Ross Drive, which is connected directly to the Sturt Highway (A20), some 3 kilometres to the north. The Sturt Highway is the national east-west highway connecting the site to Adelaide and Sydney. The site is also connected south to Melbourne via Kidman Way (B87) to the Newell Highway (A39).



Legend

Project Boundary

Edify Energy - Darlington Point Solar Farm

Figure 1 - Site Location

ARUP
Level 4, 108 Wickham Street
Fortitude Valley, QLD 4006
Tel +61 (7)3023 6000 Fax +61 (7)3023 6023
www.arup.com

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:250,000
Kilometres
0 1 2 4 6 8 10

Drawn by: GJH Date: 21/12/2017

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2 The proposal

2.1 Proposal objectives

Edify Energy is committed to the responsible and sustainable development of renewable energy projects in Australia; as such the objectives of the DPSF proposal are:

- Support the Australian and NSW governments' strategic goals and targets around renewable energy, climate change mitigation and emissions reduction
- Select a region with a supportive council and local community
- Select a site that would result in acceptable social and environmental impacts during construction, operation, and decommissioning
- Select technologies and design solutions that maximise energy generation and supply to the NEM, especially during peak periods
- Identify opportunities for direct benefits to the local community
- Identify opportunities to provide local and regional social and environmental benefits during construction, operation, and decommissioning
- Produce a development that is commercially viable.

2.2 Proposed site

As shown in **Figure 2**, the proposed DPSF project area comprises the TransGrid Darlington Point Substation and the proposed DPSF site.

Following discussions with TransGrid in March 2017 and guidance provided in the TransGrid publication titled "Our Connection Process – Getting You Connected", it has been confirmed that the DPSF project area also comprises the Darlington Point substation to allow for augmentation works, once approved, to be undertaken to the existing 132 kV infrastructure within the TransGrid substation, facilitating connection to the DPSF (refer **Figure 4**).

The Darlington Point substation (26.6 hectares (ha)) is located at Lot 2 DP 628785 and is zoned RU1 - Primary Production. The DPSF site directly adjoins the Darlington Point substation on three sides.

The DPSF site, including the existing Darlington Point substation, is approximately 1,042 ha, of which approximately 710 ha is proposed to be developed for the solar farm. This project area includes the site infrastructure as outlined in **Section 2.4** and 20m setbacks for firebreaks. The remaining land (~245 ha) is set aside as exclusion zones for vegetation and heritage protection and for transmission line easements (~59.9 ha).

Specifically, the DPSF site is comprised of:

- Lot 160 of DP 821551 (referred to as 'Anderson property').

- Lots 41, 42 and 64 of DP 750903, Lot 2 of DP 542215 and Lots 18, 35 and 36 of DP 750903 (referred to as 'Tubbo Station').
- Lot 2 of DP 628785 (being the TransGrid substation site to which DPSF will connect, which is included within the DA in accordance with TransGrid's connection policy to facilitate any substation augmentation works that may be necessary as part of the development).

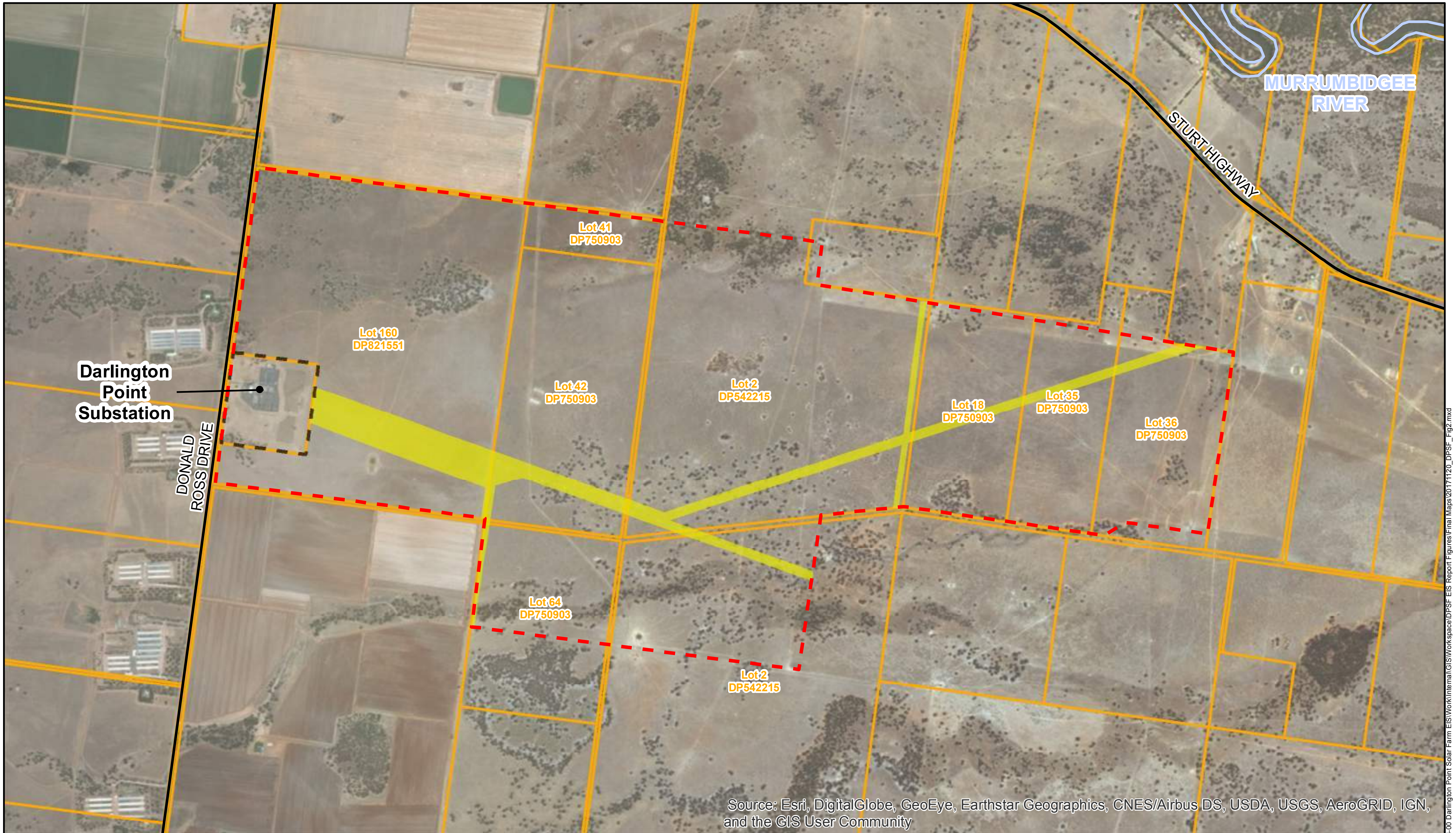
The site is zoned RU1 - Primary Production under the Murrumbidgee Local Environmental Plan 2013 (Murrumbidgee LEP) and is largely comprised of flat, open grasslands with some discrete pockets of remnant native vegetation. Historically the site has not been intensively farmed for agriculture and the properties have been used long-term for livestock grazing - sheep at Tubbo Station and cattle at the Anderson property. Photos of the existing site are provided in **Appendix A**.

The site is situated approximately 1.6 km south of the Murrumbidgee River. There are no mapped watercourses within the site, however parts of the site have been subject to inundation as a result of recent and historic major flood events.

A 330 kV and two 132 kV TransGrid overhead transmission lines cross the site from west to east, and a 33 kV Essential Energy overhead transmission line runs north-south near the eastern boundary of the site. The easements for the transmission lines would not be impacted by the proposed development of the DPSF, which has been designed to meet the minimum allowable distances for construction adjacent to transmission lines and towers.

The site is surrounded by land zoned RU1 - Primary Production accommodating farming, agribusiness and some private residences. A series of poultry farms owned by Baiada Poultry Pty Ltd are situated on land leased to it by Arrow Funds Management to the west of the site, on the other side of Donald Ross Drive. Some workers' accommodation is provided at the Baiada farms, the nearest of which is located around 100 m to the west of the DPSF site. The nearest private residence is located around 800 m to the north of the site.

Further from the DPSF site, Griffith Airport is located to the north of the site, approximately 49 km away. Narrandera Airport is located to the south-east of the site, approximately 45 km away.



Legend

- Roads
- Rivers
- Project Boundary
- Darlington Point Substation Boundary
- Transmission Easements
- Cadastre

Edify Energy - Darlington Point Solar Farm

Figure 2 - Project Area

ARUP
Level 4, 108 Wickham Street
Fortitude Valley, QLD 4006
Tel +61 (7)3023 6000 Fax +61 (7)3023 6023
www.arup.com

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:30,000

Metres

0 100 200 400 600 800 1,000

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Drawn by: GJH Date: 21/12/2017

2.3 Site opportunities and constraints

A number of site opportunities and constraints have influenced the proposed project area at the DPSF site, as shown in **Figure 3**.

Transmission infrastructure

- TransGrid Darlington Point substation location
- TransGrid 330 kV and 132 kV overhead transmission lines and easements
- Essential Energy 33 kV overhead transmission line and easement.

Biodiversity

The biodiversity of the site is dominated by plains grassland habitat with patches of remnant woodland vegetation habitat. The project area of the site is predominantly associated with the plains grassland and has avoided Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed Endangered Weeping Myall Woodland and largely avoided other endangered woodland listed under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act). Biodiversity is further discussed in Section 7.1 of this EIS and detailed biodiversity mapping is shown in **Figure 9**.

Aboriginal heritage

Ten previously unrecorded cultural heritage archaeological sites within the DPSF site were identified during a survey undertaken as part of the Cultural Heritage Assessment Report (CHAR) process. These comprised six culturally modified trees, two earth mound/hearth and modified tree, one earth mound/hearth and one surface artefact scatter.

Topography and Flooding

- The project site is located within the floodplain of the Murrumbidgee River. Site topographical data was used to estimate potential river flooding contours for the site.
- The project layout has been designed to not be impacted by potential River flooding of the site and is also not expected to have an adverse impact on adjacent properties.

Flooding and hydrology is further discussed in Section 7.3, and flood mapping shown in **Figure 19**.

Access

- Access to and from the project is via Donald Ross Drive.

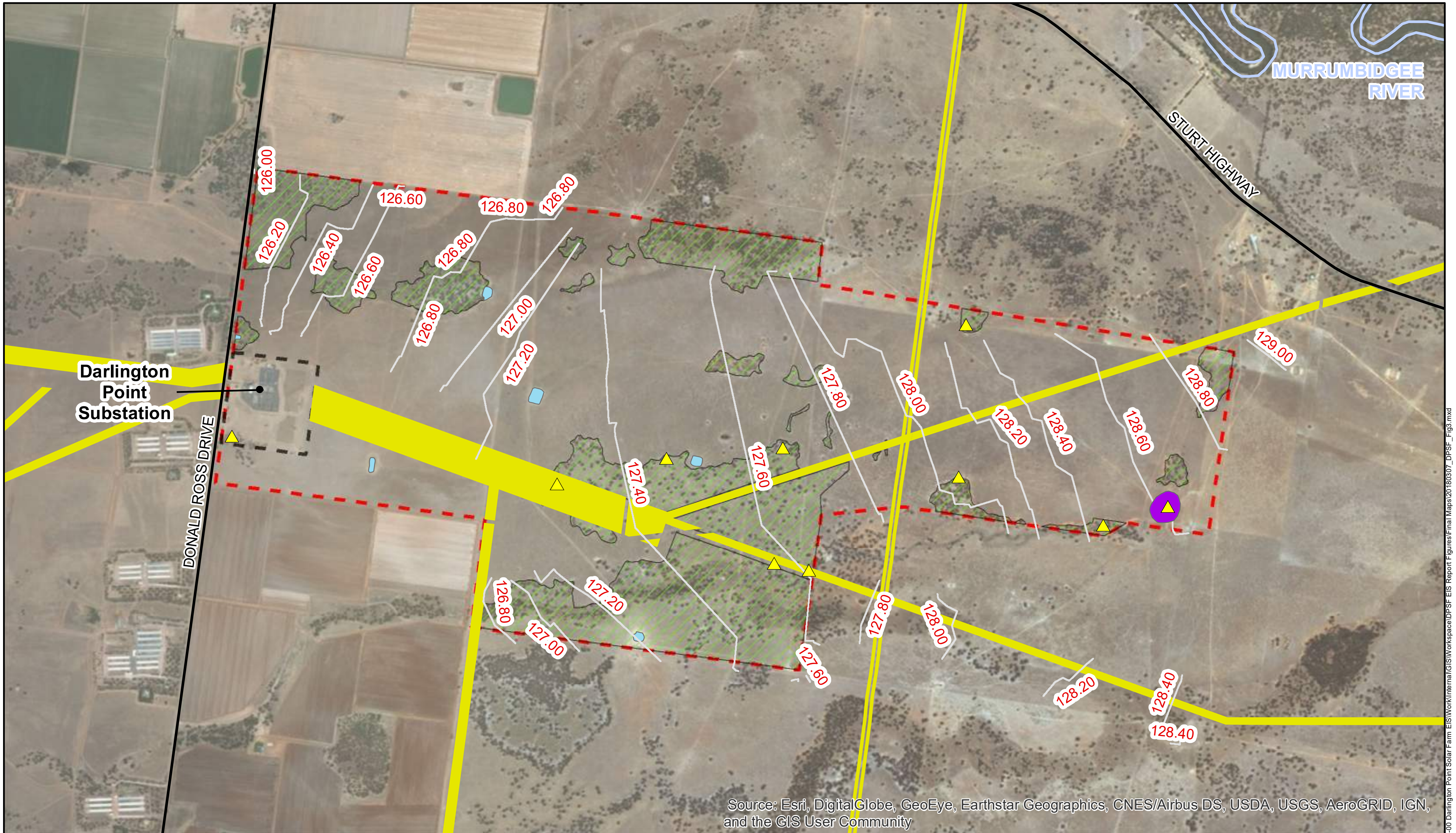
Soils and geology

- Land and soil capability mapping indicated that the site has very slight to negligible potential for acid sulphate soils and the land is capable of sustaining high impact land uses.

Bushfire protection zones

- To manage potential bushfire risk for the DPSF site, Edify Energy will maintain a 20 metre firebreak set back as recommended in RFS guidelines (NSW RFS, 2006), from the site boundary fence-lines and the vegetation and heritage protection exclusion zones.

Design measures taken to minimise environmental impacts have been listed in Section 3.2.5.



Legend

- Archaeological Site
- Archaeological Site Area
- Roads
- Rivers
- Site Contours
- Farm Dams
- Transmission easement
- Vegetation & Heritage Protection Exclusion Zone
- Darlington Point Substation Boundary
- Project Boundary

Edify Energy - Darlington Point Solar Farm

Figure 3 - Site Constraints

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Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:30,000

Metres

0 100 200 400 600 800 1,000

Drawn by: GJH Date: 3/7/2018

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2.4 DPSF description

2.4.1 Site details

The proposed DPSF project is for 275 MW (AC) of solar generated electricity, including the provision for battery technology for energy storage (battery energy storage system – BESS) and resupply during peak demand.

The key features of the DPSF include:

- Photovoltaic (PV) solar panels
- Steel mounting frames with piled foundations
- A single-axis tracking system
- Direct current (DC) / alternating current (AC) inverter stations
- Medium voltage electrical reticulation network (it should be noted that Edify Energy may seek to run a new overhead 33kV transmission line from the far eastern end of the site to the new switchyard. An overhead line in this area will minimise the need for cable trenching and ground disturbance).
- A 33/132kV switchyard and internal switchroom
- A battery yard (BESS facility), consisting of individual power pack cubicles or skid-mounted/containerised power packs and modular inverters and MV transformers, including a connection to the above switchyard.
- Internal access tracks for operational maintenance and housekeeping
- Security fencing
- Staff car park and small amenities building.

These features are all discussed in further detail in Section 2.5.

An indicative layout is shown in **Figure 4**.

The proposed life of the DPSF is 30 years, at which time it will either be decommissioned or continued to operate subject to planning and lease agreements. Decommissioning would involve the removal of all above ground infrastructure, returning the site to its existing land capability.

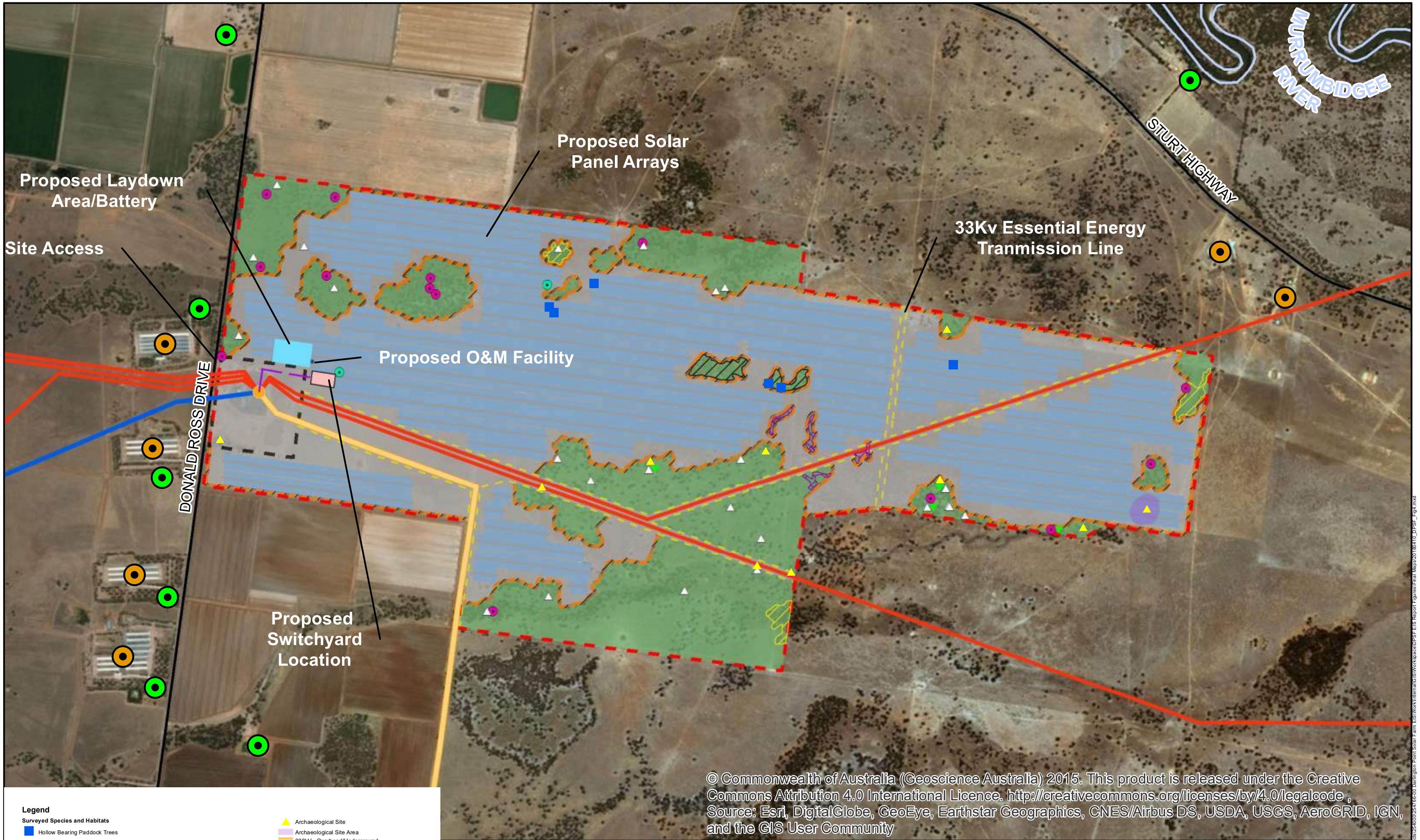
2.4.2 Site survey

A ground survey of the proposed DPSF site was undertaken by PHL Surveyors in July 2017. The survey comprised the following methodology:

- Australian Height Datum (AHD) level datum was determined from adjacent established marks where available.
- Map Grid of Australia (MGA) grid datum was established from a logging file processed by the AUSPOS facility.

- The survey was undertaken using a four-wheel drive mounted Trimble GNSS receiver and consisted of an approximate 60m x 60m grid pattern. Spot levels were undertaken in heavily treed areas due to satellite reception interference. Survey accuracy was in the order of ±5cm in X, Y, and Z.
- A total of 10 control marks were established around the perimeter of the site for future use.
- No survey of the adjacent road or access was undertaken.
- The heights of trees were not accurately determined. An indicative maximum height of trees above ground level were identified for significant tree clumps.
- Lot boundaries were shown using existing boundary fencing for approximate position.

The ground survey data was used to inform the flooding and hydrology analysis undertaken as part of the EIS and to inform the concept design. Topographical contours are discussed further in Section 8.4.2 of the EIS. The flooding and hydrology assessment is provided in Section 7.3 of the EIS.



Legend

Surveyed Species and Habitats

- Hollow Bearing Paddock Trees
- Residential Receiver
- Commercial/Industrial Receiver
- Grey-crowned Babbler
- Grey-crowned Babbler Nest
- Superb Parrot - Flyover
- Superb Parrot
- Endangered EPBC Act - Weeping Myall Woodland
- Endangered TSC Act - Myall Woodland in the Darling Riverine
- Endangered TSC Act - Sandhill Pine Woodland in the Riverina, Murray-Darling Depression
- Archaeological Site
- Archaeological Site Area
- 330kV - Overhead/Underground
- 132kV- Overead/Underground
- Proposed Substation Connection
- Substations
- Roads
- Rivers
- DPSF Project Boundary
- Darlington Point Substation Boundary
- Transmission Easements
- DPSF Project Area
- Vegetation & Heritage Protection Exclusion Zone
- 20m Firebreak

Drawn by: GJH Date: 13/04/2018

Edify Energy - Darlington Point Solar Farm

Figure 4 - Indicative Project Layout

Note:
- Refer to Chapter 8.2 of the EIS for further description on assessment of the sensitive receivers.
- Indicative location of substation connection is to be confirmed during detailed design.
- Indicative arrangement of solar arrays to be confimed during detailed design.

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Datum: GDA 1994

Reference Scale: 1:30,000

Metres
0 125 250 500 750 1,000

2.5 Key design features and components

2.5.1 Solar arrays and mounting frames

The DPSF would consist of a number of solar arrays comprising PV solar panels mounted on steel frames with a single-axis tracking system to follow the path of the sun and optimise energy generation. The arrays would be arranged in a series of long rows, as shown indicatively in **Figure 5**. The rows would be arranged in a north-south alignment and would interconnect to form blocks of circa 5.5 MW (AC).

The steel mounting frames would be installed on driven steel piles and sit above ground level and design flood levels. The maximum height of the panels would be determined during detailed design, however is not expected to exceed 3 m when at the maximum tracking extent.

The exact number of piles will be determined by detailed design studies accounting for the soil conditions and wind loading. It is expected that the total number of piles would be of the order of 150,000.

Figure 5 Example solar array arrangement

Drainage design will be further developed during detailed design, and due to the flat terrain it is not expected that substantive earthworks will be required for the project. Typically, solar farms have limited impact on the natural flow paths for stormwater. Potential flooding and hydrology impacts have been assessed further in Section 7.3.

2.5.2 Inverter stations

Each block of panels would contain an inverter station, similar to the one shown in **Figure 6**. The station would comprise an inverter and a transformer to convert DC to AC and step up the output voltage level. The final number of inverter stations would be determined during detailed design, however preliminary calculations suggest around 55 inverter stations would need to be installed for

275MW facility and would be spread evenly in a grid across the site, and where practicable away from the site boundaries.

A typical inverter container is shown in **Figure 6**. Approximate dimensions for an inverter container are 12.2 metres long, 2.4 metres wide and 2.9 metres high. Inverter containers will be mounted at circa 1 metre above ground level for ease of cable connections and to protect against flooding.

Electrical connections would be constructed between the arrays as well as to associated protection and monitoring equipment and the central inverters.

Figure 6 Example inverter

2.5.3 Electrical reticulation

Primarily, underground electrical cabling would be used to connect the solar arrays and the inverter stations to the DPSF substation.

Underground cables will consist of DC and AC cables with a voltage of typically 1500V and 33 kV respectively. Burial depths would typically vary between approximately 0.3 and 1.2 metres. Cables would be covered by marking tape to prevent accidental damage, and designed and installed to be compliant with AS3000 and other applicable standards.

To optimise the electrical reticulation system, a short section of overhead 33kV may be utilised to connect the eastern portion of the DPSF site with the new 33/132kV switchyard located to the west. This will significantly reduce the amount of ground and vegetation disturbance by avoiding multiple cable trenches. The 33kV overhead line would be mounted on single poles and where practical would run adjacent to the existing power line easements across the site.

2.5.4 Network connection

The DPSF would connect into the existing TransGrid Darlington Point 330/220/132 kV substation, specifically at the 132kV operating voltage and would supply electricity as part of the NEM. A new 33/132kV switchyard, comprising of one or more 33/132kV transformers, switchgear, metering, protection and communications infrastructure would be constructed adjacent to the TransGrid substation and connect via augmentation to the existing TransGrid 132kV overhead gantry.

The connection to the TransGrid substation will make use of an existing spare 132kV bay. Additional electrical switching equipment would be installed within the existing bay.

Works within the TransGrid substation could include installation of an additional 132/330 kV transformer, switchgear and extension to the 132kV bus-bar. Any augmentation works to the TransGrid Darlington Point substation would occur within the current TransGrid substation fence boundary and/or on the adjacent land within the DPSF site.

2.5.5 Access and transport

The DPSF site's primary access point will be via the existing point of ingress on Donald Ross Drive (refer **Figure 4**), albeit modified to comply with council requirements for traffic management. The DPSF site has no other road or street frontage other than from Donald Ross Drive. Truck turning areas and parking for construction workers will be implemented during construction. A temporary laydown area (close to the site access point) will cater for all parking, servicing and manoeuvring of vehicles, and for the delivery and storage of plant and equipment to the site. During operation, a small unsealed car parking area would be located adjacent to the control building.

A secondary, emergency-only, access point will be provisioned in the north-east corner of the site, utilising the existing Tubbo Station internal roads to connect with the Sturt Highway.

A network of internal unsealed roads will provide access to the solar arrays. The location of the roads will be finalised during detailed design, likely utilising areas for firebreaks and existing transmission easements.

2.5.6 Ancillary compounds

A construction compound/site office and temporary laydown area would be established close to the site access point. The construction site office will include office space for approximately 20 persons. Laydown areas would be cleared and compacted for delivery of equipment (ultimately the DPSF laydown area will become the location for the BESS, following completion of the construction of the solar farm).

During construction, the appointed Engineering, Procurement and Construction (EPC) Contractor will be responsible for supplying on-site toilet facilities, consisting of either dry or septic system. Operational facilities will be a septic system. There will not be any direct discharge of sewage on-site.

The DPSF switchyard will be located in close proximity to the existing TransGrid substation, likely to the immediate north or east. The DPSF switchyard compound will be approximately 75m by 75m, and will include a building approximately

20m by 10m in size consisting of a 33kV switchgear room, control room and amenities. A maintenance and storage building, also sized in the order of 20m by 10m, would be constructed. Both buildings will be single storey.

2.5.7 Security

The DPSF site would be fenced around the entire site boundary using a 1.8m chain-wire fence, topped with barbed wire strands. This would be established early in the construction phase.

Security staff would monitor the site on a 24 hour basis during construction with a remotely accessible security system used during operations.

2.5.8 Battery storage

The DPSF project includes the addition of a battery energy storage system (BESS). A 2 ha footprint area has been set aside at the construction laydown area for the installation of the BESS. Given the substantive advances in storage technologies over time, the exact storage capacity cannot be confirmed at this time, however it is anticipated that a circa 100MWh facility would allow the optimisation of the DPSF in the NEM.

The BESS would either comprise multiple individual cubicles each of circa 250kW (which would be directly mounted on a concrete plinth and connected together on-site or skid mounted and pre-commissioned) or otherwise a containerised system of circa 10MW capacity per container. Either option would appear similar, as the individual cubicles would be arranged in such a way as to appear as a single container, however, they contain some technical differences. The preferred means of managing fire risk of a cubicle system is containment; each cubicle is a fire-rated and sealed system which prevents the spread of fire from one cubicle to another and the fire can quickly burn out without a material loss of battery capacity or capital value across the system as a whole. A containerised system has a fire suppression system (typically inert gas or water deluge) to prevent the spread of fire within the container.

Irrespective of the technology deployed, the BESS facility will encompass a surface area of up to 20,000m^2 (~2ha) and include a series of concrete pads, suitably spaced for optimum operations and maintenance and separated by gravel/road-base to assist in fire management. The final decision on the preferred technology provider and detailed technology specification would be confirmed during the detailed design phase of the project, and would comply with applicable Australian standards, licences and codes.

Indicative battery modules would be of the order of 2.5 metres in height. An example battery pack is shown in **Figure 7** below.

Figure 7 Example battery pack

The noise specification sound power levels for the BESS facility are summarised below:

- Powerpack Inverter: <70 dBA at 1 meter
- Powerpack Unit: <82.5 dBA at 1 meter

A series of individual concrete slabs equating to a total of 2,000m^2 would be spaced for ease of installation and maintenance within the 2

The following equipment deliveries would be expected for the battery storage facility:

- Powerpacks and inverter cubicles: a 100MWh nominal facility comprises approximately 970 cubicles, which would be shipped in HC 40’ containers at 10 cubicles per container, equating to 97 deliveries.
- Cubicle transformers: 100MWh nominal facility comprises 20 MW transformer cubicles, which would be shipped at a quantity of 4 per delivery on low-loader flat-bed vehicle, equating to 5 deliveries.
- Cables (to connect MV transformer to the DPSF switchyard): approximately 3 to 5 deliveries via standard truck
- Concrete slab materials: for a 2,000m^2 slab at 0.2m thick, 400m^3 of concrete would be required. Concrete trucks would deliver at 9m^3 per delivery, so 45 concrete deliveries to site would be required. Concrete deliveries would occur during month 1 – 2 of the BESS construction period.

- Crane: staged deliveries via crane, which would involve transit to site four instances across the BESS construction period.
- Earthworks equipment (grader, roller etc)
- Other miscellaneous site construction vehicles
- Personnel, assume 10-20 average, peak 20.

2.6 Construction activities

The timeline for the proposed DPSF is summarised in Table 1.

Table 1 Indicative timeline

Phase	Approximate commencement	Duration
Pre-construction	Late 2018	One month
Construction	Late 2018	12 months
Commissioning	Late 2019	One month
Operation	Late 2019	Approximately 30 years
Construction of battery storage facility	Q3 to Q4 2020	Three to six months
Operation of battery storage facility	Q4 2020	Approximately 30 years
Removal and replacement of batteries	2035	Two to three months
Decommissioning	2049	Approximately six months

A summary of the activities proposed to be undertaken during each phase is provided below. A summary of the proposed construction methodology is detailed in Section 2.6.4 below.

2.6.1 Pre-construction

Prior to construction commencing, a number of activities are proposed including:

- Upgrades to the existing point of access/egress from Donald Ross Drive
- Site fencing
- Site surveys, geotechnical investigations and other preliminary investigations (expected to occur in the first month of the construction program).

2.6.2 Construction

The construction and commissioning phase is expected to be 12 months in duration, and will consist of the following sequence of activities:

- Construction of access roads (clearing and levelling) and drainage
- Establish construction offices and laydown areas

- Slashing and/or removal of areas of non-native vegetation
- Clearing and levelling of the substation and operations and maintenance (O&M) building areas
- Delivery of equipment
- Driving of piles into ground
- Construction of foundations for the substation and inverter stations
- Installation of underground cables
- Assembly of tracking system and frames on top of driven piles
- Installation of modules on frames
- Installation of inverter stations on foundations
- Installation of substation switch-room and electrical equipment
- Electrical connection of cables
- Remove construction facilities and site tidy up.

An indicative construction program is shown in Table 2.

Table 2 Indicative construction timeline

Activity	**Month**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Site surveys/ geotechnical												
Construction of compound, access roads and drainage												
Piling												
Underground cables												
Assembly of frames												
Installation of modules												
Substation installation												
Electrical connection and commissioning												

Construction of the BESS facility would follow immediately after the 12 month solar farm construction period, and would run for a period of 3 to 6 months (e.g. Q3 to Q4 (August to December) 2020).

During the construction phase of the solar farm, and then the BESS facility, standard daytime construction hours will be adopted on site:

- Monday to Friday: 7 am to 6 pm
- Saturday: 7 am to 1 pm

In general, no construction activities will occur over night, on Sundays or public holidays, however, exceptions to these hours may be required on limited occasions; for example:

- The delivery of materials as requested by the NSW Police Force or other authorities for safety reasons and/or to minimise disruption to local traffic;
- Augmentation works to the TransGrid substation, which may require a temporary power outage, such that the impact on power supplies to the local community is minimised; and
- Emergency work to avoid the loss of life, property and/or material harm to the environment.

The local council, surrounding landholders and other relevant authorities will be notified of any exceptions prior to the works being undertaken.

2.6.3 Construction resourcing and equipment

Labour resourcing

During the peak construction period of the solar farm (approximately months 5-8), it is expected that the construction workforce would be approximately 300 personnel. The total resource-hours required is anticipated to be approximately 400,000 hours. The vast majority of construction supervisors and the construction labour force are expected to be hired locally.

For non-local construction workers, it is anticipated the majority will be accommodated within the local region, including Darlington Point, Coleambally and Griffith. The EPC Contractor would be responsible for developing a construction traffic management plan including providing suitable transport (e.g bus transfer) to and from the construction site to minimise traffic volumes and transit risks during construction.

For the construction of the BESS facility, it is expected that 10 to 20 personnel, reaching a peak of 20 personnel, would be required over the 3 to 6 month period.

Machinery and equipment

Equipment used during construction of the DPSF is expected to include earthmoving equipment such as excavators, bulldozers, pile drivers, backhoes, compactors, rollers and graders. A cable trencher and post driving equipment will also be used.

Trucks will be used to deliver construction equipment and components to site, while materials handling equipment such as small cranes and forklifts will manoeuvre equipment around site. A water truck will be used for dust suppression purposes during construction.

The majority of the equipment is expected to be shipped to major ports in Melbourne, Sydney or Wollongong and transported to site via road.

For the construction of the BESS facility, construction equipment would include earthmoving equipment (e.g. grader, roller), crane, and miscellaneous site construction vehicles. Details of the deliveries to the site are summarised in Section 2.5.8. The majority of the equipment and deliveries are expected to be shipped to major ports in Melbourne, Sydney or Wollongong and transported to site via road.

Materials

It is estimated that approximately 15,200 m^3 of gravel would be required for access tracks. Gravel for access tracks is expected to be sourced locally. Table 3 provides details of resource quantities required for the project's construction, however these quantities are subject to change during the detailed design phase.

Table 3 Resource quantities for the DPSF

Resource	Quantity
Gravel for access tracks	20,000 m^3
Sand (back-filling trenches)	4,500 m^3
Concrete – foundations of substation, and O&M building	500 m^3
Concrete for fence footings	4000 m^3
Concrete for the BESS facility slab	400 m^3
Metal (components for mounting system, delivery system containers, fencing, site buildings, transmission line poles	60,000 tonnes
Glass for panels	17,000 tonnes
Silicon for crystalline wafers	3,000 tonnes
Water during construction	750,000 kL total

Table note: The above quantities represent preliminary estimates of the resources required. Final quantities will be determined during the detailed design phase of the project.

It should be noted that construction water use will be minimal and mainly used for dust suppression on unsealed roads. Actual use would depend on weather and ground conditions. Potential sources would be existing onsite dams and truck delivery sourced from local recycled sources where available.

During construction, power will be sourced from the local network or via generators.

2.6.4 Construction methodology

This construction methodology is indicative of the staging that will be implemented at the DPSF site. Some activities may occur in parallel, particularly given the size of the DPSF site, however, the following methodology is indicative of construction sequencing and vehicle movements. The photographs in the below section were taken during the recent construction of other Edify Energy solar farm projects in Australia, built using the same construction practices as will be deployed at the DPSF site.

Stage 1 – Enabling works

The following activities would be undertaken as part of the enabling works:

- For the establishment of the site access and laydown area, some minor earthworks may be required.
- Clearing and grading of perimeter access roads (within the 20m firebreak areas) will occur, along with the establishment of internal access roads.
- Installation of the security perimeter fence – steel posts will be either direct driven or drilled and grouted (vehicle mounted diesel/electric auger). Wire-mesh rolls at various points along the fence line will be rolled out and manually wire tied to posts. Note: As the fence line runs along the outside of the perimeter road, all fence construction activity and vehicle movements are within the road corridor.

The above areas impacted by site access, laydown area, firebreak and access roads are accounted for within the direct impact assessment at 100% impact for biodiversity calculations.

Stage 2 – Substation benching

Bulk earthworks will be undertaken to construct a flat, compacted and raised (above 1-in-100 year flood event) bench for the new DPSF 33/132kV switchyard. This will require the use of graders, diggers, haulage trucks and rollers. Note: The switchyard area is only 70 x 40m and situated directly off the main solar farm access road, just inside the site boundary. This area has been assessed as a 100% direct impact for biodiversity calculations.

Stage 3 – Piling

Piling requires the grass to be close cropped via mowing to approximately 100-200mm to allow the posts to be set out within allowable tolerances. Set-out is achieved manually, on-foot, via portable laser alignment and pin markers (e.g. coloured nails) are driven into the ground to indicate the position of each individual pile. Steel posts are delivered by wheeled forklift and set down proximate to each pin marker pending installation. This requires a single pass along each row by the delivery vehicle and posts are manually unloaded by hand. A tracked pneumatic/hydraulic piling rig moves along each row, with each pile being manually lifted into position by two labourers and driven to the required depth, checking for alignment throughout via laser situated at the end of the row.

The piling rig moves once along each row, installing piles sequentially and then proceeds back along the neighbouring row, such that there is only one pass per row. The DPSF site may have 10-15 piling rigs working in sections across the site, with the total piling programme taking approximately 4 months.

Due to the nature of the piling work, it will not be undertaken in wet weather conditions or on wet ground, to minimise impacts to ground cover, and each row is only traversed twice in the process – once during pile delivery and once during install.

Photograph 1 and Photograph 2 show examples of the level of mowing required for pile set-out, the piling process and grassland rehabilitation immediately after completion of piling.

Photograph 1 Examples of piling process and grassland rehabilitation post-piling

Photograph 2 Regenerating grasses in piling set-out area

Stage 4 – Cabling

DC cables, which run from combiner boxes at the end of each row to the inverter station servicing each block of panels, are laid in trenches approximately 0.9m deep and dug by a compact trench digger. DC cables are laid manually by hand, from rolls of cable delivered to and stored on pallets at various laydown locations near each inverter station. DC cable trenches run along the edge of the internal roads, within the cleared road corridor.

The larger AC cabling from the inverter stations to the 33kV switchroom is laid via a cable laying machine, which trenches and lays cable simultaneously. All cabling runs within the cleared road corridors.

Stage 5 – Tracker install

The tracking system is delivered to a central laydown area, near the site entrance, unpackaged and deposited at strategic locations around the site by wheeled forklift.

Some sub-assembly occurs in situ, by hand, and then six tracker sections are loaded onto a wheeled, all-terrain forklift. This forklift positions itself at the first row and the first section of tracking system is lifted into place and manually bolted into position. It then reverses to the adjacent, neighbouring row and also installs the first section on this row, continuing the process up to six times. The second section of the tracker is then loaded, the forklift moves down the row and installs the second section along each of the six rows, and so on until the tracker system is complete along the entire row length. The process then continues on the next six rows and so on.

As such, each row is only traversed once by wheeled rather than tracked forklift, in a perpendicular direction to the travel by the piling rigs, during the tracker install. As this occurs sometime after completion of piling, it is expected that grasses will have regrown by this time and impacts on ground cover are minimal (as shown in Photograph 3 below).

Following tracker install, the torsion bar prevents vehicular access between rows and the linked drive shaft prevents vehicular access along each row.

Photograph 3 Tracker installation

Stage 6 – Module install

PV modules are delivered to the central laydown area and as with the tracker systems, unpacked, delivered by wheeled fork-lift on pallets to each row and deposited at the end of each row or in some instances, pallets may be deposited at staged locations along the row. Panels and DC harnesses are manually carried into position along each row and installed by hand (refer Photograph 4). Other than delivery of the panels, there is no vehicular traffic along the rows during module install.

Stage 7 – Inverter install

Where possible, inverters are delivered by side-lift trucks and placed directly onto the footings. If access requires otherwise, inverters are delivered by conventional low-loader and craned into position. Note: An allowance of 2x the inverter footprint has been made within the direct impact assessment for biodiversity calculations to account for the 'hard-stand' area required by truck/crane.

Photograph 4 Module installation

Stage 8 – Switchyard construction

Bulk items for the switchyard, such as transformers and circuit breakers etc, are delivered on specialist transportation and immediately craned into place (refer Photograph 5). All construction activities will occur within the switchyard compound perimeter fence, which is located on the main internal access road and proximate to the main site entry. The switchyard area has been assessed as a 100% direct impact for the purpose of biodiversity offset calculations.

Photograph 5 Indicative switchyard works

Stage 9 – Commissioning

Commissioning will be largely undertaken remotely from the main control room. Some site works may be required for attendance at inverter control panels, and diagnostic checking of the arrays with hand-held multi-meters. This is undertaken by light vehicle using the internal access tracks, with some foot traffic only, between the arrays.

Photograph 6 and Photograph 7 shows examples on other Edify Energy sites of the grassland rehabilitation that typically occurs between and under panels approximately 2 to 4 weeks after completion of the construction of solar arrays.

Photograph 6 Example of grassland rehabilitation between and under panels within 2 to 4 weeks after completion of construction of solar arrays

Photograph 7 Example of grassland rehabilitation 2 to 4 weeks after completion of solar array construction

Methodology summary

In summary, the majority of vehicle movements involved in the construction of the solar farm terminate at the site entrance/laydown area. The majority of vehicular traffic onsite is by light vehicle (e.g. ute) and restricted to internal access tracks only. The notable exceptions are during piling and the tracker install, when tracked piling rigs and wheeled forklifts will traverse the grasslands along and across each row. However, this is limited to only a handful of vehicle movements (pile deliver, piling and tracker install).

2.7 Operational activities

2.7.1 Operational hours

Operational activities will include daily operations and maintenance. Daily operations and maintenance activities by site staff would be undertaken during standard working hours of:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm.

With the exception of emergencies or major asset inspection or maintenance programs, night works or work on Sundays and public holidays would be minimised. There would be no permanently lit night lighting installed within the array, but lighting may be included in each inverter station for maintenance purposes. There would also be maintenance lighting installed at the switchyard that would only be used in case of emergency, and security lighting at the operation and maintenance building. All lighting would be designed to reduce disturbance to neighbouring properties and would be utilised only when there are staff on site or during emergency situations.

The PV solar panels will operate during daylight hours, seven days per week, 365 days per year. During summer months, the solar farm may continue to produce electricity after 6pm and prior to 7am while the days are longer. In the case that the panels installed are single-axis trackers, the tracker units would potentially operate outside standard working hours during summer months.

2.7.2 Operational activities

A total of five full-time maintenance staff would be employed during operation and it is expected that they would only drive light-vehicles to and from site. Typically, maintenance staff would attend the site most days to undertake routine maintenance such as electrical repairs, module cleaning and replacement, and vegetation management.

Vegetation management would likely include the following activities:

- Management of vegetation in accordance with the fire management and biodiversity management plans (eg slashing or similar).
- A maintenance program to address any bare areas that develop, by seeding or armouring (eg jute mesh) to avoid erosion

Operational water use will be minimal. Water would be required for staff amenities at the O&M building and for panel cleaning. Requirements would be minor, but is dependent on the weather. Where water is required, it would be sourced locally and trucked in to site.

In addition, contractors may be engaged to undertake specific tasks from time to time.

On commencement of operation of the solar farm, the construction of the BESS facility would commence, running for a period of 3 to 6 months (e.g. Q3 to Q4 (August to December) 2020).

It is expected that approximately 10 to 20 personnel, reaching a peak of 20 personnel during the 3 to 6 month period, will be working on site (in addition to the 5 operational staff for the solar farm). Expected deliveries to site for the BESS facility are summarised in Section 2.5.8 above.

2.7.3 Operational methodology

During operations, there will be negligible traffic between the solar panels. Periodic light vehicle access along the site perimeter and along internal access roads (but not between panels) would be undertaken by maintenance workers to check for general integrity and security at the site. Drone flyovers will also be used for the same purpose, operated remotely from the control room.

The solar farm system is highly automated, so any diagnostics will be done via the SCADA system (which computes down to 3 x inverter strings, approximately 90 panels) and any discrepancy is between neighbouring strings that suggests a loss of performance (e.g. broken panel, short circuit etc) is investigated. If there are no concerns, there would be no activities undertaken in the field. Should any further investigations be required, they would be done on foot, as the technicians need to multi-meter each panel and check each cable connection.

The maintenance of the tracking system would be inspected and maintained on foot. Given the mechanics (drive shaft) runs perpendicular to the panels and inspections are undertaken perpendicularly across each row, the use of a light vehicle would be hindrance to the maintenance crew, taking much longer to drive into and out of each row to inspect the tracker mechanism. Therefore, only 2 vehicle movements between each row per year would be undertaken for panel washing as needed. The vehicle movements during solar farm operations would therefore be comparable to current duties for farming practices.

2.8 Decommissioning

The expected life of the DPSF is 30 years. The BESS facility's life is specified for 15 years, so it is likely that the battery cubicles would be removed and replaced at year-15, and that the facility would operate for another 15 years up to the DPSF's expected life of 30 years. For the replacement of the battery cubicles at year-15, approximately 90 to 100 deliveries over a 2 to 3 month window would occur. No changes to the concrete slab, cables and transformers would be expected.

At the end of the 30 year period, the project area would be decommissioned or there may be options to extend the life of the plant.

Decommissioning would involve the removal of all above ground structures from the site, such as modules, racking, piles and inverters. Key elements of project decommissioning would include:

- The solar arrays would be removed, including the piles. Materials would be sorted and packaged for removal from the site for recycling or reuse. Solar array panels would be recycled where possible.
- Battery cubicles, cables and transformers would be removed.
- All site amenities and equipment would be removed and materials recycled or reused, where possible.
- Cabling would be removed where practical and recycled (infrastructure at least 500 mm below the ground may be left in place). This would enable a greater opportunity for agricultural activities to continue over the top once restoration is complete.

In terms of the site control room, concrete slab for the BESS, gravel on access tracks, and fencing on site, consultation would be undertaken with the land owner as to whether the buildings and fences would be of value to the ongoing use of the land (possibly for agricultural purposes). This would be agreed through consultation with the landowner prior to finalising decommissioning.

Workforce resources and traffic generated by the decommissioning is anticipated to be similar in type but of shorter duration than that required for the construction phase.

Should there be the potential to upgrade the solar infrastructure to extend its operational life, panels, tracking structures, and battery cubicles would likely be replaced with the latest technology at the time. Piling would need to be assessed for structural integrity as well as compatibility with the latest modules and could be retained or replaced. However, the works would be determined closer to the end of the DPSF's operational life, and does not form part of the proposal assessed in the EIS.

A decommissioning management plan would be developed prior to the commencement of decommissioning, in consultation with the landowner. The decommissioning plan would include:

- Rehabilitation strategies and objectives
- Timeframes for rehabilitation
- Indicators that guide the land back to agricultural production
- Infrastructure (if any) agreed to remain in place
- Monitoring and mitigation measures.

3 Project need and options considered

3.1 Strategic need

The DPSF project supports the following Australian and New South Wales Government strategic objectives:

3.1.1 Australian renewable energy target

The large-scale renewable energy target (RET) is an Australian Government policy which commenced in 2001 to ensure that at least 20% of Australia's electricity consumption comes from renewable sources by 2020. Following review, the RET was confirmed in early 2015 as 33,000 gigawatt hours (GWh) by 2020. To meet the RET, around 6,700 GW of new renewable energy capacity is needed.

3.1.2 COP21 commitments

At the COP21 climate talks in Paris in December 2015, the Australia Government committed to (and has now ratified) an emissions target of a 26-28% reduction by 2030 compared to 2005 levels. Prime Minister Malcolm Turnbull announced at the end of 2016 that the Australian climate and energy policies will be reviewed this year (2017) to make sure the 2030 targets are met.

3.1.3 NSW Renewable Energy Action Plan

The NSW Renewable Energy Action Plan 2013 supports the achievement of the national target of 20% renewable energy by 2020. The Plan positions NSW to increase the use of energy from renewable sources at least cost to the energy customer and with maximum benefits to NSW.

The Renewable Energy Action Plan comprises 24 actions to achieve the three goals of:

- Attract renewable energy investment and projects
- Build community support for renewable energy
- Attract and grow expertise in renewables.

3.1.4 NSW Climate Change Policy Framework

The NSW Government has also developed a NSW Climate Change Policy Framework 2016 in support of Australia's COP21 commitments and to demonstrate action on climate change. The NSW Climate Change Policy Framework is still in its infancy (published October 2016), however long term objectives include achieving net zero emissions by 2050, and enabling NSW to become more resilient to a changing climate. This includes implementing emission savings policies and taking advantage of opportunities to grow new industries in NSW, such as ‘advanced energy’, including combined renewables and storage.

3.1.5 Security of supply

In Australia, energy security is defined as “the adequate, reliable and competitive supply of energy to support the functioning of the economy and social development” (Australian Government, 2011). A National Energy Security Assessment (NESA) carried out in 2011 found that while Australia’s energy security was deemed ‘moderate’, significant amounts of new capacity would be needed over the medium to long term to compensate for the retirement of emissions intensive coal plants and to help achieve emissions reduction targets.

3.2 Options and alternatives

The DPSF development process has considered the following options:

- A ‘do nothing option’
- Different technology options
- Alternative sites
- Different generating capacities.

The options are discussed below and have been considered against the proposal objectives identified in Section 2.1.

3.2.1 ‘Do nothing’ option

The ‘do nothing’ option would not help achieve the strategic goals and targets set by the Australian and NSW governments around renewable energy, climate change and emissions, as listed in Section 3.1 above.

Any environmental, heritage or social impacts associated with construction and operation of the DPSF would not occur under a ‘do nothing’ option. However given these would be minor, manageable and offset where feasible, the economic and overall strategic benefits of the project (see Section 3.1 and 3.3) mean the do nothing option is not the preferred option.

3.2.2 Technology options

Different technology options are available for the DPSF, including:

- Thin film or polycrystalline solar panels
- System mounting: Fixed tilt, single axis tracking, or dual axis tracking modules

Solar panels

The DPSF proposes to use polycrystalline silicon solar panels. Crystalline silicon panels are popular internationally due to their performance, durability and cost. In comparison, thin film solar panels are not as efficient and are generally more costly to install.

Polycrystalline silicon solar panels are the preferred technology for the DPSF project, however, a final decision between polycrystalline solar panels and thin film solar panels would be confirmed during the detailed design phase.

System mounting

The difference between the mounting systems options include:

- Single axis tracking – follows the sun as it moves across the sky through the day from east to west. It is called single-axis tracking as the mechanism only rotates in one plane around a single axis (Solar Choice, 2017).
- Dual axis tracking – follow the sun completely using two axes of rotation to allow the tracker to position the solar cells directly perpendicular to the sun's ray all the time (Solar Choice, 2017).
- Fixed tilt – fixed mounted solar panels are held in a fixed position, however their productivity is compromised when the sun passes to a less than optimal angle.

Out of all mounting options, fixed tilt has the smallest footprint and requires slightly less maintenance, however results in the least energy output. Between the two tracking options, single axis is less complicated and therefore less expensive. It is also structurally more rigid and stable, however has a slightly lower output than dual axis tracking.

At this stage of development, single axis tracking modules are preferred to take advantage of the good solar resource and maximise output energy over a longer period each day, including generating large volumes of power during the late afternoon summer peaks when demand on the NEM is at its greatest. However, the comparison between fixed tilt and axis tracking technology would be further assessed during detailed design to understand costs and potential energy yields across the site.

3.2.3 Alternative sites

Darlington Point enjoys a favourable solar resource and is considered an ideal location for the connection of a large scale solar project into the NEM. The Darlington Point substation has been nominated by TransGrid as a favoured transmission node for the connection of new renewable energy generation (TransGrid, 2016) and is one of only a small number of transmission nodes in rural/ broadacre NSW with exceptionally large grid capacity to support a large development. Connection to the grid at the strategically identified nodes will assist TransGrid address the challenges being faced across its network with the increase of decentralised renewable energy sources.

Being directly adjacent to the TransGrid Darlington Point substation, the site proposed for DPSF was consciously selected by Edify Energy to make use of historical grazing land that is in part being retired, and to limit the extent of additional transmission easements and infrastructure impacting a wider number of properties in the area. It was considered prudent that development at this site would save utilising arable land in the high-value Coleambally Irrigation Area and Murrumbidgee Irrigation Area.

Edify Energy has secured agreements to purchase Lot 160 of DP 821551 (the Anderson property) adjoining the existing Darlington Point substation on 3-sides, and to lease land to the east from the adjoining Tubbo Estate.

Other properties proximate to the Darlington Point substation, as shown in **Figure 8**, were investigated for their suitability and availability as alternative sites for the DPSF. As the proposed DPSF is located on grazing land with native grassland coverage, the basis of the alternative site investigation was to determine whether suitable sites were available on an alternative land use such as arable cropping land. As outlined in Table 4 below, Edify Energy's discussions with adjacent landowners did not yield any arable land within a feasible radius of the Darlington Point substation as being available, commercially or otherwise, for lease or purchase.

The proposed DPSF site was selected due to:

- Proximity to the Darlington Point substation, eliminating the need for additional overhead transmission easements and replication of costly infrastructure
- Access to large areas of flat, open terrain historically used for grazing, reducing the need for vegetation clearing, major earthworks and site preparations
- Favourable solar resource with an annual average of 7.8 hours' sunshine a day
- Excellent road access to the site off Donald Ross Drive, via the Sturt Highway and/or Kidman Way, which allows easy supply of plant and equipment during construction
- Positive support from landowners, neighbours and the Murrumbidgee Shire Council
- Lack of alternative brownfield or cropping sites available within close proximity.

Darlington Point has been identified by TransGrid as a preferred node with large capacity for additional connections and the region has favourable solar resource. Being adjacent to the substation, the proposed DPSF site is considered to be the optimum site for electricity generation to connect to the Darlington Point node and meets the primary key criteria for large scale solar site selection (NSW Government, 2017).

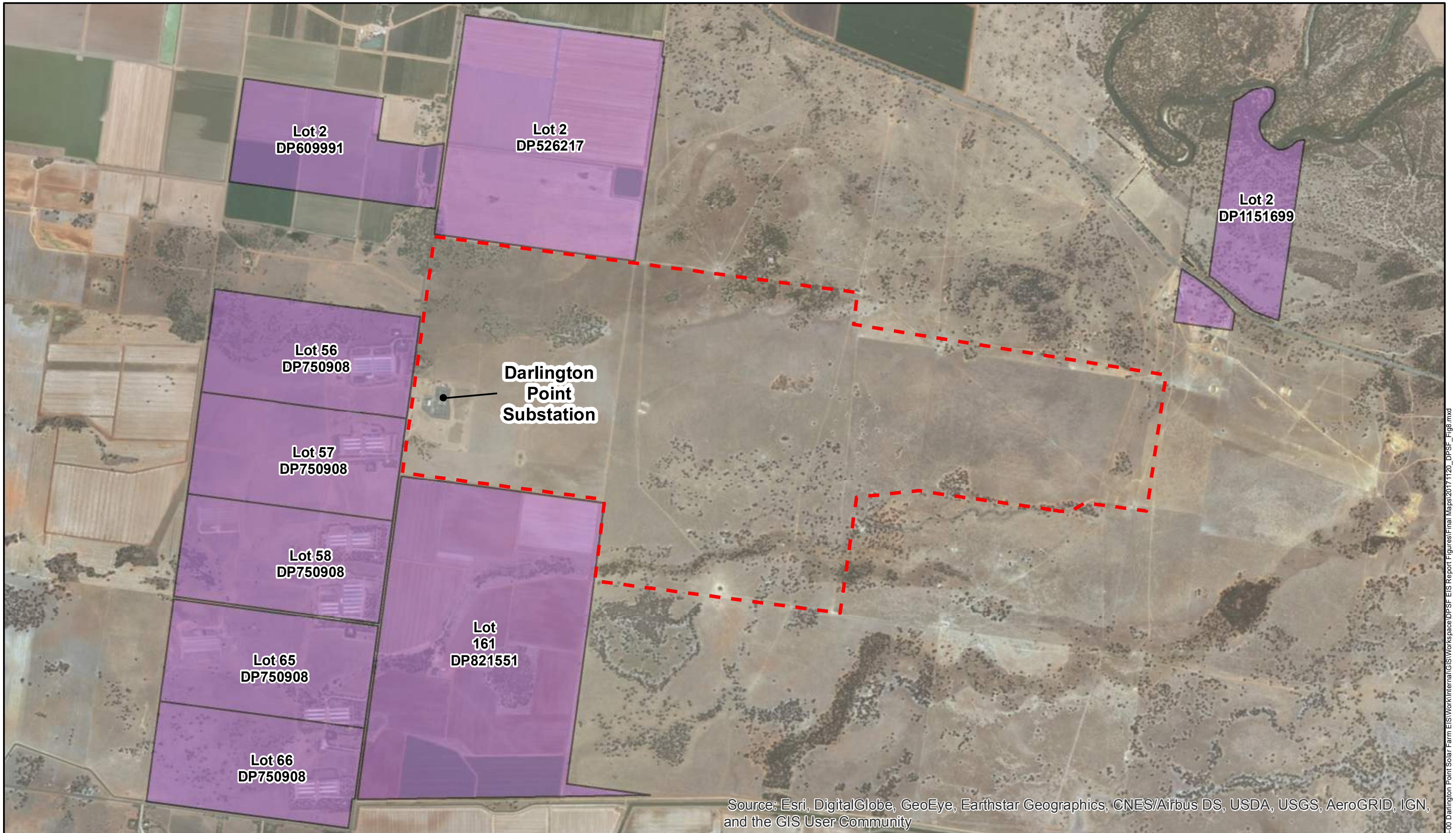
Whilst the DPSF site meets the primary key criteria for large scale solar site selection (NSW Government, 2017) as outlined above, the development of the site would impact the native grassland vegetation of the site. A number of properties in close proximity to the existing Darlington Point substation were investigated for their suitability and availability as alternative sites for the DPSF. As the proposed DPSF is located on grazing land with native grassland coverage, the basis of the alternative site investigation was to identify any available alternative sites devoid of native vegetation, such as arable cropping land or other brownfield developments.

Edify Energy undertook discussions with adjacent landowners during the site selection and feasibility phase and did not identify any arable or brownfield land within a feasible radius of the Darlington Point substation as being available, commercially or otherwise, for lease or purchase.

Notwithstanding the above and albeit with limited land alternatives proximate to the Darlington Point substation, Edify Energy has intentionally overlooked areas of high-value agricultural production within the Murrumbidgee and Coleambally Irrigation Areas, as it is considered counter-intuitive to displace material food crops with renewable energy facilities. Such an approach would be highly likely to attract significant community concerns as has been evident at other proposed solar farm projects on productive arable lands in North Queensland and the Murray River region.

Edify Energy will be the long-term equity participant and asset manager of DPSF and retaining community support is vital to the success of the project. The DPSF site enjoys local land owner support, good neighbourly relations (including with nearby food producers), and the unanimous desire of the Murrumbidgee Shire Council and local Member of NSW Parliament to see the project approved and implemented.

Therefore, in selecting the DPSF site and progressing with the development of the project, Edify Energy has sought to achieve a balanced outcome, considering the limited but manageable impacts on the Riverine Plains Grasslands in parallel with the strong community support and significant social and economic benefits the project will bring to the Darlington Point community.



Legend

Project Boundary

Alternative Sites

Edify Energy - Darlington Point Solar Farm

Figure 8 - Alternative Sites Considered

ARUP
Level 4, 108 Wickham Street
Fortitude Valley, QLD 4006
Tel +61 (7)3023 6000 Fax +61 (7)3023 6023
www.arup.com

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:40,000

Metres

0 125 250 500 750 1,000 1,250

Drawn by: GJH Date: 22/12/2017

Path: \\global.arup.com\australasia\SYD\Projects\254000\254766-00 Darlington Point Solar Farm EIS\Work\Internal\GIS\Workspace\DPSF EIS Report Figures\Final Maps\20171120_DPSF_Fig8.mxd

Table 4 Alternative sites for the DPSF

Property	Comment
Lot 161 DP 821551 (Cadorin property)	Not available for lease or purchase.
Lot 2 DP 526217 (Cavaso property)	Agricultural land on this property may be available. However, this land is not contiguous with the Darlington Point substation and contains a crown land easement. As such, any potential development would likely require a transmission easement along Donald Ross Drive which would likely impact threatened vegetation at the north eastern portion of the Anderson property, which development on the Anderson property could avoid by connecting directly into the substation. A Crown land easement is located on the southern boundary of this property.
Lot 2 DP 609991 (Filmer property)	This property is over 2 km away from the Darlington Point substation, which would require a transmission easement across and along Donald Ross Drive, potentially impacting threatened vegetation at the north east of Anderson property.
Tubbo Estate (east)	The remainder of the Tubbo Estate is of a similar nature containing native grasslands and does not offer an alternative to the current DPSF lease option.
Baida poultry farms	This property has not been previously cleared and from aerial photography appears likely to also contain native grasslands, so would offer no benefit as an alternative site. Further, this property is currently utilised for an ongoing, viable commercial operation which adheres to strict biosecurity practices, and hence easements across this site from private development are unlikely to be easily agreed with this site.
Other	Broadacre cropping land occurs some 7 km west of the Darlington Point substation. TransGrid would not allow a tee-connection into the transmission lines in such close proximity to an existing substation, as such any development in this area would be required to obtain easements for a new transmission line back to Darlington Point substation. This incurs the same issues to those identified above, whilst also directly impacting on the Coleambally Irrigation arable lands.

3.2.4 Generating capacities

An in-feed capacity study undertaken by Jacobs in April 2017 confirmed with reasonable certainty that 275 MW AC can be accommodated via a connection to 132 kV transmission infrastructure at the Darlington Point substation. The exact method and point of connection is being developed in conjunction with TransGrid in parallel with this planning application and the detailed infrastructure layout developed during detailed design will confirm the generating capacity of the DPSF.

3.2.5 Preferred option and design refinements

In line with the proposal objectives, the preferred option, as described in Section 2, would produce a commercially viable development which supports the Australian and NSW governments' strategic goals and targets around renewable energy, climate change mitigation and emissions reduction. It has the support of the local council and community and would employ technologies to maximise energy generation and supply to the NEM, including during peak periods.

The following project refinements have been included in the preferred option:

- Site location and layout to minimise distance and impact of additional overhead transmission lines
- Site layout and design (ie panels to be above existing flood level) to minimise impact to river flood flow regime. On-site or offsite impacts are not anticipated
- Development of a Biodiversity Management Plan and ongoing grassland monitoring for the site to manage biodiversity impacts for the project
- Site layout designed to avoid key ecological and heritage constraints. These areas have been identified as Vegetation and Heritage Protection Exclusion Zones.

3.3 Proposal benefits

Construction and operation of the DPSF would provide the following benefits:

- Contribution of approximately 275 MW AC producing some 577,000 MWh to the Australian RET
- Provision of a clean energy source, with enough power to supply around 130,000 homes each year for 30 years through the NEM (based on typical NSW household electricity consumption specified by Origin Energy in 2016) (Origin Energy, 2016)
- Assisting the RET and Paris Agreement obligations, as well as NSW's own transition to net zero emissions and accelerate advanced energy technology, including battery storage to firm otherwise intermittent renewable energy generation.
- Provision of around 300 jobs during peak construction and about five full-time jobs during operation, with an emphasis on local content amounting to circa 42% of capital deployed.
- Potential for direct and indirect investment into the Murrumbidgee Shire during construction.
- Edify Energy's development intent is to maximise direct benefits to the local community. Opportunities for additional community benefits would be further explored throughout the planning and development process.
- Unlocks available connection capacity in TransGrid's Darlington Point node, which is identified by TransGrid as a robust node with large capacity for

additional connections (TransGrid, 2016). There are no alternative brownfield sites (without native vegetation) within reasonable proximity to the TransGrid substation. Therefore, the proposed DPSF site is considered the optimal location for renewable energy generation at the Darlington Point node and meets the primary key criteria for large scale solar site selection (NSW Government, 2017).

It is considered that proceeding with the DPSF project would result in a balanced outcome with significant economic and social benefits, alignment with climate change and energy policy objectives for renewable energy development, and with manageable environmental impacts, which are described throughout this EIS.

The consequences of not undertaking the DPSF project would include the loss of significant economic and social benefits to the Darlington Point region. This would be a lost opportunity for large scale renewable electricity generation feeding into the NEM at Darlington Point, given the lack of other alternative, suitable, and available sites at this node.

4 Statutory and planning framework

4.1 *Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* (EP&A Act), Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) and associated environmental planning instruments (including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs)) provide the framework for the assessment of environmental impacts and approval of development in NSW.

The DPSF project is State Significant Development (SSD 8392) and subject to approval under Part 5.1 of the EP&A Act.

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

State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) identifies development that is classified as State Significant Development (SSD) or State Significant Infrastructure (SSI). Clause 20 of Schedule 1 of this SEPP states that the following is considered SSD:

Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:

a) has a capital investment value of more than $30 million, or

b) has a capital investment value of more than $10 million and is located in an environmentally sensitive area of State significance.

As the DPSF will have a capital investment cost estimate of more than $30 million, the proposal classifies as “State Significant Development” and is subject to assessment under Part 4 of the EP&A Act.

SSD projects are major projects that require preparation of an EIS in accordance with the bespoke project SEARs, and approval from the Minister for Planning and Environment. The SEARs outline the guidelines for coverage of issues associated with the DPSF and are summarised in Table 8.

SSD matters for consideration under the EP&A Act

Section 89H of the EP&A Act provides that section 79C applies to the determination of Das for SSD. Under Section 79C of the EP&A Act, the consent authority is required to consider a number of matters when determining a DA under Part 4. These matters are listed in Table 5 and assessed in terms of their relevance to the DPSF.

Table 5 SSD Matters for Consideration

Provision	Relevance to the DPSF
Any environmental planning instrument	Relevant environmental planning instruments (EPIs) are discussed in Section 4.1.
Any proposed instrument that is or has been the subject of public consultation under the EP&A Act and that has been notified to the consent authority	This is not applicable to the DPSF as there are no draft instruments relevant to the proposal.
Any development control plan	Murrumbidgee Council has a number of development control plans, however, these do not apply to the DPSF location. Also, clause 11 of the SRD SEPP provides that development control plans do not apply to SSD.
Any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F	There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the proposal.
The regulations (to the extent that they prescribe matters for consideration)	Clause 92 of the EP&A Regulation requires consideration of: - the Government Coastal Policy, for development applications in certain local government areas; and - the provisions of AS 2601 for development applications involving the demolition of structures. Neither of these matters are relevant to the DPSF.
Any coastal zone management plan (within the meaning of the *Coastal Protection Act 1979*), that apply to the land to which the development application relates	Coastal zone management is not applicable to the DPSF.
The likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	The likely impacts of the DPSF, including environmental impacts on both the natural and built environments, is discussed in Sections 7 and 8 of this EIS.
The suitability of the site for the development	The suitability of the site for development of the DPSF is discussed in section 3.2.3 and 3.3.
Any submissions made in accordance with this Act or the regulations	Public submissions would be sought and responded to as part of the EIS determination process. Edify Energy would consider and respond to any submissions made in relation to the DPSF proposal in a Submissions Report following the public exhibition period.
The public interest	A number of public benefits have been noted for the DPSF proposal in Section 3.3.

4.1.2 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 34(7) of ISEPP states that development for the purpose of a solar energy system may be carried out by any person with consent on any land (except land in a prescribed residential zone). The DPSF is not located in a prescribed residential zone and is therefore permissible with consent.

4.1.3 State Environment Planning Policy No. 33 – Hazardous and Offensive Development

The State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) defines and regulates the assessment and approval of potentially hazardous or offensive development. SEPP 33 defines ‘potentially hazardous industry’ as:

> *“…a development for the purposes of any 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:*
>
> *(a) To human health, life or property; or*
>
> *(b) To the biophysical environment,*
>
> *and includes a hazardous industry and a hazardous storage establishment.*

‘Potentially offensive industry’ is defined as:

> *“… 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 emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment”.*

For development proposals classified as ‘potentially hazardous industry’, SEPP 33 requires a preliminary hazard analysis (PHA) to determine any potential risks to people, property and the environment.

A risk screening procedure and checklist is outlined in DP&E’s *Applying SEPP 33 Guidelines: Hazardous and Offensive Development Application Guidelines* (DOP, 2011a) to assist in determining whether a development is considered potentially hazardous industry. Appendix 3 of the guideline (DOP, 2011a) lists industries that may fall within SEPP 33, however, solar farms and energy storage facilities are not listed under Appendix 3. The hazards and risks of the solar farm and BESS facility are considered in Section 8.9 of the EIS.

4.1.4 Murrumbidgee Local Environmental Plan 2013

The Murrumbidgee LEP sets out the framework for the planning and development of land within the Murrumbidgee Shire. Even though the DPSF proposal is considered SSD and will be determined by the Minister for Planning and Environment, the land uses and objectives prescribed in the Murrumbidgee LEP have still been considered.

The DPSF site is located on land zoned RU1 – Primary Production. The objectives of zone RU1 as stated in the Murrumbidgee LEP are:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- To encourage diversity in primary industry enterprises and systems appropriate for the area
- To minimise the fragmentation and alienation of resource lands
- To minimise conflict between land uses within this zone and land uses within adjoining zones.

Although electricity generation is not listed as permissible on land zoned RU1 under the Murrumbidgee LEP, clause 34(7) of ISEPP allows development for the purpose of a solar energy system on any land with consent, including land zoned RU1.

During operation, sheep grazing may continue on the Tubbo Station property and could also be extended to the Anderson property, preserving, in part, the historical land use. The site would not be rezoned and on decommissioning would be returned to its full existing land capability.

Murrumbidgee Council is supportive of siting the DPSF at the proposed location, as outlined in Section 5.

4.2 Other relevant NSW legislation

Other NSW Acts that have been considered are summarised in Table 6.

Table 6 Other NSW legislation

Legislation	Applicability to the project
Biosecurity Act 2015	The *Biosecurity Act 2015* (BSA Act) outlines priority weeds (previously noxious weeds) with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. These weeds reduce diversity of native plant and animal species. The BSA Act is implemented and enforced by the Local Control Area for the LGA. The presence of weeds at the DPSF site is discussed in Section 7.1 of the EIS.

Legislation	Applicability to the project
Crown Lands Act 1989	Part 3 of the *Crown Lands Act 1989* (Crown Lands Act), requires an assessment to satisfy the Minister for Lands prior to any reservation, dedication, sale, lease, licence or permit affecting Crown land in NSW. An easement prescribed as Crown land runs along the northern boundary of the Anderson property at the DPSF site. There is no intention to impact this land, however consultation with the Department of Industry – Lands would be undertaken if and as required throughout development of the DPSF.
Roads Act 1993	Approval from the roads authority (Roads and Maritime Services and/or Murrumbidgee Local Government) would be required under Section 138 of the *Roads Act 1993* (Roads Act) to erect a structure or carry out a work in, on or over a public road. Murrumbidgee Council and Roads and Maritime Services would both be consulted regarding the use of roads during construction and site access points as required.
Native Vegetation Act 2003	Pursuant to Section 89J of the EP&A Act, an authorisation referred to in Section 12 of the *Native Vegetation Act 2003* (Native Vegetation Act) to clear native vegetation is not required for State Significant Development. The potential impact on native vegetation is discussed in Section 7.1 of this EIS.
Threatened Species Conservation Act 1996	If a proposal is likely to impact on threatened species, populations or ecological communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) an assessment is required. Pursuant to Section 79B of the EP&A Act, for State Significant Development concurrence by the Chief Executive of the Office of Environment and Heritage is not required for development that is likely to significantly affect a threatened species, population, or ecological community, or its habitat. The potential impact of the proposed works on any threatened species, populations or communities is assessed using Assessments of Significance under Section 5A of the EP&A Act (also known as a seven-part test). If the impacts are found to be ‘significant’, a Species Impact Statement (SIS) and concurrence from the Secretary of the OEH is required. It should be noted that the *Biodiversity Conservation Act 2016* (BC Act) came into force on 25 August 2017 and supersedes the *Threatened Species Conservation Act 1995*. The BC Act requires all Part 4 and Part 5 developments to be assessed as to whether the biodiversity offset scheme is to be applied. However, a transitional arrangement has been implemented by the OEH to allow major project development applications to be considered under the previous legislation if they have substantially commenced before 25 August 2017. Assessment under the new BC Act is not required as this project is being assessed under the transitionary arrangements. The potential to impact threatened species, populations and ecological communities listed under the TSC Act is discussed in Section 7.1 of this EIS.
National Parks and Wildlife Act 1974	The *National Parks and Wildlife Act 1974* (NPW Act) outlines the approval requirements for work in the vicinity of Aboriginal heritage and provides for the protection of flora and fauna. Pursuant to Section 89J of the EP&A Act, an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act is not required for State Significant Development. The potential to impact Aboriginal heritage and native fauna and flora are discussed in sections 7.4 and 7.1 respectively.

Legislation	Applicability to the project
Heritage Act 1977	Development or activities cannot be carried out which may affect an item listed on the State Heritage Register without approval under Section 60 of the *Heritage Act 1977* (Heritage Act). Pursuant to Section 89J of the EP&A Act, an approval under Part 4 or an excavation permit under Section 139 of the Heritage Act is not be required for State Significant Development. The potential to impact non-Aboriginal heritage items is discussed in Section 8.1 of this EIS.
Contaminated Land Management Act 1997	Section 60 of the *Contaminated Land Management Act 1997* (CLM Act) imposes a duty on landowners to notify OEH, and potentially investigate and remediate land if contamination is above levels set by the Environmental Protection Authority (EPA). The potential for contamination at the site is discussed in Section 8.4.2 of this EIS.
Water Management Act 2000	Water use approval, water management work approval and activity approvals are required under Sections 89, 90 and 91 of the *Water Management Act 2000* (WM Act). Pursuant to Section 89J of the EP&A Act, these approvals are not required for State Significant Development. The potential to impact water resources is outlined in Section 8.6 of this EIS.
Protection of the Environment Operations Act 1997	The *Protection of the Environment Operations Act 1997* (POEO Act) is the key piece of legislation for environmental protection in NSW. The POEO Act also clearly outlines pollution offences relating to land, water, air and noise pollution and includes a duty to report pollution incidents. Solar energy generation does not fall within the definition of electricity generation under Schedule 1 of the POEO and therefore does not require an environmental protection licence (EPL).
Waste Avoidance and Resource Recovery Act 2001	The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) introduces a scheme to promote extended producer responsibility for the life-cycle of a product. The WARR Act outlines the resource management hierarchy principles of priority as: • Avoidance of unnecessary resource consumption • Resource recovery (including reuse, reprocessing, recycling and energy recovery) • Disposal. Resource and waste management is discussed in Section 8.7 of this EIS.

4.3 Commonwealth legislation

4.3.1 *Environmental Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Commonwealth Department of the Environment and Energy (DoEE) and provides for the regulation of environmental impacts on Matters of National Environmental Significance (MNES). Any proposed action that will have or is likely to have a significant impact on MNES under the EPBC Act should be referred to the DoEE for determination as to whether it is considered to be a “controlled action” or not. If the action is controlled (potential for a significant impact to a MNES), environmental assessment and / or approval will be required under the EPBC Act.

The EPBC Act identifies the following nine MNES:

- World Heritage properties
- National heritage places
- Ramsar wetlands of international significance
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- Water resources (in relation to coal seam gas development and large coal mining development).

Of the above MNES, threatened species, ecological communities and listed migratory species have been noted as potentially occurring at the site. Detailed flora and fauna studies have been carried out part of the preparation of the EIS (refer to Section 7.1 of the EIS for further information) and an EPBC Referral recommending a Not a Controlled Action Particular Matter will be submitted to the DoEE for the DPSF Project shortly after submission of this EIS to DP&E.

4.3.2 *Native Title Act 1993*

The *Native Title Act 1993* (Native Title Act) provides a legislative framework for the recognition and protection of native title rights. Native title is the recognition that some Indigenous people continue to hold rights to their land and waters, which come from their traditional laws and customs.

The Native Title Act sets up processes to determine where native title exists, how future activity impacting upon native title may be undertaken, and to provide compensation where native title is impaired or extinguished.

When a native title claimant application is registered by the National Native Title Tribunal, the people seeking native title recognition gain a right to consult or negotiate with anyone who wants to undertake a project on the area claimed.

The National Native Title Tribunal does not identify any Native Title applications or determinations that affect the DPSF site. Further review of Native Title considerations has been undertaken as part of the Aboriginal cultural heritage assessment discussed in Section 7.4.

5 Consultation

Edify Energy has implemented a Stakeholder and Community Engagement Program throughout the EIS phase of the DPSF project. Development of the program was guided by the International Association for Public Participation's (IAP2) Core Values and Public Participation Spectrum.

The objectives of the engagement program include:

- Consult with decision makers to ensure their requirements are met
- Consult with key stakeholders during preparation of the EIS so their issues and opportunities are considered
- Inform the broader community about the project and provide opportunities for their questions to be answered and their issues and opportunities to be considered
- Position Edify Energy as a 'good neighbour' and progressive and reputable large scale solar farm developer and operator.

The following sections detail the consultation that has been carried out with stakeholders and the community to-date, as well as the proposed on-going and future consultation activities and tools.

Consultation tools which have been utilised to-date include:

- A briefing pack – a slide pack was prepared comprising key project facts and maps to assist with key stakeholder meetings
- A project fact sheet – hard copy fact sheets were prepared for distribution to community members and key stakeholders during consultation activities, and are also accessible on the project webpage (see below point)
- Project webpage – a dedicated project page has been established on the Edify Energy website announcing the project and providing key information. http://edifyenergy.com/projects/darlingtonpoint/
- Letters to State and Local ministers – letters were prepared and sent to the State Member for Murray and the NSW Environment Minister introducing the project as a prelude to meetings with the same
- Regular meetings and updates with the Murrumbidgee Shire Council
- Community information session – a drop in community information session was held from 2-5pm at the Darlington Point Community Hall on 5th December 2017 to provide a chance for community members to learn about the project, ask questions and provide feedback. The event was advertised in the local newspaper – The Observer – and also via Murrumbidgee Shire Council's social media platforms in the weeks prior to the session.

5.1 Government agency and key stakeholders

Consultation has been carried out with a range of government agencies and key stakeholders. These stakeholders were identified as those involved in the planning approval or grid connection process, and those who may have a keen interest in the strategic planning and assessment of the project. They include:

- Murrumbidgee Shire Council
- TransGrid
- NSW Department of Planning and Environment
- NSW Office of Environment and Heritage
- NSW Renewable Energy Advocate, Amy Kean
- Rural Fire Service
- NSW Department of Industry – Lands.

Table 7 provides a summary of the consultation and any specific issues raised by these stakeholders. Edify Energy will continue to consult with these stakeholders and others throughout the planning approval process as required.

Table 7 Summary of agency and stakeholder consultation

Agency / stakeholder	Summary	Response / where addressed in EIS
Murrumbidgee Shire Council	Regular meetings with Murrumbidgee Shire Council's elected representatives and planning team, throughout the preparation of the EIS. Council expressed its full support for the project and has provided this in a letter to Edify Energy (see Appendix B). Two issues Council requested to be considered in the planning process include flood management and construction workforce accommodation. Edify Energy will continue to work collaboratively with Council as the project progresses to keep Council and the community informed and adequately address any issues.	Flooding has been discussed in Section 7.3 of this EIS. Construction work force housing has been discussed in Section 2.6.3 and 8.8 of this EIS.
TransGrid	Consultation with TransGrid has been undertaken in accordance with their network connection guidelines. TransGrid has confirmed that Edify Energy needs to obtain their own environmental approvals and licences for any upgrades required to TransGrid infrastructure in order to facilitate connection to the DPSF. Therefore, the Darlington Point substation has been included within the project area in this EIS. In parallel, Edify Energy is working closely with TransGrid to finalise the	This issue is discussed in Section 2.2 of the EIS.

Agency / stakeholder	Summary	Response / where addressed in EIS
	DPSF electrical connection; a connection process agreement has been executed, system studies have been completed and draft Generator Performance Standards have been submitted.	
NSW Department of Planning and Environment (DP&E)	Preliminary meetings were held with DP&E to introduce the project and key team members, discuss the planning framework and timing of key project milestones, and identify the key project issues for consideration. Follow-up meetings and consultation has been held with DP&E throughout the planning process as required.	Addressed throughout the EIS.
NSW Office of Environment and Heritage (OEH)	Preliminary conversations were undertaken with OEH regarding historic flood events and biodiversity values at the site. Further consultation has been undertaken with OEH during the EIS process, including a visit to the DPSF site.	Flooding has been addressed in the EIS in Section 7.3, while biodiversity is discussed in Section 7.1.
NSW Renewable Energy Advocate, Amy Kean	An early meeting was held with Amy Kean to introduce the project and key team members. Amy expressed her full support for the project in order to achieve the strategic goals established by the NSW Government around renewable energy, emissions reduction, and grid stability.	The alignment of the project with the strategic goals of NSW Government for renewable energy, emissions reduction and grid stability is discussed in Section 3 of the EIS.
Rural Fire Service (RFS)	A meeting was held with a representative of the RFS to discuss the project and any recommendations in terms of bushfire management.	Bushfire management is discussed in Section 8.11 of the EIS.
NSW Department of Industry – Lands	Preliminary conversations with the DPI – Lands indicated that appropriate land management practices during construction, operation and rehabilitation and decommissioning would result in limited impacts to the native grasslands.	Land management has been discussed in Section 7.5 of the EIS.

5.2 Community engagement

On-going consultation has been carried out with the proposed DPSF site landowners and farm managers, who are strong supporters of the proposal. Edify

Energy has received letters of consent from landowners of both the Anderson property and Tubbo Station.

In early April 2017, consultation was also carried out with the immediate neighbours and adjacent land users and some other community members who expressed interest. This included a mix of face-to-face meetings and phone conversations for those not available to meet at their properties, as summarised below:

- Face-to-face meeting with the directors of the Cavaso farming operation, located some 1700 m from the northern boundary of the DPSF site
- Telephone conversation with the owner of the private residence situated on Donald Ross Drive some 800 m to the north
- Face-to-face meeting with the proprietor of the Terra Nova farmstead, located some 1700 m from the southern boundary of the DPSF site
- Face-to-face meeting with the manager of the Tubbo Estate, whose homestead is located around 1650 m from the north-western site boundary and who will continue grazing operations on the remaining 30,000 acres of the Tubbo Estate
- Telephone conversation and subsequent face-to-face meeting with the Regional Manager of Baiada Poultry, who operate the poultry farms on the western side of Donald Ross Drive
- Telephone conversation with Arrow Funds Management Limited, which owns the land presently leased to Baiada Poultry
- Face-to-face meeting with the proprietor of the Darlington Point Caravan Park
- Telephone conversation and subsequent meeting with the proponents of a planned new motel facility and cabin park in Darlington Point
- Many electronic queries via the project website, relating almost entirely to business and employment opportunities.

All of the above-mentioned discussions were very positive, and to-date, community interests have been limited to:

- Potential impacts to water flow during flood events
- Business and employment opportunities
- Opportunities for neighbours and community members to connect their facilities directly to the DPSF.

Drainage and flooding is discussed in Section 7.3 of this EIS. No levees, major earthworks or levelling is proposed at or around the site, with the exception of the proposed new 132 kV switchyard which will be benched to match the level of the TransGrid substation.

The structure of the NEM unfortunately does not readily allow local community members to either directly connect to or procure electricity directly from the DPSF. All the electricity produced by the DPSF would be transmitted through the transmission network and traded via the NEM. However, as recently quoted in reference to other similar large-scale solar PV projects by Parliamentary Secretary for Renewable Energy, Adam Marshall MP, "renewable projects would bring down electricity prices for everyone over the long term".

Edify Energy and its project partners are willing to engage in separate discussions with community members to understand any additional upside potential to the local community in line with our experiences elsewhere.

A register is being maintained to capture all business and employment opportunity information requests, which will be made available to potential EPC Contractors during a tender process with a strong emphasis on local content.

5.3 Ongoing and future consultation

Edify Energy will continue to keep the community and key stakeholders informed about the progress of the DPSF.

The key consultation tools are likely to include:

- The project webpage, which will continue to be updated at key stages of the project and includes a "Contact Us" form to provide an ongoing communication channel and enable people to contact the project team
- Project fact sheets, which will continue to be distributed amongst the community at key stages
- Ongoing stakeholder/landowner meetings to discuss the project and key issues as required
- Media releases, which will be prepared at key milestones and may be included in local and/or more widespread media sources
- Other tools may be utilised as required.

The Stakeholder and Community Engagement Plan will continue to be a live document that will be reviewed and updated by Edify Energy and Arup in response to feedback received and any conditions required by the DP&E.

In accordance with the NSW planning framework, this EIS will be on public exhibition for a minimum of 30 days to provide stakeholders and the community with an opportunity to review and provide feedback on the proposal. Following exhibition of the EIS, all comments received will be recorded and addressed in a Submissions Report to the DP&E detailing how each issue raised has or would be considered.

6 Environmental assessment methodology

6.1 General methodology

A preliminary environmental assessment (PEA) prepared for the project assisted in the identification of key environmental matters that were identified as having a potential impact on the environment without mitigation measures and therefore required a more detailed assessment.

A number of issues with the potential for a significant impact were assessed in Section 7 of this EIS:

- Biodiversity
- Traffic and access
- Flooding and hydrology
- Aboriginal heritage
- Land compatibility.

Other environmental matters with less significant effects have been assessed in Section 8 of this EIS:

- Non-Aboriginal heritage
- Noise and vibration
- Visual amenity
- Soils and geology
- Contamination
- Air quality
- Water quality
- Resource use and waste
- Socio-economic
- Electromagnetic fields
- Bushfire risk.

The assessment of all of the above issues had been guided by the SEARs for the project which have been summarised in Table 8.

The cumulative impacts of the project have also been assessed and are discussed in Section 8.12 of this EIS.

The study area for the environmental assessment covers the proposed DPSF development area, the Darlington Point substation, and where relevant, surrounding areas that may experience impacts from construction or operation of the project.

6.2 Secretary’s Environmental Assessment Requirements

Table 8 Summary of SEARs

Issue Summary	Where addressed in EIS
General Requirements	
A stand-alone executive summary	Section ES
A full description of the development, including: • details of construction, operation and decommissioning; • a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process); • a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development	Section 2
A strategic justification of the development focusing on site selection and the suitability of the proposed site	Section 3.1
An assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: • a description of the existing environment likely to be affected by the development; • an assessment of the likely impacts of all stages of the development (which is commensurate with the level of impact), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; • a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and • a description of the measures that would be implemented to monitor and report on the environmental performance of the development	Section 7 and 8
A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS	Section 9.2
The reasons why the development should be approved having regard to: • relevant matters for consideration under the Environmental Planning and Assessment Act 1979, including the objects of the Act and how the principles of ecologically sustainable development have been incorporated in the design, construction and ongoing operations of the development; • the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and • feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.	Section 4
A signed report from a suitably qualified person that includes an accurate estimate of the capital investment value of the development (as defined in Clause 3 of the *Environmental Planning and Assessment Regulation*	Provided separately to DP&E

Issue Summary	Where addressed in EIS
2000), including details of all the assumptions and components from which the capital investment value calculation is derived	
The consent in writing of the owner of the land (as required in clause 49(1)(b) of the *Environmental Planning and Assessment Regulation 2000*)	Provided separately to DP&E
Biodiversity	
An assessment of the likely biodiversity impacts of the development, (including but not limited to the impacts on any threatened species, populations or ecological communities, having regard to the *NSW Biodiversity Offsets Policy for Major Projects*, and in accordance with the Framework for Biodiversity Assessment, unless otherwise agreed by the Department	Section 7.1
Heritage	
An assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community	Section 7.4 and 8.1
Land	
An assessment of the impact of the development on agricultural land and flood prone land, a soil survey to consider the potential for erosion to occur, and 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, 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 7.5
Visual	
An assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners	Section 8.3
Noise	
An assessment of the construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG) and operational noise impacts in accordance with the *NSW Industrial Noise Policy* (INP), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria	Section 8.2
Transport	
An assessment of the site access route (including Donald Ross Drive), site access point, and likely transport impacts of the development on the capacity and condition of roads (including on any Crown land), a description of the measures that would be implemented to mitigate any	Section 7.2

Issue Summary	Where addressed in EIS
impacts during construction, and a description of any proposed road upgrades developed in consultation with the relevant road authorities (if required)	
Water	
An assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including watercourses), wetlands, riparian land, groundwater dependent ecosystems and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts	Section 7.3 and 8.6
Details of water supply arrangements	Section 8.6.2
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 8.6.4
Hazards and electromagnetic interference	
An assessment of potential hazards and risks associated with bushfires and the proposed transmission line and substation against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields.*	Section 8.9 (Hazardous materials and development), 8.10 Electro-magnetic fields (EMFs), and 8.11 (Bushfire risk)
Socio-economic	
An assessment of the likely impacts on the local community and a consideration of the construction workforce accommodation	Section 8.8
Consultation	
Consultation with relevant local, State or Commonwealth Government authorities, infrastructure and service providers, community groups, affected landowners, exploration licence holders, quarry operators and mineral title holders	Section 5.1 and 5.2
Detailed consultation with affected landowners surrounding the development and Murrumbidgee Shire Council	Section 5.1
A description of the consultation that was carried out, identifying the issues raised during this consultation, and explaining how these issues have been addressed in the EIS	Section 5

7 Key environmental issues

7.1 Biodiversity

7.1.1 Methodology

This section summarises the findings on the BAR prepared by Environmental Property Services (EPS) in relation to the existing environment and the extent of impact of the project on biodiversity within the DPSF site under the EP&A Act and the EPBC Act. A full copy of the BAR is provided in **Appendix C** of the EIS. In addition, this section provides reference to a report prepared by Charles Sturt University (CSU) on the effects of solar farm installation and operation on Riverine Plain Grasslands. A full copy of the CSU report is provided as **Appendix D** to the EIS.

The *Biodiversity Conservation Act 2016* (BC Act) supersedes the *Threatened Species Conservation Act 1995* (TSC Act) and requires all types of developments (Part 4 and Part 5 developments) to be assessed as to whether the biodiversity offset scheme is to be applied. For all Major Projects, the Biodiversity Offset Scheme applies. However, a transitional arrangement has been implemented by the OEH to allow major project development applications to be considered under the previous legislation if they have substantially commenced before the 25 August 2017. Therefore, this project continues to be assessed under the Framework for Biodiversity Assessment (FBA) methodology (OEH, 2014a).

The objectives of the BAR were to:

- Undertake field surveys and vegetation condition mapping in accordance with the Framework for Biodiversity Assessment Methodology (2014a)
- Description of the biodiversity values that will be impacted and require offsets using the FBA
- Calculate the BioBanking credits using the FBA methodology that are required to offset biodiversity impacted as a result of the project.

The methodology of the BAR has been informed by the following:

- A search of online and publicly accessible databases was undertaken to assess the likelihood of threatened species, populations and ecological communities within or in close proximity to the DPSF project area. Databases included the Protected Matters Search Tool (DoEE, n.d.), Australian Atlas of Groundwater Dependent Ecosystems (BOM, 2017), NSW BioNet (NSW BioNet, 2018), PlantNet (PlantNet, n.d.), OEH Critical Habitat Register (OEH, n.d.), and the DPI's aquatic records viewer for Griffith LGA (DPI, n.d.).
- A literature review of relevant reports, including *Preliminary Environmental Assessment for the DPSF* (Arup, 2017), *Broad Scale Vegetation of Central Southern NSW* (OEH, 2011), *Plains Wanderer Habitat Mapping* (Roberts, I & J, 2001), *Noxious weeds for Griffith LGA control* (DPI, 2017b), *Threatened Species, Populations and Ecological Communities of NSW profiles* (OEH,

n.d.) and the *Vegetation Information System Classification Database v2.1* (OEH, 2015).

- Consultation with OEH, including discussion on 27 April 2017 to discuss the biodiversity assessment approach to the project. Ongoing consultation with OEH is proposed to ensure that potential impacts to the project will be adequately offset to meet the FBA assessment guidelines.
- Field surveys of the project area were undertaken from 3 April to 7 April 2017, 5 September to 11 September 2017 and 5 November to 10 November 2017 (refer **Appendix C**).
- The flora surveys were conducted using BioBanking/FBA plots in accordance with the BioBanking Assessment (OEH, 2014b) (refer to **Appendix C** for further detail). Vegetation communities were assigned into Plant Community Types in accordance with the OEH Vegetation Information System (VIS) classification database version 2.1. Targeted seasonal flora surveys were conducted for three flora species identified by the BioBanking Calculator as credit species that require targeted surveys. The SEARs identified threatened flora species were also surveyed. Details of the flora surveys and transects are provided in **Appendix C**.
- The fauna surveys were conducted in accordance with the *NSW Threatened Biodiversity Survey and Assessment Guidelines* (DECC, 2004)*, Survey guidelines for Australia's threatened birds* (DEWHA, 2010) and *Survey Guidelines for Australia's threatened mammals* (DSEWPaC, 2011) according to the following steps:
  - To assess the fauna habitat present within the project area, habitat data was collected to determine the range of fauna that may utilise the area for roosting, breeding and/or foraging. Opportunistic habitat searches throughout the project area, plus 29 habitat searches at each BioBanking plot location were undertaken.
  - 30 dawn and dusk diurnal bird surveys were undertaken at 15 survey locations. Targeted surveys for the Grey Falcon (*Falco hypoleucos*), Superb Parrot (*Polytelis swainsonii*), Grey-crowned Babbler (*Pomatostomus temporalis*), Painted Honeyeater (*Grantiella picta*) and Varied Sittella (*Daphoenositta chrysoptera*) were undertaken.
  - Call playback and spotlighting techniques were used to assess nocturnal birds, while bat surveys consisted of Anabat, Harp trapping and spotlighting using ultrasonic Anabat detectors. Further details on the Anabat, harp trapping and spotlighting assessment is provided in **Appendix C**.
  - To determine the likelihood of occurrence if threatened biodiversity has habitat within the project area, four categories have been utilised:
    1. Low – no habitat within the project area
    2. Moderate – moderate quality habitat, within the project area, likely to be disturbed with limited amount of breeding, foraging and roosting habitat

3. High – high quality habitat within the project area including breeding, foraging and roosting habitat. Previous records in close proximity or within the project area
4. Recorded – species recorded during current field surveys.

Investigative approach

An investigative approach was adopted to develop the concept design of the project, seeking to avoid impacts on wooded areas of the site, with the majority of the project area located within areas of Riverine Plains Grassland in varying conditions. There are no known specific project examples in Australia which have sought to quantify the indirect impacts of solar farm operation on Riverine Plains Grasslands. However, the Riverine Plains Grassland have a long history of supporting the livestock grazing industry and as such there is a depth of agricultural industry knowledge and scientific assessment available to understand and optimise grassland growth and management.

Therefore, specialist input from Dr Jeff McCormick, Lecturer in Agronomy, Charles Sturt University and Dr Peter Orchard, Adjunct Senior Lecturer and Visiting Scientist Graham Centre for Agricultural Innovation, Charles Sturt University was sought to determine what impacts the construction and operation of a solar farm would be likely to have on the Riverine Plains Grasslands diversity, persistence and structure. The results of the Charles Sturt University (CSU) report (McCormick & Orchard, 2018) (included as **Appendix D** to this EIS) were used to aid in determining likely impacts to the native grasslands, development of the site management plan and resultant calculation of biodiversity offset requirements as reported within this Biodiversity Assessment Report.

This section of the EIS provides a summary of the BAR and CSU study, with full copies provided in **Appendix C** and **Appendix D** respectively.

Australian project grassland experience

Having regard to the above investigative approach, Edify Energy have provided real life examples of their experience with vegetative growth within their other solar farm projects in Australia. It is considered that photographs from these projects provide useful context when considering biodiversity impacts likely to result from this project, particularly to grassland areas.

Photograph 6 and Photograph 7 in Section 2.6.4 of this EIS depict the grassland rehabilitation between and under panels within approximately 2 to 4 weeks of completion of solar array construction. The grass regrowth in this 2 to 4 week period is substantial and this is likely due to the minimal ground disturbance that occurs when adopting the construction methodology (as described in Section 2.6.4).

7.1.2 Existing environment

Legislative requirements

A discussion of the applicable biodiversity legislative instruments to the DPSF project is provided in Section 4.

Landscape context

The DPSF is located within the Riverina region of New South Wales. The project area occurs on the floodplain of the Murrumbidgee River in south-western NSW. The majority of the project area has been cleared for agricultural uses, with the main land use being cattle and sheep grazing. The project area is dominated by grassland with fragmented areas of grassy woodland and open forest. Donald Ross Drive occurs along the western boundary of the project area and contains remnant native vegetation. Cropping occurs to the north-west and south-west of the project area.

Landscape value assessment

The landscape value assessment was undertaken in accordance with Appendix 4 of the Framework for Biodiversity Assessment (OEH, 2014a). Two IRBA subregions occur within the project area, being Murrumbidgee Scaled Plains and Murrumbidgee Depression Plains (refer Figure 4-1 in **Appendix C**). The dominant IRBA subregion, Murrumbidgee Scaled Plains, was used for the landscape value assessment.

Strategic location

The project area does not meet any of the requirements listed in Table 10 Appendix 4 of the FBA and therefore the project area is not assessed as being in a strategic location.

Percent native vegetation cover

Due to the area of native vegetation of the project that will be impacted on a larger assessment an inner circle size of 3,000 ha and a 30,000 ha outer assessment circle have been used to estimate the percentage native vegetation cover. A summary of the landscape assessment is provided in Table 9 and is shown in Figure 4-2 in **Appendix C**.

Table 9 Percentage native vegetation

Attribute	Before Development	After Development
Outer Assessment Circle	41-45	36-40
Inner Assessment Circle	76-80	56-60

Connectivity value

Connectivity of the native grassland occurs to the north, south and east of the project area. Donald Ross Drive occurs to the west of the project area in which a small area of woodland vegetation is connected to roadside vegetation. Due to the large area of connectivity of native grassland the width of connectivity is >500 m (refer Table 10). The project will impact on a large area of native grassland thus reducing the connectivity link to less than 5 m.

Table 10 Connectivity value

Attribute	Before Development	After Development
Connectivity width (m)	>500	0 – 5
Overstorey condition	PFC at benchmark	No native over-storey
Mid storey/ground-layer condition	PFC of mid-storey/ground cover at benchmark	No mid-storey/ground cover

Patch size

Table 11 provides a summary of the assessed patch size.

Table 11 Patch size

Mitchell Landscape	Percentage Cleared	Area (ha) of patch	Patch size class	Patch size score
Murrumbidgee Scalded Plains	67%	260	>200	12

Geographic habitat features

Two geographic habitat features were identified by the BioBanking calculator as follows:

- *Lepidium monoplocoides* – land containing seasonally damp or waterlogged sites
- Grey Falcon – land containing within 100 m of riparian woodland on inland rivers containing mature living eucalypts or isolated paddock trees overhanging water or dry watercourses.

Both of the above habitat features occur within the project area.

Plant community types

Broad scale vegetation mapping

The Central South NSW Vegetation Mapping (OEH, 2011) has mapped seven vegetation communities (refer Figure 4-3 in **Appendix C**) within the project area:

- Native Grassland Complex;
- Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW;
- Yellow Box – River Red Gum tall grassy riverine woodland of NSW South West Slopes and Riverina;
- Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South Western Slopes Bioregions;
- River Red Gum – Black Box woodland wetland of the semi-arid (warm) climatic zone (mainly Riverina and Murray Darling Depression Bioregion);
- White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) Climate zone; and
- Weeping Myall Open Woodland of the Riverina and NSW South-western Slopes Bioregion.

Plant community types within the project area

Five Plant Community Types (PCTs) were recorded within the project area, in various forms and conditions. Table 12 below outlines the PCTs identified during the field surveys by EPS and the corresponding threatened ecological communities. **Figure 9** shows the location and condition of the PCTs mapped within the project area.

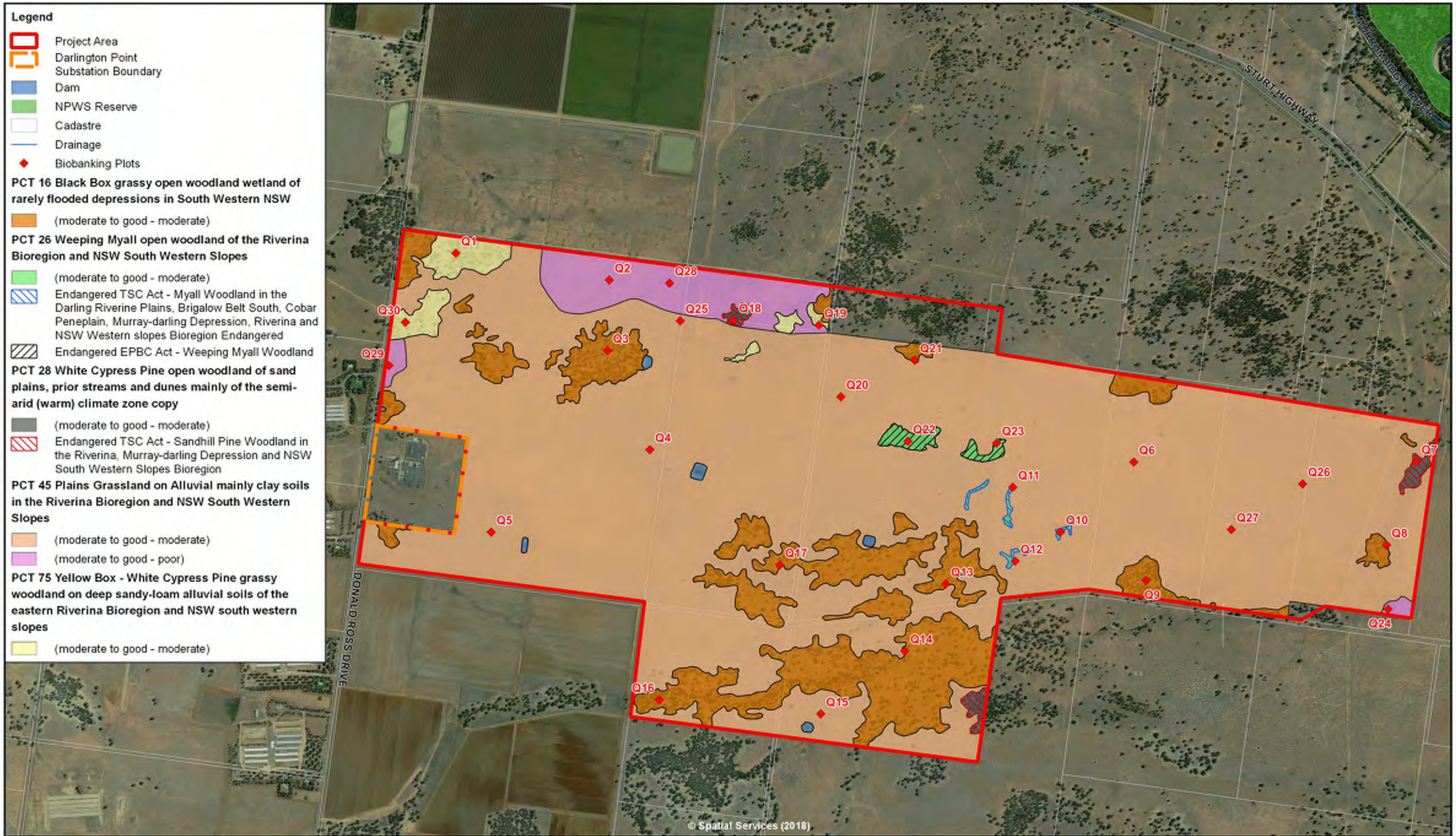
The field verified communities have been named in accordance with PCT terminology, the current NSW standard. A summary of each of the vegetation communities is provided in **Appendix C**.

Table 12 Plant community types descriptions

Field-verified Plant Community Type (PCT)	Vegetation Zone	Area extent (ha) within project area	BioBanking Condition	Endangered Ecological Community (BC Act)	Endangered Ecological Community (EPBC Act)
Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45)	1	781.6	Moderate to Good (Moderate) quality	Not listed	Not listed
Black Box grassy open woodland wetland of rarely flooded depressions in	2	135.8	Moderate to Good (Moderate) quality	Not listed	Not listed

Field-verified Plant Community Type (PCT)	Vegetation Zone	Area extent (ha) within project area	BioBanking Condition	Endangered Ecological Community (BC Act)	Endangered Ecological Community (EPBC Act)
south western NSW (PCT 16)					
Weeping Myall Open Woodland of the Riverina and NSW South-western Slopes Bioregion (PCT 26)	3	6.2	Moderate to Good (High) quality	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW Western Slopes Bioregion	Weeping Myall Woodland (2 patches meet the criteria for the federal listing)
Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South Western Slopes Bioregions (PCT 75)	4	16.1	Moderate to Good (Moderate) quality	Does not meet criteria for the State listing	Does not meet criteria for the federal listing
Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45)	5	43.5	Moderate to Good (Poor) quality	Not listed	Not listed
White Cypress Pine open woodland of sand plain, prior streams and dunes mainly on the semi-arid	6	5.2	Moderate to Good (Moderate) quality	Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South	Not listed

Field-verified Plant Community Type (PCT)	Vegetation Zone	Area extent (ha) within project area	BioBanking Condition	Endangered Ecological Community (BC Act)	Endangered Ecological Community (EPBC Act)
(warm) climate zone (PCT 28)				Western Slopes bioregion	
Farm dams	-	1.92	-	-	-



Author:	S. Wilkin
Reviewer:	T. Lambert
A3 Scale:	1: 20 000
Job Ref:	11299

Map Projection: GDA 1994 MGA Zone 55

Figure 9

Plant Community Types and Biobanking Plots

Darlington Point Solar Farm | NSW Australia

6 March 2018

EPS ENVIRONMENTAL PROPERTY SERVICES

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Flora species recorded

Seventy-one flora species were recorded in the project area from 16 families. The most common family was Poaceae and Asteraceae. 27 species were exotic. No threatened flora species were recorded.

No exotic species of flora are listed as Weeds of National Significance (WONS) or as priority weeds listed on the Biosecurity Act for the Griffith Control Area. One invasive species Bathurst Burr was recorded throughout the project area.

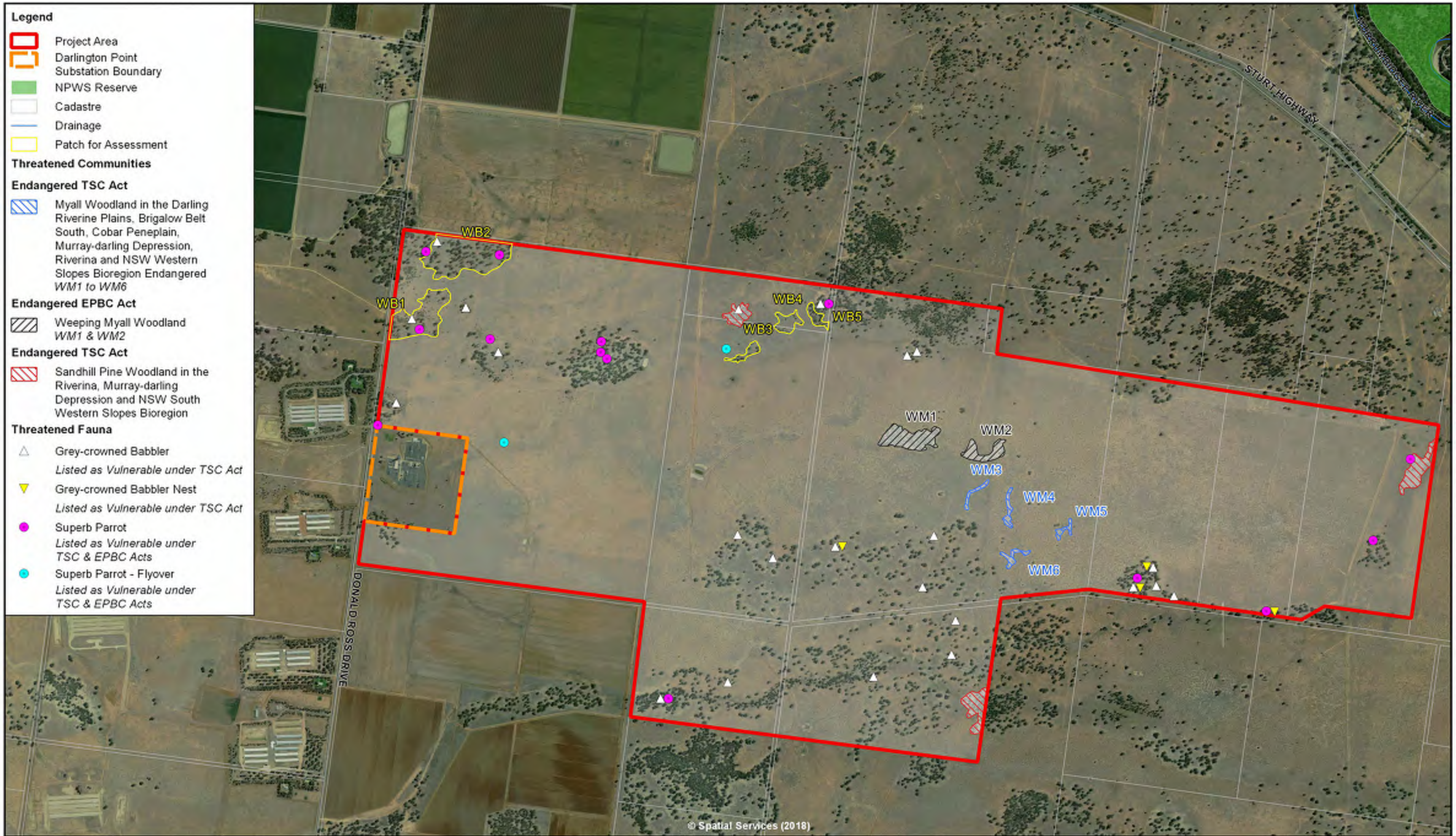
Fauna species recorded

Fifty-two species of fauna were recorded within the project area (refer **Appendix C**). Fauna recorded included Birds (34) and Mammals (17). Four invasive species were recorded being Fox, Rabbit, Common Blackbird and Common Starling.

Two species of threatened fauna were recorded during the field surveys. These were:

- Superb Parrot listed as vulnerable under both the BC Act and EPBC Act; and
- Grey-crowned Babbler listed as vulnerable under the BC Act.

Detailed observations in relation to these recorded species are summarised in **Appendix C**. **Figure 10** outlines the locations of threatened recorded fauna.



Author:	S. Wilkin
Reviewer:	T. Lambert
A3 Scale:	1: 20 000
Job Ref:	11299

0 250 500 750 1000 Metres

Map Projection: GDA 1994 MGA Zone 55

Figure 10 **Threatened Communities & Threatened Fauna Locations**

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6 March 2018

EPS ENVIRONMENTAL PROPERTY SERVICES

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Recorded fauna habitats

Three main fauna habitats were identified as occurring in the project area. These three habitats provide a range of roosting, breeding and foraging habitat for commonly occurring and threatened species of fauna. The three fauna habitats are as follows:

- Open Forest/Woodland habitat
- Grassland
- Aquatic habitat

Open Forest/Woodland

The open forest/woodland habitat within the project area includes the following PCTs:

- Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW
- Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and NSW south western slopes
- White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (Warm) climate zone; and
- Weeping Myall open woodland of the Riverina Bioregion and NSW South Western slopes communities.

This habitat type contains a high density of hollow-bearing trees, fallen timber and leaf litter which provides habitat for a number of fauna species. This habitat occurred in patches throughout the project area interspersed with native grassland. The condition of the habitat is moderate to good and the vegetation within the project area has fragmented connectivity to greater regional vegetation patches to the south and north of the project area.

This habitat consisted of a mixture of open grassy woodland open forest with the structure dominated by canopy species including *Eucalyptus largiflorens* (Black Box), *Eucalyptus melliodora* (Yellow Box), *Callitris glaucophylla* (White Cypress Pine) and *Acacia pendula* (Weeping Myall). The eucalypt species provide a range of habitat resources including hollow-bearing trees which provide nesting opportunities for birds, arboreal mammals and roosting habitat for microchiropteran bats. The eucalypt species provide nectar resources for a range of nectivorous birds and mammals. Threatened species that were observed within the eucalypt habitat include the Grey-crowned Babbler and Superb Parrot. Common species recorded including Noisy Miner, Eastern Rosella, Australian Raven, Galah, Sulphur-crested cockatoo, Pied Butcherbird, Australian Magpie and Apostlebird.

Grassland

The grassland habitat generally occurs in moderate quality and is dominated by the native grass *Austrostipa aristiglumis* (Plains Grass), which occurs densely up to a height of 2 m. Small areas of this community were dominated by exotic species in areas where a high density of sheep and cattle grazing was evident, particularly around the existing dam sites. Scattered trees, mostly consisting of juvenile regrowth with six larger paddock hollow-bearing trees also occur infrequently throughout the grassland habitat.

The grassland habitat provides foraging habitat in the form of grasses, seeds, insects and saltbush fruits. The grassland provides foraging habitat for insectivorous micro bats, small mammals (e.g. house mouse), birds (e.g. Stubble Quail) and birds of prey (e.g. Peregrine Falcon and the Wedge-tailed Eagle). Other animals such as the Grey Kangaroo use this area as grazing habitat, where it also acts as foraging and refuge habitat for lizards and snakes.

The grassland was generally devoid of micro habitat features such as leaf litter, fallen timber and understorey shrubs. Commonly occurring species recorded in this habitat included Eastern Grey Kangaroo, Australian Raven, Peregrine Falcon and Australasian Pipit. Pest species recorded in this habitat included the European Rabbit and European Fox.

Aquatic habitat

Aquatic habitat noted within the project area included six small farm dams. The farm dams provide marginal potential habitat for a range of amphibians and waterbirds. The Pacific Black Duck was observed within these farm dams. The farm dams are used for watering stock and are typically fringed by areas of disturbed grassland.

Threatened biodiversity

Ecosystem species

One ecosystem credit species, Grey-crowned Babbler, was recorded within the project area. This species was recorded in 23 locations with four nest sites within woodland habitats (refer **Figure 10**). Table 13 provides a summary of the BioBanking calculator's predicted species and their likelihood of occurrence in the project area.

Table 13 Ecosystem credit species

Threatened Species	Tg Value	Recorded in the project area	Habitat recorded in the project area	Likelihood of Occurrence
Australian Bustard	2.6	No	Yes	Likely to occur. Breeding habitat recorded, grazing pressures would limit breeding opportunities.
Barking Owl	3.0	No	Yes	Unlikely. Foraging and breeding habitat recorded in the project area. 20 yr old records within 50 km of the project area.
Brolga	1.3	No	Yes	Likely. Grassland habitat within the project area.

Threatened Species	Tg Value	Recorded in the project area	Habitat recorded in the project area	Likelihood of Occurrence
Bush Stone-curlew	2.6	No	Yes	Likely. Foraging and breeding habitat, grazing pressures would limit breeding opportunities.
Diamond Firetail	1.3	No	Yes	Likely. Grassy woodland habitat within the project area and may support a small population of this species.
Grey-crowned Babbler	1.3	Yes	Yes	Recorded with nesting and forages within the project area.
Hooded Robin	1.7	No	Yes	Unlikely to occur as this species is sedentary and records within the vicinity of the project area are over 20 years old.
Little Eagle	1.4	No	Yes	Likely. Grassland habitat within the project area. Prey species present within the grassland areas.
Magpie Goose	1.3	No	No	No wetland habitat occurs within the project area.
Major Mitchell's Cockatoo	1.9	No	Yes	May occur intermittently in foraging habitat in the grassland areas. Roosting habitat, the project area is at the eastern end of this species distribution.
Masked Owl	3.0	No	Yes	Unlikely foraging and breeding habitat recorded in the project area. 30 yr old records within 40 km of the project area.
Painted Honeyeater	1.3	No	Yes	Likely. No mistletoe was recorded on the weeping myall trees. May fly over the project area on a seasonal basis.
Pied Honeyeater	1.3	No	Yes	Unlikely. Limited foraging habitat in the form of saltbushes, no nectar resources on project area.
Spotted Harrier	1.4	No	Yes	Likely. Grassland habitat within the project area. Prey species present within the grassland areas.
Square-tailed Kite	1.4	No	Yes	Unlikely, scattered records for this species which are over 30 years old.
Varied Sittella	1.4	No	Yes	Likely, recent records of this species within 1 km of the project area.
White-fronted Chat	0.8	No	No	No wetland areas in the project area.

Species credits

Table 14 outlines the species credit species which have been identified by the BioBanking calculation that cannot be predicted to occur based on habitat assessment. Species credit species require targeted surveys to determine if they occur within the project area. Four species credit species (refer Table 14) were identified by the BioBanking calculator as requiring targeted surveys. Target surveys were conducted for these species as part of the field surveys. One additional species credit species, the Superb Parrot, was recorded within the project area but not identified by the BioBanking calculator. Therefore, this species was added to the BioBanking calculator to calculate the species credits required to offset impacts to this species. Refer to Section 3.5.3 of **Appendix C** for further detail on the targeted surveys conducted for these species.

Table 14 Species credit species

Common Name	Scientific Name	Survey timing	Likelihood of occurrence	Recorded in the project area	Details of surveys
Grey Falcon	*Falco hypoleucos*	All year	High	No	This species can be surveyed at any time of year. Surveys during April, September and November included diurnal bird surveys and opportunistic surveys. This species was not recorded.
Superb Parrot*	*Polytelis swainsonii*	Sept to Nov	High	Yes	This species was recorded in all the woodland habitats within the project area and was observed foraging on Yellow Box blossom (refer **Figure 10**). The Black Box Grassy Open Woodland and Yellow Box – White Cypress Pine Grassy Woodland communities contain a large number of hollow-bearing trees which provide nesting habitat; however, this species was not observed nesting in these trees. The BioNet Database Atlas shows that a high number of records for this species have been observed along the Murrumbidgee River, which contains *Eucalyptus camaldulensis* (River Red Gum) which are favoured by this species for breeding (OEH, n.d.). It is likely that the main breeding for this species occurs in the River Red Gums along the Murrumbidgee River, which is approximately 1.5km away from the project at its closest point. The project will remove negligible areas of woodland and is unlikely to impact upon this species, particularly its breeding habitat.
Lanky Buttons	*Leptorhynchos orientalis*	Sept to Nov	High	No	Targeted surveys for these two species was conducted within the required flowering time of September in accordance with the BioBanking calculator requirements. Neither of these species were recorded during the surveys. Other daisy species recorded flowering were *Leptorhynchos squamatus* subsp. s*quamatus*, *Vittadinia gracilis* and *Leiocarpa panaetioides*.
Mossgiel Daisy	*Brachyscome papillosa*	Sept to Nov	High	No	
Winged Peppercress	*Lepidium monoplocoides*	Nov to Feb	High	No	Targeted surveys were undertaken within the required flowering time of November in accordance with the BioBanking calculator requirements. This species was not recorded during surveys. The exotic weed, *Lepidium africanum* was recorded during the field surveys.

Table Note: * Superb Parrot was not identified by the BioBanking Calculator as requiring surveys, species was recorded in the project area.

SEARs species

In accordance with the SEARs issued for the DPSF project on 9 May 2017 (SSD 8392), an additional seven threatened fauna species, seven threatened flora species and two endangered ecological communities (EEC) are required to be addressed. The SEARs threatened fauna and flora species are discussed below, while ecological communities are discussed further below.

SEARs threatened fauna species

Seven additional threatened fauna species are required to be assessed as to whether nest trees will be impacted upon. The Black Box Grassy Open Woodland and Yellow Box – White Cypress Pine Grassy Woodland communities contain a large number of hollow-bearing trees which provide nesting habitat for all of the species listed in Table 15.

No hollow-bearing trees located in vegetation communities which provide nesting habitat for these species will likely be impacted from the project. Six isolated hollow-bearing paddock trees (refer Figure 3-3 in **Appendix C**) will be removed as part of the project.

Table 15 SEARs threatened fauna species

<table>
<tr><th>Threatened Species</th><th>Nest trees in project area</th><th>Habitat in project area</th><th>Project impact</th></tr>
<tr><td>Regent Honeyeater
Anthochaera phrygia</td><td>Yes</td><td rowspan="5">Yes
Breeding and foraging habitat in woodland areas.</td><td rowspan="5">Low.
Negligible woodland habitats will be removed by the project.</td></tr>
<tr><td>Spotted Harrier
Circus assimilis</td><td>Yes</td></tr>
<tr><td>Black Falcon
Falco subniger</td><td>Yes</td></tr>
<tr><td>Little Eagle
Hieraaetus morphnoides</td><td>Yes</td></tr>
<tr><td>Square-tailed Kite
Lophoictinia isura</td><td>Yes</td></tr>
<tr><td>Major Mitchell's Cockatoo
Lophochroa leadbeateri</td><td>Yes</td><td rowspan="2">Yes
Breeding and foraging habitat in woodland areas.
Six hollow-bearing paddock trees occur in the grassland.</td><td rowspan="2">Low.
Negligible woodland habitats will be removed by the project.
Potential – six hollow-bearing paddock trees occur in the grassland.</td></tr>
<tr><td>Barking Owl
Ninox connivens</td><td>Yes</td></tr>
</table>

SEARs threatened flora species

Of the seven additional flora species required to be assessed (refer Table 16), six of these species have habitat such as Black Box Grassy Open Woodland, White Cypress Pine Open Woodland and Yellow Box – White Cypress Pine Grassy Woodland communities within the project area. Negligible impacts to these three communities, which provide potential habitat for these species, will occur as part of the project.

In addition, field surveys have been conducted during the flowering period, as listed in Table 16, for all these species in the targeted surveys. None of these species were recorded during any of the field surveys.

Table 16 SEARs threatened flora species

Threatened Species	Flowering period	Habitat in project area	Project impact
Sand-hill Spider Orchid *Caladenia arenaria*	Aug to Oct	Yes All woodland areas in project area.	Negligible woodland habitats will be removed by the project. Not recorded during the field surveys during flowering period.
Bindweed *Convolvulus tedmoorei*	Aug to Nov	Yes All vegetation types in project area.	Unlikely to occur, one record to the west of the project area from 1969.
Oakland Diuris *Diuris* sp. (Oaklands, D.L. Jones 5380)	Nov	Yes Yellow Box Woodland	Negligible woodland habitats will be removed by the project. Not recorded during the field surveys during flowering period.
Austral Pillwort *Pilularia novae-hollandiae*	All year	No Occurs in shallow swamps and waterways.	Negligible habitat within the project area.
Turnip Copperburr *Sclerolaena napiformis*	Nov to Feb	Yes All woodland areas in project area	Negligible woodland habitats will be removed by the project. Not recorded during the field surveys during the flowering period.
Red Darling Pea *Swainsona plagiotropis*	Aug to Sept	Yes All woodland areas in project area	Negligible woodland habitats will be removed by the project. Not recorded during the field surveys during flowering period.
Silky Darling Pea *Swainsona sericea*	Sept to Oct	Yes All woodland areas in project area	Negligible woodland habitats will be removed by the project. Not recorded during the field surveys during flowering period.

Species identified by databases that have potential to occur

Database searches undertaken within a 20km radius recorded an additional five threatened fauna species and two threatened flora species that have not been identified by the SEARs or the BioBanking calculator as having the potential to occur within the project area (refer Table 17). None of these species were recorded during the field surveys. The FBA does not require a significance assessment under the TSC Act for these species.

Table 17 BC Act species

Species/Ecological community	Recorded	BC Act Status
Fauna		
Dusky woodswallow	No	V
Flame Robin	No	V
White-bellied Sea Eagle	No	V
Southern Myotis	No	V
Yellow-bellied Sheathtail-bat	No	V
Flora		

Species/Ecological community	Recorded	BC Act Status
Slender Darling Pea (*Swainsona murrayana*)	No	V
Pine Donkey Orchid (*Diuris tricolor*)	No	V

Threatened ecological communities

Two threatened ecological communities (refer **Figure 10**) were recorded in the project area. Both Weeping Myall Woodland and Sandhill Pine Woodland were identified in the SEARs and are required to be assessed as part of the project. The communities which were recorded within the project area include the following:

- Weeping Myall Woodland is listed as endangered on both the BC Act and EPBC Act. Six patches of this community occur in the project area and have been numbered from WM1 to WM6 for assessment purposes.
- Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions listed as endangered on the BC Act.

EPBC Act Weeping Myall Woodlands

An assessment of the Weeping Myall Open Woodlands of the Riverina Bioregion and NSW Southern Western Slopes recorded within the project area and been undertaken to determine if this community meets the criteria for the Weeping Myall Woodland listed as endangered under the EPBC Act. The Weeping Myall Woodlands EPBC Act Policy Statement 3.17 (DEWHA, 2009) has been used to assess the patches of Weeping Open Woodland of the Riverina Bioregion and NSW Southern Western Slopes recorded within the project area that may meet these criteria.

As shown on **Figure 10**, two patches (WM1 and WM2) within the northern section of the project area meets the EPBC Act criteria for this community, with the remaining patches identified as not meeting the criteria as they are less than 0.5 ha in size, as shown in Table 18 below.

Table 18 EPBC Act Weeping Myall Woodlands Assessment

EPBC Act Policy statement criteria	Weeping Myall Woodlands Patches WM1, WM2	Weeping Myall Woodlands Patches WM3, WM4, WM5, WM6
Are there Weeping Myall trees present?	Yes	Yes
Does the patch have a native understorey?	Yes	Yes
Does the patch have at least 5% tree canopy?	Yes	Yes
Is the canopy dominated by more than 50% cover of living and/or dead Weeping Myall trees?	Yes	Yes
Is the patch greater than 0.5 ha?	Yes	Yes
Does the patch have more than two layers of regenerating Weeping Myall trees present?	Yes	-
Do the patches meet the criteria for federal listing of Weeping Myall woodland?	**Yes**	**No**

To avoid any uncertainty, the EPBC Act listed Weeping Myall Woodlands do not include a derived grassland component. As per the Listing Advice for Weeping Myall Woodlands ecological community:

> *"As it is not possible to determine whether the existing grasslands and shrubland were formerly associated with Weeping Myall Woodlands or whether they always existed as independent vegetation types, the grasslands and shrublands that now lack Weeping Myall trees are excluded from the current listing. In addition, any areas that are known to have been derived from Weeping Myall Woodlands, having lost the Weeping Myall overstorey, are not included."*

Therefore, no grassy areas within the project area are included in the mapping of this threatened community and do not require further consideration.

BC Act Weeping Myall Woodland

All patches WM1 to WM6 (refer **Figure 10**) of the Weeping Myall open woodland of the Riverina Bioregion and NSW Western Slopes mapped within the project area are definitively commensurate with the endangered community of Myall Woodland in the Darling Riverine Plains Brigalow Belt South, Cobar Peneplain, Murray-darling Depression, Riverina and NSW Slopes Bioregion listed as endangered on the BC Act.

As detailed in Section 4.3 of the BAR (refer **Appendix C**), the grassy areas within the project area have been definitively identified as *Plains Grass grassland on alluvial mainly clay soils in the Riverina and NSW South-western Slopes Bioregions* (PCT 45) and are not considered derived grassland communities for the reasons outlined below.

To avoid any uncertainty, the BC Act listed Weeping Myall Woodland within the project aera is not considered to include any derived grassy areas. Consistent with the wording in Commonwealth Listing Advice, it is not possible to determine whether the existing grasslands were formerly associated with Weeping Myall Woodlands (or indeed the Black Box grassy woodland or other woodland types) or whether they had always existed as independent vegetation types.

The Final Determination for Weeping Myall Woodland states that "the structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history". The grassland areas within the project area do not contain any of these types of structure.

The NSW Vegetation Information System (VIS) also does not list PCT 45 as being Weeping Myall Woodland and the OEH website does not include PCT 45 as being one of the vegetation types which represent this TEC within the Riverina Interim Biogeographic Regionalisation of Australia. Section 5.5.3 of the BAR (refer **Appendix C**) provides further detail on this, and in conclusion, there is no definitive reason for any of the grassland areas within the project area to be included in the Weeping Myall Woodland TEC.

EPBC Act White Box Yellow Box Blakely's Red Gum Grassy Woodland Assessment

An assessment of the Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and NSW Western slopes recorded within the project area has been undertaken to determine if this community meets the criteria for the critically endangered community White Box Yellow Box Blakely's Red Gum grassy woodland and derived native grassland (Box Gum Woodland) listed under the EPBC Act. The White Box Yellow Box Blakely's Red Gum EPBC Act policy statement (Department of Environment & Heritage, 2006) has been used to assess the patches of Yellow Box – White Cypress Pine grassy woodland recorded within the project area that may meet these criteria (refer Table 19 below).

This assessment concluded that the Yellow Box – White Cypress Pine grassy woodland recorded within the project area does not meet the criteria for the federal listing of Box Gum Woodland. The Yellow Box – White Cypress Pine Grassy Woodland patches WB1 and WB2 have less than 50% of native understorey cover and patches WB3, WB4 and WB5 are less than 2 ha and have less than 12 native species excluding grasses in the understorey.

Table 19 EPBC Act criteria for Box Gum Woodland

EPBC Act Policy statement criteria	Box Gum Woodland Patches WB1, WB2	Box Gum Woodland Patches WB3, WB4, WB5
Is or was previously the dominant overstorey species, White Box Yellow Box or Blakely's Red Gum?	Yes	Yes
Does the patch have predominately native understorey (greater than 50% cover native species)?	**No**, these patches were surveyed to have less than 30% of the understorey cover as native species.	Yes
Is the patch 0.1 greater in size?	-	Yes
Does the patch have 12 more native species excluding grasses in the understorey?	-	**No**, the patches have 4 native species excluding grasses
Is the patch 2 ha or greater in size?	-	No
Does the vegetation in the project area meet the criteria for federal listing of Box Gum Woodland?	**No**	**No**

No threatened communities listed under the EPBC Act were recorded within the project area during the current surveys.

BC Act White Box Yellow Box Blakely's Red Gum Grassy Woodland Assessment

The Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and NSW Western slopes **is not** commensurate with the endangered ecological community (EEC) White Box

Yellow Box Blakely's Red Gum Woodland as listed on the BC Act. No derived native grassland form of this community is present within the project area.

This is because the site is located in the Riverina Bioregion. The Riverina Bioregion is not included in the final determination as a bioregion in which the TEC occurs, as follows: *"The community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions"*.

BC Act Sandhill Pine Woodland Assessment

The two patches of White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone mapped within the project area (refer **Figure 10**) are commensurate with the endangered ecological community (EEC) of Sandhill Pine Woodland in the Riverina, Murray-darling Depression and NSW South Western Slopes Bioregions.

EPBC Act Matters of National Significance

Threatened flora

The EPBC Act Protected Matters Search identified 2 threatened flora species, *Brachyscome papillosa* and *Swainsona murrayana* as having the potential to occur within the project area. Both of these species have been identified as having potential habitat within the project area; however, September field surveys undertaken during the flowering period for these species did not find any records.

Threatened fauna

The EPBC Act Protected Matters Search identified 13 threatened fauna and 3 threatened fish species with potential habitat within a 20 km radium of the project area (refer to **Appendix C** for further detail). Three birds (Painted Honeyeater, Plains Wanderer and Superb Parrot) and one species of bat (Corben's Long-eared Bat) were identified as having habitat within the project area.

Targeted surveys for the species noted as having habitat within the project area was undertaken. The Painted Honeyeater, Plains Wanderer and the Corben's Long-eared Bat were not recorded within the project area during targeted surveys.

The Superb Parrot was recorded in 16 locations within woodland habitat of the project area and is listed as Vulnerable under the EPBC Act (refer **Figure 10**). Observations of this species included foraging in Black Box trees, Yellow Box trees and exotic grassland adjoining the project area. No nesting pairs were observed to be associated with the hollow-bearing trees, during the field surveys within the project area.

Migratory species

The EPBC Act Protected Matters Search identified one migratory marine species, two terrestrial migratory species and four migratory wetland species with the potential to occur within the project area.

Three species were assessed as having habitat within the project area, Latham's Snipe, Common Greenshank and Fork-tailed Swift. Under the EPBC Act, listed migratory species have areas of important habitat. The EPBC Act Significant Impact Guidelines for Matters of National Significance (DEWHA, 2013) defines important habitat for migratory species as:

- *Habitat utilised by migratory species occasionally or periodically within a region that supports ecological significant proportion of the species; and /or*
- *Habitat that is of critical importance to the species at particular life-cycle stages; and/or*
- *Habitat utilised by a migratory species which is at the limit of the species range; and/or*
- *Habitat in an area where the species is declining.*

Habitat within the project area for these species does not meet the above criteria and therefore the project is unlikely to impact upon any migratory species.

Wetlands of International Importance

Five wetlands of international importance were identified by the EPBC Act Protected Matters Search, being Banrock Station Wetland Complex, Fivebough and Tuckbil Swamps, Hattah-kulkyne Lakes, Riverland and The Coorong, and Lakes Alexandrina and Albert wetland. Rivebough and Tuckbil swamps occur 20 km upstream with the remainder over 400 km upstream. As all these wetlands occur upstream, the project is unlikely to have an impact upon these wetlands.

No other MNES are relevant to this project.

Threatened Aquatic Species and Communities

No threatened endangered habitat, aquatic species, endangered populations or communities listed under the FM Act was recorded or have habitat within the project area.

7.1.3 Potential impacts

The DPSF project design has been situated on the site to avoid areas with the highest biodiversity value (e.g. threatened ecological communities and threatened flora and fauna habitat). The project design has considered the following:

- Retention of the majority of the woodland and open forest vegetation, identified as Vegetation and Heritage Protection Exclusion Zones;
- Retention of the threatened communities listed as endangered under the EPBC Act and/or the BC Act recorded within the project area;
- Retention of the majority of structurally diverse flora and fauna habitat; and
- Installation of a 20 m buffer surrounding the retained open forest and woodland habitats, for bushfire management but also to provide for a

manageable interface between the project footprint and the Vegetation and Heritage Protection Exclusion Zones.

Existing research on solar farm impacts to native vegetation

There is limited information in Australia on solar farm impacts to native vegetation. However, there are international examples of solar farm projects that resulted in a significant gain in biodiversity through management approaches such as using native grass and herb seed mixes.

Consideration of existing research has been provided in Section 7 of **Appendix C** in relation to likely impacts of the project. Key findings of this literature review indicated that provided suitable management occurs, with a focus on native species, management measures can actually increase native grassland and herbfield diversity and condition. Such an approach is proposed for this project, with a key focus being on ensuring native grassland diversity and condition does not decrease (and actually may increase).

The grassland growth at the DPSF site varies throughout the year and from season to season depending on growing conditions (e.g. rainfall and temperature etc). Photographs showing the condition of the grassland in April, July and December 2017 are shown in **Appendix A.**

CSU assessment

An independent assessment of the native grassland by Dr Jeff McCormick and Dr Peter Orchard of CSU was commissioned to assess the current condition of the grassland and the potential for the native grassland to retain biodiversity values post construction of the project. This report is attached as **Appendix D**.

Based on observations of the site together with the available scientific literature, the CSU report concluded that:

> *"the overall impacts of the photovoltaic solar array on grassland diversity, habitat value and fire risk should be insignificant and in certain aspects such as weed management potentially highly positive. Given the dynamic nature of biological systems monitoring will be essential and an adaptive management approach implemented based on, and responsive to, seasonal/annual conditions. This will be critical during the early stages when the solar plant has been set up and the grassland is re-establishing. There will be a need from the site development phase onwards for a focus on monitoring annual exotic weeds numbers and the strategic imposition of interventions via grazing, mowing and possibly herbicides to maintain and improve the present condition".*

Proposed biodiversity management regime

The proposed biodiversity management regime is based on the approach outlined by CSU - McCormick & Orchard (2018). The proposed management strategy includes:

> *"During the operational phase of the site, a management strategy will need to be implemented. The primary aims of this strategy would be:*

- *To enhance native species within the pastures (diversity and abundance)*
- *Provide sufficient structure within native grasses for habitat*
- *Reduce fuel load during the fire danger season.*

The primary management tools to achieve the aims of the management strategy will focus on grazing and mowing that will reduce potential fuel load but that they will occur at times that are advantageous to the native perennials while inhibiting the exotic annuals. To achieve the aims of the management strategy with the tools available, the following management strategy is suggested:

- *During winter graze sheep/mow. Primarily this will reduce the level of dry matter from annual growing species for summer fire hazard. The annuals will tend to have a greater palatability/digestibility than the natives at this stage and be preferentially grazed.*
- *Remove sheep/mow mid-August. This will allow annual grass seed heads to emerge evenly.*
- *Mow to 5-10cm mid-September/October when annual grasses are flowering.*
- *Destock/low stocking rate over summer. Enhance seed set of perennial native species.*
- *Only mow/graze during fire season if grassland growth will result in average dry matter exceeding 5,000 kg/ha DM. This value was taken from the Murrumbidgee Irrigation Area Bush Fire Management Committee with regards to the Asset Protection Zone (APZ) fuel load in forested areas, in the absence of a defined fuel load for grassland in the RFS guidelines".*

Construction impacts

The following potential impacts have been identified and are discussed in further detail below:

- Vegetation impacts
- Fauna habitat loss
- Impact to threatened ecological communities
- Disturbance and/or impact to threatened species
- Fire buffer impacts
- Groundwater Dependent Ecosystems
- Habitat fragmentation and connectivity
- Edge and barrier effects
- Injury and mortality

- Sedimentation and erosion
- Weeds
- Noise impacts
- Impact on key threatening processes (KTPs)

Vegetation impacts

The DPSF project area (including site infrastructure covers approximately 710 ha of the project area. Due to the nature of a solar farm project however, vegetation impacts are likely to include a mixture of:

- Areas of complete removal of vegetation
- Areas of minor impacts to vegetation below the solar panels.

It should not be forgotten that the existing grasslands are used for agricultural purposes and are regularly grazed by sheep and cattle to just above ground level. They should not be considered "pristine" native grasslands without disturbance from the existing agricultural management regime.

The direct impacts to the vegetation within the project area include total clearance for the following infrastructure:

- Internal roads
- Fire breaks (maintained short grass <100 mm year round)
- 132/33kV switchyard
- Office, car park, other amenities
- Battery facility
- Inverters and hardstand
- Piles

Rationale for and justification of the varying indirect impacts of the project was guided by the site-specific native grassland study conducted by McCormick & Orchard (2018) at CSU (refer **Appendix D**). This study was undertaken in order to predict the likely vegetation impact of the project, with a focus on whether the structure of the native grassland might be altered to any substantial degree post-construction.

The outcomes of the CSU study provide details on the potential native grassland impacts from the project. However, the pertinent information for determining the impact of the project on the native grassland consists of the following:

- Of the under-panel area (188 ha), 56% is dominated by the taller Plains Grass which can grow up to 2m. The other areas dominated by other native grassland, excluding Plains Grass, only normally grow to about 50cm;

- The Plains Grass dominated areas will therefore be the focus of the management measures to keep grass height below panel height to prevent shading and to keep fire fuel load below RFS guideline levels;
- The CSU study states that the average structure of the Plains Grassland dominated area should only be reduced by a maximum of 20% by the proposed management regime. Hence, total percentage vegetation impact is 0.56 x 0.20 x 188 ha = 21.06 ha impact, for the under-panel area;
- The other areas of native grassland in the under-panel area will be allowed to continue to grow to close to its natural 50cm height on a frequent/regular basis;
- The CSU study states that the between-panel area should not significantly change once it is recovered from construction
- The CSU study states that native grass and forb abundance will increase with the implementation of the suggested management strategy due to the selective pressure against exotic annual species; and
- The under-panel area will not be permanently mown or grazed, only as recommended in the management regime as outlined by CSU (usually in winter, mid September – October and if required in summer when dry matter exceeds 5t/ha). This will control weeds, give an advantage to native grasses to set seed and still control fuels regarding the fire threat.

The inter-panel grassland areas are to be retained and have been calculated as no impact. As described in the project description section of the BAR and in Section 2.6.4 of this EIS, ongoing disturbance (via vehicles etc) will be negligible. Other areas that have been included that have no impact include:

- TransGrid substation, as augmentation works to existing facility only
- Transmission easements
- Retained vegetation (Vegetation and Heritage Protection Exclusion Zones)

Subsequently, the impacts to vegetation, albeit at a level of varying disturbance in accordance with the CSU study, will include:

- 8.14 ha direct impact to Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (PCT 16) moderate to good – moderate;
- 0.16 ha direct impact to Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South Western Slopes Bioregions (PCT 75) moderate to good – moderate;
- 37.7 ha direct impact to Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45) moderate to good – moderate;
- 21.06 ha net impact on grassland (refer to CSU study, Appendix D).

Fauna habitat loss

Net fauna habitat loss as part of the proposal equates to the following:

- 58 ha of grassland habitat;
- 8.30 ha of woodland habitat; and
- 1.92 ha of aquatic habitat.

The clearing and alteration of the native grassland within the direct impact areas will result in the loss of foraging, breeding and sheltering habitat for small grassland species such as ground foraging birds, macropods, Microchiroptern bats, skinks and snakes. The retention of the grassland in the under-panel area and the between-panel areas, albeit in a modified form, would allow continued habitat for some of the ground dwelling species such as birds and reptiles.

The vast majority of trees (including those with hollows) within woodland areas of the site will be retained, however, six isolated hollow-bearing trees are required to be removed by the project, within the grassland vegetation of the project area. These trees have a combined 39 hollows. One of these trees contained a large stick nest in the upper branches of the tree likely to be a bird of prey nest. No bird species were recorded nesting in any of the hollows. The Superb Parrot was not recorded breeding within any of these trees. The vast majority of the open forest and woodland areas will be retained as part of the project.

The proposal will remove a comparatively negligible area of woodland habitat (8.3 ha) within the project area. Woodland removal will consist of the following:

- 8.14 ha of Black Box grassy open woodland
- 0.16 ha of Yellow Box – White Cypress Pine grassy woodland

The clearing of this comparatively small area of native woodland habitat will result in the loss of minor foraging, breeding and sheltering habitat for some woodland species such as birds, arboreal mammals and microchiroptern bats. However, the retention of the vast majority of the woodland habitat that occurs on site would allow continued habitat for these woodland dwelling species.

Six farm dams (a combined area of 1.92 will be removed. All of these dams were devoid of vegetation and heavily used by cattle and had very poor water quality. The removal of these farm dams is unlikely to significantly impact foraging, breeding and sheltering habitat for fauna species which may occur within the project area.

Threatened ecological communities

No threatened ecological communities will be impacted upon by the proposal, as they have been avoided and retained/protected with the Vegetation and Heritage Protection Exclusion Zones. Twenty metre firebreaks have been provided around all Vegetation and Heritage Protection Exclusion Zones to provide a protective management interface.

Disturbance and/or impact to threatened species

Grey-crowned Babbler

This species was recorded at 23 locations in the Yellow Box, Black Box and White Cypress Pine woodland habitat within the project area (refer **Figure 10**). Four Grey-crowned Babbler nests were recorded in the project area. The project area provides foraging, roosting and breeding habitat for this species.

The DPSF project will remove only a negligible area of woodland habitat (8.30 ha) within the project area. The clearing of this small area of native woodland habitat will result in the loss of minor foraging, breeding and sheltering habitat for this species. No other areas of woodland habitat suitable for this species will be removed as part of the project.

Superb Parrot

This species was recorded at sixteen locations with the majority observed bordering the north-western region of the project area (refer **Figure 10**). The Superb Parrot was recorded within the woodland and open forest habitat within the project area. The project area provides foraging, roosting and breeding habitat for this species.

The DPSF project will remove only a negligible area of woodland habitat (8.30 ha) within the project area. The clearing of this small area of native woodland habitat will result in the loss of minor foraging, sheltering and potential breeding habitat for this species. No other areas of woodland habitat suitable for this species will be removed as part of the project.

Six isolated paddock trees containing hollows will be impacted upon by the project which contain potential nesting habitat for this species. This species is highly unlikely to utilise these isolated trees for nesting as they would be vulnerable to attack by prey species. Furthermore, large numbers of hollow-bearing trees occur within the project area and the locality of the project area.

Fire buffer impacts

A firebreak buffer of 20m will be incorporated around the retained woodland and grassland habitat. These buffers will be slashed at regular intervals to an approximate height of approximately 30cm, altering the grassland habitat and requiring the removal of some of the woodland habitat. The clearing for the fire buffer will alter the available habitat for fauna. Ground-dwelling fauna will be impacted upon the most by the firebreak buffer as the edge of the fire buffer will adjoin maintenance tracks.

The impact from the firebreak buffer have been included in the vegetation removal calculations outlined above. The firebreak buffer may impact upon fauna species that use the grassland for foraging, breeding and refuge habitat. Ground-dwelling birds such as the Australasian Pipit and the Stubble Quail were observed in the grassland habitat during field surveys.

Groundwater Dependent Ecosystems

The Atlas of Groundwater Dependent Ecosystems (BOM, 2017) has identified the Black Box Grassy Woodland community within the project area as having a high potential for being reliant on subsurface groundwater. The project will involve the installation of poles to support the solar panels and would not be installed to a depth that is likely to interact with groundwater. Therefore, the project is unlikely to impact upon GDEs.

Habitat fragmentation and connectivity

Habitat fragmentation is where removal of native vegetation causes an area of intact vegetation to become fragmented, resulting in loss of connectivity and a reduction in habitat availability. Types of fauna impacted include ground dwelling and arboreal mammals, ground dwelling birds and sedentary fauna.

The project area contains existing fragmented woodland areas in the south and west of the project area.

The DPSF project will remove only a negligible area of woodland habitat (8.30 ha) within the project area. No other areas of woodland habitat are proposed to be removed. The removal of this negligible area of woodland habitat is unlikely to further fragment the grassy woodlands and will retain connectivity to areas of existing woodland.

Some areas of the grassland community are likely to be removed where roads, the substation, the battery area and the firebreak are proposed. Where the solar array installation extent occurs, grassland will be modified to varying degrees. Complete removal of vegetation will be restricted to solar array pole locations and cable trenching. However, it is expected that after topsoil is returned to the cabling route, pre-existing vegetation will become re-established. Moderate impacts to the vegetation below the solar array installation may also occur as outlined in the CSU report (refer **Appendix D**) and the sections above where a modified management regime will be implemented. Minor construction vegetation impacts are anticipated to occur in the between-panel areas, however, beyond the construction stage, impacts are not expected. A small area which contains the existing transmission line in the north-east of the project area will be retained and connectivity to the north east will be retained.

Overall, grassland underneath the solar panels will be predominantly retained, albeit in a modified form, and will allow for movement of ground dwelling fauna across the project area. The movement of large macropods such as the Eastern Grey Kangaroo will be inhibited through the project area, however grassland areas occur to the east of the project area which will allow movement to the east of the project area.

Edge and barrier effects

Edge effects are areas that interface between native vegetation and modified landscapes. These areas result in changes to ecological function of native vegetation and can result in reduced availability of habitat for fauna species.

These areas can increase weeds and the habitat for pest fauna species such as foxes and rabbits (Moenting & Morris, 2006).

The project area is within the modified agricultural landscape of the Riverina which contains areas of intense cultivated cropping areas particularly associated with the Murrumbidgee and Coleambally Irrigation Areas as well as areas of livestock grazing which are predominantly located on the grassland areas. Patches of remnant woodland vegetation remain throughout the Riverina area.

The project is located within grazed grassland areas and is surrounded by cultivated cropping to the north and south with grassland occurring to the east, and Donald Ross Drive to the west. The project will largely avoid removing areas of remnant woodland, with the solar farm layout predominantly located on the grasslands. The proposed biodiversity management regime (including a Biodiversity Management Plan) is aimed at improving the quality of the grassland, removing weed species and increasing native perennials such as Plains Grass. As such, it is not anticipated that edge effects from an increase in weed species will occur.

As identified above, the solar farm infrastructure may provide a barrier to movement of large ground animals such as the Eastern Grey Kangaroo, however grassland areas to the east of the project area will remain as habitat for large ground animals. It is unlikely that a significant physical impediment to the movement of small ground dwelling fauna under the solar panel area will occur.

Avifauna such as birds and bats are not anticipated to have any significant edge effects or barriers to movement between the higher value woodland habitat areas, which are surrounded by 20m firebreak areas. The grassland area will still be able to be accessed by avifauna. In terms of knowledge about how the solar farm infrastructure could impact their use of the grasslands, Montag *et al*. (2016) would seem to indicate that birds and bats will be able to continue to utilise the habitats present throughout the project area.

The project may result in removal of edge vegetation surrounding the project area and it is expected that this project could affect habitat used by both the Grey-crowned Babbler and Superb Parrot to a minor degree.

Injury and mortality

During construction of the project, there is the potential for an increase in fauna mortality through collision with construction machinery and light vehicles. Mobile species such as birds can mostly avoid collision through moving out of the path of any vehicles. The removal of hollow-bearing trees has the potential to injure and result in the mortality of hollow dependent species such as the Superb Parrot, Common Brushtail Possum and microchiropteran bats. In addition, significant areas of grassland habitat will require slashing in accordance with the management regime detailed in the CSU report, which has the potential to injure and result in the mortality of grassland-dwelling species such as the Australasian Pipit.

Mitigation measures discussed in Section 7.1.7 below would limit the effect of the project on fauna species, and therefore the potential for injury or mortality to fauna is likely to be minor.

Sedimentation and erosion

The project may potentially contribute to sediment and erosion issues during construction works. Runoff containing excessive amounts of sediment can impact waterways, altering water quality and adversely affecting aquatic life.

Given the relatively modified nature of the project area and adjacent areas, the potential for impacts is negligible. This impact is likely to be mitigated with the application of water quality mitigation measures summarised in Section 8.4.4.

Weeds

Twenty-seven species of weed were recorded within the project area. None of these species are listed on either the BS Act and/or are weeds of national significance. Other invasive weeds that were recorded include *Xanthium spinosum* (Bathurst Burr) and *Marrubium vulgare* (Horehound). During construction, the project has the potential to spread weeds through the movements of heavy machinery and light vehicles.

The increase in weeds degrades the habitat for flora and fauna species and ecological communities. The Grey-crowned Babbler, was recorded in the project area in woodland habitat. The spread of weeds in this habitat may reduce the quality of the habitat for these species and other woodland bird species (Robinson et al, 2001).

Invasion of native plant communities by exotic perennial grass is a key threatening process (KTP) under the BC Act. The project has the potential to further spread weeds throughout the project area and exacerbate this KTP, if not appropriately mitigated.

If the mitigation measures outlined in Section 7.1.7 are implemented, then the impact of the project is unlikely to increase the spread of weeds recorded in the project area.

Noise impacts

Sound is important for fauna for communication, navigation, foraging and detecting prey species or danger. Changes in noise through a number of human induced noise sources, such as vehicle traffic, can affect fauna species ability to function (Forman, et al., 2000). Adaption by animals to noise in their natural environment such as wind or other animals can cause them to change their behavior to function within their environment (Eve, 1991).

Heavy machine, vehicle movements and vegetation clearing will cause an increase in noise levels in the construction phase of the project. This increase in noise level may be detrimental to fauna and their ability to function in their environment. Noise might startle animals such as mammals and birds. The increase in noise levels during construction will temporarily impact on fauna species, but would not have a long-term impact.

Impact on key threatening processes

Forty KTPs are currently listed on the BC Act and/or the EPBC Act. Of these the following have been assessed as having the potential to be increased by the proposal. These include the following:

- **Anthropogenic Climate Change** – minor incremental contribution to greenhouse gas;
- **Clearing of Native Vegetation** – The project will contribute to an incremental loss in native vegetation. Impact assessments for removal of vegetation and assessment of the need for biodiversity offsets is required;
- **Competition and grazing by the feral European Rabbit, *Oryctolagus cuniculus* (L**.) – The project has the potential to increase grazing by rabbits through ongoing slashing of native grasses;
- **Infection of native plants by *Phytophthora cinnamomi* –** No evidence of Phytophthora was recorded on any plant species, however the project may facilitate the transmission of this disease through machinery transportation;
- **Invasion of native plant communities by exotic perennial grasses –** The project has the potential to increase the spread of exotic perennial grasses through ongoing slashing of native grasses;
- **Loss of hollow-bearing trees** – Six isolated paddock hollow-bearing trees containing 39 hollows will be impacted upon by the project; and
- **Removal of dead wood and trees –** fallen timber and dead trees were recorded throughout the project area. The project is likely to remove these during construction works.

Section 7.1.7 outlines proposed mitigation measures to address these KTPs where possible.

Operation

Injury and mortality

During operation of the solar farm, there is the potential for a ‘lake effect’ whereby the reflection of light off photovoltaic panels resembles the constant reflective surface similar to a waterbody. Birds can experience injury and even mortality if they attempt to land (thinking they were water) on the surfaces of the panels. However, typical photovoltaic panels are designed to reflect approximately 2% of incoming sunlight. Subsequently, potential for bird collision risks due to the ‘lake effect’ are considered to be low.

Noise impacts

The establishment and operation of the solar farm is unlikely to have a long-term impact on fauna within the project area due to increased noise.

Decommissioning

There is the potential for minor impacts to fauna during decommissioning of the solar farm such as potential injury and mortality. However, these would be limited in nature and of short duration.

7.1.4 FBA assessment

Areas not requiring assessment

Areas that do not require FBA assessment include areas that do not contain native vegetation, unless the SEARs issued for the project require an assessment.

Six farm dams that occur within the project area will not require assessment as they are devoid of native vegetation. The farm dams will not require offsets as a result of the impacts from the project. The farm dams encompass 1.92 ha and are mapped in Figure 4-4 of **Appendix C**.

An offset is not required for impacts to PCTs if it meets the following criteria:

- In a vegetation zone with a site value score of <17, and the PCT has not been identified as a EEC or CEEC
- Not associated with threatened species habitat and are not identified as an EEC or CEEC.

Zone 5 Plains Grassland in poor condition has a site score of less than 17 and therefore does not require further assessment. The remaining PCTs require further assessment and provision of biodiversity offsets.

PCTs requiring offsets

Six vegetation zones have been identified as occurring within the project area, as described in Table 12. The following will be impacted by the DPSF project:

- Zone 1 – Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45) – Moderate to Good Condition – Moderate
- Zone 2 – Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion) (PCT 16) – Moderate to Good Condition – Moderate
- Zone 4 – Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina Bioregion and western NSW south Western Slopes Bioregion (PCT 75) – Moderate to Good Condition – Moderate

Thus, Zones 1, 2 and 4 are the only zones requiring offsetting to any degree.

PCTs not requiring offsets

Two threatened ecological communities are listed as threatened under the EPBC Act and/or the BC Act. These communities occur in Zones 3 and 6 and are outlined below:

- Zone 3 – Weeping Myall Woodland is listed as endangered under the BC Act and EPBC Act:
  - Two patches WM1 and WM2 meet the criteria for listing of the endangered ecological community (EEC) of Weeping Myall Woodlands under the EPBC Act
  - Patches WM1 to WM6 meet the BC Act listing for Weeping Myall open woodland of the Riverina Bioregion and NSW Western Slopes
- Zone 6 – Sandhill Pine Woodland in the Riverina, Murray-Darling Depression and NSW South Western Slopes bioregions listed as endangered on the BC Act.

These zones will not be impacted as they have been avoided during project design and as a result offsets are not required for these PCTs.

Threatened species offsets

Threatened flora species

Three threatened flora species, *Leptorhynchos orientalis* (Lanky Buttons), *Brachyscome papillosa* (Mossgiel Dasiy) and *Lepidium monoplocoides* (Winged Peppercress) have been identified as species credit species for assessment (refer Table 14). All three of these species have habitat within the project area. Targeted field surveys were conducted in September 2017 and November 2017 within the flowering period for these species.

None of the flora species credit species were detected during the targeted field surveys and therefore these species are considered unlikely to be affected by the DPSF project. No offsets will be required for these species.

Threatened fauna species

Fauna species credit species

One species credit species, the Superb Parrot, was recorded within the project area. This species was recorded utilising woodland and open forest habitat throughout the project area. The Superb Parrot was not initially identified as a species credit species in the calculator and therefore was manually added into the calculator for biodiversity offset calculations. 8.30 ha of woodland habitat for this species will be affected as part of the project. Such a reduction in woodland habitat is considered to be comparatively minor for the Superb Parrot, with large numbers of this species being recorded along the Murrumbidgee River less than 2 km to the north of the project area. Habitat for this species will still be available post-construction, with the majority of the woodland habitat identified for retention within the Vegetation and Heritage Protection Exclusion Zones. This species will require biodiversity offsets as a result of the project due to the removal of 8.30 ha of woodland habitat.

One species credit species, Grey Falcon (refer Table 14), listed in the calculator required targeted survey. This species can be surveyed all year round. The three field surveys undertaken for the DPSF project in April, September and November 2017 did not detect this species and therefore this species is not required to be offset.

Ecosystem credit species

One ecosystem species was recorded, the Grey-crowned Babbler, in the project area. This species was recorded in family groups and nesting throughout woodland areas of the project area.

The vast majority of its habitat will be retained post-construction in the Vegetation and Heritage Protection Exclusion Zones and offsets will be provided via provision of offsets for the ecosystem credits.

A further 17 ecosystem credit species of fauna were identified as having predicted habitat within the project area by the BioBanking calculator. Nine of these species were identified as having habitat within the project area (refer Table 13). Offsets for these species will be provided via provision of offsets for the ecosystem credits.

Biodiversity credit requirement calculations

Appendix C provides further detail on the Biodiversity Credit Report resulting from the BAR assessment. The ecosystem credits requirements calculated for the project is 25,660 and consists of the following:

- Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45): **25,061 credits**
- Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (PCT 16): **489 credits**
- Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South Western Slopes Bioregions (PCT 75): **10 credits**

Table 20 provides a summary of the inputs and credit requirements.

Table 20 Ecosystem credits required for offset

Plant Community Type	Management Zone	Management Zone area	Loss in Landscape Value	Loss in site value score	EEC Offset Multiplier	Ecosystem credits required
Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South	1	656.3	26.2	48.67	1.0	25,061

Plant Community Type	Management Zone	Management Zone area	Loss in Landscape Value	Loss in site value score	EEC Offset Multiplier	Ecosystem credits required
Western Slopes (PCT 45)						
Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (PCT 16)	3	8.14	26.20	71.33	1.0	489
Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South Western Slopes Bioregions (PCT 75)	4	0.16	26.20	71.88	1.0	10
Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45)	2	43.13	26.20	16	731	0
					Total	**25,560**

Species credit species requirements for the Superb Parrot is 149 credits as outlined in Table 21.

Table 21 Species credit species calculations

Species	Scientific name	TS Offset Multiplier	Species Credits Required
Superb Parrot	*Polytelis swainsonii*	1.8	149

Application of credit discount to ecosystem credits

It was identified that the project has the potential to remove a maximum 656 ha of Management Zone 1 and this has been included in the calculation.

However, it is significantly more complex than assuming the solar project will result in wholesale clearing and loss of the native grassland.

It is recognised that the loss of the Black Box and Yellow Box Woodlands will mean a substantial change in species composition and structure, so the credits generated in the calculator for these PCTs are proposed to be provided as part of the Biodiversity Offset Strategy (BOS).

Based on the results of the study by McCormick & Orchard (2018) at CSU, the Plains Grassland (PCT 45) will be able to be retained substantially in keeping with the existing species diversity, abundance and structure.

As outlined above, based on observations of the site together with the available scientific literature, the CSU report by McCormick & Orchard (2018) concluded that:

> *"the overall impacts of the photovoltaic solar array on grassland diversity, habitat value and fire risk should be insignificant and in certain aspects such as weed management potentially highly positive. Given the dynamic nature of biological systems monitoring will be essential and adaptive management approach based on, and responsive to, seasonal/annual conditions. This will be critical during the early stages when the solar plant has been set up and the grassland is re-establishing. There will be a need from the site development phase onwards for a focus on monitoring annual exotic weeds numbers and the strategic imposition of interventions via grazing, mowing and possibly herbicides to maintain and improve the present condition."*

Impacts to native vegetation, albeit at a level of varying disturbance in accordance with the CSU study, will include:

- 8.14 ha direct impact to Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (PCT 16) – moderate to good condition – moderate;
- 0.16 ha direct impact to Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South Western Slopes Bioregions (PCT 75) – moderate to good condition – moderate;
- 37.7 ha direct impact to Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45) – moderate to good condition – moderate;
- 21.06 ha net impact calculated from CSU study assessment impact to Plains Grassland under the solar panels (refer to **Appendix D** for further information).

Essentially the discount that is proposed to be applied is that under the panel area should only need to be offset where the structure of the grassland is likely to be altered to any substantial degree.

Approximately, 56% of the under-panel area is dominated by the taller Plains Grass (which can grow up to 2 m). The other areas of the native grassland only normally grow to about 50cm and will not require substantial management intervention to keep the fuel load down. The CSU study estimates that under the proposed management regime, the average structure of the Plains Grassland dominated area would be reduced by a maximum of 20%. Hence, total percentage impact is 0.56 x 0.20 x area, for the under-panel area.

McCormick & Orchard (2018) indicates the between-panel area should not significantly change once it is recovered from construction, hence offsets are not proposed for this component.

The panel area will not be permanently mown or grazed, only as recommended in the management regime as outlined by CSU (usually in winter, mid-September – October and if required in summer when dry matter exceeds 5t/ha). This will control weeds, give an advantage to native grasses to set seed and manage the fire fuel load to within acceptable limits. The grassland will be allowed to continue to grow to close to its natural 50cm height on a frequent/regular basis.

All direct impact areas (roads, substation, battery facility, firebreaks) are to be offset in accordance with in the FBA calculations as required.

Proposed final adjusted ecosystem credit requirements

As a result of the proposed credit discount application in the above manner, based on McCormick & Orchard (2018), the final credits proposed to be provided as part of the BOS are summarised in Table 22.

Table 22 Proposed Final Adjusted Credit Requirements

PCT Type	Zone and Condition	Equivalent Direct Impact Area (ha)	Discount Applied?	Final Adjusted Equivalent Credit Requirements
Plains Grass grassland on alluvial mainly clay soils in the Riverina and NSW South-western Slopes Bioregions (PCT 45)	Zone 1 moderate to good – moderate	58.76 ha	Yes	2,233
Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (mainly Riverina and Murray Darling Depression Bioregions) (PCT 16)	Zone 2 moderate to good – moderate	8.14 ha	No	489
Weeping Myall open woodland of the Riverina and NSW South-western Slopes Bioregions (PCT 26)	Zone 3 moderate to good – high	0 ha	No	0
Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW South-western Slopes Bioregions (PCT 75)	Zone 4 moderate to good – moderate	0.16 ha	No	10

PCT Type	Zone and Condition	Equivalent Direct Impact Area (ha)	Discount Applied?	Final Adjusted Equivalent Credit Requirements
Plains Grass grassland on alluvial mainly clay soils in the Riverina and NSW South-western Slopes Bioregions (PCT 45)	Zone 5 moderate to good – poor	43.13 ha	Offsets not required as site value score less than 17	0
White Cypress Pine open woodland of sand plains, prior streams and dunes mainly of the semi-arid (warm) climate zone (PCT 28)	Zone 6 moderate to good – moderate	0 ha	No	0
			Total	**2,732**

Section 7.1.6 discusses how this adjusted credit requirement might be satisfied.

7.1.5 Commonwealth impact assessment

One threatened fauna species, Superb Parrot, and one endangered ecological community (EEC) of Weeping Myall Woodlands have been recorded within the project area. A further two birds, two species of plant and one bat species have potential habitat within the project area (refer Table 23).

Assessments of significance under the EPBC Act have been undertaken for threatened biodiversity listed under the EPBC Act (refer to Table 23 and **Appendix C** for further detail).

As Weeping Myall Woodlands and the Superb Parrot have been recorded within the project area, an EPBC referral is proposed, with the recommendation for a Not a Controlled Action Particular Matter determination, based on the biodiversity management regime to be applied to the project as outlined in Section 7.1.7 below.

Table 23 EPBC Act Biodiversity

Species/Ecological Community	Recorded	EPBC Act Status	Likely significant impact
Weeping Myall Woodlands	YES	EEC	NO
Superb Parrot	YES	V	NO
Painted Honeyeater	NO	V	NO
Plains Wanderer	NO	CE	NO

Species/Ecological Community	Recorded	EPBC Act Status	Likely significant impact
Slender Darling Pea (*Swainsona murrayana*)	NO	V	NO
Mossgiel Daisy (*Brachyscome papillosa*)	NO	V	NO
Winged Peppercress (*Lepidium monoplocoides*)	NO	E	NO
Corben's Long-eared Bat	NO	V	NO

No other Commonwealth MNES were recorded within the project area and therefore are not considered likely to be impacted by the project.

7.1.6 Biodiversity offset strategy

The BAR (refer **Appendix C**) has outlined the threatened species, populations or ecological communities that are considered likely to be impacted by the project. The BAR and EIS outlines how avoidance has been considered as part of the consideration of project alternatives.

To address the residual impacts of the project, following consideration of the potential for avoidance and for implementation of mitigation measures, Edify Energy recognises that a biodiversity offset will be required and the approach to determining the offset is outlined as part of the BOS (discussed in Chapter 11 of **Appendix C**). Section 11.2 of **Appendix C** provides further details on the regulations applicable to biodiversity offset provision.

It is recognised that at both a State and Commonwealth level, direct biodiversity offsets are preferred as the primary option for offsetting. It is also recognised that the preferred mechanism for this to occur is BioBanking. All avenues should be explored in sourcing the required offset land and ecosystem credits before considering other options such as indirect offsets or payment into the Biodiversity Offsets Fund.

Communities and species requiring offsetting

As summarised in Table 22, the following credits (or their equivalent value) are proposed to be provided:

- Plains Grass grassland: **2,233 credits**
- Black Box grassy open woodland: **489 credits**
- Yellow Box – White Cypress Pine grassy woodland: **10 credits**
- Superb Parrot: **149 credits.**

Potential offset measures

Historically there have been a variety of options available for biodiversity offsetting, which have included:

- Direct offsets:
  - On-site offsets: protection and rehabilitation of on-site ecological communities and species
  - Off-site offsets: sourcing and conserving off-site properties containing suitable ecological communities and species, including dedication to National Parks or Councils where deemed appropriate
  - Third party off-site offsets: purchasing credits or funding a third party to provide offsets in an off-site location
- Indirect (supplementary) offsets (note: the FBA indicates that supplementary measures can only be used in lieu of offsets when offsets are not feasible and other options are needed):
  - Funding land management activities by others
  - Funding threatened species research and recovery
- NSW Biodiversity Offsets Fund:
  - The FBA process has introduced an option of payment into a dedicated Biodiversity Offset Fund as an additional option for Major Projects.

Direct offset search criteria

Having already committed to prioritising like-for-like offsets, the search for biodiversity offsets will be guided by the NSW Biodiversity Offsets Policy for Major Projects. Further details are provided in Section 11.6 of **Appendix C**.

Project commitment

Edify Energy commits to working with DP&E, OEH (and DoEE if required) towards producing a Biodiversity Offset Package (BOP) that addresses previous advice and which provides an improved conservation outcome as a result of the impacts of the project. The primary commitments in developing the BOP are;

1. Direct offsets conserving like-for-like vegetation is the first preference, including the option of paying into the Biodiversity Offsets Fund
2. The preferred conservation mechanism for the offset site is BioBanking/Stewardship Agreement
3. Supplementary measures will only be considered if all other avenues in sourcing appropriate offsets have been exhausted (however, it is noted that Edify Energy wish to fund research on the biodiversity impacts of the DPSF project as this would increase industry knowledge on the impacts and optimal management of solar farms on native grasslands, providing benefits beyond this project. It would be proposed that this would satisfy part of the offset requirements).

The BOP will be developed in accordance with the criteria summarised in Chapter 11 of Appendix C.

7.1.7 Management and mitigation

Table 24 presents the recommended biodiversity mitigation measures for the DPSF site.

Table 24 Biodiversity mitigation measures

No.	Recommended mitigation measures	C	O	D
B1	Prepare Biodiversity Management Plan based on the biodiversity management regime as outlined in the CSU study and Section 7.1.3 (‘Recommended approach to biodiversity management’) and Action B13 (see below) of this report, before commencement of construction. This plan will encompass, but is not limited to: • Measures to be implemented for biodiversity management, including protection of Vegetation and Heritage Protection Exclusion Zones and biodiversity management regime; • Seasonally-based program to monitor and report on the effectiveness of the measures; • Responsibilities for implementation of the plan; and • Plains Grassland monitoring – development of a monitoring plan in consultation with CSU. This should include further baseline surveys prior to construction.	✓		
B2	Engage site workers to provide an environmental induction prior to commencement of on-site works. This induction will encompass ecologically important matters on site and the procedures to protect flora and fauna.	✓		
B3	Sediment and erosion measures should be implemented in accordance with approved guidelines to control any potential sediment runoff (refer Table 74).	✓		
B4	Vegetation and Heritage Protection Exclusion Zones and trees identified to be retained should be clearly marked (e.g. fencing) to ameliorate unnecessary impacts to vegetation.	✓		
B5	Stockpiling of construction materials to be limited to existing cleared areas on-site.		✓	
B6	Application of water to stockpile areas during high wind to prevent air quality impacts.		✓	
B7	A suitably qualified ecologist is to conduct pre-clearing surveys before removal of any native vegetation to remove any fauna and mark up hollow bearing trees to be removed. All trees proposed to be removed should be re-checked for hollows prior to clearing.	✓	✓	
B8	A suitably qualified ecologist will be required to be present during hollow-bearing tree removal to relocate any displaced fauna.		✓	
B9	Where possible, dead wood, hollow trunks and tree limbs should be relocated to woodland areas not to be cleared.		✓	
B10	Re-establishment of stabilised surfaces as soon as possible following construction.		✓	✓

No.	Recommended mitigation measures	C	O	D
B11	'Lake Effect' – monitor site for bird injury or mortality, with a search for carcasses under and around areas with solar panels.			✓
B12	The spread of noxious weeds should be managed (e.g. the invasive weed Bathurst Burr should be removed and be suitably disposed of offsite to reduce weed spread).		✓	✓
B13	During the operational phase, the biodiversity management regime will focus on grazing and mowing that will reduce potential fuel load at times that are advantageous to native perennials and inhibiting exotic annual species. The following overarching biodiversity management regime is proposed to be implemented: • During winter graze sheep/mow: primarily this will reduce the level of dry matter from annual growing species for summer fire hazard. The annuals will tend to have a greater palatability/digestibility than the natives at this stage and be preferentially grazed. • Remove sheep/mow mid-August: this will allow annual grass seed heads to emerge evenly. • Mow to 5-10 cm mid September/October when annual grasses flowering: this will prevent seed set of exotic annual species enhancing native abundance as well as reducing combustible load. • Destock/low stocking rate over summer: enhance seed set of perennial native species. • Only mow/graze during fire season if grassland growth will result in average dry matter exceeding 5,000kg/ha DM: this value was taken from the Murrumbidgee Irrigation Area Bush Fire Management Committee in regard to the APZ fuel load in forested areas, in the absence of a defined fuel load for grassland in the RFS guidelines. An adaptive management approach will be adopted whereby management actions will be adjusted to optimise the grassland growth addressing on-site observations.		✓	
B14	Implement the BOP recommendations as agreed with DP&E/OEH	✓	✓	✓

7.2 Traffic and access

7.2.1 Methodology

The traffic impact assessment undertaken for the proposed DPSF has been carried out in accordance with the *Guide to Traffic Generating Developments* (RTA, 2002) and the *Guide to Traffic Management Part 12: Traffic Impacts of Developments* (Austroads, 2016). This assessment has considered the existing road network and assessed the likely construction and operational traffic generation and impacts associated with the development of the DPSF site.

This section provides a summary of the traffic impact assessment undertaken for the DPSF site, while **Appendix E** contains the full copy of the traffic impact assessment.

7.2.2 Existing environment

Site location

The proposed DPSF site is located approximately 10 km south of the township of Darlington Point along Donald Ross Drive (3.5 km south of the Sturt Highway / Donald Ross Drive intersection).

Donald Ross Drive is a north-south orientated sealed two-lane local road (posted speed limit of 100 km/h) which can be directly accessed via the Sturt Highway from the north and the Kidman Way/Ringwood Road intersection from the west.

The Sturt Highway is an east-west orientated sealed two-lane national highway with a posted speed limit of 110 km/h. The intersection of Sturt Highway and Donald Ross Drive is a priority-controlled T-intersection. From the east, access to Donald Ross Drive includes a 120 m auxiliary left-turn treatment (AUL), while from the west a 50 m auxiliary right-turn treatment (AUR) is provided.

Kidman Way is a north-south orientated state-controlled sealed two-lane road. Site access is via the Kidman Way/Ringwood Road priority-controlled T-intersection to the west of Donald Ross Drive. Basic left- (BAL) and right-turn (BAR) treatments are provided for the northern and southern approaches.

Traffic volumes

Traffic volumes for Sturt Highway (April 2017) and Kidman Way (February 2006 – Feb 2011) have been sourced from the Roads and Maritime Services (RMS) online traffic volume viewer service. A summary of the average daily traffic volumes for Sturt Highway and Kidman Way (including heavy vehicle percentages) are included in Table 25 and Table 26.

Table 25 Kidman Way average daily traffic volumes

Count Year	Average daily traffic volumes (vpd)		% Heavy vehicles		Annual growth
	Northbound	Southbound	Northbound	Southbound	
2006	503	511	22%	24%	-
2007	521	532	24%	26%	3.8%
2010	530	536	22%	21%	0.4%
2011	477	526	-	-	-5.9%

Table 26 Sturt Highway average daily traffic volumes

Count Year	Average daily traffic volumes (vpd)		% Heavy vehicles		Annual growth
	Westbound	Eastbound	Westbound	Eastbound	
2015	582	578	33%	31%	-
2017	666	660	37%	37%	3.9%

From Table 25 and Table 26, no constant historic growth rate is apparent. Therefore, in order to forecast future traffic volumes, a conservative value of 1% annual compound growth rate has been adopted.

At the time of preparing the traffic impact assessment (refer **Appendix E**), no traffic volumes for Donald Ross Drive or Ringwood Road were available. Therefore, in order to estimate the existing traffic volumes on these local roads, it was assumed that the local roads generate up to a maximum of 50% of the major road traffic:

- Donald Ross Drive: 50% of westbound traffic on Sturt Highway
- Ringwood Road: 50% of northbound traffic on Kidman Way.

The resultant existing (2017) traffic volumes on the road network are presented in **Appendix E**.

Traffic generation during construction

The DPSF site's sole access point will be via the existing ingress on Donald Ross Drive. The DPSF site has no other road or street frontage. A temporary laydown area (close to the site access point) will cater for all parking, servicing and manoeuvring of vehicles.

Major traffic generating activities at the DPSF site are anticipated to be carried out during construction of the DPSF. As described in Section 2.6, construction is likely to take 12 months, with the peak period occurring for approximately 4 to 5 months. During construction, the hours of operation for the site will be:

- Monday to Friday – 7 am to 6 pm
- Saturday – 7 am to 1 pm.

In general, no construction activities will occur over night, on Sundays or public holidays, however, exceptions to these hours may be required on limited occasions, for example:

- The delivery of materials as requested by the NSW Police Force or other authorities for safety reasons and/or to minimise disruption to local traffic;
- Augmentation works to the TransGrid substation, which may require a temporary power outage, such that the impact on power supplies to the local community is minimised; and
- Emergency work to avoid the loss of life, property and/or material harm to the environment.

The local council, surrounding landholders and other relevant authorities will be notified of any exceptions prior to the works being undertaken.

The peak of the construction period will be approximately for 4 – 5 months. During the peak of construction, it is expected that there will be in the order of 300 light vehicles transporting workers to and from Darlington Point/Griffith (i.e.

north-west of the site) via Donald Ross Drive, and approximately 30 to 50 heavy vehicles delivering to the site each day.

Construction haulage routes for the delivery of materials and equipment will include Kidman Way (northbound from Melbourne) and the Sturt Highway (eastbound from Adelaide and westbound from Sydney/Wollongong).

Delivery of PV modules, tracking systems, transformers, battery storage and related equipment is anticipated to utilise various large vehicles, ranging from standard container (20ft) trucks or 19m articulated vehicles (largely for the delivery of the PV modules and tracking), and potentially B-Doubles.

Heavy construction vehicles (e.g. earth and pile driving machinery) will be required to travel to site and will remain onsite until completion. As such, they will have no significant ongoing impacts on the road system.

Traffic generation during operation

The operation of the site will involve five full-time staff who would attend the site on most days. An unsealed car parking area for staff and visitors is to be designed and located adjacent to the O&M building.

A network of internal access tracks in the form of unsealed gravel roads will provide access to the arrays. The location of the roads will be determined during the detailed design stage of the development.

During this stage of development, the hours of operation for the site will be Monday to Friday from 7am to 6pm and Saturday from 8am to 1pm. Outside of emergencies or major asset inspection or maintenance programs, night works or work on Sundays or public holidays would be minimised.

Trip generation

There are limited published traffic generation rates for the construction and operation of solar farms. As such, a first principle's approach has been adopted in order to estimate the traffic generation of the proposed DPSF site.

With approximately 300 light vehicles transporting workers to and from Darlington Point and approximately 30 to 50 heavy vehicles delivering to the site each day, it is assumed that 80% of light vehicles will arrive/depart during the peak hour. Additionally, it is assumed that heavy vehicles will arrive/depart evenly throughout the day.

The operation of the DPSF site will involve five full-time staff who would attend the site on most days.

A summary of the trips generated by the subject site during both the construction and operational phases of development is presented below in Table 27 and Table 28.

Table 27 Total trip generation summary

Class of vehicle	No. Vehicles per day	Total Daily Trips	Proportion vehicles arrive / depart during peak	No. vehicle trips per hour (in / out)
CONSTRUCTION PHASE				
Light vehicle	300	600	80%	240
Heavy vehicles	50	100	9%*	9
OPERATIONAL PHASE				
Light vehicles	5	10	80%	4

Table 28 Peak hour trip generation summary

Class of vehicle	In (%)	In (vph)	Out (%)	Out (vph)
CONSTRUCTION PHASE – AM PEAK				
Light vehicle	90%	216	10%	24
Heavy vehicles	50%	5	50%	5
CONSTRUCTION PHASE – PM PEAK				
Light vehicle	10%	24	90%	216
Heavy vehicles	50%	5*	50%	5*

* All volumes have been rounded

As demonstrated, the DPSF is anticipated to generate up to 249 vehicles per hour during the morning and evening peak hour periods during construction. Edify Energy propose to use a park-and-ride system to transport construction workers to and from the site. A number of options are currently being assessed by Edify Energy to use a parking area within close proximity to the DPSF site. The EPC Contractor would be responsible for operating the transport mode (e.g. bus charter) to and from the site during construction of the DPSF.

Once operational, the subject site is expected to generate a total of five vehicles per hour.

Trip distribution

Light vehicle trips will mostly occur for the transporting of staff to and from the township of Darlington Point and Griffith. It has been assumed that 80% of light vehicle trips will therefore access from the Sturt Highway (west of Donald Ross Drive).

Heavy vehicle trips will be generated from hauling plant and materials from Sydney (Sturt Highway eastbound), Melbourne (Kidman Way southbound) and Adelaide (Sturt Highway westbound). An even distribution between these three city centres for haulage routes has been assumed.

The resultant trip distribution adopted was:

- Sturt Highway (west of Donald Ross Drive): 80% LV, 33% HV
- Sturt Highway (east of Donald Ross Drive): 10% LV, 33% HV
- Kidman Way (south of Ringwood Road): 10% LV, 33% HV

The development traffic profiles during the morning and evening peak periods at the construction phase is presented in **Appendix E**.

7.2.3 Potential impacts

Construction

With and Without Development Volumes

An annual growth rate of 1% was applied to forecast the existing background traffic volumes to the anticipated peak construction year, being 2018. To forecast the post development traffic volumes, the pre-development traffic profiles and the development traffic profiles were summed together. The pre-development and post development (construction) traffic volumes are presented in **Appendix E**.

Road link assessment

During construction, it is understood that up to 700 vehicles per day will be generated by the DPSF site. Given the surrounding major road network (i.e. Sturt Highway and Kidman Way) both carry less than 1,200 vehicles per day (two-way), construction activities would be expected to increase existing daily volumes by greater than 5%, the threshold beyond which a road link analysis is recommended (Austroads *Guide to Traffic Management Part 12*). Due to the impact of this volume increase, a road link analysis based on the Transportation Research Board *Highway Capacity Manual* (HCM) (TRB, 2016) has been carried out for the key road links of the Sturt Highway and Kidman Way to determine their resultant pre and post development Level of Service (LOS) during the peak construction period.

According to the HCM (TRB, 2016), at LOS A, motorists experience high operating speeds and little difficulty in passing. At LOS B, passing demand and passing capacity is balanced. Once a road link reaches LOS E, the demand is observed to approach capacity. LOS F exists whenever demand flow in one or both directions exceeds the segment’s capacity. Operating conditions are unstable, and heavy congestion exists.

According to Austroads: *Guide to Traffic Management Part 12*, it is preferred that new rural road projects operate of LOS A or B at opening.

The LOS results of the road link analysis indicated that on both Sturt Highway and Kidman Way, the LOS is anticipated to remain at LOS A even with the addition of development construction-related traffic. Therefore, the proposed development, during the peak construction period is not expected to impact significantly on the operation of the surrounding key road network (refer Table 29).

Table 29 Road link analysis result summary

Level of Service (LOS)	AM Peak		PM Peak	
	Pre Development	Post Development	Pre Development	Post Development
Sturt Highway (west of Donald Ross Drive)				
Eastbound	A	A	A	A
Westbound	A	A	A	A
Kidman Way (south of Ringwood Road)				
Northbound	A	A	A	A
Southbound	A	A	A	A

Intersection assessment

The performance of the following intersections were assessed using SIDRA Intersection 7.0 with the existing geometry and lane configurations and 2018 traffic volumes (i.e. peak construction period):

- Kidman Way/Ringwood Road
- Sturt Highway/Donald Ross Drive
- Donald Ross Drive/Site Access

In order to quantify the intersection performance, the following performance measures of each intersection has been reported as per the *Guide to Traffic Management Part 12* (Austroads, 2016) and the *Guide to Traffic Generating Developments* (RTA, 2002):

- Degree of saturation (DOS) (%) – the ratio of demand flow to capacity. For priority junctions, the DOS for any movement should not exceed 0.80
- Average delay (sec) – the average delay per vehicle in seconds incurred by vehicles over the modelled time period. Average delay exceeding 42 seconds is considered near/at capacity and other control modes should be considered.
- 95th percentile queue – a queue length measured in metres of which only 5% of queues are greater than or equal to.

The fourth approach at the intersection of Kidman Way/Ringwood Road is Boondilla Road. Boondilla Road is currently an unsealed local road and is anticipated to carry minimal traffic volumes. For the purpose of this assessment, a nominal value of 10 vehicles per hour to each turning movement in/out of Boondilla Road has been adopted.

Table 30 Intersection performance overview (2018 Post Development)

Time Period	Maximum DOS (%)	Maximum Average Delay (sec)	Maximum 95%ile Queue (m)
Sturt Hwy / Donald Ross Drive			
AM Peak	16%	8.8	5.1

Time Period	**Maximum DOS** (%)	**Maximum Average Delay** (sec)	**Maximum 95%ile Queue** (m)
PM Peak	23%	7.0	7.4
Donald Ross Drive / Site Access			
AM Peak	14%	8.6	1.4
PM Peak	20%	9.1	5.4
Kidman Way / Ringwood Road / Boondilla Road			
AM Peak	6%	6.4	1.6
PM Peak	7%	6.4	2.1

The analysis results show that the intersections all function within the acceptable limits of operation in both the AM and PM peak periods during the peak construction period even with the addition of development related trips.

Swept path analysis

During the construction period, delivery of equipment is anticipated to utilise various large vehicles, ranging from standard container (20ft) trucks or 19m articulated vehicles (largely for the delivery of the PV modules and tracking) and potential B-Doubles.

In order to confirm that the surrounding road network can cater physically for the manoeuvring of the construction vehicles attracted to the site, swept path analysis using a B-Double design vehicle has been carried out at the key intersections. The vehicle characteristics and profile adopted for the analysis is presented in **Figure 11**.

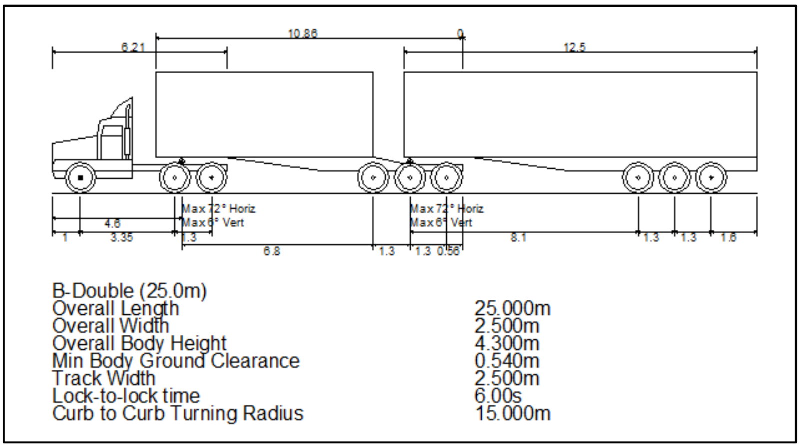


Figure 11 B-Double Vehicle Profile

Sturt Highway/Donald Ross Drive

The swept path of a B-Double entering and exiting Sturt Highway is presented below in **Figure 12** and **Figure 13** respectively.

Figure 12 Sturt Highway/Donald Ross Drive (entering Sturt Highway: B-Double)

Figure 13 Sturt Highway/Donald Ross Drive (exiting Sturt Highway: B-Double)

A B-Double is able to manoeuvre in/out of Donald Ross Drive from the Sturt Highway within the existing intersection pavement extents.

Donald Ross Drive/Site access

The swept path of a B-Double entering and exiting the proposed site access is presented below in **Figure 14** and **Figure 15** respectively.

Figure 14 Donald Ross Drive/Site access (entering site access: B-Double)

Figure 15 Donald Ross Drive/Site access (exiting site access: B-Double)

It is recommended that during the initial stages of construction (i.e. when the access roads within the site are constructed) that the access is upgraded to enable the swept paths of a B-Double as shown above in **Figure 14** and **Figure 15**.

Kidman Way/Ringwood Road

The swept path of a B-Double entering and exiting Ringwood Road from Kidman Way (South) is presented in **Figure 16**.

Figure 16 Kidman Way/Ringwood Road (B-Double)

A B-Double is able to manoeuvre in/out of Ringwood Road from Kidman Way (south) within the existing intersection pavement extents.

Operation

During operation, it is understood that up to five staff may be required onsite for operational management and maintenance. For the purpose of this assessment, it has been assumed that all arrive / depart the site from the Sturt Highway. The resultant impact of development once operational on the external road link is presented in Table 31.

Table 31 Operational Phase Traffic Impact

Road	2017 AADT	Daily development vehicle trips	Impact
Sturt Highway	1326 vpd	10 vpd	0.8%

As shown, the operational traffic impact due to the project is deemed to be insignificant, as the additional levels will be less than 5% of existing daily traffic levels. The level of operational activity is therefore considered to have an insignificant traffic impact on the Sturt Highway in the vicinity of the site.

As discussed in Section 2.5.8, construction of the BESS facility is proposed to run from Q3 to Q4 (August to December) 2020, once the solar farm is in operation (expected commencement of solar farm operation is Q3/Q4 2019). An approximate 156 vehicle deliveries for the battery powerpacks and inverters, cables, crane movements, and concrete deliveries would be expected over the BESS facility construction period (Q3 to Q4 2020). A further 10 to 20 personnel (peak of 20 vehicles) would attend site during the BESS construction period.

From this, the expected number of vehicles attending the site during the BESS construction period would be approximately 176 vehicles over the period, which is significantly less than that expected for the construction period of the solar farm (e.g. up to 249 vehicles per hour during the morning and evening peak hour periods). On this basis, it is anticipated that the construction of the BESS facility would not impact significantly on the operation of the surrounding road network.

Decommissioning

The traffic generation for the decommissioning phase of the project is expected to be similar or less than for the construction phase, with vehicles utilising the same routes.

On this basis, it is anticipated that the decommissioning phase of the project will not impact significantly on the operation of the surrounding road network.

The BESS facility life is likely to be 15 years, so may require replacement halfway through the solar farm's 30 year design life at year-15. This would involve the removal and replacement of battery cubicles only. Approximately 90 to 100 battery cubicle deliveries would occur over a two to three month window at year-15.

The volume of vehicles to make these deliveries is not expected to have a significant impact on the operation of the surrounding road network, as the vehicle volumes would be significantly less than for the construction phase, and vehicles would utilise the same routes.

7.2.4 Management and mitigation

A summary of the recommended mitigation measures to address traffic and access to and from the DPSF site is provided in Table 32.

Table 32 Recommended traffic and access mitigation measures

No.	Recommended mitigation measures	C	O	D
TA1	To enable the swept paths of a B-Double (as shown in **Figure 14** and **Figure 15**) to adequately enter and exit the DPSF site, the site access would be upgraded during the initial stages of construction. This will be addressed during the detailed design	✓		

No.	Recommended mitigation measures	C	O	D
	phase of the project and included in the construction Traffic Management Plan.			
TA2	A construction Traffic Management Plan will be developed for the project and implemented during construction.	✓		
TA3	Edify Energy propose to use a park-and-ride system to transport construction workers to and from the site. A number of options are currently being assessed by Edify Energy to use a parking area within close proximity to the DPSF site. The EPC Contractor would be responsible for operating the transport mode (e.g. bus charter) to and from the site during construction of the DPSF.	✓		

7.3 Flooding and hydrology

7.3.1 Methodology

A flood impact assessment has been undertaken for the DPSF site, which has assessed the existing and post-development flood levels across the site and current and future flood risks. This was undertaken according to the following:

- Flood levels based on the 1974 flood extents and current ground survey (existing scenario) were estimated from background information and the Murrumbidgee River Flood Atlas
- Flow and velocities for the pre-development scenario for the 1974 flood event for a number of cross sections across the site using the Manning's equation were estimated.
- Calculation of the flood levels and velocities for the post-development scenario for the 1974 flood event by calculating hydraulic energy losses associated to the obstruction of flow caused by the development.

A summary of the flood impact assessment is provided below, with the full copy of the assessment contained in **Appendix F.**

7.3.2 Existing environment

Background

The DPSF site is located within the Murrumbidgee River floodplain that is generally flat and the soil is high in clay content. Parts of the site have been subject to inundation as a result of recent and historic major flood events.

Whilst anecdotal evidence and historic flood mapping exists for the site, there is no known previous flood modelling work available. There is no evidence of previous flood modelling undertaken for the site. However, it is understood that Murrumbidgee Council has commissioned a consultant to undertake a comprehensive flood study of Darlington Point and the surrounding floodplain.

This study is currently ongoing, however, it is understood that the hydraulic model extent is unlikely to cover the floodplain where the DSPF is be located.

As such, the flood assessment consisted of a desktop hydraulic analysis based on historical flood evidence sourced from the Murrumbidgee River Flood Atlas provided by OEH (OEH, 2017, pers. Com.) and existing ground survey of the site to estimate flood levels and velocities. The Flood Atlas depicts the estimated flood extent that was experienced by local residents during the August 1974 flood event, which has been estimated to be around a 90 year ARI flood event. Ground survey was undertaken and utilised to estimate flood levels within the site. A summary of the ground survey methodology is provided in Section 2.4.2.

Available data

The data used in producing the flood impact assessment is summarised below:

- An image of the August 1974 flood event (provided by the OEH) depicting the approximate flood extent across the Murrumbidgee River floodplain. The image originates from the Murrumbidgee River Flood Atlas (refer **Figure 17**);
- Ground survey (July 2017) for the site; and
- The proposed layout of the solar modules and other site layout details (refer Section 2.5).

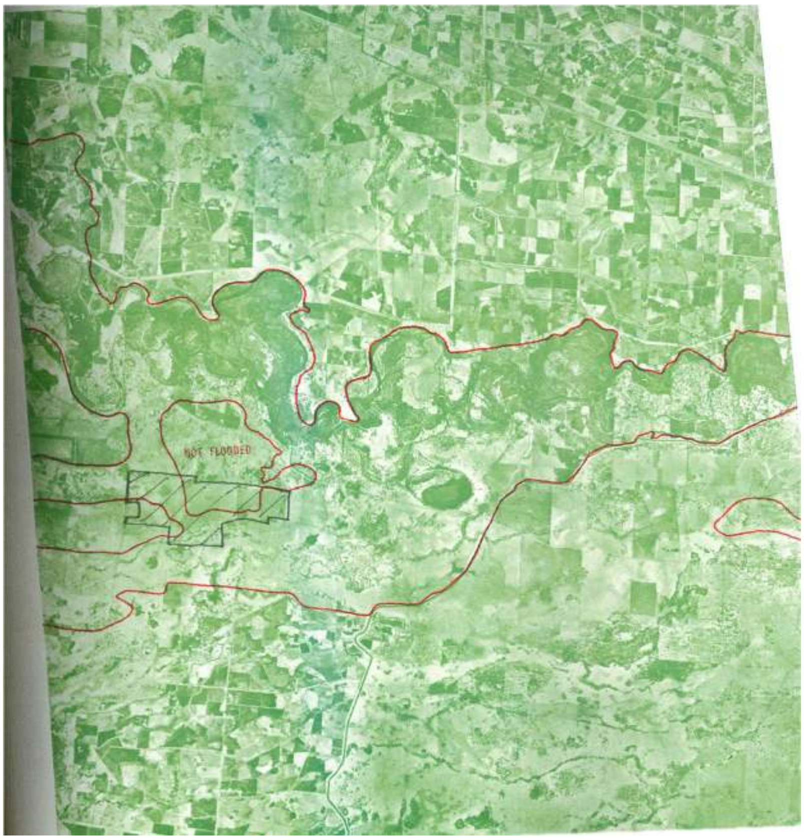


Figure 17 Murrumbidgee River hand-drawn flood atlas with extents for the 1974 flood event (Source: OEH 2017)

Pre-development scenario

In order to derive flood levels for the 1974 flood, the extents of the flood were overlayed on top of the existing site ground survey. Corrections to the flood extent data were made in areas where flood extents were not consistent with ground levels (either too low or too high, depending on the undulating topography). A flood depth map across the site was estimated by subtracting the flood level surface from ground survey levels.

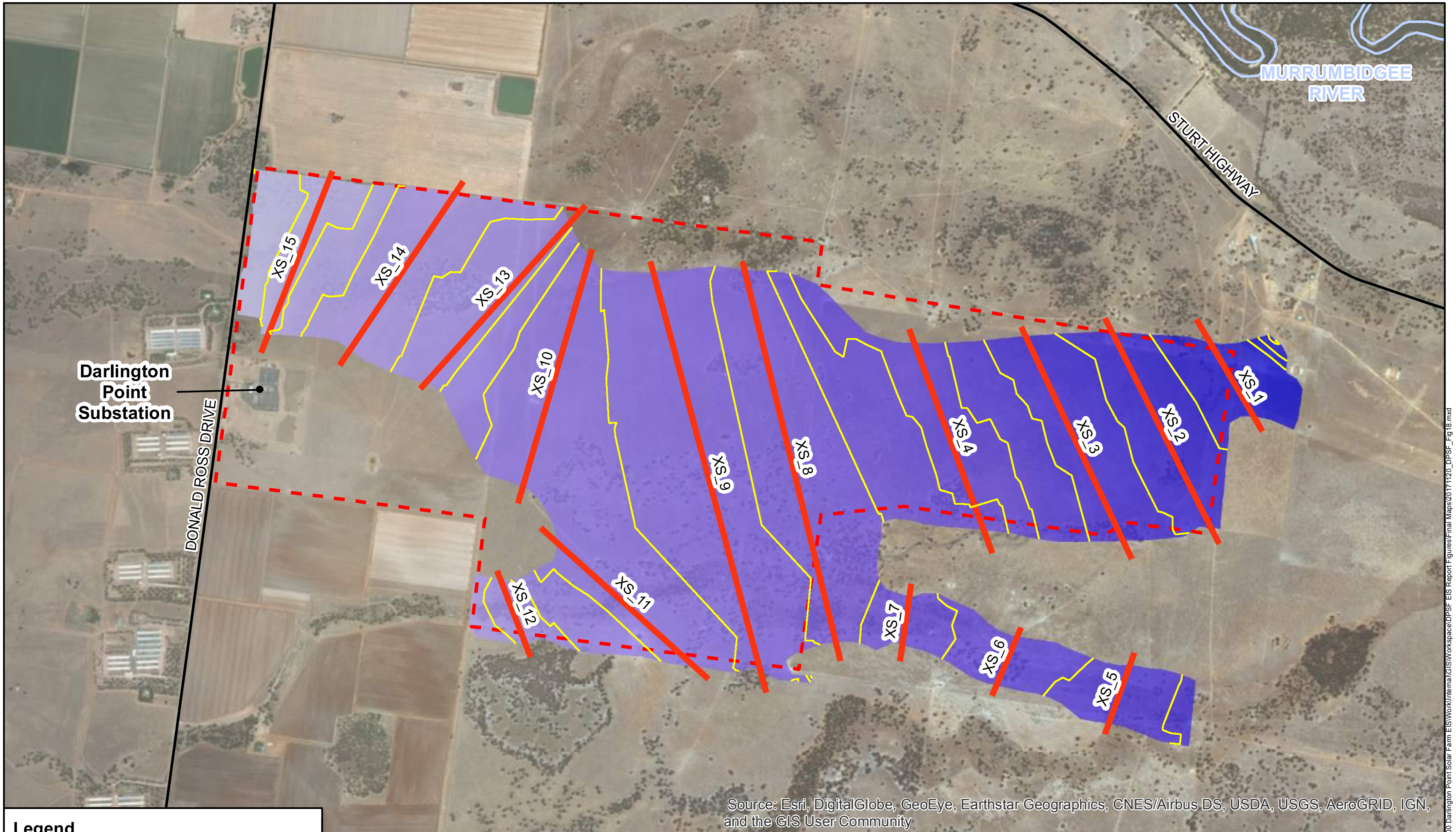
Flow velocities for a number of sections across the site were estimated using Manning's equation for uniform flow:

$$\mathbf{u} = \frac{\mathbf{1}}{\boldsymbol{n}} \boldsymbol{R}_h^{\frac{2}{3}} \boldsymbol{S}^{\frac{1}{2}}$$

where *u* is velocity, *n* is Manning's roughness coefficient, R_h is the hydraulic radius and *S* is the slope.

Ground survey and estimated levels were used for determining the hydraulic radius and slope for each cross section. **Figure 18** shows the location of cross sections for which the calculations of velocity was performed.

The site is generally covered with dense, low to medium grass. As such, a Manning's n value of 0.04 was adopted in the calculations as per recommendations in Project 15 of AR&R 2016.



Legend

Flood Levels (mAHD)
High : 129
Low : 126

Roads
Rivers
Project Boundary
Velocity Section Lines
Flood Level Contour (mAHD)

Edify Energy - Darlington Point Solar Farm

Figure 18 - Location of Flow Cross Sections

ARUP
Level 4, 108 Wickham Street
Fortitude Valley, QLD 4006
Tel +61 (7)3023 6000 Fax +61 (7)3023 6023
www.arup.com

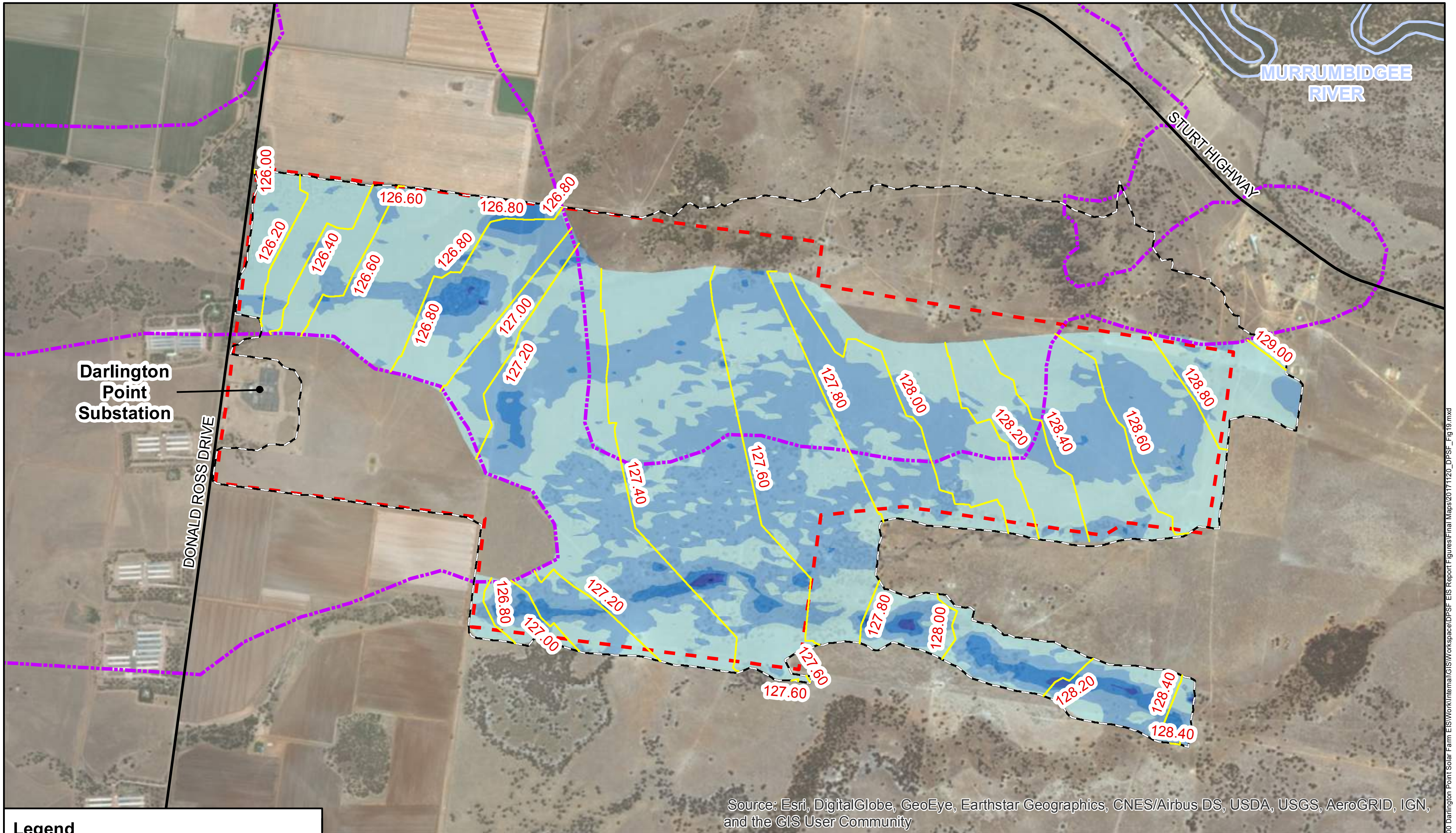
Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Reference Scale: 1:30,000
Metres
0 100 200 400 600 800 1,000

Drawn by: GJH Date: 22/12/2017

Modelling results for pre-development scenario

Figure 19 depicts the flood depth across the site for a 90 year ARI flood event based on the 1974 flood event. Flood depth across the DPSF site for the existing case is generally less than 0.25 metres. Results show localised areas with flood depths of up to 0.50 metres. The maximum depth noted is to the south of the site reaching 0.75 metres.

Velocity across the DPSF site ranges from 0.07 to 0.23 m/s.



Legend

Peak Flood Depth (mAHD)

- < 0.05
- 0.06 - 0.25
- 0.26 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00

- Roads
- Rivers
- Site Contours
- Project Boundary
- 1974 Derived Flood Extent
- Extent of Survey

Edify Energy - Darlington Point Solar Farm

Figure 19 - Existing Peak Flood Depth Based on 1974 Flood Atlas and 2017 Ground Survey

ARUP
Level 4, 108 Wickham Street
Fortitude Valley, QLD 4006
Tel +61 (7)3023 6000 Fax +61 (7)3023 6023
www.arup.com

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:30,000

Metres
0 100 200 400 600 800 1,000

Drawn by: GJH Date: 22/12/2017

Document Path: Z:\SYD\Projects\254000\254766-00 Darlington Point Solar Farm EIS\Work\Internal\GIS\Workspace\DPSF EIS Report Figures\Final Maps\20171120_DPSF_Fig 19.mxd

Proposed post-development scenario

The site layout and solar unit specifications discussed in Chapter 2 were used to determine the post development site flooding conditions for the 1974 flood event. Individual solar unit and inverter station piles were treated as flow obstacles through the site during flooding from the Murrumbidgee River. Inverter stations will be placed on piles above flood level and determined during detailed design through a revised flood assessment. The proposed substation and O&M facility location is outside of the known flood prone area (refer **Figure 18**) and hence was not included in the modelling.

The hydraulic energy losses that would be experienced at the DPSF site as a result of the obstruction to the flow by the piles have been calculated utilising theory of energy losses from bridge piers as documented in the US Federal Highways Administration (US FHWA, 1978) document. The solar panel piles were assumed to have similar behaviour as bridge piers, thus adopting the same methodology has been deemed adequate. The head loss through the piles can be estimated by:

$$\Delta h = \Delta K_p \frac{V^2}{2g}$$

where Δh is difference in water surface elevation, ΔK_p is incremental backwater coefficient for piers, v is the averaged velocity at the cross section (m/s) and g is acceleration of gravity.

This equation calculates changes in kinetic energy using the velocity head at each cross section (determined in existing scenario) to determine changes in flood level.

Modelling results for post-development scenario

Changes in peak flood level at each cross section are presented in Table 33. It is noted that the predicted changes in flood levels due to the proposed development are less than 0.001m for the modelled scenario and therefore considered minor.

It is noted that debris dragged by floodwater may deposit or hit the boundary site fence, increasing the risk associated with blockage. However, the likelihood of debris being collected around the fence is relatively low, as floodwaters around the site are described to be of low velocities, hence a lower potential to drag physical elements that may be considered flood debris. Additionally, it is noted that high vegetation and trees are present in the floodplain upstream of the site, which may block debris transported by the river during flood events.

As a result, it is likely that no adverse flood impacts will occur on-site or on nearby properties as a result of the proposed development.

Table 33 Flood level for existing and post-development scenarios, and changes in flood level across the DPSF site

Location	Velocity (m/s)	Existing Case Average Flood Level (mAHD)	Post-development Average Flood Level (mAHD)	Changes in Flood Level (m)
XS_2	0.16	128.75	128.75	0.00003

Location	Velocity (m/s)	Existing Case Average Flood Level (mAHD)	Post-development Average Flood Level (mAHD)	Changes in Flood Level (m)
XS_3	0.14	128.57	128.57	0.00002
XS_4	0.07	128.08	128.08	0.00002
XS_8	0.12	127.67	127.67	0.00001
XS_9	0.11	127.53	127.53	0.00001
XS_10	0.14	127.36	127.36	0.00003
XS_11	0.10	127.29	127.29	0.00000
XS_12	0.23	127.12	127.12	0.00003
XS_13	0.14	127.01	127.01	0.00003
XS_14	0.17	127.00	127.00	0.00003
XS_15	0.18	126.58	126.58	0.00005

Flood immunity

The detailed design of the solar farm facilities including the substation and O&M facility will need to meet relevant design criteria, including flood immunity. As presented in **Figure 4**, the proposed substation and O&M facility location is located outside the flood prone area presented in **Figure 19**. As such, these areas are deemed flood free in a 90-year ARI flood event.

7.3.3 Potential impacts

Construction

During construction of the DPSF, in the event of a flood event, it would be anticipated that construction work would cease until it is determined by the site manager that it is safe to resume work at the site.

Operation

The flood modelling results indicated that it is likely that no adverse flood impacts will occur in nearby properties as a result of the proposed development.

During operation of the DPSF, in the event of a flood event, it would be anticipated that any operations and maintenance work occurring on site would cease until it is determined by the site manager that it is safe to resume work at the site.

7.3.4 Management and mitigation

Table 34 provides a summary of the recommended mitigation measures for flooding and hydrology.

Table 34 Flooding and hydrology mitigation measures

No.	Recommended mitigation measures	C	O	D
FH1	In the event of a flood event during construction, it would be anticipated that construction work would cease until it is determined safe to resume work at the site.	✓		
FH2	An Emergency Response Plan for the site shall include measures of what to do in the event of flood (eg cease work and recommence once it is safe to do so).	✓	✓	✓

7.4 Aboriginal heritage

7.4.1 Methodology

An Aboriginal Cultural Heritage Assessment Report (CHAR) has been prepared in accordance with the SEARs and the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010) and the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (OEH, 2010). For the purposes of the CHAR, the study area is defined as the DPSF site.

A review of the landscape and ethnohistoric context of the study area was undertaken to provide an understanding of the existing cultural environment. This was supplemented by desktop reviews of the Aboriginal Heritage Information Management System (AHIMS) and reviews of previous cultural heritage studies undertaken in the area. Aboriginal community consultation and participation has also been undertaken in accordance with the OEH guidelines (OEH, 2010) and the requirements of Clause 80C of the *National Parks and Wildlife Regulation* 2009.

This study also undertook an archaeological survey with the aim of surveying the study area to record any Aboriginal archaeological sites or areas with potential to contain Aboriginal objects.

The study area was inspected by Matthew Kelleher (KNC) and Neerim Carroll (Griffith Local Aboriginal Land Council) in November 2017. Based on the archaeological background and landform context of the study area, the survey closely inspected any areas of surface exposure for artefacts, evidence of intact soils or Aboriginal hearths/ovens and any mature trees for evidence of Aboriginal bark removal. Assessments of soil disturbance were also made during the survey.

The survey team were equipped with high resolution aerial photography and topographic maps showing the study area boundary. A non-differential GPS receiver was used for spatial recordings. All GPS recordings were made using the Geocentric Datum of Australia (GDA) coordinate system. Detailed notes on the condition of the survey unit were compiled by the survey team including an assessment of surface visibility, vegetation coverage, modern disturbance and current land use.

A full copy of the CHAR is provided as **Appendix G** to this EIS.

7.4.2 Existing environment

Landscape context

The study area is located on the Riverine Plain, the eastern geomorphic subdivision of the Murray Basin that encompasses an area of 77,000 square kilometres. The Riverine Plain is characterised by almost flat topography with extremely low gradients which is traversed by several major rivers and their tributaries that flow from the east and south. The Murray Basin is a large low lying intracratonic basin containing Cainozoic unconsolidated sediments and sedimentary rocks.

The study area is situated on the flat and open depression landforms which form a large plain adjacent to the Murrumbidgee River. The study area contains several minor drainage lines which flow into the Murrumbidgee River approximately 2.8 kilometres to the north east. The landforms of the Riverine Plain formed as a result of changes to the river systems during the Pleistocene and Holocene periods.

The present day Murrumbidgee River is a narrow, incised and sinuous watercourse that transports small quantities of sediment; however, traces of old aggraded and abandoned river channels, known as palaeochannels, are present on the adjacent plains. Archaeologically, the changing location and nature of permanent water sources across the Riverine Plain would have affected the location of associated resources and focal points for past Aboriginal occupation sites.

As discussed in Section 8.4.2, the underlying geology of the study area consists of the Shepparton Formation, which consists of unconsolidated to poorly consolidated variegated and mottled clay, silt, silty clay, with intercalated lenses of fine to coarse sand and gravel. The soils within the study area are predominantly black vertosols with an area of red chromosols in the north-west (refer to Section 8.4.2 for further information). Archaeologically, vertosols are prone to frequent subsurface movement due to cracking and it is unlikely that intact archaeological deposits would occur within these soils. Intact subsurface archaeological deposits may occur within red chromosols where gradient is low and the landform has not been disturbed.

The landscape of the study area has been modified by modern land use practices. European land use within the study area has primarily been related to pastoral activities and has resulted in the clearance of native vegetation and construction of several access tracks, fence lines and dams. More recently, an electrical substation has been constructed in the south western portion of the study area and several above ground power lines have been constructed. Large areas of remnant native woodland remains within the southern and northern portions of the study area while smaller clusters of remnant native woodland remain along the eastern and western boundaries.

Ethnohistoric context

Historic accounts of the Indigenous inhabitants of the region provide an insight into Aboriginal life at the time of initial European exploration and settlement. The study area lies within a landscape which was important to, and frequently used by, past Aboriginal peoples. Aboriginal people living across the Riverina region of NSW at the time of first European contact were distinguished by various language groups. These communities included the Wiradjuri, Nari-Nari, Mudi-Mudi, Gurendji and the Yida-Yida, while the Bangerang, Yorta-Yorta, Baraba-Baraba, Wamba-Wamba, Wadi-Wadi and Dadi-Dadi communities were found along the Murray River (NPWS, 2003, p. 95).

The study area lies in a landscape traditionally considered the province of peoples of the Wiradjuri language group. Wiradjuri was one of the largest tribal groupings in Australia, with many smaller subgroups. The Wiradjuri who lived in the region of the study area are likely to have lived in small and highly mobile family groups who came together regularly to participate in trade, marriage and ceremonial gatherings.

The varied geology and topography of the region provided diverse habitats for a range of flora and fauna. The traditional subsistence economy of the Wiradjuri was centred on the river corridors and their hinterlands. The river economy was dominated by fishing from canoes and river banks, using nets, fish traps, spears and lines. Firing of the landscape was used to strand and gather animals and may also have ensured the fruiting of certain plant species and allowed for new vegetation growth, which encouraged kangaroos and other grazing animals to the area. Extensive ‘fire-stick’ farming such as this has been recorded throughout the region and included deliberate reseeding and management of the area to ensure optimal regrowth of various species.

By 1832 the first settler had arrived at Wiradjuri Land near Darlington Point and within a year the Murrumbidgee river frontage between Wagga Wagga and Darlington Point was fully occupied by Irish settlers. European colonial farmers occupied and sub-divided the land, displacing Wiradjuri hunter-gatherers and establishing Darlington Point as a small town. The effects of European arrival on Aboriginal people of the land were many and widespread: affecting their food sources, introducing contagious and fatal disease and decimating their population. Relations between the Wiradjuri and settlers appeared to be good at first, but rapid pastoral expansion and a severe drought between 1834- 1838 put extreme pressure on food supplies and relations deteriorated.

No direct historical or ethnographic recordings relate to the specific study area; however it is clear that the variety of resources available in and around the Darlington Point area would have made it attractive and it is known that past Aboriginal people and families occupied the area. The value of the area and surrounds to both the past and the present Aboriginal community is also underscored by the presence of one particularly important place of post-European settlement history: the Warangesda Aboriginal Mission and Station.

The Mission site is located approximately 5.5km to the north west of the study area and was established between 1879-1884 by the Reverend John Brown Gribble, with the help of local Aboriginal men. Warangesda is listed on the NSW State Heritage Register as a place of exceptional and unique significance in the post-European Aboriginal settlement history of NSW. The Mission was established to offer displaced Wiradjuri a permanent home and attempted to create a managed farming community out of the local Aboriginal population.

The Warangesda Mission has historic significance for its role in the founding or growth of other Aboriginal communities. Warangesda is highly significant to the Aboriginal communities of Narrandera, Darlington Point and Cowra whom have a demonstrated cultural affiliation with the place. Warangesda Mission has outstanding social significance as a heartland for some important Aboriginal family networks in south-eastern Australia. It is highly significant to the thousands of Warangesda Aboriginal descendants. While the ethnohistorical and historical record may be lacking for the current study area, the nearby presence of significant sites such as Warangesda strengthens the contemporary cultural associations that Aboriginal people and groups hold for the wider landscape.

Archaeological context

The Aboriginal Heritage Information Management System (AHIMS) is a database operated by OEH and regulated under section 90Q of the National Parks and Wildlife Act 1974. AHIMS contains information and records pertaining to registered Aboriginal archaeological sites (Aboriginal objects, as defined under the Act) and declared Aboriginal places (as defined under the Act) in NSW.

A search of AHIMS was conducted on 20 April 2017 to identify registered (known) Aboriginal sites or declared Aboriginal places within or adjacent to the study area. Table 35 lists the frequencies of the site types ('site features') within the AHIMS database search area.

Table 35 Frequency of site features from AHIMS database search

Site context	Site Features	Frequency	(%)
Open site	Artefact	2	16.67
	Artefact and Modified Tree (Carved or Scarred)	1	8.33
	Earth Mound and Hearth	2	16.67
	Modified Tree (Carved or Scarred)	7	58.33
	Total	12	100

A search was undertaken of the following statutory and non-statutory heritage registers for Aboriginal heritage items:

- Murrumbidgee Local Environmental Plan 2013
- State Heritage Register and State Heritage Inventory
- Section 170 Heritage and Conservation Registers
- Commonwealth Heritage List
- National Heritage List
- Australian Heritage Database

- Australian Heritage Places Inventory
- Register of the National Estate (non-statutory archive).

There were no listed Aboriginal heritage items or places within the study area. However, as discussed in Section 8.1, the eastern portion of the study area is within the boundary of Tubbo Station, which is listed on the Murrumbidgee LEP (Murrumbidgee Council, 2013).

Previous archaeological investigations of the study area

Thompson (1982) undertook a survey for Aboriginal and historical sites within the corridor of proposed transmission line between Darlington Point and Yanco that included a portion of the current study area. The survey identified 24 culturally modified trees, two possible culturally modified trees, one artefact scatter, four isolated artefacts, one earth oven and 15 potential hearths or ovens.

The culturally modified trees exhibited bark removal scars comprising four large bark removal scars, one probable large bark removal scar, 17 smaller bark removal scars, two possible smaller bark removal scars and two very long thin bark removal scars. The culturally modified trees were predominantly black boxes with bark removal scars also identified on yellow box and on cypress pine trees.

Stone artefacts comprised flakes, flaked pieces, rejuvenation flakes, grinding stone fragments, one bondi point and one core. The stone artefacts were made from chert, quartzite and silcrete. Thompson noted that the stone artefact materials were absent in the local geology and must have been sourced from outside the survey area.

The survey noted approximately 15 areas of burnt earth within the corridor which were interpreted as potentially being Aboriginal hearths or ovens; however, Thompson noted that a more likely explanation is that natural or historical fires could have caused a tree to burn and produce baked earth similar to that of an oven. The survey identified one definite Aboriginal oven mound where disturbance from rabbit diggings had revealed mussel shell, charcoal, ash stained soil and burnt earth.

Of the identified sites, four (AHIMS 49-5-0027, 49-5-0028, 49-5-0029 and 49-5-0030) were found within the current study area. AHIMS Site 49-5-0027 was a culturally modified black box tree located within a drainage depression. A single bark removal scar was identified on the eastern site of the tree that was approximately 150 centimetres long and 80 centimetres wide with regrowth measuring 10 centimetres.

AHIMS Site 49-5-0028 was a probable Aboriginal hearth/oven and a black box tree with a bark removal scar of possible Aboriginal origin. The probable Aboriginal hearth/oven consisted of a slight mound with a diameter of approximately 4 metres with visible burnt earth. The bark removal scar was located on a dead black box that was situated on the western edge of the mound. Thompson noted that the mound was probably an Aboriginal oven but may be natural and that the bark removal scar was possibly of Aboriginal origin.

AHIMS Site 49-5-0029 was a possible Aboriginal hearth/oven. The possible Aboriginal oven consisted of a slight mound measuring 5 metres in diameter with areas of burnt earth. Thompson noted that the mound was of doubtful Aboriginal origin. AHIMS Site 49-5-0030 consisted of five culturally modified trees and one possible Aboriginal hearth/oven. The culturally modified trees were black box trees with bark removal scars comprising three large scars, one smaller scar and one tree with two smaller scars. The possible Aboriginal oven comprised a scatter of burnt earth lumps which were identified over an area of approximately 10 metres.

Aboriginal stakeholder consultation

For the preparation of the CHAR, consultation with Aboriginal people has been undertaken in accordance with the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (OEH, 2010) and the requirements of Clause 80C of *the National Parks and Wildlife Regulation 2009*. The formal consultation process has included:

- government agency notification letters (letters dated 12/05/2017);
- advertising for registered stakeholders in local media (The Area News 19/07/2017);
- notification of closing date for registration (03/08/2017);
- ongoing compilation of registrants list, through continuing to register individuals and groups for consultation on the project;
- provision of project information and proposed assessment methodology (letters dated 18/09/2017) allowing for a 28 day review period;
- provision of draft CHAR (28 day review period to be provided); and
- ongoing consultation with the local Aboriginal community.

Registration of interest

Aboriginal people who hold knowledge relevant to determining the cultural heritage significance of Aboriginal objects and Aboriginal places in the area in which the proposed activity was to occur were invited to register an interest in a process of community consultation. Investigations for the proposed development have included consultation with Aboriginal community individuals and groups as listed in Table 36.

Table 36 Registered Aboriginal stakeholders

Registered Aboriginal stakeholder	Representative and/or Contact Person
Griffith Local Aboriginal Land Council	CEO

Stakeholder responses to proposed assessment methodology

No formal responses were received from the stakeholders regarding the proposed assessment methodology for the CHAR.

Stakeholder review of draft CHAR

A copy of the draft CHAR was provided to registered Aboriginal stakeholders for review and comment on 7th December 2017. A 40 day review period was provided (extended in consideration of the Christmas holiday period) with the closing date for comment on 15th January 2018. No responses were received during the review period.

Griffith Local Aboriginal Land Council were contacted to discuss the completion of the final CHAR and recommendations relating to storage of artefacts (email dated 22/02/2018). KNC enquired as to whether the Land Council had any further comments or feedback on the project, and requested a confirmation that the Land Council would be happy to act as caretaker for the collected objects, as per the CHAR recommendations. Griffith Local Aboriginal Land Council confirmed that they had no comments to make on the draft CHAR and confirmed their request that the collected artefacts be given to the Land Council for safe storage and future use as educational resources.

Aboriginal archaeological survey

An Aboriginal archaeological survey was undertaken by KNC of the proposed impact area to inform the DPSF project EIS. The assessment comprised an archaeological survey in addition to a desktop review of previous archaeological investigations, stakeholder consultation, and a review of the environmental context.

Desktop review

The desktop review included a search of the AHIMS and other heritage registers and lists. A review of the AHIMS search results and associated AHIMS site cards identified four Aboriginal archaeological sites (AHIMS 49-5-0027, 49-5-0028, 49-5-0029 and 49-5-0030) within the study area but outside the proposed impact area. The sites comprise culturally modified black box trees and possible Aboriginal hearths/ovens. No Aboriginal heritage items or places were listed on other heritage registers and lists within or in the vicinity of the study area.

Survey results

The survey commenced in the western portion of the proposed development area, noting that it was predominantly cleared of trees and covered in dense grass cover with clusters of native trees adjacent to minor drainage lines in the north and south.

The central portion of the proposed project area was characterised by an open grass land bound by large areas of native trees within minor drainage lines to the north and south.

The eastern portion of the study area comprised a large grassland area with smaller areas of remnant native vegetation to the north, east and south.

Review of background information, Aboriginal community consultation, and archaeological survey has resulted in the identification of ten (10) Aboriginal archaeological sites within the study area. These locations are listed in Table 37 and shown on **Figure 20**.

Table 37 Identified Aboriginal archaeological sites within the study area

Site name	AHIMS ID	Site feature
Tubbo; Darlington Point	49-5-0027	Modified tree (Carved or Scarred)
Tubbo	49-5-0028	Earth mound/hearth and modified tree (Carved or Scarred)
Tubbo	49-5-0029	Earth mound/hearth
Tubbo	49-5-0030	Hearth and modified tree (Carved or Scarred)
Tubbo TRE 01	tbc	Modified tree (Carved or Scarred)
Tubbo TRE 02	tbc	Modified tree (Carved or Scarred)
Tubbo TRE 03	tbc	Modified tree (Carved or Scarred)
Tubbo TRE 04	tbc	Modified tree (Carved or Scarred)
Tubbo TRE 05	tbc	Modified tree (Carved or Scarred)
Tubbo AFT 01	tbc	Artefact

A summary of the previously recorded sites is provided in Table 38. The survey identified six previously unrecorded sites within the study area comprising four culturally modified trees, one possible culturally modified tree and one surface artefact scatter. Table 39 presents a summary of the newly recorded sites identified during the archaeological survey.

Table 38 Previous recorded Aboriginal sites

Site	Description
Site Name: Tubbo; Darlington Point **AHIMS Number:** 49-5-0027	Site 49-5-0027 was a culturally modified black box tree located within a drainage depression. The site was located within a clump of black box trees in the south western corner of Lot 2 DP628785 (formerly Portion 72) approximately 100 metres north east of the south west corner of the paddock. The site is situated 80 metres east of Donald Ross Drive and 3.6 kilometres south of the intersection of the Sturt Highway and Donald Ross Drive. A single bark removal scar was identified on the eastern site of the tree that was approximately 150 centimetres long and 80 centimetres wide with regrowth measuring 10 centimetres.
Site Name: Tubbo **AHIMS Number:** 49-5-0028	Site 49-5-0028 was a probable Aboriginal hearth/oven and a black box tree with a bark removal scar of possible Aboriginal origin. The site was located within the southern portion of Lot 42 DP750903 (formerly Portion 42). The site is approximately 2 kilometres east of Donald Ross Drive and 4 kilometres south east of the intersection of the Sturt Highway and Donald Ross Drive. The probable Aboriginal hearth/oven consisted of a slight mound with a diameter of approximately 4 metres with visible burnt earth. The bark removal scar was located on a dead black box that was situated on the western edge of the mound. The scar extended to the ground and measured approximately 130 centimetres long and 20 centimetres wide. Thompson noted that the mound was probably an Aboriginal oven but may be natural and that the scar was possibly of Aboriginal origin.
Site Name: Tubbo **AHIMS Number:** 49-5-0029	Site 49-5-0029 was a possible Aboriginal hearth/oven. The site was located within the southern portion of Lot 2 DP542215 (formally Lot 2 Portion 101). The site is approximately 3.3 kilometres east of Donald Ross Drive and 3.6 kilometres south of Sturt Highway. The possible Aboriginal oven consisted of a slight mound measuring five metres in diameter with areas of burnt earth.

Site	Description
Site Name: Tubbo **AHIMS Number:** 49-5-0030	Site 49-5-0030 consisted of five culturally modified trees and one possible Aboriginal hearth/oven. The site was location within the southern portion of Lot 2 DP542215 (formally Lot 2 Portion 101). The site is approximately 3.5 kilometres east of Donald Ross Drive and 3.6 kilometres south of Sturt Highway. Tree 1 was a black box with a large bark removal scar measuring 300 centimetres long by 50 centimetres wide. The scar was approximately 15 centimetres deep. Tree 2 was a black box with a bark removal scar measuring 130 centimetres long by 40 centimetres wide. Tree 3 was a black box with a large bark removal scar measuring 350 centimetres by 70 centimetres. Tree 4 was a black box with two bark removal scars and Tree 5 was a black box with a large bark removal scar measuring 300 centimetres by 40 centimetres. The possible Aboriginal oven comprised a scatter of burnt earth lumps measuring up to 20 centimetres in diameter which were spread over an area of approximately 10 metres.

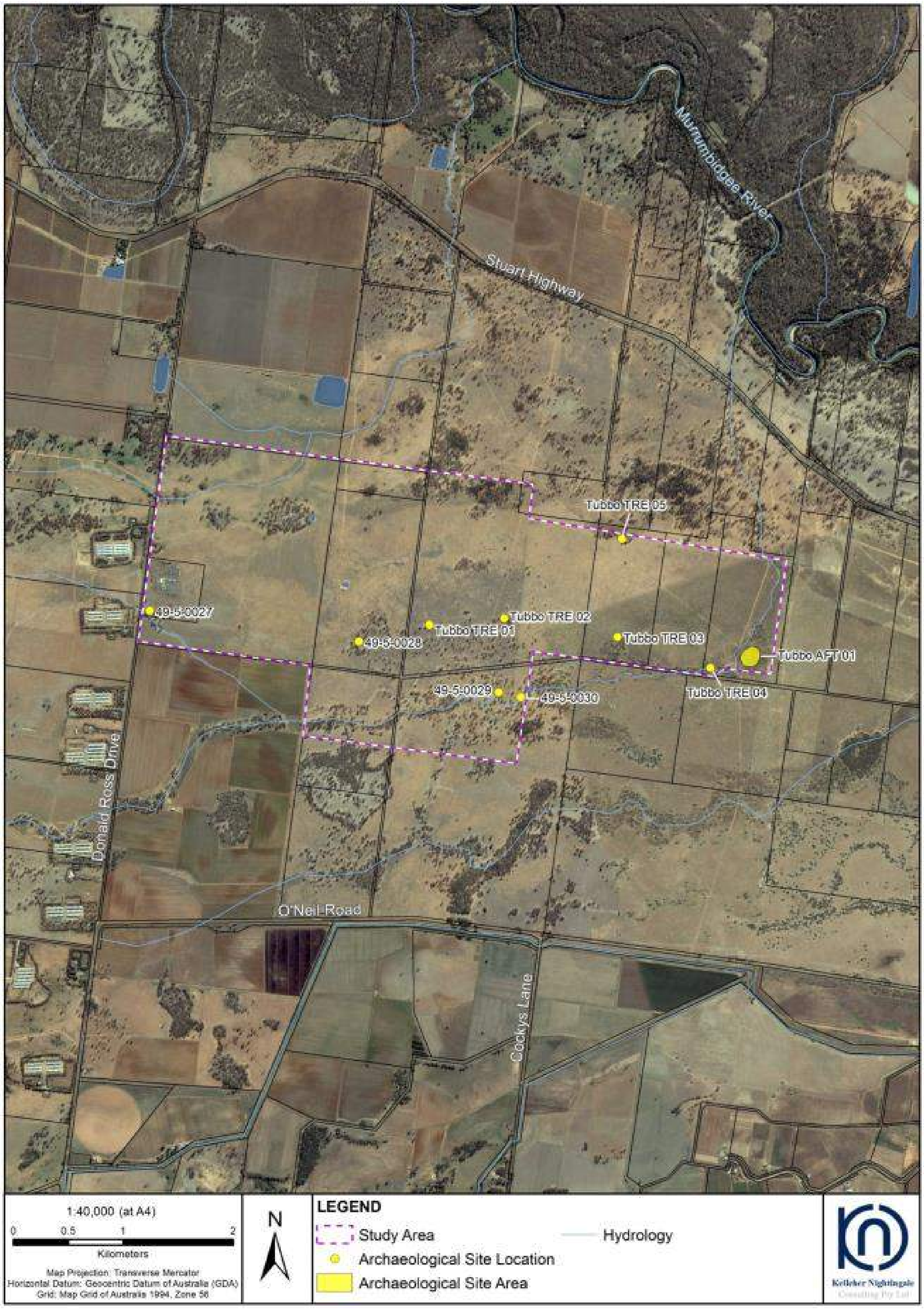
Table 39 Newly recorded sites identified during archaeological survey

Site Name and Coordinates	**Site Type**	**Description**	**Photographs**
Tubbo TRE 01 413892E, 6165058N	Culturally Modified Tree	Site Tubbo TRE 01 was a culturally modified tree that was situated on a flat landform approximately 760 metres north of an unnamed drainage line. The tree formed part of the northern edge of a large dispersed area of native trees and was approximately 680 metres west of Tubbo TRE 2. The site was located in the central portion of Lot 2 DP542215, approximately 550 metres west of a north south running vehicle track and 3.3 kilometres south of the Sturt Highway. The culturally modified tree was a Black Box (*Eucalyptus largiflorens*) which had a single bark removal scar on the southern face. The bark removal scar was situated 40 centimetres above the ground surface and the scar dry face was 180 centimetres long and 40 centimetres wide. The bark overgrowth was approximately 10 centimetres thick. The tree was in good health; however, the dry face was cracked and uneven due to the partially removal of the hardwood, possibly through past termite activity.	  Plate 1. Tubbo TRE 01 location Plate 2. Tubbo TRE 01 scar detail
Tubbo TRE 02 414572E, 6165118N	Culturally Modified Tree	Site Tubbo TRE 02 was a culturally modified tree that was located on a flat landform approximately 780 metres north of an unnamed drainage line. The tree formed part of the northern edge of a large dispersed area of native trees and was approximately 680 metres east of Tubbo TRE 1, 680 metres north of the site 49-5-0029 and 730 metres north west of site 49-5-0030. The site was located in the central portion of Lot 2 DP542215, approximately 550 metres east of a north south running vehicle track and 2.9 kilometres south of the Sturt Highway. The culturally modified tree was a Black Box (*Eucalyptus largiflorens*) which had a single bark removal scar on the southern face. The bark removal scar was situated 1 metre above the ground surface and the scar dry face was 175 centimetres long and 35 centimetres wide. The bark overgrowth was approximately 10 centimetres thick. The tree was in good health.	  Plate 3. Tubbo TRE 02 location Plate 4. Tubbo TRE 02 scar detail

Site Name and Coordinates	Site Type	Description	Photographs
Tubbo TRE 03 415601E, 6164947N	Culturally Modified Tree	Site Tubbo TRE 03 was a culturally modified tree that was located on a flat landform approximately 350 metres north of an unnamed drainage line. The tree formed part of the northern edge of a small cluster of native trees and was approximately 890 metres north west of Tubbo TRE 04 and 1,050 metres east of Tubbo TRE 20. The site was located in the southern portion of Lot 18 DP750903, approximately 1 kilometre west of a north south running vehicle track and 2.7 kilometres south of the Sturt Highway. The culturally modified tree was a Black Box (*Eucalyptus largiflorens*) which had a single bark removal scar on the south eastern face. The bark removal scar was situated 10 centimetres above the ground surface and the scar dry face was 220 centimetres long and 50 centimetres wide. The bark overgrowth was approximately 10 centimetres thick. Three horizontal indentations were present on the dry face which may have been caused during the bark removal process. The tree was in good health; however, the dry face had a large crack and an uneven surface with the underlying hardwood had been removed, possibly through past termite activity.	  Plate 5. Tubbo TRE 03 location Plate 6. Tubbo TRE 03 scar detail
Tubbo TRE 04 416447E, 6164667N	Culturally Modified Tree	Site Tubbo TRE 04 was a culturally modified tree that was located on a flat landform on the northern side of an unnamed drainage line. The tree formed part of a small cluster of native trees and was approximately 300 metres south west of Tubbo AFT 01 and 890 metres south east of Tubbo TRE 03. The site was located in the southern portion of Lot 36 DP750903, approximately 120 metres west of a north south running vehicle track and 2.2 kilometres south of the Sturt Highway. The culturally modified tree was a Black Box (*Eucalyptus largiflorens*) which had a single bark removal scar on the north eastern face. The bark removal scar was situated 10 centimetres above the ground surface and the scar dry face was 215 centimetres long and 45 centimetres wide. The bark overgrowth was approximately 10 centimetres thick. Three horizontal cut marks were present approximately 10 centimetres from the top of the dry face and a horizontal indentation was present approximately 10 centimetres from the bottom of the dry face. The cut marks indicate that a metal axe head was used. The bark overgrowth was approximately 10 centimetres thick. The tree was in good health.	  Plate 7. Tubbo TRE 04 location Plate 8. Tubbo TRE 04 scar detail

Site Name and Coordinates	Site Type	Description	Photographs	
Tubbo TRE 05 415644E, 6165839N	Possible Culturally Modified Tree	Site Tubbo TRE 05 was a possible culturally modified tree that was located on a flat landform approximately 1.25 kilometres west of an unnamed drainage line. The tree formed part of a small cluster of native trees and was approximately 900 metres north of Tubbo TRE 05. The site was located in the northern portion of Lot 18 DP750903, approximately 1.3 kilometre west of a north south running vehicle track and 1.8 kilometres south of the Sturt Highway. The possible culturally modified tree was a Black Box (*Eucalyptus largiflorens*) which had a large possible bark removal scar on the south face and a smaller possible bark removal scar above a tree branch on the north west face. The large scar was situated 20 centimetres above the ground surface and the dry face was 250 centimetres long and 60 centimetres wide. The smaller scar was located 160 centimetres above the ground surface and the dry face was 50 centimetres long and 10 centimetres wide. The bark overgrowth was approximately 10 centimetres thick. The tree was in overall good health; however, the dry faces and underlying hardwood had been damaged by a termite nest.	 Plate 9. Tubbo TRE 05 scar 1 detail	 Plate 10. Tubbo TRE 05 scar 2 detail
Tubbo AFT 01 416824E, 6164777N	Artefact Scatter	Site Tubbo AFT 01 was a surface artefact scatter situated on a slightly raised landform approximately 50 metres east of an unnamed north flowing drainage line. The site was located in the south eastern portion of Lot 36 DP750903 and approximately 1.6 kilometres south west of the Sturt Highway. The site comprised a low density scatter of quartz and lithified sandstone artefacts that were dispersed over an area measuring 200 x 160 metres. The deposit was heavily deflated and had low to nil subsurface potential. Further detail on the artefacts is provided in **Appendix G**.	 Plate 11. Facing north west across Tubbo AFT 01 towards clump of trees	 Plate 12. Tubbo AFT 01 facing west with surface exposure and artefacts in foreground

Figure 20 Identified Aboriginal archaeological sites within the study area



The spatial distribution of the four previously identified archaeological sites and six previously unknown archaeological sites is consistent with the results of previous archaeological investigations in the area which indicates that sites were predominantly located in association with water sources (eg within 1km of an unnamed drainage line).

The distribution of culturally modified trees was further restricted to areas where the trees could grow and where natural processes or modern land use practices had not removed them. The size and shape of the bark removal scars on the culturally modified trees identified within the study area indicate that the bark was being acquired for a range of activities. The presence of cut marks potentially made from a metal axe head on the culturally modified tree at site Tubbo TRE 04 indicates that traditional bark removal continued in the area post European contact.

The sites comprised four culturally modified trees, one possible culturally modified tree, one cluster of five culturally modified trees and a possible Aboriginal hearth/oven, one probable Aboriginal hearth/oven and a possible culturally modified tree, one possible Aboriginal hearth/oven, and one surface artefact scatter. The archaeological evidence indicated that a range of activities were being undertaken within the study area. The presence of cut marks that were potentially made with a metal axe head suggests that the utilisation of these resources continued after European contact in the region.

The archaeological survey found that overall ground surface disturbance across the study area was low with areas of surface exposure where natural processes or land use practices had removed vegetation or restricted its growth.

7.4.3 Potential impacts

Significance assessment criteria

The *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010) requires significance assessment according to criteria established in the Australia ICOMOS Burra Charter (Australia ICOMOS, 1999). Guidelines to the Burra Charter set out four criteria for the assessment of cultural significance:

- Aesthetic value – relates to the sense of the beauty of a place, object, site or item
- Historic value – relates to the association of a place, object, site or item with historical events, people, activities or periods
- Scientific value – scientific (or research) value relates to the importance of the data available for a place, object, site or item, based on its rarity, quality or representativeness, as well as on the degree to which the place (object, site or item) may contribute further substantial information
- Social value – relates to the qualities for which a place, object, site or item has become a focus of spiritual, political, national or other cultural sentiment to a group of people. In accordance with the OEH *Guide to investigating, assessing*

and reporting on Aboriginal cultural heritage in NSW, the social or cultural value of a place (object, site or item) may be related to spiritual, traditional, historical or contemporary associations. According to OEH, "social or cultural value can only be identified though consultation with Aboriginal people" (OEH, 2010, p. 8).

There are ten locations of recorded Aboriginal cultural heritage values within the study area. The significance assessment for the identified archaeological sites has focused on the social/cultural, historic, scientific and aesthetic significance of Aboriginal heritage values as identified in the Burra Charter. Table 40 summarises the values of the recorded Aboriginal cultural heritage within the study area.

Table 40 Values of recorded Aboriginal cultural heritage

Value type	Applicability to the study area
Aesthetic	No specific associated aesthetic values have been identified by registered Aboriginal community groups to date. Specific associated aesthetic values for the sites within the study area provided by the registered Aboriginal stakeholders will be included in the final version of this document following the review of the draft CHAR. Archaeologically, the study area does not contain these values.
Historic	No specific historical significance for the sites within the study area has been provided by the registered Aboriginal stakeholders to date. Any specific historical significance for the sites within the study area provided by the registered Aboriginal stakeholders will be included in the final version of this document following the review of the draft CHAR.
Scientific	Scientific values have been assessed for the identified Aboriginal archaeological sites in the study area. These values have been developed based on significance criteria of research potential (including integrity/condition, complexity and archaeological potential), representativeness and rarity. Identified archaeological sites in the study area displayed moderate scientific significance. Sites of low significance are those that do not offer this potential and are unlikely to provide any further scientifically valuable information. Sites with moderate significance are those that offer the potential to yield information that will contribute to the growing holistic understanding of the Aboriginal cultural landscape of the Murrumbidgee catchment. Archaeological investigation of moderately significant sites will contribute knowledge regarding site type interrelationships, cultural use of landscape features and occupation patterns.
Social	No specific cultural or social values expressed by these Aboriginal sites have been identified to date. Any cultural or social values for these sites identified by the registered Aboriginal stakeholders will be included in the final CHAR (once the draft CHAR public consultation period is complete).

Statement of significance

Table 41 summarises the levels of significance that have been ascribed to the ten Aboriginal sites within the study area.

Table 41 Assessed significance of Aboriginal archaeological sites within the study area

Site Name	AHIMS ID	Site Feature	Significance	Statement of Significance
Tubbo; Darlington Point	49-5-0027	Modified tree (Carved or Scarred)	High	High cultural value Commonly occurring site type in region of moderate scientific value
Tubbo	49-5-0028	Earth mound/hearth and modified tree (Carved or Scarred)	High	High cultural value Commonly occurring site type in region of moderate scientific value

Site Name	AHIMS ID	Site Feature	Significance	Statement of Significance
Tubbo	49-5-0029	Earth mound/hearth	Moderate	Commonly occurring site type in region of moderate scientific value
Tubbo	49-5-0030	Hearth and modified tree (Carved or Scarred)	High	High cultural value Commonly occurring site type in region of moderate scientific value
Tubbo TRE 01	tbc	Modified tree (Carved or Scarred)	High	High cultural value Commonly occurring site type in region of moderate scientific value
Tubbo TRE 02	tbc	Modified tree (Carved or Scarred)	High	High cultural value Commonly occurring site type in region of moderate scientific value
Tubbo TRE 03	tbc	Modified tree (Carved or Scarred)	High	High cultural value Commonly occurring site type in region of moderate scientific value
Tubbo TRE 04	tbc	Modified tree (Carved or Scarred)	High	High cultural value Commonly occurring site type in region of moderate scientific value
Tubbo TRE 05	tbc	Modified tree (Carved or Scarred)	High	High cultural value Commonly occurring site type in region of moderate scientific value
Tubbo AFT 01	tbc	Artefact	Moderate	Commonly occurring site type in the region of moderate value

Construction

During the planning phase, locations of Aboriginal heritage and archaeological sensitive areas (remnant vegetation) were avoided to minimise impacts to nine Aboriginal archaeological sites. However, one Aboriginal archaeological site (Tubbo AFT 01) is directly impacted by the DPSF project area. As noted above, this site is of moderate significance based on scientific value and potential to inform on Aboriginal landscape use in the area.

Due to the direct impact (total loss of value) to this Aboriginal archaeological site (Tubbo AFT 01), during Aboriginal stakeholder consultation the Griffith Local Aboriginal Land Council has recommended an archaeological collection process of surface artefacts be undertaken prior to commencement of construction. This should be done with the assistance of local Aboriginal people and can only occur once project approval from DP&E is obtained. Section 7.4.4 provides further details on the proposed management policy for this site.

Should other unexpected archaeological finds be found during construction, recommended safeguards are included in Section 7.4.4.

Operation

During operation, it is unlikely that the DPSF project would impact on Aboriginal archaeology. No mitigation is required.

Decommissioning

It is unlikely that decommissioning activities would impact on Aboriginal archaeology. No mitigation is required.

7.4.4 Management and mitigation

Table 42 provides a summary of the recommended Aboriginal cultural heritage mitigation measures for the DPSF site.

Table 42 Aboriginal cultural heritage mitigation measures

No.	Recommended mitigation measures	C	O	D
ACH1	An Aboriginal Heritage Management Policy will apply to the site prior to construction to allow for the management and conservation of Aboriginal heritage in relation to salvage activities and construction activities. The following measures apply as part of the Management Policy: • The proponent will ensure all of its employees, contractors and subcontractors and agents are made aware of and comply with this Aboriginal Heritage Management Policy. • The proponent will appoint a suitably qualified and experienced environmental manager who is responsible for overseeing the activities related to the Aboriginal Heritage Management Policy. • The proponent will appoint a suitably qualified and experienced archaeologist who is responsible for overseeing, for and on behalf of the proponent, the archaeological activities relating to the project. • Where the surface collection of artefacts has been nominated for the impacted site, no construction activities (or fencing, geotechnical investigations, minor clearing, establishing site compounds, adjustment to services/utilities etc) can occur on the lands to be investigated until the relevant surface collection at the nominated site (i.e. Tubbo AFT 01) has been completed. • Prior to the commencement of early works activities (eg fencing, minor clearing, establishing site compounds etc), the Contractor will prepare a construction heritage site map identifying the Aboriginal site requiring the collection of surface artefacts and the Aboriginal sites to be avoided (for all sites in proximity to the project boundary). The Contractor’s construction heritage site map should be prepared to the satisfaction of Edify Energy. • All employees, contractors, subcontractors and agents carrying out early works activities will undertake a Project induction (including the distribution of a construction heritage site map) to ensure that they have an understanding and are aware of the Aboriginal heritage issues affecting the activity. • Opportunity must be provided to the Griffith Local Aboriginal Land Council to assist with the surface collection of Tubbo AFT 01. • During the surface collection process, the DP&E, as the approval authority, will be consulted. Recovered Aboriginal objects will be transferred in accordance with a Care Agreement or similar agreement to the Griffith Local Aboriginal Land Council.	✓		

No.	Recommended mitigation measures	C	O	D
	• A written archaeological report documenting the salvage collection must be provided to Edify Energy within a reasonable time in accordance with the Project Approval following the completion of the archaeological program. The Aboriginal Heritage Management Policy does not authorise any damage of human remains. The project approval through the CHAR process does not include the destruction of Aboriginal remains. If potential human remains are to be disturbed, the proponent must follow the procedures listed under Item ACH2 below.			
ACH2	In accordance with the *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the* Heritage Act 1977 (NSW Heritage Office, 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS, 1997), should the construction activities reveal possible human skeletal material (remains), the following procedure is to be followed: • As soon as remains are exposed, all work is to halt at that location immediately and the Project environmental manager on site is to be immediately notified to allow assessment and management: (i) Stop all activities; and (ii) Secure the site. • Contact police, the discovery of human remains triggers a process which assumes that they are associated with a crime. The NSW Police retain carriage of the process until such time as the remains are confirmed to be Aboriginal or historic • DP&E, as the approval authority, will be notified when human remains are found • Once the police process is complete and if remains are not associated with a contemporary crime, contact DP&E. DP&E will determine the process, in consultation with OEH and/or the Heritage Office as appropriate: (i) If the remains are identified as Aboriginal, the site is to be secured and DP&E and all Aboriginal stakeholders are to be notified in writing according to DP&E instructions; or (ii) If the remains are identified as non-Aboriginal (historical) remains, the site is to be secured and the DP&E is to be contacted. DP&E will act in consultation with the Heritage Division as appropriate. The Heritage Division will be notified in writing according to DP&E instructions. • Once the NSW Police process is complete and if the remains are identified as not being human, work can recommence once the appropriate clearances have been given.	✓		

No.	Recommended mitigation measures	C	O	D
ACH3	Incident reporting requirements in accordance with the Project Approval is to include Aboriginal heritage.	✓		
ACH4	During construction, project design alterations or other changes to the Approved Project may be required (such as an alteration of the current design, the location of ancillary facilities) within the project corridor may result in a reduced or increased impact to Aboriginal cultural heritage. Any change in the overall impact on Aboriginal cultural heritage would need to be assessed to determine consistency in consultation with an archaeologist, with continued involvement of the Aboriginal stakeholders. 1. If a proposed change to the Approved Project is considered to have a neutral or lesser significant impact on Aboriginal cultural heritage than that identified in this document, it would be a consistent impact. If the proposed change is considered to be consistent with the Approved Project, Edify Energy may approve the change with no requirements to seek further approval. However, in certain circumstances, further consultation with Aboriginal stakeholders may still be required. 2. If a proposed change to the Approved Project is considered to have a more significant impact on Aboriginal cultural heritage than as detailed in the Project Approval, it would be considered an inconsistent impact and would require an amendment to the mitigation measures. This would require a modification of the Approved Project and further consultation with Aboriginal stakeholders.	✓		
ACH5	The extent to which Edify Energy will continue to consult with Aboriginal stakeholders is dependent on the level of impact: 1. **Reduced or neutral impact:** if as a result of alterations to the project design a previously identified impact to an Aboriginal heritage item is reduced or neutral, then no further consultation is required. If as a result of alterations to the project design an impact to an Aboriginal heritage item is proposed that results in a reduced impact on the overall heritage significance of the project area, then further consultation with Aboriginal stakeholders will be undertaken. This consultation may entail a phone call and phone log of comments received or the provision of a report for comment (10 working days). 2. **Increased impact:** Where as a result of alterations to the project design an impact on Aboriginal heritage is considered to be greater than identified by the Approved Project, further consultation will be undertaken. This consultation will either entail a phone call and phone log of comments received or the provision of a report for comment (10 working days).	✓		

No.	Recommended mitigation measures	C	O	D
	3. **Unknown impacts:** Where a proposed change is an area located outside the project boundary assessed as part of the Approved Project, the impact on Aboriginal cultural heritage is considered to be unknown. This area would require preliminary assessment to determine any impacts upon Aboriginal heritage. Should no impacts be identified then no consultation with Aboriginal stakeholders is required. Should potential impacts be identified, consultation with Aboriginal stakeholders will be undertaken. This consultation will entail the provision of a report for stakeholder comment (10 working days) detailing the impacts and mitigation strategies proposed.			
ACH6	Should an unexpected archaeological find be made during construction, the following procedures will be adopted: • As soon as found, all work is to halt at that location immediately and the Project environmental manager on site is to be immediately notified to allow assessment and management: (i) Stop all activities; and (ii) Secure the site. • Consult with project archaeologist and DP&E on proposed actions.	✓		

7.5 Land compatibility

7.5.1 Methodology

The potential for land use conflicts have been assessed using the Land Use Conflict Risk Assessment (LUCRA) tool outlined in the NSW Department of Primary Industries' *Land Use Conflict Risk Assessment Guide* (October 2011), which generally includes the following steps:

1. Gather information about proposed land use change and associated activities
2. Evaluate the risk level of each activity
3. Identify risk reduction management strategies
4. Record results.

Desktop searches were performed to understand the historic and current land uses, attributes, and capabilities of the site. These have been considered in evaluating whether the proposed site is fitting for the development of large-scale solar.

7.5.2 Existing environment

Land uses

The proposed site is located on land zoned RU1 – Primary Production under the Murrumbidgee LEP. Historically the Anderson property located on the western end of the proposed site has been used for beef cattle and sheep grazing, however the property owner has recently retired the land from this use. The Tubbo Station land is currently used for sheep grazing as part of a wider business operation. The DPSF site has been highly modified by associated agriculture practices over the past 100+ years.

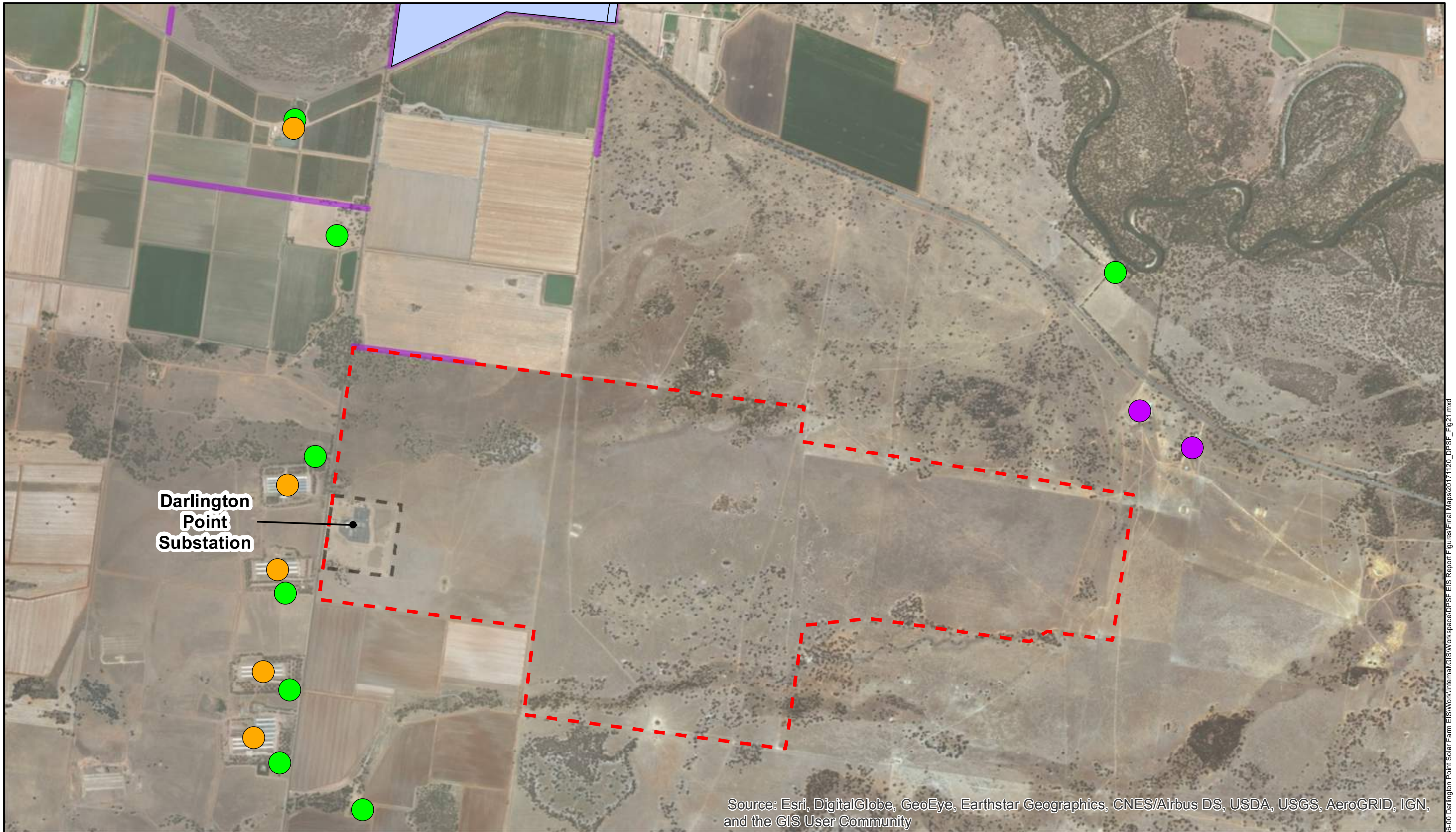
The site is surrounded by production facilities accommodating farming, agribusiness and some private residences. A series of poultry farms owned by Baiada Poultry Pty Ltd are situated on land leased to it by Arrow Funds Management to the west of the site, on the other side of Donald Ross Drive (refer **Figure 21**).

Data collected in the 2016 census indicates that sheep, beef cattle and grain farming industries employ 17.8 percent of the population within the Murrumbidgee LGA, while poultry processing employs 4.1 percent of the population (ABS, 2016).

The site is not located in an area of Biophysical Strategic Agricultural Land (BSAL), as mapped areas are more than 90 kilometres south-east of the DPSF site. BSAL is land that meets specific scientific criteria levels for soil fertility, land and soil capability classes and access to reliable water and rainfall levels.

The proposed site is located just to the north of the northern boundary of the Coleambally Irrigation Area (CIA) as shown in the Murrumbidgee Local Environment Plan (Murrumbidgee Council, 2013). The CIA covers an area of approximately 400,000 hectares, of which 79,000 hectares is intensively irrigated (Coleambally Irrigation, 2017).

Travelling stock reserves (TSRs) are parcels of Crown land reserved under the *Crown Lands Act 1989* (Crown Lands Act) for use by travelling stock. A TSR is located approximately 2 kilometres to the north of the project site. It is not expected that the construction and operation of the project would impact on the TSR.



Legend

- Commercial, Farming and Agribusiness
- Poultry Farm
- Residential Receiver
- Travelling Stock Reserves
- Crown Land / Easement
- Project Boundary\
- Darlington Point Substation Boundary

Edify Energy - Darlington Point Solar Farm

Figure 21 - Surrounding Land Uses

ARUP
Level 4, 108 Wickham Street
Fortitude Valley, QLD 4006
Tel +61 (7)3023 6000 Fax +61 (7)3023 6023
www.arup.com

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:37,500

Metres

0 125 250 500 750 1,000 1,250

Document Path: Z:\SYD\Projects\254000\254766-00 Darlington Point Solar Farm EIS\Work\Internal\GIS\Workspace\DPSF EIS Report Figures\Final Maps\20171120_DPSF_Fig21.mxd

Drawn by: GJH Date: 22/12/2017

Land titles and licences

A search of publicly available information including:

- NSW Government MinView (DP&E Resources & Energy, 2017)
- NSW DP&E's Division of Resources and Geoscience (DRG) Common Ground viewer (DP&E Resources and Geoscience, 2017)
- Murrumbidgee Local Environmental Plan 2013 (Murrumbidgee Council, 2013)
- Publicly available information from NSW government on locations of transmission easements and Crown land.

A summary of known land titles and licences on the site and surrounds is summarised below and shown on **Figure 22**.

NSW Government's MinView (DP&E Resources & Energy, 2017) was undertaken in November 2017 and confirmed that the site is not subject to any current or historic mining or exploration licences. In addition, a search of the NSW DRG Common Ground viewer in November 2017 (DP&E Resources and Geoscience, 2017), indicated that no current mineral or energy titles were listed within or within close proximity to the proposed site. It is noted that during preparation of the SEARs, DP&E's Division of Resources and Geoscience (DRG) indicated that historical petroleum exploration licences may be known to have covered the DPSF project site and surrounding areas in the past. However, no evidence of these could be identified on the publicly available websites.

From MinView (DP&E Resources & Energy, 2017), one metallic and industrial deposit was identified on the Tubbo property as '219492 – Tubbo Sand Pit'. This site is located approximately 2 kilometres east of the eastern-most boundary of the proposed site (refer **Figure 22**) and is not expected to be impacted by the proposed development. Consultation with Murrumbidgee Council (operators of the Tubbo Sand Pit) in July and December 2017 confirmed that the proposed development would not impact on the Tubbo Sand Pit and its operations.

The Darlington Point substation and a 330 kV and two 132 kV TransGrid overhead transmission lines cross the site from west to east, and a 33 kV Essential Energy overhead transmission line runs north-south near the eastern boundary of the site. Easements for this infrastructure exist across the DPSF site (refer **Figure 22**.

A crown land easement exists to the north of the site (refer **Figure 22**). During preparation of the EIS, consultation with the NSW Department of Land and Property in July 2017 indicated that there were no concerns with regard to the DPSF project potentially impacting on the crown land easement. Further consultation with the NSW Department of Industry – Crown Lands and Water noted that there would be no direct impact to the crown land easement as a result of the project. However, agency consultation should be undertaken during detailed design to confirm on any administrative arrangements associated with the easement, particularly with regard to works along the boundary.

Legend

- Electricity Transmission Lines
- Transmission Easements
- Darlington Point Substation Boundary
- Project Boundary
- Crown Land
- Tubbo Sand Pit (Murrumbidgee Shire Council)

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Figure 22 - Leases and Titles within proximity to the DPSF site

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www.arup.com

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:32,500

Metres

0 100 200 400 600 800 1,000

Drawn by: GJH Date: 22/12/2017

7.5.3 Potential impacts

The NSW Department of Primary Industries' *Land Use Conflict Risk Assessment (LUCRA) Guide* (DPI, 2011) describes that land use conflicts occur when one land user is perceived to infringe upon the rights, values or amenity of another. The risk ratings in Table 43 covers each combination of five levels of 'probability' (a letter A to E) and five levels of 'consequence' (a number 1 to 5) to identify the risk ranking of each impact.

As per the LUCRA system, an assessment of the potential risk to adjacent land uses and activities has been demonstrated in Table 44.

Table 43 Risk ranking matrix (Source: (DPI, Land Use Conflict Risk Assessment Guide, 2011)

PROBABILITY	A	B	C	D	E
Consequence					
1	25	24	22	19	15
2	23	21	18	14	10
3	20	17	13	9	6
4	16	12	8	5	3
5	11	7	4	2	1

Table 44 Land use conflict risk assessment summary

Surrounding land use/activity	Identified potential conflict	Risk rating		Management Strategy* (refer to Table 45)	Residual risk rating	
Agricultural land (eg Tubbo Station and adjacent grazing/cropping properties)	Potential for increased bushfire risk. Potential for increased weed introduction from construction and operation of the DPSF. Potential impacts to crop spraying activities from the solar farm operation Potential for minor interactions with Tubbo Station, however, it is more than 2 kilometres north of the project site. During construction, the potential for surface water runoff from the site.	B4	12	A Bushfire Management Plan (refer Action LU4) would be implemented to reduce the probability of the solar farm operation starting a fire and for the management of internal/external fires to minimise impact on the DPSF and surrounding properties. There is unlikely to be an impact to aerial crop spraying activities given the limited height of the solar farm, limited additional overhead transmission infrastructure and low levels of glare from the panels. A Weed Management Plan (refer Action LU3) will be implemented during construction and operation phases as part of the biodiversity management of the site. It is not expected that the construction and operation of the project would impact on the Tubbo Station. A Soil and Water Management Plan and an Erosion and Sediment Control Plan (Action LU7) would minimise potential impacts. Sheep grazing is likely to continue on the DPSF site as part of land management regime and post-decommissioning it is expected that the land would be returned to rural/agricultural practices.	C4	8

Surrounding land use/activity	Identified potential conflict	Risk rating		Management Strategy* (refer to Table 45)	Residual risk rating	
Adjacent poultry farms along Donald Ross Drive	Increased traffic and disruptions in the area during construction and operation Potential increased dust impacts during construction and decommissioning Noise generated during construction and decommissioning would be temporary in nature	B4	12	A Traffic Management Plan (refer Action LU5) would be implemented during construction and decommissioning phases, however, impacts are considered to be temporary and manageable. Use of dust suppression techniques such as the use of water carts or wetting agents during the construction and decommissioning activities where required (Action LU7). Dust is not expected to be a land use impact during operation. Noise generated during construction and decommissioning would be temporary in nature and would be minimised through the implementation of mitigation measures (Action LU7). It is expected that regularly maintained solar farm equipment would not generate excessive levels of noise during operation and is not expected to generate a land use conflict.	C4	8
Tubbo Sand Pit – Metallic and industrial deposit	Increased traffic and disruptions in the area during construction, however, it is unlikely to significantly impact on the Tubbo Sand Pit operations.	B4	12	A Traffic Management Plan (refer Action LU5) would be implemented during construction, operation and decommissioning. Impacts are considered to be temporary and manageable.	C4	8
TransGrid Substation and overhead transmission lines; Essential Energy overhead transmission line	All works for connecting to the TransGrid substation will be undertaken in consultation with TranGrid to minimise any disruption. Increased traffic and disruptions in the area during construction, and decommissioning for maintenance or emergency works vehicles for existing infrastructure	B4	12	A Traffic Management Plan (refer Action LU5) would be implemented during construction, operation and decommissioning. Impacts are considered to be temporary and manageable. Consultation with TransGrid for substation works.	C4	8

Note:

* Refer to Table 45 for details on mitigations.

7.5.4 Management and mitigation

The potential for changes to land compatibility will be addressed through the following mitigation measures in Table 45.

Table 45 Recommended mitigation measures to address potential land use impacts

No.	Recommended mitigation measures	C	O	D
LU1	Regular and ongoing consultation with adjacent landholders would be undertaken to manage land use interactions between the solar farm and adjacent properties.	✓	✓	✓

No.	Recommended mitigation measures	C	O	D
LU2	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	✓		
LU3	Prepare a pest and weed management plan to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Murrumbidgee Council and NSW DPI requirements. Where possible, integrate weed and pest management with adjoining landowners. The plan shall include restricting vehicle and machinery movements to formed access tracks and implementing wash-down procedures for vehicles entering and exiting the site, as appropriate.	✓	✓	
LU4	A Bushfire Management Plan will be prepared for the project to be implemented during construction, operation and decommissioning (refer to Section 8.11 for further information on potential bushfire risk).	✓	✓	✓
LU5	A Traffic Management Plan would be implemented during construction, operation and decommissioning (refer to Section 7.2 for further information on traffic and access).	✓	✓	✓
LU6	A Noise and Vibration Management sub-plan to the Construction Environmental Management Plan (CEMP) will be prepared to manage any potential impacts to surrounding land uses (refer to Section 8.2 for further information on noise and vibration management).	✓		
LU7	A Soil and Water Use Management Plan, Erosion and Sediment Control Plan and dust suppression measures will be prepared to manage any potential impacts to surrounding lands (refer to Section 8.4, 8.5.4 and 8.6 for further information).	✓	✓	
LU8	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to the commencement of decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • The design criteria of the final landuse and landform and the indicators to use to guide land back to agricultural production and a timeline for the rehabilitation program. • Potential mitigation and monitoring measures to be adopted for rehabilitation remedial actions. • Identification of any land with a cropping history or land with a capability for cropping, so that should any cables/pipes buried at a depth of >500mm remain, there is greater opportunity for agricultural activities to continue over the top once restoration is complete.			✓

8 Other environmental issues

8.1 Non-Aboriginal heritage

8.1.1 Methodology

A search of the following online statutory heritage registers was carried out in July 2017:

- State Heritage Register
- Singleton LEP
- World Heritage List
- National Heritage List
- Commonwealth Heritage List
- Section 170 Heritage and Conservation registers.

The following non-statutory heritage lists were also searched:

- Register of the National Estate
- National Trust Register.

8.1.2 Existing environment

There are a number of listed heritage items within the vicinity of the site as shown in Table 46 and mapped on **Figure 23**. This includes items protected under the Heritage Act on the State Heritage Register (SHR) as well as locally listed items protected under the Murrumbidgee LEP and items on non-statutory heritage registers.

Table 46 Non-Aboriginal heritage items within and in the vicinity of the site

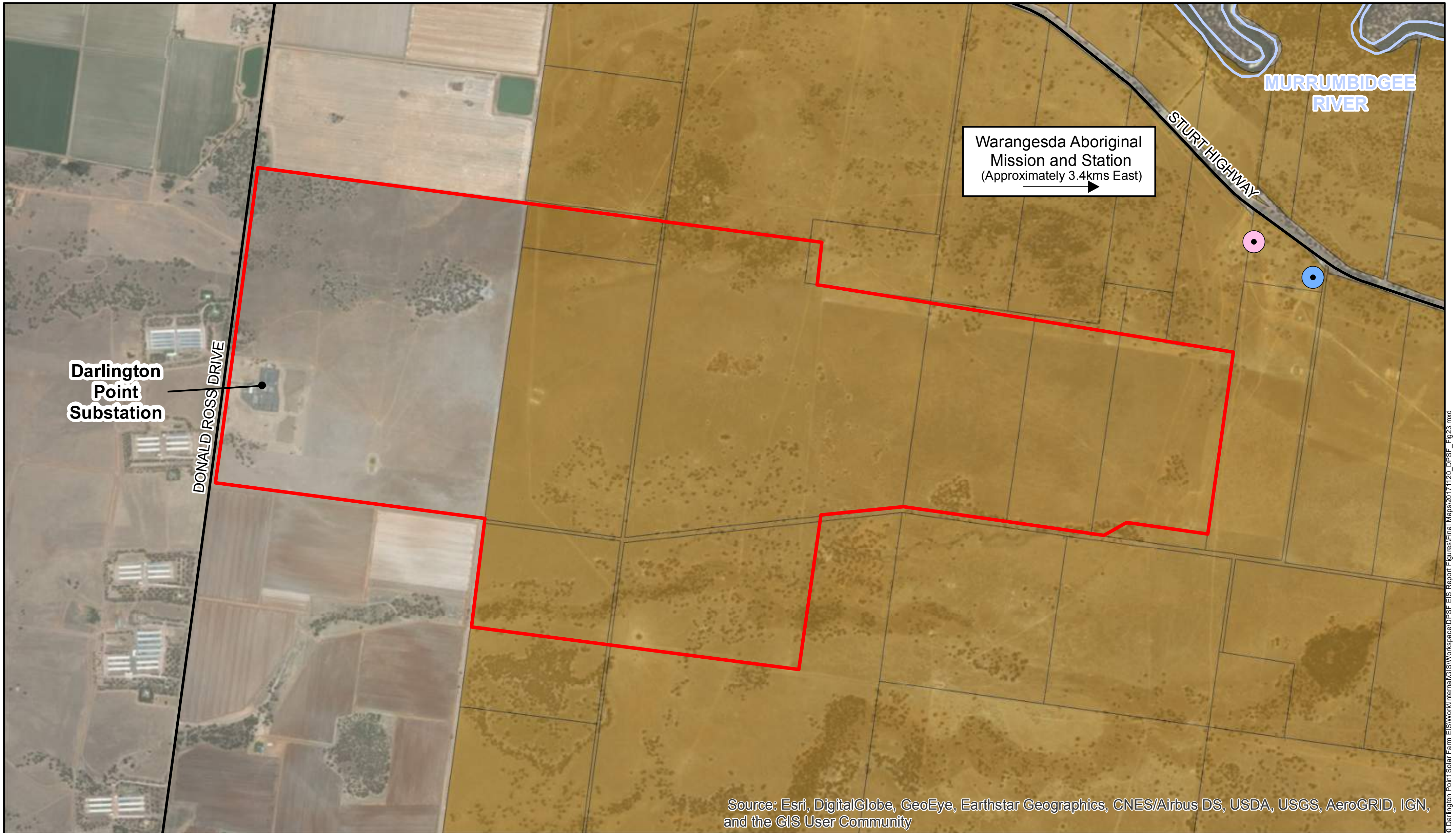
Item	Listing	Proximity to site
Tubbo Station Group*	Murrumbidgee LEP Register of the National Estate (Non-statutory archive)	Within
Tubbo Station Woolshed Complex (also part of Tubbo Station Group)	Register of the National Estate (Non-statutory archive)	~ 700 m
Tubbo Station Homestead and Outbuildings (Tubbo Station Group)	Register of the National Estate (Non-statutory archive)	~ 1.6 km
Warangesda Aboriginal Mission and Station	Heritage Act – State Heritage Register Murrumbidgee LEP	3.4 km

Note:

* The Tubbo Station Group heritage listing comprises the Tubbo Station Homestead and the jackeroos quarters, office, store, meat house, laundry, generator house, smithy, wagon house and stables, all located near the homestead, as well as the Tubbo Station Woolshed and associated buildings located about one kilometre south-east of the homestead.

The Australian Heritage Database describes Tubbo Station as:

> *"a rare survival of nearly all the buildings associated with one of the largest nineteenth century holdings in NSW. As such, the group of homestead, outbuildings, woolshed and shearers' quarters is important for the way it demonstrates life on a large working turn of the century sheep station. The homestead and woolshed buildings are valued for their fine proportions and design. The buildings of the group are important for the way they demonstrate technical achievements of the time"* (Department of the Environment and Energy, 2017)



Legend

- Tubbo Station Homestead and Outbuildings
- Tubbo Station Woolshed Complex
- Tubbo Station Group
- Roads
- Rivers
- Project Boundary

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Figure 23 - Non-Aboriginal Cultural Heritage Items

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Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:30,000

Metres

0 100 200 400 600 800 1,000

Document Path: Z:\SYD\Projects\254000\254766-00 Darlington Point Solar Farm EIS\Work\Internal\GIS\Workspace\DPSF EIS Report Figures\Final Maps\20171120_DPSF_Fig23.mxd

Drawn by: GJH Date: 22/12/2017

8.1.3 Potential impacts

Construction

During construction, the proposed development would not have a direct impact on the buildings that are subject to the heritage listing, such as the Tubbo Station Woolshed Complex, the Tubbo Station Homestead and Outbuildings, or the Warangesda Aboriginal Mission and Station. No heritage approvals are considered likely to be required for the project.

However, should an item of potential historic heritage be unexpectedly uncovered during construction, it should not be removed or disturbed, work in the area should cease and the item cordoned off. Further actions are discussed in Section 8.1.4 below.

Operation

The proposed DPSF would result in the addition of solar power generation and intensification of existing transmission infrastructure land use (existing substation and high voltage power lines) within the vicinity of the non-statutory Tubbo Station Group heritage listing. There is no direct impact on the buildings that are subject to the non-statutory heritage listing, such as the Tubbo Station Woolshed Complex, the Tubbo Station Homestead and Outbuildings, and any indirect impacts are addressed in Section 8.3 visual impact.

Decommissioning

Following decommissioning, the development site would be expected to be returned to its original condition suitable for agriculture (eg grazing). It is not expected that there would be any impacts to non-Aboriginal cultural heritage as a result of decommissioning plans.

8.1.4 Management and mitigation

Suggested mitigation measures to manage any potential non-Aboriginal cultural impacts are outlined in Table 47.

Table 47 Mitigation measures for non-Aboriginal cultural heritage

No.	Mitigation measures	C	O	D
NA1	Should any object or item of non-Aboriginal cultural heritage be discovered during construction, the following actions would be undertaken: • The object or item must not be removed or disturbed. • All work at the find location must cease and the item cordoned off. • The Heritage Division (OEH) would be notified of the find for advice if needed, prior to further work being carried out in the vicinity.	✓		

8.2 Noise and vibration

8.2.1 Methodology

A quantitative approach has been taken to outline the potential noise impacts during the construction and operational phases of the DPSF. As part of the assessment, the relevant NSW policies and existing noise environment have been outlined to derive project specific construction and operational noise and vibration assessment criteria and establish the existing ambient noise environment. The potential impacts of the construction and operation of the DPSF were assessed based on the constructability information available at this stage of development. A number of mitigation measures have been recommended to reduce the potential for noise impacts from the development of the DPSF.

The full copy of the noise and vibration assessment in provided in **Appendix H**.

8.2.2 Policy Setting

Construction Noise

Construction noise management levels are stated in the NSW *Interim Construction Noise Guideline* (ICNG; DECCW, 2009). As detailed in the guideline, a quantitative assessment of noise impacts is expected when works are likely to impact an individual or sensitive land use for a period of greater than three weeks and focuses on minimising noise disturbance through the implementation of feasible and reasonable work practices and community notification. The guideline specifies noise targets, or 'noise management levels', for residential receivers (refer Table 48) and other noise sensitive receivers (refer Table 49).

Table 48 Construction noise management levels at residential receivers

Time of Day	Management Level, $L_{Aeq,15min}$	How to apply
Recommended Standard Hours: Monday to Friday – 7.00am to 6.00pm Saturday – 8.00am to 1.00pm No work on Sundays or Public Holidays	Noise affected RBL + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted sensitive receivers of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences

Time of Day	Management Level, $L_{Aeq,15min}$	How to apply
		• if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

1 – Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 49 Construction noise management levels at other noise sensitive land uses

Land use	Where objective applies	Management level $L_{Aeq(15\ min)}$[1]
Commercial premises	External noise level	70 dB(A)
Industrial premises	External noise level	75 dB(A)

1 – Noise management levels apply when receiver areas are in use only.

2 – Where some nearby receivers may operate with both commercial and residential land uses, the more stringent criteria will apply. For this project, residential criteria will prove more stringent.

For work within standard construction hours, if after implementing all ‘feasible and reasonable’ noise levels the site still exceeds the noise affected level, the ICNG does not require any further action – since there is no further scope for noise mitigation.

For out-of-hours work, the ICNG uses a noise level of 5 dB above the noise-affected level as a threshold where the proponent should negotiate with the community. While there is no ‘highly-noise affected level’ outlined in the ICNG for out-of-hours work, the noise assessment adopted the terminology where the construction noise level is 5 dB above the noise affected level.

Project construction noise management levels

Construction noise criteria are typically set relative to the background noise levels of the project area, and therefore may differ across a construction site if variable background levels exist. Given the consistency of the measured background noise levels at the DPSF site and surrounds, a single Noise Management Level has been determined for receivers within the site vicinity (refer Table 50). Additionally, as works are only proposed to be conducted during daytime hours, only a daytime criteria has been set.

Table 50 DPSF Project construction noise management levels

Time Period	Daytime (7:00 to 18:00 weekdays / 8:00 to 13:00 Saturday)	
Receiver	Background Noise Level (RBL), L_{A90}	Noise Management level (NML), $L_{Aeq(15\text{-minute})}$
Residential	30[1]	40
Commercial		70
Industrial		75

Note: 1 – Section 3.1.2 of the NSW INP states that where measured background noise levels are below 30 dB(A), background noise levels should be set to 30 dB(A)

Construction traffic noise criteria

The NSW ICNG states that traffic increases on local roads as a result of construction traffic is to be assessed in accordance with the NSW Road Noise Policy (RNP).

The RNP outlines road traffic noise criteria impacting upon residential areas as a result of an increase in traffic flows. Where noise levels are predicted to exceed the criteria and pose a more than 2 dB(A) increase over an existing 'no-build' scenario, all feasible and reasonable mitigation measures should be applied.

Operational noise criteria

Operational noise emissions from the project has been assessed in accordance with the NSW *Industrial Noise Policy* (INP) (NSW EPA, 2000), which is primarily concerned with controlling intrusive noise impacts in the short-term for residences, and maintaining long-term noise level amenity for residences and other land uses.

Intrusive noise criteria

The intrusiveness criteria is applicable to residential premises only. The intrusiveness criterion is summarised as follows:

- $L_{Aeq,15minute} \leq$ Rating Background Level (RBL) plus 5 dB

As the intrusiveness criteria is established from the prevailing background noise levels at the residential receiver locations, the rating background noise level is required to be quantified in order to establish project noise goals.

As per Section 3.1.2 of the NSW INP:

> *"Where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A)."*

Consequently, where background noise levels are less than 30 dB(A), intrusiveness criteria will be set to 35 dB(A).

Amenity noise criteria

The INP amenity criteria are for the purpose of maintaining noise amenity, for which the INP recommends 'acceptable' and 'recommended maximum' cumulative noise levels for all industrial noise at different receiver types, including residential, commercial, industrial receivers and other sensitive receivers (refer Table 51).

Table 51 INP amenity criteria – recommended L_{Aeq} noise levels from industrial noise sources (NSW INP Table 2.1)

Receiver Type	Indicative Noise Amenity Area	Time of Day[1.]	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75
1 – Daytime, 7.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night-time 10.00pm to 7.00am On Sundays and Public Holidays, Daytime 8.00am – 6.00pm; Evening 6.00pm – 10.00pm; Night-time 10.00pm – 8.00 am				

In accordance with INP principles, adjustments to acceptable and recommended noise levels are required where existing industrial noise dominates the ambient noise environment. As per site observations, the existing ambient noise environment is typical of a rural setting and is not dominated by industrial noise. Therefore, the amenity goals remain as per Table 51.

Reference should be made to the INP (NSW EPA, 2000) for further details of the full assessment procedures and application, including modifying factor adjustments, background measurement procedures, adverse meteorological effects as well as assessment of sleep disturbance.

Project specific noise criteria

Based on the background and ambient noise monitoring, Table 52 summarises the derived project noise criteria based on the INP methodology.

Table 52 Project specific operational noise criteria, residential receivers

Noise level / Criteria	Criteria at time period, dB(A)		
	Day	Evening	Night
Background noise level, dBL_{A90}	29	28	28

Noise level / Criteria	Criteria at time period, dB(A)		
Background noise level (corrected), dBL_{A90}[1]	30	30	30
Amenity criteria	50	45	40
Intrusive criteria	35	35	35
Final Criteria	**35**	**35**	**35**

1 – Section 3.1.2 of the NSW INP states that where measured background noise levels are below 30 dB(A), background noise levels should be set to 30 dB(A)

2 – Daytime, 7.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night-time 10.00pm to 7.00am

On Sundays and Public Holidays, Daytime 8.00am – 6.00pm; Evening 6.00pm – 10.00pm; Night-time 10.00pm – 8.00 am.

Poultry farms

In addition to the residential receivers along Donald Ross Drive, there are currently operating poultry farms with livestock kept on site.

There is no evidence that suggests that livestock or poultry is any more sensitive to noise to that of a residential receiver. As a result, properties with livestock have been assessed with the same criteria and procedure to that of residential receivers.

No additional assessment criteria has been imposed as a result of nearby poultry farms.

Vibration criteria

Vibration criteria relate to construction and operation of the development and are generally assessed against two considerations:

- Structural damage
- Human exposure

The following sections summarise assessment criteria relevant to each.

Structural damage

Potential structural or cosmetic damage to buildings as a result of vibration is typically assessed in accordance with British Standard BS 7385. British Standard 7385-1, defines different levels of structural damage as:

- Cosmetic – The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition the formation of hairline cracks in mortar joints of brick/concrete block construction.
- Minor – The formation of large cracks or loosening of plaster or drywall surfaces, or cracks through bricks/concrete blocks.
- Major – Damage to structural elements of the building, cracks in supporting columns, loosening of joints, splaying of masonry cracks, etc.

BS7385-2 is based on peak particle velocity and specifies damage criteria for frequencies within the range 4–250 Hz, and a maximum displacement value below 4 Hz is recommended. Table 53 below sets out the BS7385 criteria for cosmetic, minor and major damage.

Table 53 BS 7385-2 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s[1]		
			4 Hz to 15 Hz	15 Hz to 40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50		
		Minor[2]	100		
		Major[2]	200		
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor[2]	30 to 40	40 to 100	100
		Major[2]	60 to 80	80 to 200	200

1 – Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.

2 – Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2

All levels relate to transient vibrations in low-rise buildings. Continuous vibration can give rise to dynamic magnifications that may require levels to be reduced by up to 50%.

Human exposure

Potential vibration disturbance to human occupants of buildings is made in accordance with the NSW DEC '*Assessing Vibration; a technical guideline*'. The criteria outlined in the guideline is based on the British Standard BS 6472-1. Sources of vibration are defined as either 'Continuous', 'Impulsive' or 'Intermittent', as described in Table 54 below.

Table 54 Types of vibration – definition

Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time)	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers.

Type of vibration	Definition	Examples
		Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

Table 55 below is a reproduction of the 'Preferred' and 'Maximum' values for continuous and impulsive vibration from Table 2.2 of the Guideline.

Table 55 Preferred and maximum vibration acceleration levels for human comfort, m/s2

Location	Assessment period1	Preferred values		Maximum values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration (weighted RMS acceleration, m/s2, 1-80Hz)					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Impulsive vibration (weighted RMS acceleration, m/s2, 1-80Hz)					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
1 – Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am					

Table 56 reproduces the 'Preferred' and 'Maximum' values for intermittent vibration from Table 2.4 of the Guideline.

Table 56 Acceptable vibration dose values (VDV) for intermittent vibration (m/s1.75)

Location	Daytime[1]		Night-time[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Residences	0.20	0.40	0.13	0.26
[1]- Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am				

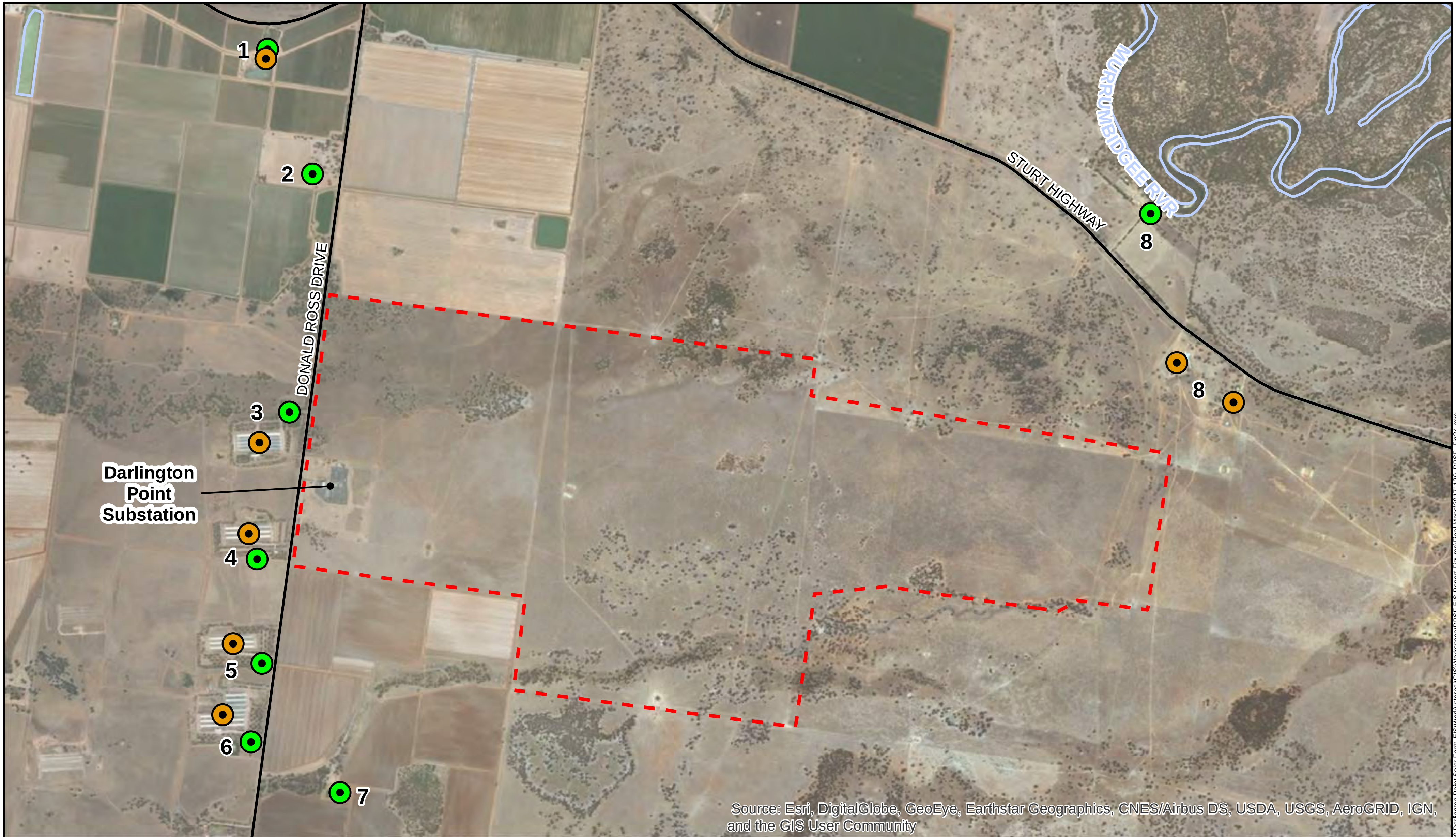
8.2.3 Existing environment

Sensitive receivers

A number of sensitive receivers have been identified within the vicinity of the DPSF site (refer Table 57). **Figure 24** shows their proximate locations to the DPSF site.

Table 57 Sensitive receivers within close proximity to the DPSF site

Receiver	Address / Location	Approximate distance from site boundary, m
1	14713 Sturt Highway	1750
2	122 Donald Ross Drive	790
3	336 Donald Ross Drive	100
4	382 Donald Ross Drive	100
5	456 Donald Ross Drive	700
6	510 Donald Ross Drive	1250
7	537 Donald Ross Drive	1500
8	Tubbo	1650



Legend

Sensitive Receivers

- Residential Receiver
- Commercial/Industrial Receiver
- Roads
- Rivers
- Project Boundary

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Figure 24 - Sensitive Receivers

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Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:30,000

Metres

0 125 250 500 750 1,000 1,250

Drawn by: GJH Date: 22/12/2017

Document Path: Z:\SYD\Projects\254000\254766-00 Darlington Point Solar Farm EIS\Work\Internal\GIS\Workspace\DPSF EIS Report Figures\Final Maps\20171120_DPSF_Fig24.mxd

Minimum standard background noise criteria have been used for the existing noise levels in a rural environment, in accordance with the NSW Industrial Noise Policy 2000 (INP) methodology. Additional on-site noise measurements were undertaken to confirm existing background noise levels were applicable to the standard background noise criteria for a rural environment.

Short term attended noise measurements were undertaken at various sensitive receptor and other representative background locations to determine the level of existing background noise in the area of the proposed development. Noise measurements were short 5-minute duration using a Burel and Kjaer 2236 sound level meter. Noise measurement data and survey information can be seen in Table 58.

Table 58 Noise survey measurement locations and results

Location (corresponding to numbering in Figure 24)	Description	Type of receiver	Background noise level, dB $L_{A90\ (5\text{-minute})}$	
			Daytime	Night time
1	"Cavaso" 14713 Sturt Highway	Commercial/industrial and residential receiver	39 [1]	46 [1]
2	"Victor Filmer" 122 Donald Ross Drive	Residential receiver	29	28
3	"Farm 46" 336 Donald Ross Drive (Baida)	Commercial/industrial and residential receiver	29	29
4	"Farm 45" 382 Donald Ross Drive (Baida)	Commercial/industrial and residential receiver	30	29
7	"Terra Nova" 537 Donald Ross Drive	Residential receiver	30	29

1 – Background noise levels measured at this location consist of noise produced by nearby mechanical equipment and plant. For this reason, noise measurements in this location have not been used for the basis of determining project noise criteria

A review of Table 58 shows that measured ambient background noise measurements are less than 29-30 dB$L_{A90\ (5\text{-minute})}$ during the day and 28-29 dB$L_{A90\ (5\text{-minute})}$ during the night. This supports the INP approach using minimum standard background noise criteria of 30 dB L_{A90} is applicable for the DPSF site.

Project construction management levels

Construction noise criteria are usually set per area of a project site in order to cover a range of zones with different background noise levels. Given the consistency of the measured background noise levels, a single Noise Management Level has been determined for receivers within the vicinity of the DPSF site. Additionally, as works are only proposed to be conducted during daytime hours, only a daytime criteria has been set (refer Table 59).

Table 59 Project construction noise management levels

Time Period	Daytime (7:00 to 18:00 weekdays / 8:00 to 13:00 Saturday)	
Receiver	Background Noise Level (RBL), L_{A90}	Noise Management level (NML), $L_{Aeq(15\text{-minute})}$
Residential	30	40
1 – Section 3.1.2 of the NSW INP states that where measured background noise levels are below 30 dB(A), background noise levels should be set to 30 dB(A)		

Project operational noise criteria

Based on the background and ambient noise monitoring, Table 60 summarises the derived project noise criteria based on the INP.

Table 60 Project specific operational noise criteria, residential receivers

Noise level / Criteria	Criteria at time period, dB(A)		
	Day	Evening	Night
Background noise level, dBL_{A90}	29	28	28
Background noise level (corrected), dBL_{A90}[1]	30	30	30
Amenity criteria	50	45	40
Intrusive criteria	35	35	35
Final Criteria	**35**	**35**	**35**
1 – Section 3.1.2 of the NSW INP states that where measured background noise levels are below 30 dB(A), background noise levels should be set to 30 dB(A) 2 – Daytime, 7.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night-time 10.00pm to 7.00am On Sundays and Public Holidays, Daytime 8.00am – 6.00pm; Evening 6.00pm – 10.00pm; Night-time 10.00pm – 8.00 am.			

8.2.4 Potential impacts

Construction noise assessment

During construction works, the main sources of noise are expected to be from traffic movements, piling of the solar array posts, construction of the project switchyard, and installation of equipment at the TransGrid substation. The primary works will be completed during recommended standard hours of construction as per the ICNG over a period of approximately 12 months, according to the following schedule:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturday: 7:00 am to 1:00 pm

In general, no construction activities will occur over night, on Sundays or public holidays, however exceptions to these hours may be required on limited occasions, for example:

- The delivery of materials as requested by the NSW Police Force or other authorities for safety reasons and/or to minimise disruption to local traffic;
- Augmentation works to the TransGrid substation, which may require a temporary power outage, such that the impact on power supplies to the local community is minimised; and
- Emergency work to avoid the loss of life, property and/or material harm to the environment.

The local council, surrounding landholders and other relevant authorities will be notified of any exceptions prior to the works being undertaken.

At this stage of the project, proposed construction activities have not been finalised. As a result, this section is subject to change as the proposal develops.

Likely construction activities, nominal equipment and sound power levels have been provided in Table 61.

Table 61 Nominal construction equipment and sound power levels per activity

Unit/Plant item	SWL per unit (A-weighted)	No. units	Operating time	SWL per activity (A-weighted)
Light vegetation clearing				**112**
Chainsaw	114	2	20%	
Dump truck	108	1	50%	
Excavation				**114**
Excavator (approx. 30 tonne)	110	1	100%	
Dump Truck	108	1	60%	
Water cart	107	1	100%	
Piling foundations				**114**
Bored Piling Rig	110	2	100%	
Dump Truck	108	1	80%	
Concrete pours				**113**
Concrete pump	108	1	90%	
Concrete truck	109	1	90%	
Truck (>20 tonne)	107	2	60%	
Installation of services				**117**
Pneumatic hammer	113	3	70%	
Vehicle (light commercial)	106	2	60%	
Hand tools (electric)	102	5	80%	
Generator	104	1	100%	
Onsite paths and road works				**117**
Vibratory Roller (approx. 10 tonne)	114	1	70%	
Scraper	110	1	40%	

Unit/Plant item	SWL per unit (A-weighted)	No. units	Operating time	SWL per activity (A-weighted)
Grader	113	1	100%	
Compactor	106	1	100%	

1 – Data inputs are based upon sound power levels for equipment and plant that have been provided to Arup from the client and/or manufacturer or industry standard performance data for nominal items. Where data for given items is not available Arup will base acoustic performance on similar equipment or our library of data.

Construction noise levels at nearby receiver locations have been determined for the various construction activities as per Table 61. Given the large area of the DPSF site and the range of distances that may occur between construction activities and nearby receivers, predictions in Table 62 show construction noise levels at the nearest receivers for works located at the project site boundary where the distance to the nearest receivers is shortest. The distances used for these predictions can be seen in Table 62. Sound attenuation for distance was predicted using the CONCAWE method.

Table 62 Predicted construction noise levels from site boundary

Receiver (refer Figure 24)	Location	Predicted noise level at project site boundary, dB L_{Aeq}					
		Light vegetation clearing	Excavation	Piling	Concrete pours	Installation of services	Onsite paths and road works
1	14713 Sturt Highway	39	41	41	40	44	44
2	122 Donald Ross Drive	46	48	48	47	51	51
3	336 Donald Ross Drive	64	66	66	65	69	69
4	382 Donald Ross Drive	64	66	66	65	69	69
5	456 Donald Ross Drive	47	49	49	48	52	52
6	510 Donald Ross Drive	42	44	44	43	47	47
7	537 Donald Ross Drive	40	43	42	41	46	45
8	Tubbo Homestead	39	42	42	40	45	44

A review of Table 62 shows that the construction is predicted to exceed noise management levels when conducted near to the project boundary. Given the size of the project site, it is likely that the majority of construction works will be undertaken at a greater distance from residential receivers resulting in lower noise levels.

Given the exceedances predicted, it is recommended that mitigation measures be applied. Details on the recommended mitigation can be seen in Section 8.2.5.

Construction of BESS facility

As discussed in Section 2.5.8, the BESS facility is proposed to be constructed over a 3 to 6 month period (expected Q3 to Q4 (August to December) 2020) once the DPSF has commenced operation. Only selected construction equipment as shown in Table 61 would be used during construction of the BESS facility (e.g. concrete pouring equipment, crane, grader, roller, miscellaneous light construction vehicles, and delivery vehicles with low-loader flat-bed).

Equipment used for the construction of the BESS facility would not be used at the same intensities and duration as that required for construction of the solar farm. Hence, it is expected that noise levels generated from equipment use would not reach the same levels at sensitive receivers as are expected for the construction of the solar farm as shown in Table 62. Standard noise mitigation measures would be applied to manage any noise concerns during construction of the BESS facility as per Section 8.2.5.

Construction traffic noise assessment

Access to the DPSF site will be via Donald Ross Drive. During construction, nearby roads are likely to feature increased traffic flows. A traffic noise assessment has been conducted to determine the acoustic impact of noise attributed to additional traffic volumes present on local roads as part of the construction activity.

RMS supplied traffic volume data for both the Sturt Highway and Kidman Way have been used to estimate existing volumes on Donald Ross Drive as outlined in the Traffic Impact Assessment (Section 7.2). These traffic volumes have been used to undertake the traffic noise assessment.

As per the proposed construction traffic movements discussed in Section 7.2.2, heavy vehicles traffic may produce up to 5 movements in a worst case 1 hour period. In addition to heavy vehicles, up to 215 light vehicle movements used in materials and personnel transport may be present in this worst case 1 hour period.

Based on this traffic information, Table 63 presents an assessment based on predicted traffic noise levels with and without construction traffic.

Table 63 Construction traffic flows and predicted noise levels on Donald Ross Drive

Scenario	**Light vehicles, per hour (two-way)**	**Heavy vehicles, per hour (two-way)**	**Noise level at residences on Donald Ross Drive, dB L_{Aeq} (1 hour)**
Existing traffic (average hourly period)	72	27	60.2
DPSF Construction Traffic (worst case hourly period)	215	5	59.9
Combined traffic during DPSF construction	287	32	63

As shown in Table 63 , additional noise generated by DPSF construction traffic will present a more than 2 dB increase in noise levels for road traffic noise on Donald Ross Drive. As a result, it is recommended that all feasible and reasonable mitigation measures are provided.

A list of mitigation measures to manage construction traffic noise is provided in Section 8.2.5 below.

BESS facility construction traffic

As indicated in Section 2.5.8, construction of the BESS facility is proposed to run from Q3 to Q4 (August to December) 2020, once the solar farm is in operation. As indicated in the traffic assessment (refer Section 7.2.3), an approximate 156 vehicle deliveries for the battery powerpacks, inverters, cables and concrete would be expected over the BESS facility construction period. A further 10 to 20 personnel (peak of 20 vehicles) would attend site during the BESS construction period.

From this, the expected number of vehicles attending the site during the BESS construction period would be approximately 176 vehicles spaced out over the period, which is significantly less than the traffic volumes expected for the solar farm construction period. In addition, the construction traffic noise generated by the BESS facility is considered to be of a shorter duration and lesser intensity than the expected solar farm construction traffic noise.

The consequent construction traffic noise levels for the BESS facility are not expected to exceed those levels identified for the solar farm construction (refer Table 63). On this basis, it is anticipated that the construction of the BESS facility would not result in significant additional traffic noise than compared to the solar farm construction (e.g. no worsening of impact).

Construction vibration assessment

Minimum working distances for typical mechanical and plant items have been published in documentation such as the Transport for NSW (TfNSW) Construction Noise Strategy (Transport for NSW, 2016). Table 64 outlines recommended minimum working distances for vibration intensive plant.

These limits determine minimum distances between source and receiver to achieve the following requirements:

- "Cosmetic damage" as described in BS 7385
- Human comfort limits as described in the EPA's *Assessing Vibration: A Technical Guideline*.

Table 64 Excerpt from TfNSW Construction Noise Strategy – Recommended minimum working distances for vibration intensive plant

Plant Item	Rating/Description	Safe Working Distance	
		Cosmetic Damage (BS 7385)	**Human Response (OH&E Vibration Guideline)**
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

A review of Table 64 shows that use of vibration intensive plant within the DPSF site is unlikely to affect nearby residential receivers given the locations and distances outlined in Table 57.

Operational noise assessment

Solar farm operation

Daily operations and maintenance activities by site staff would be undertaken during standard working hours of:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturday: 8:00 am to 1:00 pm

Outside of emergencies or major asset inspection or maintenance programs, night works and work on Sundays and public holidays would be minimised.

The operational noise assessment has been based on the concept design details of the DPSF project. It is assumed that the DPSF would operate 0.8 – 1 million solar panels, oriented on an east – west rotation, tracking the position of the sun throughout the day. The rotation of the solar panels would be driven by a motor configured to operate an array of panels. In addition to the solar panel array motors, the DPSF site will require the addition of transformers to supplement the capacity of the solar panels. It is proposed to supply additional transformer facilities throughout the extent of the property with a main transformer unit installed near the existing infrastructure towards the western boundary.

Personnel transport may involve operation of up to 5 light vehicles per hour. This number of vehicle movements is not anticipated to significantly increase the overall operational noise impact from the site and will not be discussed further.

Operational plant and equipment types, quantities and sound power levels are provided in Table 65. Sound Power Levels and unit quantities have been based on information provided by Edify Energy.

Table 65 Proposed operational plant quantities and sound power levels

Plant Item	Sound Power Level (A-Weighted) per unit, dB Laeq	Number of units on site
Solar panel array motor	78	11250
Medium voltage power station unit	102	55
Main transformer	100	1

Allowing for corrections for tonality for solar track motors and substations, a tonality assessment in accordance with the NSW INP, a 5 dB(A) tonality penalty has been applied to the predicted levels of solar tracker motors. Given the nature of solar tracking, noise generated from the solar panels is expected to be extremely intermittent given the small amount of movement required to track the sun over the period of a day. This assessment has assumed that solar tracker motors will operate no more than 0.2 minutes out of every 15 minutes.

Operational noise levels at nearby residential receivers has been predicted and compared with the relevant project criteria outlined in Table 60, sound power data and proposed plant quantities in Table 65, and the correction factors discussed above. Consideration of meteorological effects using CONCAWE metrological curves was used for operational noise assessments in accordance with the INP (NSW EPA, 2000). Further information on this methodology is provided in **Appendix H**.

The predicted operational noise emissions are shown in Table 66.

Table 66 Operational noise predictions and comparison with criteria

Receiver (refer Figure 24)	Location	Predicted Noise Level, dB Laeq	Criteria – All INP periods, dB Laeq
1	14713 Sturt Highway	15	35
2	122 Donald Ross Drive	21	

Receiver (refer Figure 24)	Location	Predicted Noise Level, dB Laeq	Criteria – All INP periods, dB Laeq
3	336 Donald Ross Drive	32	
4	382 Donald Ross Drive	29	
5	456 Donald Ross Drive	24	
6	510 Donald Ross Drive	20	
7	537 Donald Ross Drive	20	
8	Tubbo Homestead	17	

As shown in Table 66, operational noise is predicted to comply with the operational noise criteria at all locations. Noise emissions from the site are primarily driven by the collective sound pressure levels of the medium voltage transformer units with the solar tracker motors providing some minor contribution.

While a tonal penalty has not been applied to the transformer units as per the details outlined above, if this 5 dB(A) penalty were also applied to the medium voltage transformer units, compliance with the operational noise criteria is predicted to be achieved at all receiver locations.

It is important to note that the predictions in Table 66 represent noise levels on the basis of preliminary equipment selections. It is recommended that mitigation measures be applied once final equipment selections are made in order to achieve noise criteria targets for nearby residences.

BESS facility operation

The BESS facility is expected to be operational by December 2020. The noise specification sound power levels for the BESS facility are summarised below:

- Powerpack Inverter: <70 dBA at 1 meter
- Powerpack Unit: <82.5 dBA at 1 meter

As identified in Section 2.5.8, approximately 970 battery cubicles will be placed on individual concrete footings sized up to 2,000m^2 in total area across the 2 .

As per Table 65, the solar farm operational plant have higher sound power levels and quantities than the BESS facility (except for the solar arrays, which appear to have a lower sound power level than the batteries, but higher quantities). This suggests that the noise to be generated by the batteries will be at a lower intensity (lower sound power levels and quantities) than compared to other solar farm operational plant. Therefore, it is considered that the operation of the BESS facility is unlikely to significantly contribute to an exceedance of the operational noise criteria for sensitive receivers identified in Table 66.

During detailed design, the exact location of the batteries will be configured in such a way as to minimise any potential noise level exceedances to the sensitive receivers noted in Table 66, with the potential to mitigate any exceedances by increasing the distance between the BESS facility and the nearest sensitive receiver.

Decommissioning

The expected life of the DPSF is 30 years. The BESS facility's life is specified for 15 years, so it is likely that the battery cubicles would be removed and replaced at year-15. Given the likely advancements of battery technology into the future, it is assumed that a more efficient and quieter technology would be installed at the site in year-15. The facility would operate for another 15 years up to the DPSF's expected life of 30 years. Following this, the farm would be decommissioned or there may be options to extend the life of the plant.

It is expected that the indicative construction activities listed in Table 61 would be reasonably representative of noise and vibration impacts associated with decommissioning. For the replacement of the battery cubicles at year-15, approximately 90 to 100 deliveries over a 2 to 3 month window would occur. No changes to the concrete slab, cables and transformers would be expected. Similar noise impacts would be considered for the battery replacement activities but would occur over a shorter duration.

This would need to be reviewed once specific activities are known. An updated analysis of existing ambient noise environment would also potentially be required to ascertain whether the background noise level had changed and updated assessment criteria be required.

8.2.5 Management and mitigation

Noise and vibration impacts would be managed through the recommended mitigation measures outlined in Table 67.

Table 67 Recommended mitigation measures for noise and vibration impacts

No.	Recommended mitigation measures	C	O	D
NV1	Construction works should be undertaken during standard working hours only. • Monday – Friday 7am to 6pm • Saturday – 7am to 1pm In general, no construction activities will occur over night, on Sundays or public holidays, however exceptions to these hours may be required on limited occasions; for example: • The delivery of materials as requested by the NSW Police Force or other authorities for safety reasons and/or to minimise disruption to local traffic; • Augmentation works to the TransGrid substation, which may require a temporary power outage, such that the impact on power supplies to the local community is minimised; and	✓	✓	✓

No.	Recommended mitigation measures	C	O	D
	• Emergency work to avoid the loss of life, property and/or material harm to the environment. The local council, surrounding landholders and other relevant authorities will be notified of any exceptions prior to the works being undertaken. Daily operations and maintenance activities by site staff would be undertaken during standard working hours of: • Monday – Friday 7am to 6pm • Saturday – 8am to 1pm Outside of emergencies or major asset inspection or maintenance programs, night works and work on Sundays and public holidays would be minimised.			
NV2	The appointed contractor would develop and implement a Construction Noise and Vibration Management Plan (CNVMP) that should include, but not be limited to the following: • Adherence to the standard approved working hours for construction projects • Using natural screening by topography wherever possible to reduce noise impacts • Using site sheds and other temporary structures or screens to limit noise exposure where possible • Installing operational noise barriers as early as possible to provide ongoing screening from construction activities, where possible. • The appropriate choice of low-noise construction equipment and/or methods. • Modifications to construction equipment or the construction methodology or programme. This may entail programming activities to occur concurrently where a noisy activity will mask a less noisy activity, or, at different times where more than one noisy activity will significantly increase the noise. The programming should also consider the location of the activities due to occur concurrently. • Restricting or redirecting movements to reduce flows during peak times. • Community engagement notification and noise monitoring at sensitive receivers, community information programme and a complaints hotline. Maintain open communication channels with nearby receivers, including commercial tenants and residents.	✓		✓

No.	Recommended mitigation measures	C	O	D
	• Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise • Site managers to periodically check the site and nearby residences for noise problems so that solutions can be quickly applied. • Avoid the use of radios or stereos outdoors and the overuse of public address systems. • Avoid shouting and minimise talking loudly and slamming vehicle doors. • Turn off all plant and equipment when not in use.			
NV3	To reduce the effect on residents of piling noise, nearby residents should be consulted regarding the intended activities associated with the piling process. Should percussive piling be considered, activities to reduce the impact of this activity include: • Use a resilient pad (dolly) between pile and hammer head. • Enclosing the hammer head in a temporary acoustic shroud. • Rotary bored or vibro-piling may be used where consistent with the type of pile used and restrictions on soil disturbance. • Piling should not be undertaken outside of standard working hours.	✓		
NV4	Appoint a construction staff member responsible for construction noise and vibration management on site. Undertake construction noise monitoring to alert the contractor of potential exceedances of noise management levels.	✓		✓
NV5	The location of stationary plant (air-compressors, generators, etc) is to be as far away as possible from sensitive receivers.	✓	✓	✓
NV6	Apply the TfNSW Construction Noise Strategy's maximum allowable noise levels for construction equipment to screen machinery adopted for use on site by the construction contractor (refer **Appendix H** for further information).	✓		
NV7	Maintain minimum working distances for vibration intensive plant. Where this is not possible, vibration monitoring with real-time alerts should be considered.	✓		
NV8	To manage construction related traffic noise, implement the following measures:	✓		✓

No.	Recommended mitigation measures	C	O	D
	• Schedule vehicle routing and movements in order to minimise the impact of road traffic noise within a given period i.e. allow for arrival of workers and equipment deliveries to occur over a longer period to reduce the noise emissions during peak periods. • Reduce the impact of the use of compression brakes when accessing the site, management of speed to allow for minimal use of compression breaking when accessing the site. • Ensure vehicles are adequately silenced and specified for site use. Selection of transport units should be undertaken with the thought to reduce noise emissions. • Ongoing consultation with closest sensitive receivers on Donald Ross Drive. Agree acoustic treatments or management measures if construction noise exceeds criteria at these locations. • Considerations for the duration and timing of traffic should be made with community consultation to act in the best interests of the affected receivers. Given the temporary nature of construction, the duration and intensity of works should be determined to best suit the affected receivers.			

8.3 Visual amenity

8.3.1 Methodology

The visual landscape appraisal and reflected glare assessment of the proposed DPSF site has been undertaken according to the following methodology. A full copy of the visual and reflected glare assessment is provided in **Appendix I**.

Visual landscape assessment

1. **Define the visual study area:** prepare a Visual Envelope Map (VEM) including areas within and external to the DPSF site. The VEM represents the zone of theoretical view of the development based on the topography of the site and view from the surrounding terrain. Mitigating factors such as vegetation or other visual obstructions are not considered for the VEM, and hence it represents a worst-case scenario in this aspect. Existing mitigations are taken into account in step 3 (baseline review). In GIS, a VEM was generated using digital terrain data (Geoscience Australia, 2010) and 3D polylines. The underlying data used to run the analysis is based on a 1 arc second (25 metre) resolution Digital Elevation Model (DEM).
2. **Select viewpoint locations:** thirteen (13) viewpoints were selected to represent the range of viewpoints of the site within the VEM and using the sensitivity of the potential receptors. Potential sensitive receptors include

residential properties located within close proximity to the DPSF site at adjacent poultry farms on Donald Ross Drive. The viewpoints are the locations from which landscape and visual impacts have been assessed.

3. **Baseline landscape and visual conditions review:** through desktop analysis and site research, a description of the existing landscape and visual conditions of the DPSF site is provided with reference to the VEM and the 13 representative viewpoints. A summary of the character of the landscape is provided, with a focus on the landscape characteristics that inform the extent of potential views.
4. **Assessment of visual effects:** a review of the potential visual effects that would arise as a result of the proposed development. The factors used to undertake the assessment included the sensitivity of the viewpoint and the magnitude of the anticipated change.
5. **Mitigation:** Mitigation measures recommended to manage any potential impacts.

Reflected glare assessment

A high-level external glare assessment was also undertaken to determine the risk of diffuse and specular reflections as a result of the installation of the solar farm infrastructure at the DPSF site. Reflected glare has the potential to cause uncomfortable and potentially unsafe visual impacts in the built environment. This may impact on transport operators who require a high degree of concentration while operating vehicles and adjacent residential properties. This assessment of reflected glare risks is focused on identifying the risk of disability glare for relevant observers (glare receptors).

The potential impact of a solar reflection is based on several considerations:

- The intensity of the glare source: the degree to which the reflective surface reflects direct sunlight
- The distance from which the solar reflection is observed: if the observer is far away from the glare source, the impact on vision is reduced
- The size of the reflector: if the reflector is small or far away, a reflection of the sun’s full disk will not visible, and the impact on vision is reduced
- The position of the reflection in the observer’s field of vision: reflections that appear close to the direction of the observer’s view will have a much stronger impact on vision

The assessment was conducted based on the following:

- The DPSF will cover the majority of the site footprint and will consist of a single-axis tracking system
- The panels will track over a horizontal (north-south) axis, turning from east to west (refer to **Figure 25**)
- **Figure 26** shows a cross-section of the concept PV array; the rotation in each direction is limited to approximately 60° from the horizontal

- The PV panels were assumed to comprise polycrystalline panels with an aluminium frame
- The site is largely comprised of flat land
- Solar patterns, or sun path, which refers to the path of the sun through the sky. The site is located at Darlington Point, latitude 34.6° south. A sun path diagram for this latitude was referenced.

This assessment considers all of the above factors in estimating the likely impact of potential solar reflections on all identified glare receptors. This is based largely on understanding of the sun’s path through the sky at the site’s location.

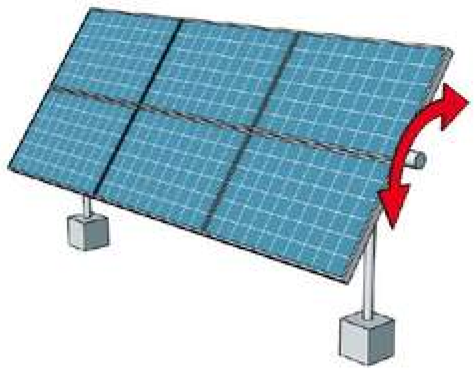


Figure 25 Horizontal single axis tracking modules (Source: (Evolve Solar, 2015)**)**

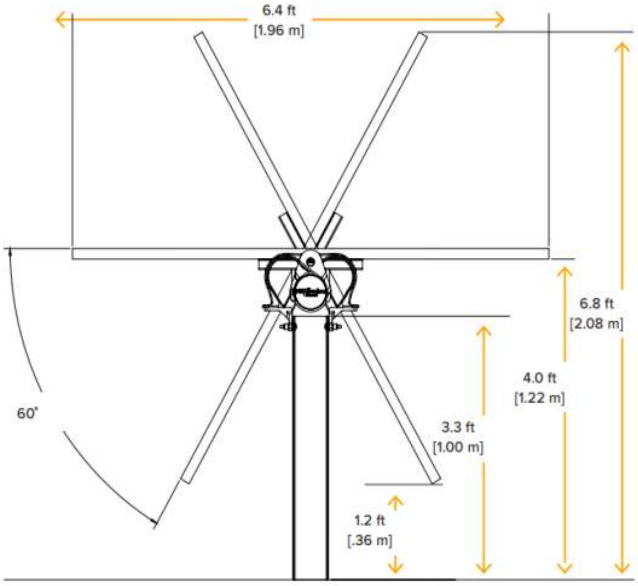


Figure 26 Indicative PV array cross-section showing limits of rotation around the axis

8.3.2 Existing environment

Visual Envelope Map

The visual study area was defined by the VEM to illustrate the potential extent of visibility of the proposed DPSF. The theoretical extent is based on 164 points located around the perimeter of the DPSF site based on an eye level of 1.7 m. The VEM is shown in **Figure 27**.

The VEM is, by its nature, approximate only and may exclude areas of existing intervening features such as built form, vegetation or localised variations in topography, representing the greatest extent of potential visual effect.

The underlying data used to run the analysis is based on a 1 arc second (25 metre) resolution Digital Elevation Model so there will be localised inaccuracies. 13 representative viewpoints have been selected through a review of the sensitivity of the visual amenity and interrogation of the VEM.

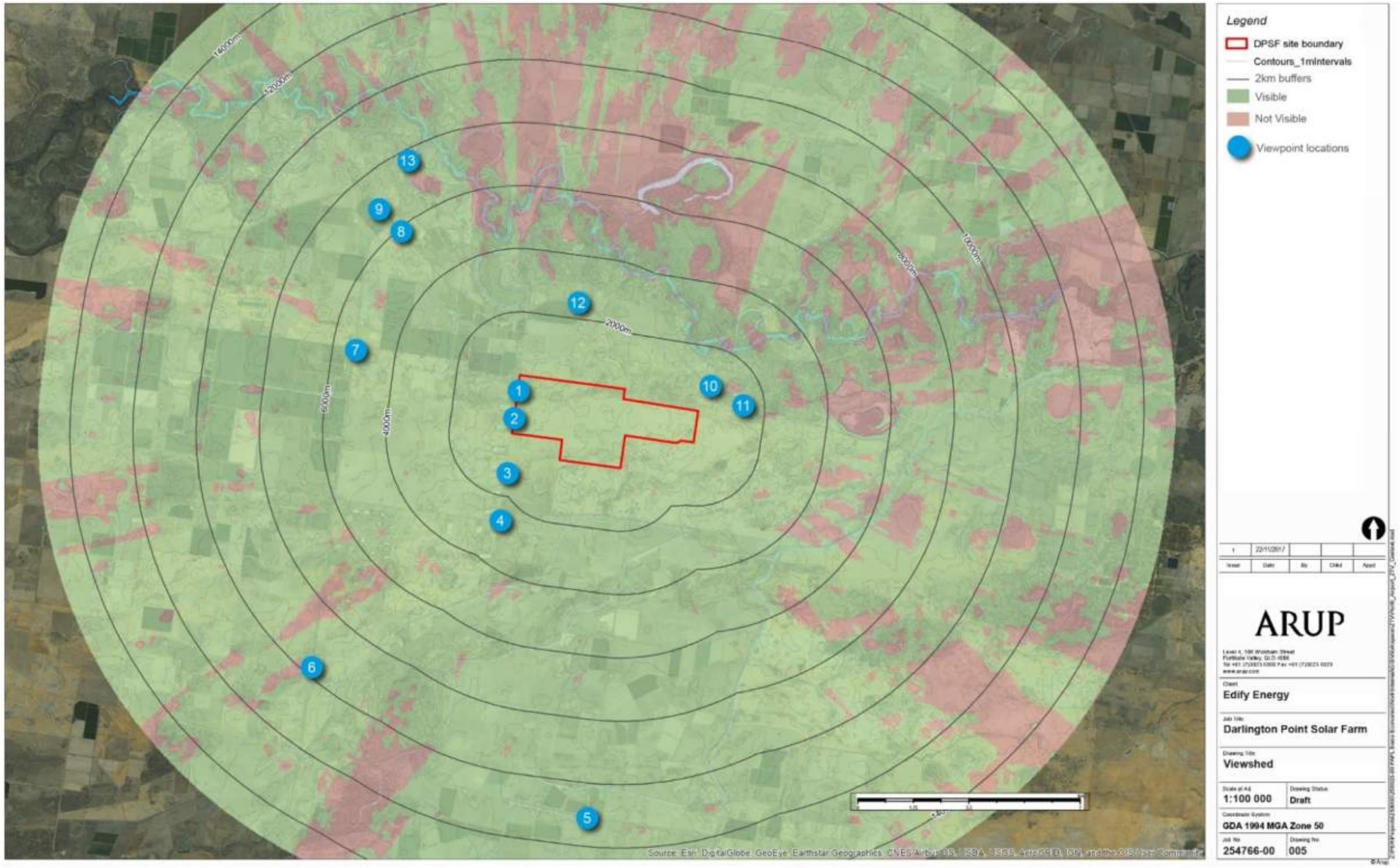


Figure 27 Visual Envelope Map

Visual amenity

The visual amenity and scenic value within the DPSF site is influenced by the topography, vegetation cover and land use. The relatively flat agricultural landscape offers expansive views with intervening vegetation transitioning with the seasons as colours and vegetative forms change.

The Sturt Highway and Donald Ross Drive road corridors provide the main vantage points from which to view the agricultural landscape, although views are frequently filtered by roadside vegetation. Some roadside patches are dense with a well-established understorey, while in other areas vegetation is limited where wide pastoral views are afforded.

Existing overhead transmission lines and substation infrastructure are visible from both the Sturt Highway and Donald Ross Drive corridors. Surrounding residences are sparsely distributed. Generally, neighbouring dwellings are associated with screen planting from adjacent road corridors or differential private planting that disconnects the residence from paddocks or industrial land use.

Scenic amenity is rated as low to moderate sensitivity. Built infrastructure within the study area includes:

- Production related infrastructure and buildings
- Farm fence structures
- Powerlines, roads and tracks
- Rural residences

Where remnant vegetation frames views across the pastoral land, scenic amenity increases. Further detail on these key components is provided below.

Topography

As discussed in Section 8.4.2, the DPSF is situated approximately 1.6 kilometres south of the Murrumbidgee River within a topographical depression within the Murrumbidgee plains. Shallow drainage lines and natural depressions intercept the low-relief alluvial clay and loamy landscape.

Mapped soils within the DPSF site are predominately characterised as grey, brown and red clays with red brown earths located in the northwest portion of the study area. The primarily low-lying, flat open grassland allows for distant views stretching across the pastoral landscape. The topography of the study area is shown in **Figure 29** in Section 8.4.2.

Vegetation cover

The study area is mapped by the NSW government as being dominated by Plains Grassland with scattered patches of woodland and forest, including Black Box grassy open woodland, Weeping Myall open woodland, White Cypress pine open woodland and Yellow Box-white cypress pine grassy woodland. Vegetation cover and drainage features are illustrated on **Figure 28**.

Patches of vegetation dispersed across the DPSF site allow for framed and intermittent views stretching east across the low-lying fields, from adjacent Donald Ross Drive. These distributed patches, with the addition of roadside buffer vegetation, limit views towards the proposed DPSF site from by-passers travelling along the Sturt Highway.

Further detail on the vegetation classifications is summarised in Section 7.1 and within the Biodiversity Assessment Report (refer **Appendix C** of the EIS).

Figure 28 Vegetation cover (Source: (Murrumbidgee CMA, 2011))

Land use

The DPSF site is zoned RU1 – Primary Production under the Murrumbidgee Local Environmental Plan 2013 (Murrumbidgee LEP) (refer to **Figure 21** in Section 7.5). The site is currently used for sheep and cattle grazing and it is understood that the historic use of the site has also been for livestock grazing (refer to Section 7.5).

The site is surrounded by land zoned RU1 – Primary Production accommodating farming, agribusinesses and some private residences. A series of poultry farms are situated to the west of the site, to the west of Donald Ross Drive. Some workers' accommodation is provided at the Baiada Farm, the nearest of which is located approximately 100m to the west of the site. The nearest private residence is located approximately 800m to the north of the site.

The site is dissected by a 330kV and two 132kV TransGrid overhead transmission lines from west to east. A 33kV Essential Energy overhead transmission line runs north-south near the eastern boundary. A TransGrid substation is located to the west of the site.

Reflected glare

Glare types

Sunlight reflects off all surfaces that it hits. Most of these reflections are easily viewed and do not present a risk to vision. Sunlight reflects off surfaces that are not shiny in a diffuse way. These surfaces reflect sunlight into a wide range of reflected directions. In spreading the reflected sunlight over a wide range of directions, the intensity of the reflected sunlight is significantly reduced. Such reflections can be considered similar to sunlight patches on grass or carpet, as they are generally bright but not uncomfortable.

Sunlight reflects off smooth, shiny surfaces, such as glass, in a specular (mirror-like) way. The intensity of specular reflections are much stronger than diffuse reflections, and such reflections are generally uncomfortable to view. Most often, this type of visual discomfort is known as 'discomfort glare'. Discomfort glare causes psychological annoyance, but is not considered to present a risk to vision as it does not require the observer to immediately turn away from the glare source.

When sunlight reflections are strong and close to the observer's direction of view, and the observer is performing detailed visual tasks that require concentration in a given direction of view, this is known as 'disability glare'. It causes the observer to be unable to perform a visual task such as driving without taking evasive action (such as turning away or raising a hand to shield the eyes). It temporarily degrades the observer's ability to perform the visual task on which they are focused. Disability glare does not imply long-term disability in any form.

Reflected glare from the solar farm installation could cause uncomfortable and potentially unsafe visual impacts in the built environment. This may impact on transport operators who require a high degree of concentration while operating vehicles and adjacent residential properties.

The assessment of reflected glare risks is focused on identifying the risk of disability glare for relevant observers (glare receptors). Diffuse reflections are generated by sunlight reflecting off surfaces in a wide range of directions, while specular (mirror-like) reflections occur off smooth, shiny surfaces (such as glass) and are much stronger and generally more uncomfortable to view than diffuse reflections. This type of visual discomfort is known as ‘discomfort glare’, which can cause psychological annoyance but is not considered to present a risk to vision as it does not require the observer to immediately turn away from the glare source.

Reflected glare from the DPSF site infrastructure could cause uncomfortable and potentially unsafe visual impacts in the built environment. This may impact on transport operators who require a high degree of concentration while operating vehicles.

The following potential glare receptors have been identified for the DPSF site and are discussed further below:

- Road corridors in the public domain
- Air traffic
- Surrounding residences.

Road corridors

There are a number of road corridors in the vicinity of the proposed DPSF site.

The Sturt Highway, a major road, is located to the north of the site. The distance between the highway and the northern boundary of the DPSF site varies between approximately 1.5km and 6km. Potential glare receptors on the Sturt Highway would be travelling in a westerly to north-westerly direction or in a south-easterly direction.

Donald Ross Drive, a minor road, runs in a north-south direction (in the vicinity of the site) and is adjacent to the western boundary of the site. Potential glare receptors would be travelling in a northerly or southerly direction due to the orientation of Donald Ross Drive.

Other road corridors are considered to be sufficiently far from the proposed site that solar reflection impacts are not anticipated.

Air traffic

Solar reflection impacts on aircraft flying over or in the vicinity of the proposed site were not considered. This matches guidance in Guideline E of the National Airports Safeguarding Framework, as quoted below:

> *The potential for glare caused by reflected sunlight from structures such as buildings has been raised in some quarters as a potential source of distraction to pilots. However, CASA has advised that glare from buildings tend to be momentary and therefore unlikely to be a source of risk. The*

> *potential for risk from building glare is further attenuated by the use of sunglasses which pilots normally wear in bright daylight.*

For the purposes of this assessment, air traffic has been considered in the context of nearby airports. Aircraft that are landing and taking off are considered to be the most susceptible to reflected glare impacts, due to their proximity to the ground, and the detailed visual tasks being undertaken.

The two nearest airports are at Griffith and Narrandera. Griffith Airport is located to the north of the site, approximately 49 km away. Narrandera Airport is located to the south-east of the site, approximately 45 km away. Both airports are considered to be sufficiently far from the DPSF site that solar reflection impacts are not anticipated.

Surrounding residences

As per **Figure 24** in Section 8.2, the eight nearest residential receivers to the proposed DPSF site range in proximity to the site boundary, from approximately 100m up to 1.5 km. Five of these residences are to the west and north-west of the site; two are to the south of the site; and one is to the north-east of the site.

Visual significance criteria

The criteria used to assess the potential visual effects have considered the sensitivity of the viewpoint and the magnitude of the anticipated change.

Sensitivity

Visual sensitivity refers to the nature, duration and quality of a view. In order to assist in the assessment of visual effects, the sensitivity of a viewpoint is considered in the broadest context, from those of national importance through to those considered to have a local visual importance. Table 68 describes the visual sensitivity criteria. The following significance criteria have been drawn from the Landscape Institute and the Institute of Environmental Management and Assessment's (LIIEMA) *Guidelines for Landscape and Visual Impact Assessment: third edition* (LIIEMA, n.d.).

Table 68 Visual sensitivity

Level of visual sensitivity	Description
National	Heavily experienced, high quality view to a national icon.
State	Heavily experienced, high quality view to a feature or landscape that is iconic to the State, e.g. views from National Parks and scenic lookouts or views of state significance. May also be less frequently visited if the iconic visual feature is viewed from a designated viewpoint such as that included in a National Park.

Level of visual sensitivity	Description
Regional	Heavily experienced, high quality view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or an important view from an area of regional open space and regional park.
Local	High quality view experienced by concentrations of residents and/or local recreational users, and/or large numbers of road or rail users, e.g. expansive urban or bushland views from residential areas or local open space.
Neighbourhood	Views from locations where visual amenity is not a key feature or not important to the viewer; these may be lesser quality views, or where views are glimpsed. These may include views briefly glimpsed from roads, those which currently include visual detractors, places where there is no designated protection for visual amenity.

Magnitude of change

Visual magnitude of change refers to the degree of change that could occur as a result of the project. A high magnitude of change could occur if the development contrasts strongly with the existing visual amenity. A low magnitude of change could occur if there is minimal visual contrast and a high level of integration of form, line and scale between the proposed options and the existing environment. In this situation, the option may be noticeable, but does not markedly contrast with the existing visual amenity.

Table 69 Visual magnitude of change

Magnitude of Change	Description
High	Considerable reduction or improvement in visual amenity. Substantial part of the view is altered.
Moderate	Noticeable reduction or improvement in visual amenity. Alteration to the view is clearly visible.
Low	No perceived reduction or improvement in visual amenity. Either the development is not visible, or if it is, the change in the view is generally unlikely to be perceived by viewers.

Visual assessment significance criteria

Although there are no recognised standards for determining the significance of visual effect, there is a need to assign significance to this assessment so that there can be a clear and consistent means of evaluating visual effect. The significance criteria for the visual effects has been adapted in Table 70 from the sensitivity criteria and visual magnitude of change detailed in Table 68 and Table 69.

Table 70 Visual assessment significance criteria for the project

Visual Significance	Criteria
Major Adverse	These impacts are considered critical to the decision making process. They tend to be permanent, or irreversible, or otherwise long term, and can occur over large scale areas. Receptors are extremely sensitive, and/or the impacts are of national significance.
High Adverse	These impacts are likely to be of importance in the decision making process. They tend to be permanent, or otherwise long to medium term, and can occur over large or medium scale areas. Receptors are high to moderately sensitive, and/or the impacts are of State significance.
Moderate Adverse	These impacts are relevant to decision making, particularly for determination of environmental management requirements. These impacts tend to range from long to short term, and occur over medium scale areas or focused within a localised area. Receptors are moderately sensitive, and/or the impacts are of regional or local significance.
Minor Adverse	These impacts are recognisable, but acceptable within the decision making process. They are still important in the determination of environmental management requirements. These impacts tend to be short term, or temporary and at the local scale.
Negligible	Minimal change to the existing situation. No adverse or beneficial change is likely to be perceived by viewers.
Beneficial	The project results in an improvement in the baseline situation, for example, improved landscape and visual amenity.

Visual modification assessment criteria

Table 71 shows how the visual sensitivity and visual modification have been combined to determine significance of impacts specific to this assessment.

Table 71 Visual assessment matrix

	Visual Sensitivity					
Visual Modification		**National**	**State**	**Regional**	**Local**	**Neighbourhood**
	Considerable reduction (high)	Major adverse	Major adverse	High Adverse	Moderate Adverse	Minor Adverse
	Noticeable reduction (moderate)	Major adverse	High Adverse	Moderate Adverse	Minor Adverse	Negligible
	No perceived reduction or improvement (Low)	Negligible	Negligible	Negligible	Negligible	Negligible
	Noticeable improvement (Moderate)	Very high Beneficial	High Beneficial	Moderate Beneficial	Minor Beneficial	Negligible
	Considerable improvement (high)	Very high Beneficial	Very high Beneficial	High Beneficial	Minor Beneficial	Minor Beneficial

8.3.3 Potential impacts

Construction

During construction, it is expected that there would be minor visual impacts to residents along Donald Ross Drive. The additional traffic impact is most likely the greatest potential for visual impacts during construction. Donald Ross Drive will be highly utilised, expected to carry a large proportion of heavy and over-sized vehicles. The visual impact of increased traffic movements to the site would be predominately limited to the construction (approximately 12 months), at a reduced intensity and duration for the construction of the BESS facility (e.g. 3 to 6 months after the solar farm construction), and decommissioning phases. As discussed in Section 7.2.4, a traffic management plan will be developed to minimise vehicle movements as much as possible for construction.

Operation

Landscape visual assessment

Through the combination of the low profile of the proposed solar array infrastructure, the proposed BESS facility, the existing overhead transmission lines present throughout the site and the existing industrial infrastructure, it can be assumed that the proposed infrastructure would not be dominant or present an unacceptable contrast to the surrounding landscape.

Thirteen representative viewpoints were selected to inform the visual appraisal. The viewpoint assessment identified the unmitigated effects that could arise from these viewpoint locations. Table 72 provides a summary of the visual appraisal of the DPSF compared to the surrounding landscape. Further details of the visual appraisal are provided in **Appendix I**.

Table 72 Visual appraisal summary

Viewpoint	Sensitivity	Magnitude of Change	Effect	Location imagery
1: Donald Ross Drive, Anderson property gate, looking east towards the proposed solar farm (directly adjacent site boundary)	***Neighbourhood:*** Views would be primarily experienced by passing motorists and employees in the context of the existing agricultural infrastructure and the TransGrid substation	***High:*** Considerable reduction in visual amenity will occur during and after the construction of the proposed solar farm and BESS facility.	The neighbourhood sensitivity and high magnitude of change would result in a **minor adverse** effect during construction and operation.	 
2: Donald Ross Drive, TransGrid substation gate, looking east towards proposed solar farm (distance from the site)	***Neighbourhood:*** The viewpoint is adjacent to an existing TransGrid substation and would primarily be experienced by road users and employees of the industrial and agricultural properties.	***Moderate:*** It is anticipated that views towards the project would be partially screened by the existing industrial infrastructure. Due to the similar nature of the proposal to the existing infrastructure and limited visibility towards the DPSF project, the magnitude of change is assessed to be moderate.	The neighbourhood sensitivity and moderate magnitude of change would result in a **negligible effect** during construction and operation.	 
3: Donald Ross Drive, looking north-east towards proposed solar farm (approximately 3 km away from site)	***Neighbourhood:*** Views are predominately focussed on the imminent surrounds i.e. agricultural landscape and would be experienced mostly by motorists utilising the adjacent road corridor.	***Low:*** It is anticipated that there will be no reduction or improvement in visual amenity with the construction and operation of the proposed solar farm. The vegetated backdrop is situated in front of the proposed, low-lying solar panels and will obstruct the majority of views.	The neighbourhood sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 

Viewpoint	Sensitivity	Magnitude of Change	Effect	Location imagery
4: Donald Ross Drive, further towards McGrath Road, looking north-east towards the proposed solar farm (approximately 5.5 km away from the site)	***Neighbourhood:*** Views are predominately focussed on the imminent surrounds i.e. agricultural landscape and would be experienced mostly by motorists utilising the adjacent road corridor. Potential affected land owner close by.	***Low:*** It is anticipated that there will be no reduction or improvement in visual amenity with the construction and operation of the proposed solar farm. The vegetated backdrop will obstruct views of the low-lying solar panels	The neighbourhood sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 
5: Intersection of Donald Ross Drive and Eulo Road, looking north towards the proposed solar farm (approximately 11 km away from DPSF boundary)	***Neighbourhood:*** Views towards the solar farm are obstructed by patches of dense vegetation situated in the distance on agricultural landscape types. Motorists using the corridor may experience views towards this area.	***Low:*** It is anticipated that there will be no reduction or improvement in visual amenity with the construction and operation of the proposed solar farm. The vegetated backdrop and warehouse structures will obstruct views of the low-lying solar panels.	The neighbourhood sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 
6: Intersection of Kidman Way and McGrath Road, looking north-east towards proposed solar farm (approximately 10 km from DPSF boundary)	***Neighbourhood:*** Views are predominately focussed on the imminent surrounds i.e. vegetated landscape and would be experienced mostly by motorists utilising the adjacent road corridor.	***Low:*** It is anticipated that there will be no reduction or improvement in visual amenity with the construction and operation of the proposed solar farm. The vegetated backdrop will obstruct views of the low-lying solar panels.	The neighbourhood sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 

Viewpoint	Sensitivity	Magnitude of Change	Effect	Location imagery
7: Kidman Way, approximately 5.8 km south of the Sturt Highway, looking east towards the proposed solar farm	***Neighbourhood:*** The densely established vegetation acts as a visual buffer to any views experienced of the proposed solar farm. Motorists using the corridor approaching Sturt Highway would potentially view this area.	***Low:*** It is anticipated that there will be no reduction or improvement in visual amenity with the construction and operation of the proposed solar farm. The vegetated backdrop and warehouse structures will obstruct views of the low-lying solar panels.	The neighbourhood sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 
8: Intersection of Sturt Highway and Kidman Way, looking south-east towards the proposed solar farm (approximately 7 km from DPSF boundary)	***Neighbourhood:*** Views are predominately focussed on the imminent surrounds. The view would be experienced by motorists using the corridor. The residential property may potentially view the area to the south-east, however, may be screened by screening vegetation.	***Low:*** It is anticipated that there will be no reduction or improvement in visual amenity with the construction and operation of the solar farm. The vegetated backdrop will obstruct views of the solar panels.	The local sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 
9: Sturt Highway, from the BP service station, looking south-east towards the proposed solar farm (approximately 7.5 km from DPSF boundary)	***Neighbourhood:*** The roadside vegetation filters views from the road corridor. The area would be experienced by motorists using the corridor and approaching Sturt Highway.	***Low:*** It is anticipated that there will be minimal reduction in visual amenity with the construction and operation of the proposed solar farm. The roadside vegetated buffer will filter views of the low-lying solar panels.	The neighbourhood sensitivity and high magnitude of change would result in a **negligible effect** during construction and operation.	 

Viewpoint	Sensitivity	Magnitude of Change	Effect	Location imagery
10: Tubbo Homestead entrance off Sturt Highway, looking south-west towards the proposed solar farm (approximately 7.5 km from DPSF boundary)	***Neighbourhood:*** Views are predominately focussed on the roadside and scattered native vegetation within the landscape, adjacent to the corridor. The area would be experienced by motorists using the corridor and approaching Sturt Highway. No residents onsite at this location. Potential minor effect to the amenity associated with the heritage listing of the homestead.	***Low:*** It is anticipated that there will be minimal reduction in visual amenity with the construction and operation of the solar farm. The vegetated backdrop will obstruct majority of views to the solar farm, including from the Tubbo Homestead.	The local sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 
11: Sturt Highway, approximately 3 km east of the Tubbo Woolshed (listed under the Murrumbidgee LEP as local heritage), looking south-east towards the proposed solar farm	***Neighbourhood:*** The roadside vegetation acts as a visual buffer to views experienced of the proposed solar farm. The area would be experienced by motorists using the corridor and approaching Sturt Highway. Seasonal farm worker users of the Tubbo Woolshed may experience minor impact to the amenity of views towards the proposed solar farm.	***Low:*** It is anticipated that there will be minimal reduction in visual amenity with the construction and operation of the proposed solar farm. The roadside vegetated buffer will obstruct dominate views of the low-lying solar panels.	The neighbourhood sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 

Viewpoint	Sensitivity	Magnitude of Change	Effect	Location imagery
12: Sturt Highway, near the Altina Wildlife Park, looking south towards the proposed solar farm	***Local:*** Views are focussed on the roadside buffer vegetation that encloses the road corridor for this section of the Sturt Highway. As one of the leading tourist attractions for the Darlington Point area, tourists and highway motorists would experience this viewpoint frequently.	***Low:*** It is anticipated that there will be minimal reduction in visual amenity with the construction and operation of the solar farm. The vegetated backdrop will obstruct the majority of views to the solar farm.	The local sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 
13: Kidman Way, southern city limits of Darlington Point, looking south-east towards the proposed solar farm	***Local:*** Kidman Way changes to Carrington St as the speed allocated to the highway is dropped to 50km/hr on approach to Darlington Point town's centre. This section of the highway experiences users and motorists entering and exiting Darlington Point.	***Low:*** It is anticipated that there will be no reduction in visual amenity with the construction and operation of the proposed solar farm. A combination of dense patches of established vegetation and the flat terrain restrict views of the solar farm from this distance.	The local sensitivity and low magnitude of change would result in a **negligible effect** during construction and operation.	 

Industrial sheds and power substation and transmission infrastructure within a predominantly agricultural setting dominate the proposed solar farm site and surrounds.

The low profile of the proposed solar array infrastructure combined with the ability of existing woodland vegetation within the landscape to screen views from the surrounding area, will result in the proposed solar farm development not causing a dominant or unacceptable contrast to the surrounding landscape from the available views.

The operational view of the DPSF from Donald Ross Drive, will mainly be visible to motorists and site workers. The proposed substation, BESS facility, and maintenance facilities will be sited adjacent to the existing Transgrid substation and fencing will be contiguous along the perimeter to minimise the cumulative visual intrusion for this infrastructure.

The potential impacts from the 13 representative views were assessed to be minor adverse to negligible during operation of the solar farm development. The highest impacts (rated minor adverse impact) were identified from Donald Ross Drive to the immediate east of the site where vegetation screening is limited (viewpoint 1). Donald Ross Drive motorists and local industry workers will be the main receivers of this visual impact. The existing view of the expansive agricultural landscape will be replaced by the DPSF infrastructure visible from the adjacent road corridor, producing a high magnitude of change to existing views.

There were no specific viewpoints identified in the visual impact assessment that require site specific mitigation.

During construction, the additional traffic impact has potential for cumulative temporary visual impacts. Donald Ross Drive will be highly utilised, expected to carry a large proportion of heavy and over-sized vehicles. The visual impact of increased traffic movements to the site would be predominately limited to construction (approximately 12 months), and a 3 to 6 month period for the BESS facility, albeit with lesser traffic volumes, and will be managed as part of the construction traffic management plan that will be developed to minimise vehicle movements as much as possible for construction.

Reflected glare assessment

Road corridors

As shown in **Figure 26**, the maximum tilt of the PV panels is approximately 60° from the horizontal. When the altitude of the sun is less than 30° in the morning or the evening, any direct sunlight incident on the panels will be reflected upwards to the sky and away from the identified glare receptors in the road corridor.

Once the sun altitude is above 30°, the panels will track to face the sun as it moves across the sky from east to west. Any incident direct sunlight will continue to be reflected upwards and away from the identified glare receptors.

Based on consideration of the geometry of the tracking PV panels and the location’s sun path, it is determined that no solar reflections will be directed toward glare receptors travelling on Sturt Highway or Donald Ross Drive. This implies that no reflected glare risks are anticipated for these glare receptors.

Air traffic

Both Griffith and Narranderra airports are considered to be sufficiently far from the DPSF site that solar reflection impacts are not anticipated.

Surrounding residences

As explained above, due to the limits of the PV array axis rotation and tracking during the day, any incident direct solar radiation will be reflected upwards to the sky and away from the identified glare receptors.

No solar reflection impacts are anticipated for glare receptors at surrounding residences.

Decommissioning

When the DPSF is decommissioned, the disassembly of the solar farm infrastructure would be expected to have a similar minor impact as during construction. Additional traffic movements to the site are expected to be the only impact to visual amenity and would be managed through a Traffic Management Plan suited to decommissioning activities.

8.3.4 Management and mitigation

Table 73 presents the recommended visual amenity and landscape mitigation measures for the DPSF site.

Table 73 Recommended visual amenity and landscape mitigation measures

No.	Recommended mitigation measures	C	O	D
VA1	As part of the detailed design, the materials and colour of the site infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape, including: • Pole mounts will be non-reflective • Security fencing posts and wire would be non-reflective • Screening vegetation and landscaping options will be considered and agreed with adjacent landowners and in discussion with Murrumbidgee Council if required.	✓	✓	
VA2	Dust will be controlled (with the application of mitigation measures detailed in Table 76) in response to visual cues.	✓		✓
VA3	Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at the main component locations). It would be directed away from	✓	✓	✓

No.	Recommended mitigation measures	C	O	D
	Donald Ross Drive, so as not to cause light spill that may be hazardous to drivers.			
VA4	Areas of soils disturbed by the project would be rehabilitated progressively or immediately post-construction and decommissioning, reducing views of bare soil.	✓		✓

8.4 Soils and geology

8.4.1 Methodology

This section outlines the issues relating to soils and land contamination associated with the Project and discusses appropriate mitigation measures. This assessment has been completed as a desktop exercise, and has been supplemented by a preliminary geotechnical investigation. Arup conducted a geotechnical site walkover and initial geotechnical field tests in May 2017, and provided preliminary geotechnical design recommendations for the concept design. Further field assessment will be undertaken during the detailed design phase, to determine exact locations and design of poles.

8.4.2 Existing environment

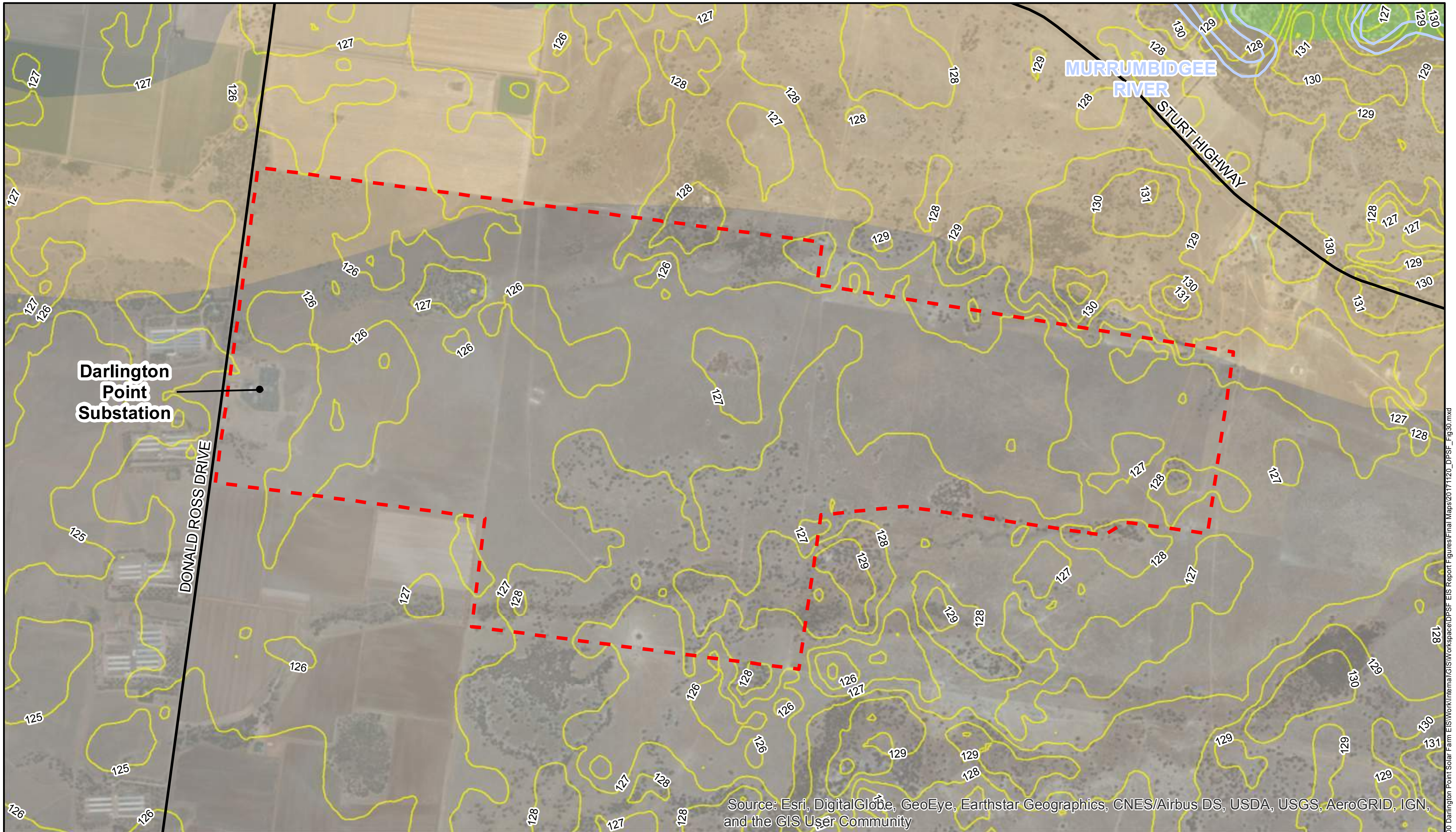
Topography

The DPSF site is situated approximately 1.6 kilometres south of the Murrumbidgee River within a topographical depression within the Murrumbidgee plains. Shallow drainage lines and natural depressions intercept the low-relief alluvial clay and loamy landscape. The topography of the study area is shown in **Figure 29**.

Soil landscapes

Soils within the proposed site are part of the 'Murray Lowlands Province' which is coincident with the Murray sedimentary basin, consisting of flat alluvium with aeolian sands and parna (CSIRO, 2014). The underlying geology of the study area consists of Shepparton Formation which formed in a fluvio-lacustrine environment between the Pleistocene and Holocene. The Shepparton Formation consists of unconsolidated to poorly consolidated variegated and mottled clay, silt, silty clay, with intercalated lenses of fine to coarse sand and gravel. The formation has been partially modified by pedogenesis and groundwater table fluctuation.

Soil mapping from the Office of Environment and Heritage (OEH) (refer **Figure 29**) indicates that soils within the project area are black Vertosols and a small area of red chromosols in the north-west (NSW OEH, 2017). Vertosols consist of clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates. They have a clay field texture of 35% or more throughout the solum (CSIRO, 2016). Black vertosols are found in imperfectly drained areas with rainfall up to 1150 millimeters. Red chromosols are characterised by strongly contrasting textural B horizon and are found in well drained areas with rainfall between 350 millimetres and 1400 millimetres.



Legend

Australian Soil Classification

- Chromosols
- Tenosols (Alluvial)
- Vertosols
- Roads
- Rivers
- Contours - 1m
- Project Boundary

Edify Energy - Darlington Point Solar Farm

Figure 29 - Topography and Soil Types

ARUP
Level 4, 108 Wickham Street
Fortitude Valley, QLD 4006
Tel +61 (7)3023 6000 Fax +61 (7)3023 6023
www.arup.com

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:30,000

Metres
0 100 200 400 600 800 1,000

Drawn by: GJH Date: 22/12/2017

Document Path: Z:\SYD\Projects\254000\254766-00 Darlington Point Solar Farm EIS\Work\Internal\GIS\Workspace\DPSF EIS Report Figures\Final Maps\20171120_DPSF_Fig30.mxd

The soil profile records for the proposed site indicate a number of soil types, with the majority of the site featuring grey, brown and red clays, with some red brown earths mapped in the northwest portion of the proposed site. The hydrologic soil groups within the proposed site are listed as 'very slow infiltration' or 'slow infiltration' (NSW OEH, 2017), which is consistent with the nature of the clay content of the soils.

According to the Land and Soil Capability and salinity mapping from NSW OEH's E-spade, the land has very slight to negligible potential and has moderate limitations capable of sustaining high impact land uses with respect to salinity (NSW OEH, 2017).

Acid sulfate soils

The Australian Soil Resource Information System (ASRIS) online database maintained by CSIRO Land and Water indicates there is a 'low' probability of occurrence of acid sulfate soils (CSIRO, 2014).

Potential contamination

A search of the NSW EPA contaminated land public record (NSW EPA, 2017) was undertaken for contaminated sites within the suburb of Darlington Point and the Murrumbidgee LGA on 3 November 2017. No records for contaminated land within Darlington Point or Murrumbidgee LGA were returned.

There is the potential for contamination associated with agricultural activities (eg cattle dip, use and storage of pesticides) to be present within close proximity to the proposed site, however none is known on the DPSF site. In addition there is potential for contamination associated with construction and operation of electricity generation infrastructure (e.g. the TransGrid substation and transmission lines). Should contamination be identified within the proposed site during construction, it would be managed in accordance with the Construction Environmental Management Plan (CEMP) for the project.

Mineral resources

As outlined in Section 7.5.2, a search of the NSW Government's MinView was undertaken in November 2017 which confirmed that the proposed site is not subject to any current or historic mining or exploration licences and is not subject to any known mineral commodities (DP&E Resources & Energy, 2017).

Crown road

A Crown road (refer is located along the north-west boundary of the proposed site associated with an easement. There is no intention to impact this land for the DPSF. Consultation with NSW Department of Land and Property in July 2017 and NSW Department of Industry – Crown Lands and Water in December 2017 with regard to the easement indicated that there were no concerns with direct impacts to this land as a result of the project.

8.4.3 Potential impacts

Construction

The following construction activities have the potential to disturb soils, making them more vulnerable to soil erosion and subsequent sedimentation:

- Minor excavations and disturbance of vegetation (eg grasses) for the placement of poles (it is intended that grasses will be retained as far as possible except in areas where the solar panel piles will be driven into the soil)
- Construction of internal access tracks, compound, laydown and parking areas
- Construction of site access point(s) and associated road improvement works
- Construction of trenching for the proposed underground medium voltage electrical network, which would connect to the switchyard and existing TransGrid substation
- Low risk of contamination to soils due to potential fuel/chemical spills during construction

Soil disturbance

It is expected that these construction activities may disturb soils at the site. This may cause temporary erosion, sedimentation or dust generation. Soils may be compacted as a result of construction equipment movements across the site, which potentially would reduce soil permeability and increase run-off. The trenching required for the underground medium voltage network will be minor. The proposed site is relatively flat and trenching of cables would typically be within 0.3m to a maximum of 1.2m depth. There is the potential for erosion due to disturbing soils when laying the cables.

To address any erosion impacts, a soil survey would be undertaken with guidance from the *Australian Soil and Land Survey Handbook* (CSIRO, 2009) assessing clay content, electrical conductivity (EC) and exchangeable cation capacity (ECC) for both top and subsoils. This data will inform the soil rehabilitation process, including the identification of ameliorants to be incorporated during the construction stage during cable laying.

The solar farm design will follow the existing contours of the land and the level of the site would not be altered. There would be no impact to any groundwater resource and minimal changes to surface hydrology based on the flood modelling undertaken for the project (refer Section 7.3).

For the installation of the solar panel piles and perimeter fencing of the site, light construction plant equipment with a minor footprint would be used and would result in minimal disturbance to soils. However, there is the potential for dust generation as a result of the works, but this is considered to be manageable with the application of mitigation measures. Dust impacts are discussed in further detail in Section 8.5.

Due to previous grazing activities, the soils have been exposed and/or disturbed from agricultural practices. The proposed solar farm does not compromise the capacity for immediate neighbours to continue primary production land uses at this locality.

The risk of erosion is considered to be low, as long as the project adopts measures as recommended in the *Managing Urban Stormwater: Soils and Construction, volume 1, 4th edition* (Landcom, 2014). Sediment laden run-off from the site is expected to be minimal, given the proposed site is relatively flat and is expected to be manageable through the adoption of erosion and sediment control measures during construction.

Potential contamination

No known areas of contaminated land are known to occur within the DPSF development area. Should potential contamination be encountered, a site contamination investigation should be undertaken in accordance with the suite of guidelines available on the NSW EPA's website (NSW EPA, 2017) and any contaminated material disposed to regulated facilities.

Fuels and other chemicals used during construction have the potential to result in soil contamination in the event of a spill. This has the potential to be conveyed via drainage depressions across the site and mobilised downstream. However, it is considered that this risk is minor and manageable.

Operation

There is expected to be minimal impacts to soils during operation of the project. Maintenance activities and vehicles would be largely confined to the formalised access tracks. There is the potential for erosion of the access tracks, but regular maintenance of internal access tracks will be undertaken at the site.

Decommissioning

Decommissioning would involve the removal of all above ground infrastructure, returning the site to its existing land capability. Solar array modules and piles would be removed and recycled wherever possible. Soil disturbance will be minimised and once the farm has been decommissioned the ground would be worked and returned to agricultural use (eg grazing).

To inform the soil rehabilitation process, a soil survey guided by the *Australian Soil and Land Survey Handbook* (CSIRO, 2009) assessing clay content, EC and ECC for both top and subsoils. This will identify any ameliorants to be used in the rehabilitation process.

8.4.4 Management and mitigation

During construction, operation and decommissioning of the project, activities with the potential for adverse soil impacts would be managed through the development and implementation of site specific sediment control plans and spill controls (refer Table 74).

Table 74 Soil impact mitigation measures

No.	Mitigation measures	C	O	D
SO1	A Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP) would be prepared, implemented and monitored during the construction and decommissioning of the proposed site in accordance with the *Managing Urban Stormwater: Soils and Construction, volume 1, 4th edition* (Landcom, 2014) covering items such as: • Primary erosion and sediment controls shall be installed prior to any site disturbance, vegetation clearance or service installation eg sediment fences etc. • Regularly inspect erosion and sediment controls, particularly following storm and rainfall events • Maintain an inspection register that records monitoring data on the effectiveness of the ESCP, and maintenance record of the erosion and sediment capture measures. • Ensure that machinery arrives on site in a clean, washed condition and is in good working order (to avoid fluid leaks). • Any machinery leaving site is to be visually checked before leaving the site to ensure it is in a clean condition to avoid tracking of sediment onto public roads. • For excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Stockpile topsoil appropriately so as to minimise weed infestation, maintain soil organic matter, maintain soil structure and microbial activity. • In areas of disturbed soil, the site would be progressively rehabilitated as soon as possible after completing works.	✓		✓
SO2	Prior to commencing construction, soil testing is to be undertaken to determine the clay content, EC and ECC of the soils. This will assist in determining the required gypsum application rates for the purposes of cable trenching in potentially sodic soils (to prevent tunnel erosion).	✓		
SO3	If a potential contamination risk is identified during construction, measures outlined in the Construction Environmental Management Plan (CEMP) will be adopted such as undertaking a detailed site investigation to characterise the soil before taking further action.	✓		
SO4	To minimise dust generation in disturbed areas during construction and operation, the following measures are recommended: • Use of dust suppression (eg dampening of soils, or use of dust suppression chemical) • Scheduling of works outside the summer period (to avoid wet weather)	✓	✓	

No.	Mitigation measures	C	O	D
	• Limit construction activity to localised areas on the site • Restricting vehicle movements and speeds on site during dry and windy conditions.			
SO5	During construction, operation and decommissioning, dust would be managed to prevent dust leaving the proposed site.	✓	✓	✓
SO6	A Spill Response Plan would be developed and implemented during construction, operation and decommissioning that would cover: • Activities with the potential for spills (refuelling) would not be undertaken within 50 m of any farm dams and an adequately stocked spill response and containment kit will be available on site. • Appropriately store, handle and use any potential hazardous materials (eg fuel) in accordance with the *Code of Practice for Storage and Handling of Dangerous Goods* (WorkCover NSW, 2005). • Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation).	✓	✓	✓
SO7	A vegetation and land management plan will be developed for the site and will include considerations to address soil erosion. The plan would include monitoring and triggers for action to address issues arising from erosion that develops during operation		✓	

8.5 Air Quality

Impacts to air quality can result from construction, operational and decommissioning activities through the release of air pollutants. The potential impacts can cause nuisances to the surrounding environment and sensitive receptors in the vicinity of the emission sources. At a worst-case, they can interfere with natural ecosystems, increase human health risks and contribute to GHG emissions (anthropogenic climate change).

8.5.1 Methodology

Air quality is not considered to be a key environmental impact from the development of the DPSF. A qualitative approach has been applied to outline the existing environment, expected emission sources and potential impacts as a result of the DPSF project. A range of mitigation measures have been recommended to manage any potential impacts during the construction, operation and decommissioning phases.

8.5.2 Existing environment

Local climate conditions

The proposal site is located in rural NSW, within the Murrumbidgee region. The closest Bureau of Meteorology Automatic Weather Station (AWS) to the site is the Yanco Agricultural Institute, approximately 35 km east. The climatic information for this location is presented in Table 75.

The annual average maximum temperature recorded at the site is 24.1°C and the annual average minimum temperature is 11.4°C. The highest maximum temperature of 33.9°C is recorded in January, while the lowest minimum temperature of 5.0°C is recorded in July. The annual average humidity is 64% at 9am and 39% at 3pm. The annual average rainfall is 406.4mm, falling throughout the year over approximately 54 rain days.

Long term windroses at Hay and Wagga Wagga show that the area is subject to a high percentage (greater than 15%) of calms (wind speeds less than 0.5 m/s). Calms represent periods of poor dispersion, where air quality impacts from the proposal would be expected to be higher.

Table 75 Climate averages for Yanco Agricultural Institute

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
9am Mean Dry-bulb Temperatures (ºC), Relative Humidity (%) and Wind Speed (km/h)													
Dry-bulb	23.7	22.4	19.0	16.7	11.5	8.6	7.6	9.5	13.4	17.0	20.1	21.9	15.9
Humidity	46	55	58	61	76	87	89	80	68	53	51	46	64
Wind Speed	19.1	17.7	15.4	14.1	10.7	13.1	12.3	14.2	15.8	17.9	18.0	18.7	15.6
3pm Mean Dry-bulb Temperatures (ºC), Relative Humidity (%) and Wind Speed (km/h)													
Dry-bulb	32.1	30.6	27.8	23.3	18.5	14.5	13.5	15.4	19.2	22.8	27.0	28.8	22.8
Humidity	23	30	30	37	45	61	60	52	43	33	29	27	39
Wind Speed	19.7	17.9	16.9	15.7	15.2	15.8	15.6	18.2	18.9	20.0	19.7	20.2	17.8
Daily Maximum Temperature (ºC)													
Mean	33.9	32.5	29.0	24.2	19.0	15.1	14.3	16.3	20.4	24.7	28.8	31.1	24.1
Daily Minimum Temperature (ºC)													
Mean	18.8	18.4	15.4	11.7	7.8	5.9	5.0	5.4	7.7	10.4	14.2	16.4	11.4
Rainfall (mm)													
Mean	29.4	31.4	32.9	29.5	36.3	35.4	34.2	36.2	36.3	37.5	29.4	30.8	406.4
Rain days (Number)													
Mean	3.1	2.8	3.2	3.6	4.6	5.4	6.5	6.4	5.4	4.9	3.8	3.8	53.5

Station number: 074037; Commenced 1957; Status: Open; Elevation: 164 m AHD
Latitude: 34.62 °S; Longitude: 146.43 °E. Source: **BoM (2017)**

Background air quality

A search of the National Pollutant Inventory (NPI) undertaken in November 2017 (DOEE, 2017)identified that there are 11 facilities reporting to the NPI in the area. Ten of these are poultry farms located on Ringwood Road and Donald Ross Drive to the west of the site, with ammonia being the emission of concern. The other facility reporting to the NPI in the area is the Coleambally Depot, identified as a petroleum product wholesaler. Other sources of air pollution in the wider area are likely to include crop spraying in agricultural land use and dust generation from surrounding roads and rural activities.

Sensitive receivers

The closest sensitive receiver is located approximately 100 metres from the western boundary of the DPSF site (refer **Figure 24**). However, no air quality impacts would be expected at this residence as the works are anticipated to have negligible effects beyond the site boundary.

Climate change

Climate change refers to the warming of temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases (GHG) in the atmosphere. The projections of climate change in Australia include more frequent and hotter hot days and fewer frost days, rainfall declines in southern Australia and more extreme weather events including intense rainfall, severe drought and harsher fires (CSIRO, 2017).

Construction and maintenance activities for the DPSF would be expected to generate GHGs through the use of plant and equipment that uses diesel, gasoline and other hydrocarbons. Generation of GHGs during decommissioning activities would generally be similar to construction and maintenance activities. When compared with conventional coal and gas fired powered stations, the DPSF would produce minimal CO_2 emissions, in the order of 19-59 CO_2-e per kWh, compared with 800-100 CO_2-e per kWh for coal-fired and 400 CO_2-e per kWh for combined cycle gas turbines (Wright & Hearps, 2010).

During operation of the DPSF, it is expected that GHG emissions would be minimal due to use of cleaner electricity, compared to alternative fossil-fuel based energy generation.

8.5.3 Potential impacts

Construction

Dust (particulate matter) is the principal potential pollutant emitted during construction and demolition activities of a solar farm. The DPSF construction period will continue for approximately 12 months. Any fugitive emissions from these works will be variable and dependent upon the period of the activity, the soil type and moisture content, road surface conditions and weather conditions.

The following site specific activities have the potential to produce emissions:

- Clearing (slashing of grassland, minor vegetation removal) and excavation
- Traffic movements and heavy plant equipment
- Wind erosion.

No extensive cut and fill earthworks are proposed. Dust generation would generally occur as a result of clearing activities and excavations, trucks and work vehicles movement along access tracks. Construction equipment and vehicles will also produce exhaust fumes. Dust and emissions can cause a nuisance to construction workers and nearby sensitive receivers, including interference with visibility (eg when driving) and potential adverse health effects.

During the summer periods, soils are typically drier, and when combined with higher than average winds, there is the potential that greater amounts of dust may be generated.

The construction phase will cause GHG emissions, however the benefits of carbon reduction delivered during the operation of the DFSF over its life cycle will more than offset these minor emissions.

It is expected that the potential impacts to air quality can be adequately managed through the application of mitigation measures.

Operation

The ongoing operation of the DPSF is expected to result in negligible air quality emissions and impacts. The only potential impacts will occur during routine maintenance activities, a result of localised dust and combustion emissions caused by a maximum of five maintenance vehicles on site (at any one time). However any possible impacts will be short-term in nature.

The change in land use from grazing to a solar farm will reduce the potential for localised particulate emissions from the land.

Small quantities of fuel will be stored at the site for the maintenance vehicles and for temporary power generation in the event of an unexpected power outage.

During operation, the DPSF will have a positive impact to supporting global climate change policy efforts through reducing Australia's current reliance on fossil fuel for electricity generation. A study released by the Intergovernmental Panel on Climate Change (IPCC) presents the life cycle CO_2 equivalent (including albedo effect) from selected electricity supply technologies (IPCC, 2014). For coal the median is 820 gCO_{2eq}/kWh and for solar it is 48 gCO_{2eq}/kWh, a material difference over the life cycle of the project.

With respect to any cumulative impacts, there are some emissions sources in the vicinity of the DPSF including poultry farms, with the main emission being ammonia. However, in the context of the minimal expected emissions to be generated by the DPSF during operation, any cumulative impacts would be negligible (see Section 8.12 for more details).

Decommissioning

Decommissioning is anticipated to have comparable air quality impacts to those described during construction, however the period in which it will occur is projected to be less.

The decommissioning phase will cause GHG emissions, however the benefits of carbon reduction delivered during the operation of the DFSF over its life cycle will more than offset these minor emissions.

8.5.4 Management and mitigation

Potential air quality impacts would be addressed through the management and mitigation measures presented in Table 76.

Table 76 Recommended mitigation measures for air quality and climate change impacts

No.	Recommended mitigation measures	C	O	D
AQ1	Development and implementation of a management system to respond promptly to any air quality related complaints.	✓	✓	✓
AQ2	The CEMP will seek to minimise and control dust emissions generated from construction equipment including consideration of measures such as: • Use of a water cart (truck) to wet uncovered areas, including access tracks, as appropriate to the conditions of the site. • Stabilisation of any disturbed areas that expose soils and increase erosion risks, including covering of stockpiles (eg placement of artificial covers or revegetate with grass species) and minimising the heights of stockpiles as far as possible. • Include a washdown and/or shakedown station at the entrance to the proposed site to enable sediment to fall-off trucks that are moving from unsealed areas to sealed roads off-site. • Investigate the use of fuel-efficient machinery and vehicles (that generate) low carbon emissions for onsite use. • Restrict vehicle movements and ground disturbance to the minimum area that is safely practicable. • Temporary cessation of some works during excessively dry and windy conditions.	✓		✓
AQ3	Development of protocols to minimise and control dust emissions from construction equipment, vehicles and general operations would be included in the construction, operation, and decommissioning environmental management plans. Measures are to be developed in accordance with Australian Standards and POEO Act requirements.	✓	✓	✓

Note: C: Construction, O: Operation, D: Decommissioning

8.6 Water quality

8.6.1 Methodology

This section identifies the local water catchment within and adjacent the proposed site based on desktop searches. It also identifies the potential impacts to surface water and groundwater environments, and recommended mitigation measures.

8.6.2 Existing environment

Surface water

The proposal area is located within the floodplain of the Murrumbidgee River and is within the Murrumbidgee River catchment. Murrumbidgee River is a major tributary of the Murray-Darling River system and is located approximately 1.8 kilometres to the north of the proposed site. The Tubbo Channel, part of the Coleambally Irrigation Scheme network, is located approximately 2.3 kilometres south of the proposed site (refer **Figure 30**). A large water reservoir is located approximately 4km north-east of the site. Several smaller water bodies have been observed scattered across the site.

Water use requirements

According to the Murrumbidgee LEP, the proposed site is located just to the northe of the northern boundary of the Coleambally Irrigation Area (CIA) (Murrumbidgee Council, 2013). The CIA covers an area of approximately 400,000 hectares, of which 79,000 hectares is intensively irrigated (Coleambally Irrigation, 2017). Under the Murrumbidgee LEP, the proposed site is located in an area mapped as having groundwater vulnerability (Murrumbidgee Council, 2013).

The proposed site is located within the 'Lower Murrumbidgee Groundwater Sources' groundwater management area. The Water Sharing Plan for the Lower Murrumbidgee Groundwater Sources applies to the area.

There is no intent or need for any volumetric water licencing requirement for the DPSF project. No water entitlement is needed or required to be purchased.

Legend

Watercourse

Project Boundary

Edify Energy - Darlington Point Solar Farm

Figure 30 - Surrounding Watercourses

ARUP
Level 4, 108 Wickham Street
Fortitude Valley, QLD 4006
Tel +61 (7)3023 6000 Fax +61 (7)3023 6023
www.arup.com

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

Reference Scale: 1:75,000

Kilometres

0 0.25 0.5 1 1.5 2 2.5

Document Path: Z:\SYD\Projects\254000\254766-00 Darlington Point Solar Farm EIS\Work\Internal\GIS\Workspace\DPSF EIS Report Figures\Final Maps\20171120_DPSF_Fig31.mxd

Drawn by: GJH Date: 22/12/2017

The desired features for a solar farm site are flat topography and the absence of any watercourses. The proposed site is relatively flat with slight variations in elevation from 130 m up to 135 m. There are no mapped watercourses within the proposed site, however, there are minor drainage depressions in the southern portion of the proposed site, which flow in a south-easterly direction towards mapped watercourses downstream. One such watercourse is Spillers Creek which is located more than 6.5 kilometres south-east of the proposed site (which is a tributary of Coleambally Canal).

There are a small number of farm dams located on the proposed site. Depending on the final design layout, farm dams will be either filled in or retained.

A flooding assessment has been undertaken as part of the EIS concept design based on a major flood event that occurred in 1974, which equated to a 90 year Average Recurrence Interval (ARI) (refer Section 7.3). Across the majority of the site, the flood depth was found to be less than 250 mm. However, in some locations to the south and north-west of the site, areas may be impacted by flooding depths of up to 500 mm, while the maximum depth of up to 750 mm is noted in the southern portion of the site.

Groundwater

The groundwater standing level and quality at the DPSF site itself is not known, however concerns regarding aquifer salinity and shallow depth have been expressed within the Coleambally Irrigation Area, located south of the DPSF site (CICL, 2004) These issues have most likely been associated with the long term irrigation of this area. According to the Department of Primary Industries (DPI) website (DPI, 2017), the closest groundwater monitoring bores are located more than 700 metres to the north-east of the proposed site along the Sturt Highway and approximately 1.2 kilometres north of the proposed site on Donald Ross Drive. No data on standing water levels (SWLs) was available.

From a review of the *Groundwater Dependent Ecosystems Atlas* (BOM, 2017), a number of small water supply and monitoring bores were noted to occur more than 500 m to the north of the proposed site. However, no data on standing water levels (SWLs) was available.

Groundwater Dependent Ecosystems (GDEs)

Potential GDEs within the vicinity of the proposed site are mapped in the *Groundwater Dependent Ecosystems Atlas* (BOM, 2017). There are no aquatic GDEs listed within the proposed site. However, Murrumbidgee River, located to the north of the site, is listed as an aquatic GDE as it interacts with groundwater.

There are two terrestrial GDEs located within the proposed site, which are summarised in Table 77 below.

Table 77 Terrestrial GDEs within the proposed site

Ecosystem type	GDE Potential	River region	Groundwater management area (GMA)
Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (mainly Riverina Bioregion and Murray Darling Depression Bioregion)	Low potential GDE – from regional studies	Billabong-Yanco Creeks	Lower Murrumbidgee Groundwater Sources – Deep plus 1 other overlapping GMAs
Forb-rich Speargrass – Windmill Grass – White Top grassland of the Riverina Bioregion	Low potential GDE – from regional studies	Billabong-Yanco Creeks	Lower Murrumbidgee Groundwater Sources – Deep plus 1 other overlapping GMAs

8.6.3 Potential impacts

Construction

The flat topography of the site will not require significant earthworks or much change to landform or existing drainage patterns. However, according to the flooding assessment (refer Section 7.3 and **Appendix F**) in areas where higher flood depths were noted, these locations will require the raising of the solar panel poles, which will be confirmed as part of the detailed design.

There is the potential for localised scouring around the solar panel poles. However, with single axis tracking panels incorporated in the design, the arrays being located off-ground, and the flat topography across the site, the potential for any localised scouring will be minimised.

Subsurface works would be limited to trenching (with burial depths typically between 0.3 metres and 1.2 metres) and the driving of solar array posts into the ground (to a depth <3 metres). It is anticipated that there would be minimal interference with the underlying groundwater resource and GDEs.

There is the potential for sediment to be generated during construction for the installation of the infrastructure, and for that sediment to be mobilised if a rainfall event occurs. Sediment containment is one of the goals of the erosion and sediment control plan. A number of mitigation measures are recommended in Section 8.6.4 below.

The use of fuels and other chemicals on site pose a potential risk to surface water in the event of a spill. However, it is envisaged that a spill will be easily manageable through the application of mitigation measures as recommended in Section 8.6.4 below.

There is no intent for any volumetric water licencing requirement with no water entitlement being required to be purchased. Construction water use will be minimal and would be mainly used for dust suppression on unsealed roads. Actual water use would depend on weather and ground conditions and is difficult to estimate accurately. Potential sources would be existing onsite dams and truck delivery sourced from local water sources where available.

Operation

Operational water use will be minimal. Water would be required for staff amenities at the O&M building and for panel cleaning. Requirements would be minor except for cleaning which is dependent on weather. Some solar plants are never cleaned, while others require more than two cleanings per year. Where water is required, it would be sourced offsite and trucked in to site.

No operational activities are expected to impact on groundwater. To manage any surface water quality impacts, appropriate drainage features would be constructed along internal access roads to minimise sediment laden water leaving the site. The majority of the site will be vegetated with grass cover, minimising the risk of sediment leaving the site. Risks to water quality are anticipated to be minimal during operation.

Decommissioning

Water use during decommissioning of the solar farm would be limited to dust suppression activities. Similar impacts to those that may occur during construction may occur during decommissioning such as the generation of sediment and potential erosion with the removal of cabling and reinstatement and profiling of the ground. There is also the potential for fuel or chemical spills during disassembly activities. However, it is envisaged that these impacts will be minimal and manageable through the application of the recommended mitigation measures in Section 8.6.4 below.

8.6.4 Management and mitigation

Recommended mitigation measures for water quality and use are summarised in Table 78.

Table 78 Recommended water quality and use measures

No.	Recommended mitigation measures	C	O	D
WQ1	Prior to works commencing, a CEMP will be prepared that will include a soil and water sub-plan that details the erosion and sediment controls that will be employed throughout the construction phase. These measures will be in accordance with the provisions of *Managing Urban Stormwater: Soils and Construction*, volume 1, 4th edition (Landcom, 2014).	✓		
WQ2	Place fuel and chemical tanks/containers in locations at least 50 m away from drainage lines and any farm dams that are retained on site. Refuelling activities will be undertaken in impervious bunded areas and will not be undertaken within 50 m of drainage lines and farm dams. An adequately stocked spill response and containment kit will be available on site.	✓	✓	✓

No.	Recommended mitigation measures	C	O	D
WQ3	All staff shall be trained in spill management through toolbox talks	✓	✓	✓
WQ4	Vehicles shall be maintained according to manufacturer's specifications, with daily checks to ensure fuel, chemical and oil leaks are minimised	✓		✓
WQ5	Inclusion of incident management measures in the CEMP and the Operational Environmental Management Plan (OEMP), including the requirement to notify EPA for incidents that cause material harm to the environment (as per s147-153 of the *Protection of the Environment Operations Act 1997*).	✓	✓	
WQ6	Provide suitable and secured temporary and permanent site facilities to prevent any direct discharge of sewerage to drainage lines. It is expected that the Contractor will arrange a dry or septic system for use during construction. Operational site facilities will use a septic system.	✓	✓	
WQ7	Prior to DPSF operations, a Vegetation and Land Management Plan will be implemented with procedures to maintain a groundcover across the site to minimise soil disturbance, whilst managing the fuel load for minimising bushfire risk. A combination of mechanical slashing and grazing will require monitoring and implementation of adaptive management principles.		✓	

8.7 Resource use and waste

8.7.1 Methodology

The waste management legislation applicable to the DPSF has provided the context in which a review of the typical construction, operational and decommissioning waste types and streams expected to be generated has been undertaken. Mitigation measures to address the management of waste at the proposed site have been recommended.

8.7.2 Existing environment

Waste management policy

The *Protection of the Environment Operations Act 1997* (POEO Act) and the *Protection of the Environment Operations (Waste) Regulation 2005* (POEO Regulation) provides the legal requirements for the management of waste. Section 143 of the POEO Act stipulates that unlawful transportation and deposition of waste is an offence, while littering is an offence under Section 145 of the POEO Act.

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) outlines the principles of the resource management hierarchy to encourage the most efficient use of resources to reduce environmental harm. The DPSF's options for resource management can be considered against the waste management hierarchy of:

- Avoidance of unnecessary resource consumption
- Resource recovery (including reuse, reprocessing, recycling and energy recovery
- Waste disposal.

Through the adoption of these waste management principles, the DPSF will be able to minimise environmental harm, reduce costs associated with waste generation and disposal and maximise efficiency in resource use.

Resource use

Key resources and estimated quantities (pending the completion of detailed project design) required to construct the proposed solar farm include those listed in Table 79, however these quantities are subject to change during the detailed design phase.

Table 79 Resource quantities estimated for the DPSF

Resource	Quantity
Gravel for access tracks	20,000 m^3
Sand (back-filling trenches)	4,500 m^3
Concrete – foundations of substation, and O&M building	500 m^3
Concrete for fence footings	4000 m^3
Concrete for the BESS facility slab	400 m^3
Metal (components for mounting system, delivery system containers, fencing, site buildings, transmission line poles	60,000 tonnes
Glass for panels	17,000 tonnes
Silicon for crystalline wafers	3,000 tonnes
Water during construction	750,000 kL total

Table note: The above quantities represent preliminary estimates of the resources required. Final quantities will be determined during the detailed design phase of the project.

From these materials used, it is expected that the volumes of waste generated for the DPSF would be minor. The key waste streams likely to be generated during construction are likely to include:

- **Excavation wastes:** these are expected to be minimal, as only minor earthworks would be required to undertake cable trenching. Topsoils and subsoils would be re-used wherever possible.
- **Metal off-cuts and cabling:** any excess building wastes
- **Packaging materials:** materials delivered to site often come with packaging materials. This would consist of pallets, crates, cartons, plastics and wrapping

materials, all of which need to be disposed of once the product has been utilised. Options to reuse and recycle packaging materials will be considered.

- **Potential contaminated soils and/or materials:** there is the potential to disturb previously unidentified contaminated soils. There is also the potential for soils to have been affected by fuel/chemical spills.
- **Wastes from construction equipment maintenance:** various heavy vehicles and construction equipment would be utilised for the duration of the construction phase. Liquid hazardous wastes from cleaning, repairing and maintenance of this equipment may be generated.
- **Non-hazardous liquid waste:** generated through the use of workers' facilities such as toilets (eg water).
- **Hazardous waste:** such as hydrocarbons (waste oil, oily water, grease, batteries, paints, resins etc).
- **General refuse wastes:** this encompasses office wastes, scrap materials and biodegradable wastes.

During operation and decommissioning, resources used would be associated with maintenance activities and use of machinery and vehicles. Operational resource use requirements are expected to be minimal.

8.7.3 Potential impacts

Construction

It is not expected that the supply of materials required for the construction of the DPSF will be limited or restricted. For the material volumes required, the proposal is unlikely to place significant pressure on the availability of local or regional resources. The use of resources for the DPSF is considered negligible in the context of the benefits of offsetting fossil fuel electricity generation.

There is the potential for general litter and rubbish across the site if inadequate waste management is undertaken. General refuse waste would be stored in secure covered skips. There is the potential for wastes to spread if not adequately stored and secured.

There is also the potential for contamination of surface soils due to accidental spillage/leakage of hydrocarbon based wastes and other contaminated materials (eg disturbance of in-situ soil contaminants).

Operation

It is not expected that there will be regular waste generation during operation, except for operational staff waste, who would intermittently visit the site when responding to solar farm performance issues. Only limited amounts of fuels would be required for maintenance vehicles. Some electrical components may require replacement over the proposed life of the solar farm, such as inverters, transformers and electrical cabling. This repair or replacement may involve further use of metal or plastic based products but it is anticipated that this would occur infrequently.

With regards to the BESS facility, lithium-ion batteries are classified as Class 9 dangerous goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code). The ADG Code requires all dangerous goods, including lithium ion batteries, to be carried in a secure, safe and environmentally controlled manner (ABRI, 2018). On review of the Australian Battery Recycling Initiative (ABRI) website (ABRI, 2018), seven companies currently provide a collection and recycling service for used lithium-ion batteries in Australia.

The typical life of a lithium-ion battery is 10 years (REC, 2016). The BESS facility's life is specified for 15 years, so the batteries may requirement 1 – 2 times during the initial 15-year life timeframe of the BESS facility. As discussed in Section 2.8, the BESS facility would be replaced at year-15, and the facility would operate for another 15 years up to the DPSF's expected life of 30 years. A subsequent 1 -2 battery replacements may occur in the second 15-year time period.

As there is a significant increase in the use of lithium-ion batteries in Australia, particularly for renewable energy projects and electric cars, it is anticipated that an increase in the availability of cost-effective recycling programs may be available at the time that battery replacement would be required for the DPSF project.

Life cycle analysis for solar farms

Life cycle analysis (LCA) assesses and quantifies the energy and material flows associated with a given process to identify the resource impacts of that process and potential for resource recovery (Hsu et al, 2012). LCA tracks the GHGs emitted directly during the generation of electricity and the indirect emissions associated with the solar technology. Indirect emissions are associated with upstream processes such as materials extraction, transportation and plant construction, as well as downstream processes such as plant decommissioning, recycling of materials, and waste disposal (Hsu et al, 2012) & (NREL, n.d.).

Total life cycle GHG emissions from solar PV systems are similar to other renewable technologies and are much lower than coal-powered energy systems (NREL, n.d.). A life cycle inventory of multi-crystalline PV panels was undertaken by European and US photovoltaic module manufacturing companies in 2005-2006. Over the 25-30 year lifetime of the panels, it is expected that 28 g of GHG would be produced per kWh of energy generated (Fthenakis et al, 2011).

The 'energy payback time' for multi-crystalline PV panels is dependent on the geographical location, however, on average in southern Europe it is estimated to be 1.5 years and less (Fraunhofer ISE, 2017). The local environment of the proposed DPSF site is considered to be fairly comparable to southern Europe and it would be expected that the energy payback time would be similar.

The purification of the silicon, which is extracted from quartz, accounts for 30% of the primary energy to produce a solar panel (Fthenakis et al, 2011). A large amount of pollutants from the use of electricity and natural gas for heating also occurs during this stage. Recyclable elements from the production of solar panels can include graphite crucibles, steel wire, and waste slurry (silicon and polyethylene glycol) (Fthenakis et al, 2011).

However, silicon crystals cannot be recycled during this stage (Fthenakis et al, 2011). The production of the polycrystalline metal frames and other system components, including cabling, would produce emissions and waste, but less than the production of polycrystalline panels.

The ‘energy yield ratio’ of a product is a ratio of the energy produced by, in this case, a solar PV system over its lifetime, to the energy required to make it. According to Fraunhofer ISE (2015), the energy yield ratio for a PV system in Northern Europe was estimated to produce more than ten times the amount of energy required to make the system. This positive energy yield ratio also means that GHG emissions generated from the production of solar energy systems are more than offset over the systems’ life cycle (ARENA, n.d.).

Decommissioning

The design life of the solar PV modules will be at least 30 years. At the end of their useful life, modules and electrical equipment would be decommissioned and the site returned to agricultural (grazing) land use. Consideration would be given to recycling decommissioned equipment, with off-site lawful disposal at an approved waste management facility the alternative option. Mitigation measures will be implemented to maximise reuse and recycling in accordance with resource management hierarchy principles.

The PV modules would be dismantled and could be reused or recycled off-site. Piles will be lifted out of the ground and recycled wherever possible. Trenched cables may also be removed and recycled where possible. For cables that are greater than 300 mm below ground level that are stable and inert, they may be left buried to avoid unnecessary ground disturbance. At this depth, leaving cabling in the ground would not restrict future agricultural activities.

8.7.4 Management and mitigation

Table 80 summarises the recommended mitigation measures for waste management.

Table 80 Recommended waste management measures

No.	Recommended mitigation measures	C	O	D
WA1	A Waste Management Plan (WMP) will be developed and implemented during construction, operation and decommissioning. It would include but not be limited to: • Application of the waste hierarchy by identifying opportunities to avoid, reuse and recycle as much as possible during all phases of the project • Topsoil from disturbed areas will be stored for use in future rehabilitation activities onsite • Recovering or recycling materials for reuse or a secondary purpose • Provision for recycling management onsite	✓	✓	✓

No.	Recommended mitigation measures	C	O	D
	• Appropriate requirements for hauling of wastes (such as covered loads) • Disposal of waste at licenced facilities • The Contractor would be responsible for toilet facilities onsite during construction, which would either be a dry or septic system. There would be no direct discharge of sewage. • A septic system will be used during operation with no direct discharge of sewage • Provide adequate disposal facilities for all types of construction and decommissioning waste • Conduct routine checks for litter and rubbish along access tracks and roads and remove to appropriate disposal facilities			
WA2	The WMP shall include a tracking system for all waste leaving the site, identifying the waste classification, quantities and materials to be recycled or disposed of.	✓	✓	✓
WA3	In the event of a spill, appropriate spill management response will be undertaken such as: • Contain the spill • Use an adequately stocked spill kit (with all onsite staff being appropriately trained in its use) • Emergency response systems implemented • Contaminated spill material would be removed offsite by a licenced contractor	✓	✓	✓

8.8 Socio-economic

A socio-economic impact assessment has been prepared to detail the effects of the proposed DPSF on Darlington Point and the surrounding townships within the wider Murrumbidgee LGA, and to meet the requirements of the SEARs.

8.8.1 Methodology

The methodology is developed to identify the social and economic impacts resulting from the DPSF in order to highlight the positive impacts and ensure that any negative impacts are mitigated.

The assessment has established the baseline socio-economic environment through a review of the following:

- Australian Bureau of Statistics (ABS) socio-demographic and economic data
- Other socio-demographic and economic data available in the public domain
- Murrumbidgee Council’s wider strategic plans.

This baseline assessment set the context for the identification of potential social and economic impacts during the construction, operation and decommissioning of the DPSF. Where appropriate, mitigation measures to avoid, minimise and negate impacts have been developed.

8.8.2 Existing environment

Project site

As discussed in Section 2.2, the proposed DPSF site consists of:

- Lot 160 of DP 821551 (referred to as 'Anderson property').
- Lots 41, 42 and 64 of DP 750903, Lot 2 of DP 542215 and Lots 18, 35 and 36 of DP 750903 (referred to as 'Tubbo Station').
- Lot 2 of DP 628785 (being the TransGrid substation site to which DPSF will connect, which is included within the DA in accordance with TransGrid's connection policy to facilitate any substation augmentation works that may be necessary as part of the development).

The site is zoned RU1 - Primary Production under the Murrumbidgee LEP and is largely comprised of flat, open grasslands with some discrete pockets of remnant native vegetation. Historically the Anderson property, located on the western end of the proposed DPSF site, has been used for cattle grazing. However the property owner is retiring the land from this use. The Tubbo Station land is currently used for sheep grazing as part of a wider business operation. The proposed DPSF site has been highly modified by agriculture over the past 50 years. As discussed in Section 7.5.2, the site is surrounded by production facilities accommodating farming, agribusiness and some private residences. A series of poultry farms owned by Baiada Poultry Pty Ltd are situated on land leased to it by Arrow Funds Management to the west of the site, on the other side of Donald Ross Drive (refer Figure 21).

Socio-economic profile

Population characteristics

Darlington Point is a small town of approximately 1,160 people located on the banks of the Murrumbidgee River in the north of the Murrumbidgee LGA (ABS, 2016). Darlington Point is approximately 10 kilometres north-west of the DPSF site. Coleambally, the other main town within close proximity to the DPSF site, is approximately 20 kilometres south-west of the DPSF site and had a population of 1,331 people in the 2016 Census. The township of Jerilderie, which is approximately 100 kilometres south of the DPSF site, had a population of 1,029 people (ABS, 2016). The wider Murrumbidgee LGA had a population of 3,836 people (ABS, 2016).

The town centre of Darlington Point provides social and community infrastructure for local residents within the region. Key services include a police station, post office, primary school, community health service, recreational parks and swimming pool. Griffith, a larger town of 18,196 people, is located 38 kilometres to the north of the proposed DPSF site in the adjoining shire and is a major service centre for Darlington Point.

The 2016 Census records for Darlington Point indicate that there were 1,162 people living in the township with a median age of 41. Of these people, 15.9 percent of the population were of Aboriginal or Torres Strait Islander origin and 16.5 percent were born overseas.

Employment and industry

The main form of local employment in Darlington Point was poultry processing at 11.5 percent and local government administration at 5.1 percent (ABS, 2016). For the wider Murrumbidgee LGA, sheep and beef cattle and grain farming provided approximately 17.8 percent of employment (ABS, 2016). The unemployment rate for Darlington Point was 7.0 percent, which was higher than the wider Murrumbidgee LGA at 4.5 percent, but was similar to the national rate of 6.9 percent (ABS, 2016).

The 2016 Census industry of employment data for Darlington Point indicated that 5.0 percent of the workforce was employed in the construction industry as labourers, machinery operators/drivers, and technicians/trades workers, while for Murrumbidgee LGA, 6.0 percent of the workforce was employed in the construction industry. Only 1.0 percent of the workforce was employed in electricity, gas, water and waste services in Darlington Point and the Murrumbidgee LGA.

Historically, irrigated agriculture and the processing of agricultural products have been key industries in the Murrumbidgee Shire. Walking, camping, fishing and other water-based activities on the Murrumbidgee River are the main focus of tourism activities in the district (Murrumbidgee Council, 2017). Events in the local area attract visitors from the wider region and include, but are not limited to:

- Darlington Point Spring Festival (annually in September)
- Taste Coleambally Festival (bi-annual event in October)
- Taste Riverina (annually in October)
- Griffith Spring Fest Garden Festival (annually in October).

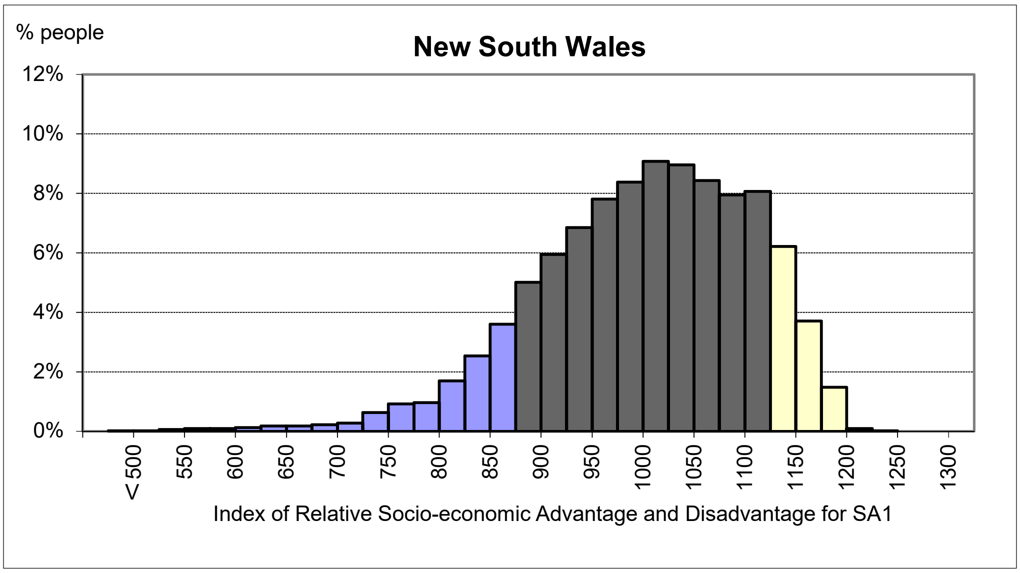
The ABS Socio-Economic Indexes for Areas (SEIFA) provides a data summary that measures relative disadvantage with respect to the social conditions of people and households within an area. The Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) ranks areas in terms of relative socio-economic advantage and disadvantage, in terms of people's access to material and social resources and their ability to participate in society.

Figure 31 and **Figure 32** presents the IRSAD for the Murrumbidgee LGA and Australia respectively, while Table 81 outlines the descriptions of the IRSAD deciles. From the two figures below, it can be seen that a greater distribution of lower decile scores (800 to 875) (~60.4 percent of people) are evident in

Murrumbidgee LGA than compared to Australia. This is representative of a higher level of relative disadvantage in the Murrumbidgee region.

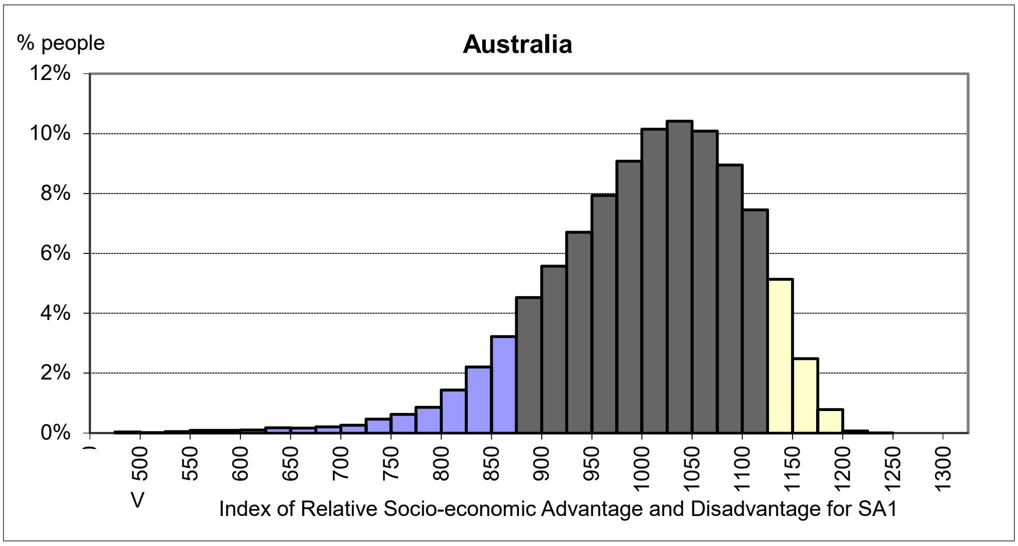
Table 81 IRSAD decile descriptions (ABS, 2011)

Colour code	IRSAD decile description
(blue)	SA1s with this range of scores are in the lowest decile for Australia (approx.)
(dark grey)	SA1s with this range of scores are in the 2nd to 9th decile for Australia (approx.)
(pale yellow)	SA1s with this range of scores are in the highest decile for Australia (approx.)



Source: (ABS, 2011)

Figure 31 Murrumbidgee LGA percent distribution of usual residents across SA1 scores



Source: (ABS, 2011)

Figure 32 Australia percent distribution of usual residents across SA1 scores

Housing and accommodation

According to the 2016 Census, Darlington Point had 421 occupied private dwellings (or 86.4 percent) of the total housing stock, while 66 dwellings (or 13.6 percent) were unoccupied. These figures are fairly consistent for Murrumbidgee LGA with 78.9 percent occupied private dwellings and 21.1 percent unoccupied private dwellings. In comparison, New South Wales had 90.1 percent occupied private dwellings and 9.9 percent unoccupied.

Of the occupied private dwellings in Darlington Point and Murrumbidgee LGA, the majority of dwellings were separate houses, with 96.9 percent and 93.3 percent respectively (ABS, 2016). As shown in Table 82 below, a higher proportion of properties were rented in Darlington Point, compared with Murrumbidgee LGA and New South Wales.

Table 82 Tenure of occupied private dwellings

Tenure	Darlington Point	Murrumbidgee LGA	New South Wales
Owned outright	129 (30.6 percent)	493 (36.3 percent)	839,665 (32.2 percent)
Owned with a mortgage	117 (27.8 percent)	338 (24.9 percent)	840,004 (32.3 percent)
Rented	161 (38.2 percent)	468 (34.4 percent)	826,922 (31.8 percent)
Other tenure type	7 (1.7 percent)	12 (0.9 percent)	23,968 (0.9 percent)
Tenure type not stated	7 (1.7 percent)	48 (3.5 percent)	73,763 (2.8 percent)

Rental vacancy rates are a measure of the proportion of residential properties vacant and available for rent at a point in time. According to the Real Estate Institute of NSW (REINSW), vacancy rates over the past 12 months (from November 2016 to October 2017) in the Murrumbidgee region varied from 1.1

percent to a peak of 2.6 percent in September 2017 (REINSW, 2017). In comparison, the wider Sydney area varied over the previous 12 months from 1.7 percent to a peak of 2.1 percent in October 2017. The rental vacancy rates indicates there has been some recent flexibility in the rental market in Murrumbidgee region and wider NSW.

Community consultation completed as part of the Murrumbidgee Community Strategic Plan indicated that there is a lack of tourist/visitor accommodation within the local region (MSC, 2012). In terms of short-term accommodation within the region, a desktop search indicated that Darlington Point has a caravan park, cabins and cottages and a hotel. Other accommodation options in surrounding areas include Coleambally (20 kilometres south-west) with a motel, a hotel/motel and caravan park (Murrumbidgee Council, 2017). The capacity of these accommodations have been sourced from desktop searches and in consultation with accommodation providers and are displayed in Table 83.

Table 83 Short-term accommodation availability in surrounding region

Location	Accommodation type	Capacity
Darlington Point Riverside Caravan & Tourist Park, Kidman Way, Darlington Point	Unpowered sites Powered sites Cabins	• 15 cabins (some cabins sleep up to 4 people; while some cabins sleep up to 5 people) • 6 caravan sites
Punt Hotel, 5 Punt Road, Darlington Point	Hotel accommodation	• 8 rooms (3 x double-beds, 2x single and double-beds, 3 x single beds) • Self-contained pump house – sleeps up to 10 people
Hawkesbury Park Country Cottage, Darlington Point	Cottage accommodation (3 bedrooms)	• Accommodation for six people
Tullac Cottages, 1 Macleay Street, Darlington Point	Cottage accommodation (2 bedrooms)	• Up to four guests
Coleambally Caravan Park, 66 Kingfisher Ave, Coleambally	Unpowered sites Powered sites Cabins	• 3 cabins (sleep 1 person each) • 1 x 'backpacker' cabin (sleeps up to 7 people) • 2 x units (sleep to 5) • 10 – 15 sites for caravan • 2 caravan sites (with caravan included)
Brogla Hotel/Motel, Coleambally	Hotel/motel rooms	• Seven rooms (each room has a single and double bed)

Location	Accommodation type	Capacity
Coleambally Motel, Kingfisher Ave, Coleambally	Motel rooms Serviced apartments Family rooms	• 9 x motel rooms (3 units – sleeps up to 2 people; 3 units – sleeps 1 person); 2 units (sleeps up to 3 people); 1 family room (sleeps up to 4 people) • 1 x apartment (sleeps up to 4 people) • 1 x cottage (with 4 bedrooms/2 bathrooms) • 3 x cottages, each with 3 bedrooms

In the nearby larger centre of Griffith (38 kilometres north), there is a wide range of short-term accommodation options including 15 motels, apartments and bed and breakfast establishments, two caravan parks, self-contained cottages, farm-stay, hostels and backpacker accommodation (Griffith City Council, 2017).

Community values

The Murrumbidgee Community Strategic Plan 2030 (MSC, 2012) outlines the community's main priorities and aspirations for the Murrumbidgee region. The Murrumbidgee community values its safe and relaxing environment and its accessibility to facilities and services that allow for an affordable and healthy lifestyle. Key principles of the Community Plan include support for economic development in industries other than agriculture, and to explore, embrace and promote alternative sustainable energy sources.

General attitudes to renewable energy projects

A study undertaken by the Australian Renewable Energy Association (ARENA, n.d.) indicated that Australian communities are generally supportive of solar energy infrastructure projects. The study found that approximately 78 percent of people were supportive of large scale solar facilities, and 87 percent were in favour of domestic installations. While the general community is aware of large scale solar energy, many do not know of the potential impacts associated with them (ARENA, n.d.).

A community's understanding of the visual impacts of solar farms is typically informed by the current function of the land proposed to hold the facility and the additional value the installation allows for (ARENA, n.d.).

This EIS outlines the potential impacts and proposed mitigations associated with the solar farm, which will assist the community to understand the project and the potential impacts and benefits. Section 8.3 and **Appendix I** provides a visual assessment of the impact that the DPSF would have on the visual amenity of the area and the surrounding rural landscape.

Community feedback on the proposal

Edify Energy has undertaken preliminary consultation with immediate neighbours and adjacent land users and other community members who expressed interest in the DPSF project as outlined in Section 5. To date, discussions with community members have been overwhelmingly positive, with community interests focused on:

- Job opportunities
- Interest from neighbours and community members to connect and power their facilities directly from the DPSF.
- Potential impacts to water flow during flood events

Details on government stakeholder consultation is provided in Section 5 of the EIS.

8.8.3 Potential impacts

It is anticipated that the DPSF will provide positive social and economic outcomes for the Darlington Point region and the wider Murrumbidgee region through employment generation. The project promotes renewable energy as an alternative to traditional coal-fired power generation, and will also contribute to the State and national targets for the development of large-scale renewable energy projects.

Further discussion of the socio-economic impacts of the DPSF project are provided below.

Construction

Project site

The DPSF project will be wholly contained on private property through purchase of the Anderson property and a lease agreement with the land owners of the Tubbo Estate. The DPSF project would not have a direct impact on land use associated with public areas, residential or business properties. As discussed in Section 7.5.3, it is not anticipated that the change in land use from agriculture/grazing to a solar farm would result in a significant impact, as it provides an opportunity to diversify rural economies from traditional grazing uses or to facilitate mixed-use with continuation of sheep grazing in and around the solar farm.

As described in Section 7.2.3, there is the potential for a temporary increase in construction related traffic which may cause an adverse impact on local residences, adjacent poultry farm traffic and the local road network. However, the traffic impact assessment noted that the impacts associated with increased construction traffic are unlikely to have a significant effect on the operation of intersections within the area during AM and PM peak periods. In addition, the peak construction period traffic is not expected to significantly impact on the operation of the surrounding key road network.

As part of the visual impact assessment undertaken for the DPSF project (refer Section 8.3), the view of the solar farm during construction was determined to have a negligible or minor effect on nearby sensitive receivers.

As discussed in Section 8.10.3, it is anticipated that electro-magnetic fields (EMFs) are unlikely to result in any impacts to the local community during construction.

During construction, the effects of noise and dust generation may impact the local community. However, as discussed in Section 8.2.4 and 8.5.3, it is envisaged that impacts are considered to be minor in nature and manageable through the application of standard environmental management measures implemented as part of the CEMP.

Socio-economic profile

The construction of the DPSF is estimated to require a construction workforce peak of approximately 300 staff. The total man hours required is anticipated to be in the order of 400,000 hours.

Based on previous Edify Energy solar farm projects, it was found that approximately 30% of the CAPEX for solar farm construction, and 20% of the CAPEX for battery storage construction, is for local supplies, trades and equipment. It is envisaged that for the DPSF project, supplies, trades and equipment would be sourced as close to the DPSF site as possible with a local contractor base being utilised. This suggests a significant investment of local supplies, trades and equipment to the Darlington Point area. An increase in workers to the Darlington Point area will provide economic stimulus into the local economy (accommodation, retail expenditure).

As noted in the 2016 Census employment data, approximately 5.0 to 6.0 percent of the workforce in Darlington Point and Murrumbidgee LGA were employed in the construction industry as labourers, machinery operators/drivers, and technicians/trades workers, while only 1.0 percent of the workforce was employed in electricity, gas, water and waste services. Following completion of the other solar farm projects programmed in the region for 2017/18, as listed in Table 84, a more skilled workforce may be available in the region. Edify Energy envisages there will be a seamless transition of labour from the Coleambally Solar project to the DPSF project. In addition, there is an existing solar farm in the region at Griffith, with proven labour, skills and trades available in the area that would be utilised on the DPSF project.

The EPC Contractor will be responsible for recruitment and training of the construction workforce for the DPSF project. Throughout the project development phase, Edify Energy has kept records of all employment and business requests and would make these available to the EPC Contractors for their reference.

Housing and accommodation

As far as possible, a local workforce would be sourced and it is expected they would have existing accommodation in the region. While there is an available accommodation stock in Darlington Point as listed in Table 83, it is expected that accommodation in the regional city of Griffith would be used by the construction workforce, an approximate 40 minute drive, or nearby Coleambally, an approximate 20 minute drive.

As discussed in Section 8.12, with a number of large projects in the region (which have been defined as projects within a 50 kilometre radius of the DPSF project), there is a potential minor risk of accommodation shortages for workers during the construction stage. In addition, this would potentially have a minor impact on accommodation availability to meet tourist demand in the region.

On review of the proposed construction programs for large projects within a 50 kilometres radius of the DPSF project (refer Table 84), there appears to be negligible overlaps of the proposed DPSF program with other nearby projects. However, some project programs are currently unknown. It is not expected that the DPSF construction program would overlap with other projects in the area, however, there is the potential for currently unknown projects to come online in the future. It is considered that any future projects would take account of this in their EIS assessments for accommodation availability.

Table 84 Potential construction program overlaps

Project	Jan-Mar 17	Apr-Jun 17	Jul-Sep 17	Oct-Dec 17	Jan-Mar 18	Apr-Jun 18	Jul-Sep 18	Oct-Dec 18	Jan-Mar 19	Apr-Jun 19	Jul-Sep 19	Oct-Dec 19	Jan-Mar 20	Apr-Jun 20	Jul-Sep 20	Oct-Dec 20
DPSF															BESS construction	
Coleambally Solar																
Griffith Solar																
Riverina Solar																
Euroley Poultry Complex	Commenced construction 2015															
Sandigo Solar	Unknown program as SEARs for the EIS are currently being prepared.															

It is noted that the proposed Inland Rail project is more than 50 kilometres from the DPSF project (~ 150 kilometres east from the nearest point at Wagga Wagga). It is understood from the Inland Rail website that construction works will commence from 2019 onwards.

The nearest township to the DPSF project that is associated with the Inland Rail project is Wagga Wagga. While the route between Wagga Wagga and Darlington Point is fairly direct (via the Sturt Highway) and more than 1.5 hours' drive, it is considered unlikely that construction workers would travel more than 100 kilometres or 1 hour to access their workplace. It is envisaged that the Inland Rail project would seek to utilise accommodation within close proximity to Wagga Wagga or within a 100 kilometre radius from the Inland Rail alignment. Hence, it is expected that there would be minimal demand and overlap for accommodation between the DPSF and Inland Rail projects.

It should be noted that seasonal workers are employed by local farms and industries (eg fruit, almonds etc) on a periodic basis (September to February) within proximity to the DPSF project. This would be taken into account by the EPC Contractor when planning accommodation options for the DPSF project (eg consultation with local farms).

The EPC Contractor will be responsible for employment of construction workers and for the accommodation and transport of workers. The Contractor would engage with Murrumbidgee Council and local accommodation providers if necessary to provide additional short term and temporary accommodation.

There is the potential for the additional demands for accommodation which may cause a minor impact on local tourism (particularly for local events, as described in Section 8.8.2). However, this impact is considered to be manageable through consultation with Murrumbidgee Council to minimise any timing conflicts.

Community values

It is anticipated that the DPSF will provide positive social and economic outcomes for the Darlington Point region through employment generation and the promotion of renewable energy as an alternative to traditional coal-fired power generation. The DPSF project directly contributes to meeting Australia's renewable energy targets. On a local scale, it is envisaged that the DPSF will directly contribute to the themes of community, environment and economy that are highlighted in the Murrumbidgee 2030 Community Strategic Plan (MSC, 2012).

Operation

Project site

It is considered that the operation of the DPSF project would be compatible with adjacent agricultural activities and with grazing still to occur on the DPSF where possible. The use of the site as a solar farm contributes to the regional economy by providing opportunities for diversification of rural economies and greater employment opportunities.

As part of the visual impact assessment undertaken for the DPSF project (refer Section 8.3), the operational view of the solar farm was determined to have a negligible or minor effect on nearby sensitive receivers. Should it be required, screening vegetation would be considered and agreed with adjacent landowners.

As discussed in Section 7.2.3, the operational traffic impact due to the DPSF project is deemed to be insignificant, as the additional levels will be less than 5% of existing daily traffic levels.

As discussed in Section 8.10.3, it is anticipated that during operation of the DPSF project, EMFs generated by the solar farm are at an insignificant level and would be unlikely to impact on the local community.

Socio-economic profile

There is the potential for socio-economic benefits associated with employment during operation (~5 positions) and occasional maintenance contractors attending site. It is expected that there will be minimal adverse impacts during operation, as staffing levels will remain constant at low levels. It is envisaged that operational staff would be either sourced in the local region, or would transfer into the region with pre-existing skills.

Operational accommodation and traffic impacts are not anticipated to have a significant impact on the local community.

Community values

While the DPSF project is considered to directly support the community values as highlighted in the Murrumbidgee 2030 Community Strategic Plan (MSC, 2012), members of the community have inquired about connecting their facilities directly to the DPSF. However, the National Electricity Market (NEM) does not readily allow local community members to directly connect to or procure electricity directly from the DPSF.

Decommissioning

The decommissioning period is expected to have similar impacts to that of the construction phase, although of a shorter duration (eg 6 months). It is expected that staffing numbers and traffic generated during decommissioning would be fairly similar to the construction phase and that impacts would be manageable through the implementation of a Decommissioning Management Plan that covers traffic management and local accommodation requirements.

During decommissioning, similar levels of dust and noise generation as per construction may occur but would be manageable though standard environmental management measures adopted from the Decommissioning Management Plan. On completion of decommissioning, the site would be returned to its existing land capability.

8.8.4 Management and mitigation

Potential socio-economic impacts would be addressed through the management and mitigation measures presented in Table 85.

Table 85 Recommended mitigation measures for socio-economic impacts

No.	Safeguard and mitigation measures	C	O	D
SE1	Community Consultation Plan that will address (but not be limited to) the following activities: • Updating the community above the progress of the proposal • Informing relevant stakeholders of potential impacts (air quality, noise, traffic issues etc.) • Complaints register and response method	✓	✓	
SE2	The Contractor would liaise with local industry representatives to maximise the use of local contractors, materials etc. wherever possible and provide training programs where required.	✓		✓
SE3	The Contractor would liaise with Murrumbidgee Council and local accommodation providers about accommodation options for staff to minimise the impact on the existing services.	✓		✓
SE4	The Contractor would liaise with Murrumbidgee Council regarding any local festivals to manage any potential timing conflicts with local events and seasonal workforce periods.	✓		✓
SE5	A Decommissioning Management Plan (DEMP) would be developed prior to undertaking decommissioning activities that would cover potential impacts such as noise, dust, and traffic management.			✓

8.9 Hazardous materials and development

A hazard assessment of the proposed, nominal 100MWh battery energy storage system (BESS) and hazardous goods associated with the DPSF project has been undertaken in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and with regard to the Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis (DOP, 2011b).

8.9.1 Methodology

The SEPP 33 Hazardous and Offensive Development requires a Preliminary Hazard Assessment (PHA) to be prepared for potentially hazardous or offensive development. Appendix 3 of the Applying SEPP 33 guidelines (DOP, 2011a) lists industries that may fall within SEPP 33, however Appendix 3 does not refer to solar farms and energy storage facilities. In instances where the applicability of SEPP 33 is not immediately apparent, projects can be assessed through the risk screening procedure outlined in Appendix 2 of the guideline.

A preliminary risk screening has been undertaken in accordance with SEPP 33 – Hazardous and Offensive Development and applying SEPP 33 (DOP, 2011a), of the approximate 100MWh battery energy storage system (BESS) and hazardous goods associated with the DPSF project.

Should the preliminary risk screening indicate the development is “potentially hazardous”, a Preliminary Hazard Analysis (PHA) must then be prepared in accordance SEPP 33 and Multi-Level Risk Assessment (DOP, 2011c).

8.9.2 Existing environment

Risk screening

SEP 33 outlines the screening and risk assessment process for a potentially hazardous development. The process is outlined graphically in **Figure 33**. The document suggests that the potential risk of a proposed development typically depends on five main factors:

- the properties of the substance(s) being handled or stored;
- the conditions of storage or use;
- the quantity involved;
- the location with respect to the site boundary; and
- the surrounding land use.

Incorporating these factors, and following the procedure outlined in **Figure 33** and detailed in the SEPP33 guidelines (DOP, 2011a), a risk screening analysis was completed for the DPSF project.

According to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code), all dangerous goods are to be carried in a secure, safe and environmentally controlled manner (ABRI, 2018). The ADG Code lists the following classes of dangerous goods:

- Class 1 – Explosives
- Class 2 – Gases
- Class 3 – Flammable liquids
- Class 4 – Flammable solids
- Class 5 – Oxidising substances and organic peroxides
- Class 6 – Toxic and infectious substances
- Class 7 – Radioactive material
- Class 8 – Corrosive substances
- Class 9 – Miscellaneous dangerous substances and articles, including environmentally hazardous substances

A development which exceeds the screening thresholds identified in Appendix 4 of the guideline would be considered potentially hazardous, and a PHA would need to be submitted with a development application. Where quantities of dangerous goods are below the Appendix 4 thresholds, the SEPP indicates that there is unlikely to be a significant off-site risk, in the absence of other risk factors.

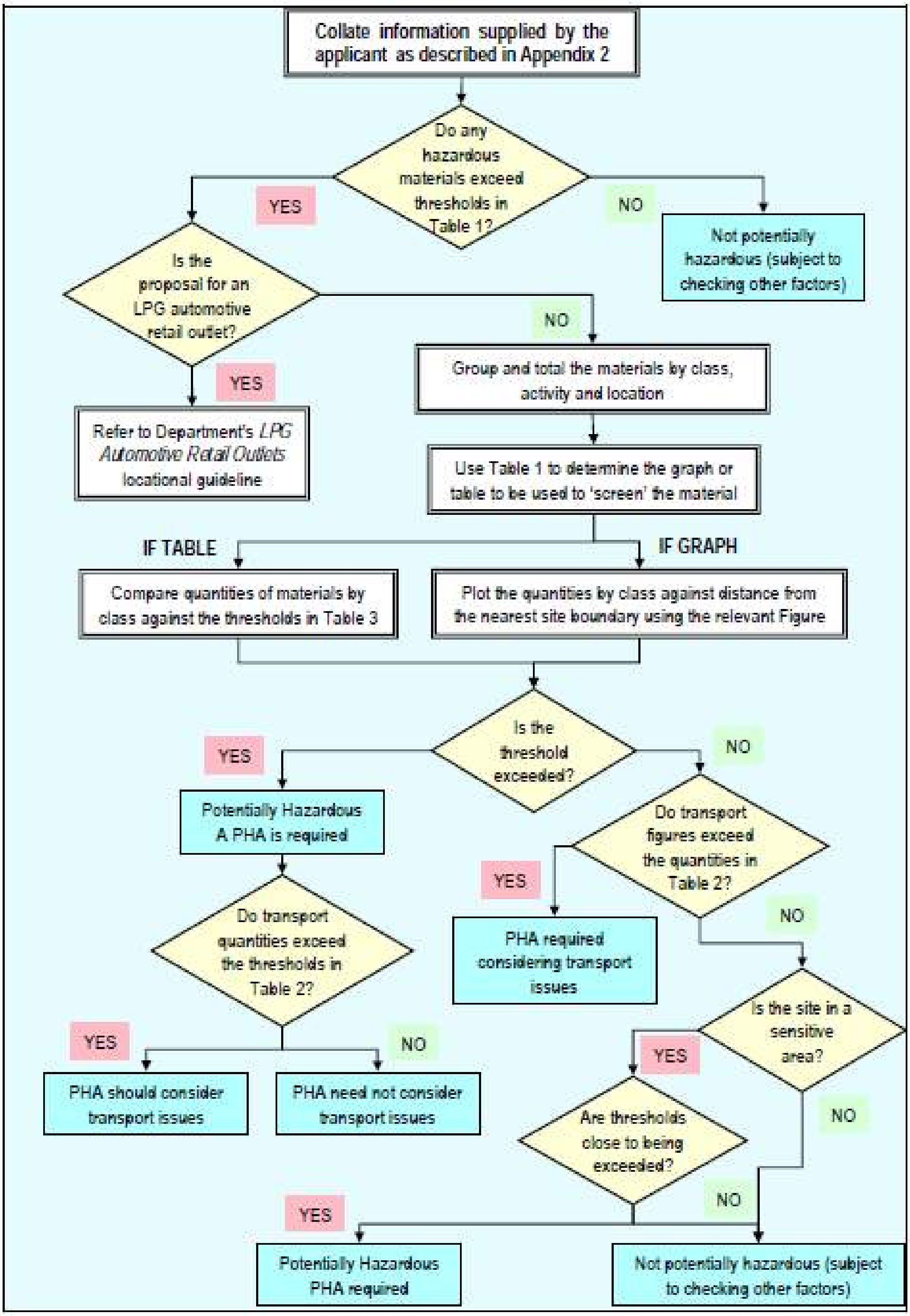


Figure 33 Potentially hazardous industry risk screening procedure outlined in the Applying SEPP33 (DOP, 2011a)

8.9.3 Potential impacts

Dangerous goods on-site

The dangerous goods that would require transportation and storage during construction or operation of the DPSF site are identified in Table 86 below, detailing the ADG Code classification, the quantities and applicable thresholds. The proposed storage of the dangerous goods is within the proposed laydown area/battery storage area as shown on **Figure 4**. All dangerous goods on site will be stored at quantities that are lower than the SEPP33 thresholds.

The proposed DPSF BESS facility configuration will be of Lithium-ion technology, sourced from a tier-one international equipment manufacturer and will be certified as compliant with applicable Australian standards, licences and codes.

The system will either comprise multiple individual cubicles each of circa 250kW (which would be directly mounted on a concrete plinth and connected together on-site or skid mounted and pre-commissioned) or otherwise a containerised system of circa 10MW capacity per container. Visually, each option appears very similar as the individual cubicles are arranged in such a way as to appear as a single container, however, they contain some fundamental technical differences. The preferred means of managing fire risk of a cubicle system is containment; each cubicle is a fire-rated and sealed system which prevents the spread of fire from one cubicle to another and the fire can quickly burn out without a material loss of battery capacity or capital value across the system as a whole. This would not be the case with a containerised system where a fire would damage material capacity unless suppressed; containerised systems therefore have a fire suppression system (typically inert gas or water deluge) to prevent the spread of fire within the container.

Irrespective of the technology deployed, the BESS facility will encompass a surface area of up to 20,000m^2 and include a series of concrete pads, suitably spaced for optimum operations and maintenance and separated by gravel/road-base to assist in fire management. The final decision on the preferred technology provider and detailed technology specification would be confirmed during the detailed design phase of the project, and as stated will comply with applicable Australian standards, licences and codes.

Table 86 List of hazardous materials on site, quantities and screening thresholds

Hazardous material	**Storage threshold**	**Transport threshold**		**Storage**	**Project compliance**
		Movements	**Quantities**		
Class 3 – Flammable liquids: Fuel (petrol)	5 tonnes	Approx. 50/week	3 – 5 tonnes	Stored in tanks on the site service vehicles and would not be stored at quantities greater than the	Yes, final quantity to be determined during detailed design but will not exceed storage or transport thresholds.

Hazardous material	Storage threshold	Transport threshold		Storage	Project compliance
		Movements	Quantities		
				storage or transport thresholds.	For instance, it is anticipated that a peak of 9,000L of fuel per day would be used during road works and piling, so would only expect 2-3 vehicle movements per day.
Class 6.1 Toxic substances Pesticides (herbicides)	2.5 tonnes	All	1-3 tonnes	Stored at the laydown area (refer Figure 4) in appropriately bunded area designed in accordance with AS1940-2004.	Yes, final quantity to be determined during detailed design but will not exceed thresholds.
Class 9 Miscellaneous dangerous substances and articles Li-ion batteries certified to UN 34.80	No storage threshold listed. (UN Code 3480)	No limit (for DPSF project, an estimated 100 deliveries are anticipated)	No limit (for DPSF project, estimated 1MW batteries per delivery)	Batteries will be stored within the BESS facility compound.	Yes, no threshold applies.

Summary of screening method

The SEPP 33 screening process does not specify a screening threshold for ADGC Class 9 materials (Miscellaneous Hazardous material). As Lithium-Ion batteries are categorised as Class 9 goods, a PHA is not triggered based solely on the screening threshold.

The SEPP 33 documentation states that the hazardous materials screening method applied in Table 87 will not be considered in isolation when determining whether an industry is considered potentially hazardous, and would therefore require a PHA to be carried out. The SEPP33 documentation refers to ‘other factors’.

Whilst what is included as ‘other factors’ is not specifically defined, examples are given indicating that it must include issues such as the combination of two previously below threshold hazardous goods to create a significant risk to people, property or environment not captured in the ADG Code.

Taking a precautionary approach, other factors that may warrant consideration in the screening process to determine whether the proposed lithium-ion batteries could be considered potentially hazardous are described in Table 87 and an assessment of the risk of the DPSF project is provided.

Table 87 Other factors assessment for the DPSF project

Other factors	Assessment of risk for DPSF project
The inherent risk of fire when locating large volumes of stored electro-chemical energy on site. These risks can and would be mitigated, but without control systems in place the risk could be significant.	The cubicle or container type of BESS facility as described above limits the potential risk of this factor, given the system will have fire mitigation controls.
The possibility of a cascading failure involving the battery system. This could be in the form of an externally initiated bushfire or electrical surge.	It is envisaged that the nature of the battery design with sufficient separation distance and fire mitigations would manage any potential risk should a bushfire or electrical surge occur. The batteries are designed to contain or suppress fire within each individual cubicle or container as appropriate, and are not anticipated to spread to other parts of the system. The Emergency Response Plan (referred to in Section 8.11) outlines the bushfire protection measures for the DPSF site, including a 20m firebreak across the site.

Result of screening method

As a result of numerous factors, including the preliminary screening, it is considered that a PHA is not required for dangerous goods to be stored on the DPSF site. However, from a conservative approach, a number of management measures have been recommended to be implemented at the DPSF site, as described in Section 8.9.4 below.

8.9.4 Management and mitigation

Potential hazardous materials risks would be addressed through the management and mitigation measures presented in Table 88.

Table 88 Recommended mitigation measures for potential hazardous materials risks

No.	Safeguard and mitigation measures	C	O	D
HM1	The DPSF site would manage the fire risks associated with the BESS by: • Installing reliable, automated monitoring and control systems, with alarm and shutdown response capability. • Taking reasonable and safe measures to prevent the risks of external heat effects in the event of a bushfire. • Designing appropriate separation and isolation between battery cubicles, and between the BESS and other infrastructure, in	✓	✓	

No.	Safeguard and mitigation measures	C	O	D
	accordance with the manufacturers recommendations, and including gravel set-off areas around the facility. • Compliance with all applicable Australian codes and standards. • Preparation of a BESS-specific fire response plan, in conjunction with the NSW Rural Fire Service. • Installing adequate supplies of firefighting water within close proximity to the BESS facility if required by the BESS-specific fire response plan.			
HM2	Fuels and pesticides/herbicides in use at the site will be stored at the laydown area in appropriately bunded areas designed in accordance with AS1940-2004.	✓	✓	

8.10 Electro and magnetic fields (EMFs)

8.10.1 Methodology

A desktop assessment of the potential hazards and risks associated with electro-magnetic fields (EMFs) in relation to the DPSF has been undertaken. This involved a review of publicly available information and research on EMFs associated with electricity generation infrastructure. This information was compared with applicable guidelines recommended by industry bodies to identify the potential impacts that may occur with solar farm development. The desktop assessment considered that impacts are minor and temporary in nature.

8.10.2 Existing environment

EMFs are produced wherever electricity is used or transmitted. The Darlington Point substation, along with the 330 kV, 132 kV and 33 kV transmission lines traversing the site are expected to be a source of EMF at the site.

With EMFs, the electric field is proportional to the voltage, which can be considered as the pressure with which electricity is pushed through the wires, and the magnetic field is proportional to the current, or the amount of electricity flowing through the wires. Both electric and magnetic fields are also dependent on the geometry of the source (i.e. conductor heights, cable depths, etc), and their level reduces quickly with distance. Most materials act as a shield or barrier to electric fields, but not to magnetic fields.

The generation, distribution and use of electricity in Australia is generally at the frequency of 50 Hz, which is considered extremely low frequency (ELF) (Energy Networks Australia, 2017).

The possible health effects from EMFs has been extensively researched internationally for over 40 years. In Australia, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is in charge of protecting health and safety from EMF. In regards to possible health impacts, ARPANSA advises (ARPANSA, 2017a):

> *"The scientific evidence does not establish that exposure to the electric and magnetic fields found around the home, the office or near powerlines causes health effects".*

These findings are consistent with the views of other credible public health authorities, including the World Health Organisation (WHO) which advises that (WHO, 2017):

> *"Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields."*

While there is no established evidence that the exposure to EMFs from powerlines, substations, transformers or other electrical sources, regardless of proximity, causes any health effects, ARPANSA advises there are still some unknowns around prolonged exposure to higher than typical magnetic fields and the risk of leukaemia in children (ARPANSA, 2017a).

ARPANSA previously referred to the National Health and Medical Research Council's (NHMRC) *Interim guidelines on limit of exposure to 50/60 Hz electric and magnetic fields (1989)*. From June 2015, ARPANSA has referred to the International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to Timevarying Electric, Magnetic and Electromagnetic Fields* (ICNIRP, 1998) and the 2010 update (ICNIRP, 2010b), which are consistent with ARPANSA and the Radiation Health Committee's (RHC) understanding of the scientific basis for the protection of people from exposure to ELF EMF.

The ICNIRP guidelines recommend the limiting of exposure to ELF EMF so that the threshold at which the interactions between the human body and external electric and magnetic fields that causes adverse effects within the body are not reached. Basic restrictions have been developed with an additional reduction factor that covers scientific uncertainties in the determination of the threshold. The exposure limits outside the body are referred to as reference levels.

The strength of the electric field is measured in units of kilovolts per metre (kV/m), while the strength of the magnetic field is measured in units of amperes per metre (A/m) but is usually expressed in terms of the magnetic flux density measured in units of microtelsa (µT) (ARPANSA, 2017b). Reference levels for occupational and general public exposure are shown in Table 89.

Table 89 ICNIRP reference levels (ICNIRP, 2010b)

Exposure characteristics	**Electric field strength (kVolts per metre – kV/m^{-1})**	**Magnetic flux density (microteslas µT)**
Occupational	10	1,000
General public	5	200

At the site, it is expected that the perimeter fence around the Darlington Point substation would limit any electric fields emerging from the substation itself. Similarly, the magnetic fields produced from equipment within the substation would fall rapidly with distance and is likely to be at background levels by the perimeter fence or at least a few metres outside of it. Therefore, any electric or magnetic fields at the site would almost entirely be from the overhead power lines (EMFsInfo, 2017a).

Electric and magnetic fields are the highest directly under overhead transmission lines, which then falls rapidly with distance. The typical fields from overhead transmission lines are shown in **Figure 34** and **Figure 35** below, sourced from online information (EMFsInfo, 2017b).

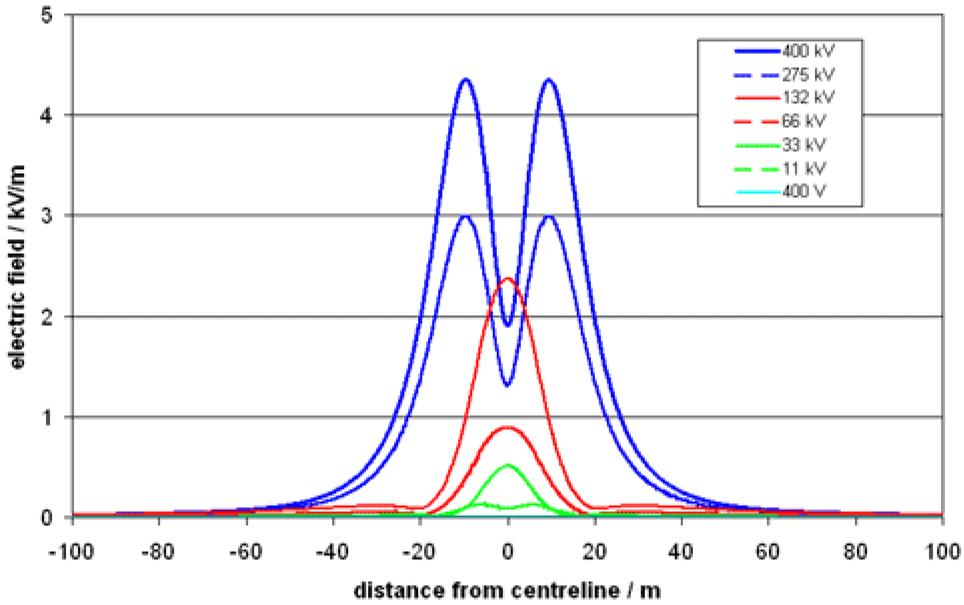


Figure 34 Typical electric fields

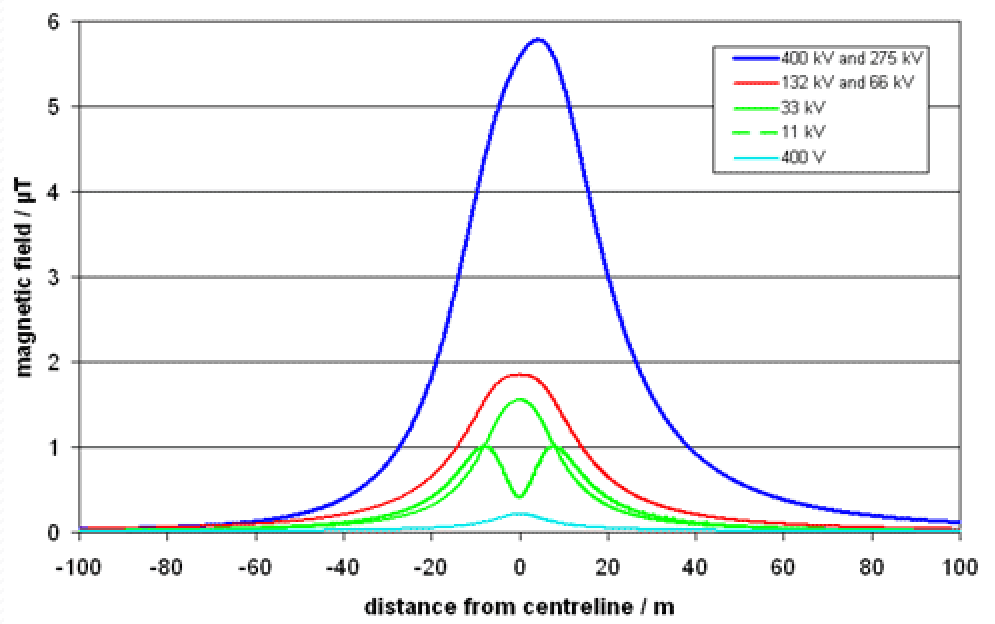


Figure 35 Typical magnetic fields

Underground cabling is not expected to generate external electric fields due to the placement under soil, which can shield the electric effects (NCCETC, n.d.). Magnetic effects cannot be shielded as effectively, nevertheless the magnetic effects are expected to be minimal.

While electric fields from solar arrays are shielded by materials such as plastic, metal or soil, magnetic fields are not and can pass through these material types. Direct current (DC) electricity produced by PV panels produce stationary (0 Hz) EMFs and there is generally minimal concern with stationary fields and their impact on human health (NCCETC, n.d.). However, when the inverters convert the DC electricity to alternating current (AC) electricity, this produces non-stationary EMF ELF. However, when substations are fenced, the levels of EMF are generally negligible as they are shielded by the fence (NCCETC, n.d.).

8.10.3 Potential impacts

Construction

During construction of the DPSF, it is expected that there would be minimal EMF impacts. However, construction staff would be intermittently exposed to EMFs in areas near the overhead transmission lines and when working near the existing Darlington Point substation. It is expected that any potential effects from EMFs would be short term in nature and negligible.

Operation

The following equipment would be installed at the DPSF site with the potential to generate EMFs:

- The solar arrays
- Electrical wiring and 33 kV underground cables
- The 33/132kV switchyard
- A short overhead 275 kV transmission line
- New 132 kV transformer at Darlington substation

The existing 330 kV, 132 kV and 33 kV transmission lines across the site are also expected to be a source of EMF.

Previous studies have indicated that magnetic fields at PV projects fall to very low levels of 0.5 mG or less (equal to 0.05 µT), and in many cases to less than background levels (0.2 mG, or 0.02 µT) at approximately 45 metres (NCCETC, n.d.). This is well below the ICNIRP guidelines recommended magnetic field level exposure limit for the general public of 2,000 mG (200 µT). It is expected that the solar arrays would generally present minimal concerns of EMF effects due to the stationary fields (DC) currents generated.

With respect to the underground cabling, electric fields would be shielded under soil, while magnetic effects are expected to be minimal. For the overhead transmission lines, the EMFs would be highest directly under the overhead transmission lines, and then would fall rapidly with distance (EMFsInfo, 2017b). As derived from **Figure 34** and **Figure 35**, even directly under a 330 kV overhead line at the site, the magnetic and electric fields would be lower than the recommended exposure limits.

It is expected that the perimeter fence around the Darlington Point substation would limit any electric fields emerging from the substation itself. Similarly, the magnetic fields produced from equipment within the substation would fall rapidly with distance and is likely to be at background levels by the perimeter fence or at least a few metres outside of it (NCCETC, n.d.).

It is expected that operational staff would be intermittently exposed to EMFs on site when responding to operational issues. However, any potential effects from EMFs would be short term in nature and negligible.

Decommissioning

During decommissioning, it is expected that impacts would be similar to the construction phase. Staff would be intermittently exposed to EMFs when in proximity to the overhead transmission lines and the substation, however, it is expected that any potential effects from EMFs would be short term in nature and negligible.

8.10.4 Management and mitigation

Table 90 provides a summary of the recommended mitigation measures to manage potential EMF impacts for the DPSF.

Table 90 Recommended mitigation measures for potential EMF impacts

No.	Recommended mitigation measures	C	O	D
EM1	All designs shall be in accordance with the *Guidelines for limiting exposure to Timevarying Electric, Magnetic and Electromagnetic Fields* (ICNIRP, 1998) & (ICNIRP, 2010b) and relevant codes and industry best practice standards in Australia.	✓	✓	
EM2	The security system for the site, including safety fencing and closure of gates, shall be maintained throughout the construction and operation, to provide safe exposure distances to the public.	✓	✓	✓

8.11 Bushfire risk

8.11.1 Methodology

A review of the existing site conditions that contribute to the bushfire risk has been undertaken using information from desktop searches, legislation and policy and other environmental studies for the site. An assessment of the potential sources of fire and its consequent risk to the site and proposed infrastructure has been provided. To manage bushfire risk at the DPSF site, a Bushfire Management Plan will be implemented during construction, operation and decommissioning.

8.11.2 Existing environment

The proposed DPSF site is relatively flat, with patches of native remnant vegetation occurring in grazing paddocks and along drainage depressions. The total area of the DPSF site is 1,042 ha, of which approximately 710 ha will be developed for the solar farm. It is expected that grasses will continue to grow within the project area under the solar panels and that a maintenance regime will be required to manage fuel load within the Asset Protection Zone (APZ) and to maintain the 20m firebreak around the development.

In consultation with the NSW Rural Fire Service (RFS) during preparation of the EIS, the proposed site was identified as not being within bushfire prone land. This is confirmed by the NSW RFS mapping indicating the site is not mapped as bushfire prone land (NSW RFS, 2017). According to the Bushfire Risk Management Plan for the Murrumbidgee Irrigation Area (MIA) (MIABFMC, 2008), the MIA Bushfire Management Committee designates the MIA Zone's Bushfire Danger Period between 1 November and 31 March, but adjusts this according to seasonal conditions in consultation with stakeholders.

Spring rainfall is the primary determinant in regard to the quantity of grass fire fuel available during the fire season. This generates green fuel in spring which cures by early summer, resulting in an increased fire danger in December. Extreme fire danger days occur in periods with dry north-westerly winds and maximum temperatures in the order of 43 degrees (usually in January and February) (MIABFMC, 2008).

Availability of resources for firefighting in the area include the NSW Rural Fire Brigades located in Darlington Point (Carrington Lane, Darlington Point), Coleambally (Calrose Avenue, Coleambally), and Tubbo (Donald Ross Drive & Walace Road, Coleambally). In addition, the nearest natural watercourse is the Murrumbidgee River located approximately 1.8 kilometres north of the proposed site.

Receivers and assets at risk from bushfire surrounding the proposed site include poultry farms and residences located along Donald Ross Drive and the wider agricultural assets of the region.

8.11.3 Potential impacts

Construction

Ignition sources for the proposed site could include machinery movement in long grass (eg slashing, mowing and petrol powered tool use), lightning strikes, storage of fuels/chemicals, hot welding activities, and cigarette butts thrown from cars travelling along surrounding roads.

Site access will be formalised at the beginning of the construction stage, which would improve the ability to access and suppress any fire onsite. Consultation with NSW RFS indicated that a water supply would need to be established on the main internal road into the site.

Bushfire risks during construction are considered to be manageable with the implementation of a Bushfire Management Plan as recommended in Section 8.11.4 below.

Operation

Given that management of ground cover beneath the solar panels will take place seasonally to coincide with high bushfire risk periods, and at all times within the 20 metre setback areas across the DPSF site during operation, it is considered that bushfire risks at the site will be manageable. There is minimal risk for ignition of electrical equipment during repairs and maintenance activities, which has the potential to increase bushfire risk. However, this risk is considered manageable with standard vehicle and equipment maintenance measures implemented on site.

An Asset Protection Zone would be set up as part of the Bushfire Management Plan for the DPSF site. The zone would be established around buildings at the site including the solar substation and battery storage. It is envisaged that TransGrid would maintain the substation infrastructure to minimise bushfire ignition risks.

The main emergency access point to the DPSF site would be via Donald Ross Drive, with a secondary emergency access via Tubbo Station. There will be a number of access tracks through the DPSF site, which would ensure safe operational access and egress for emergency services personnel.

Decommissioning

Decommissioning activities would have similar impacts to that for construction. It is considered that the risk would be manageable through the implementation of a Bushfire Management Plan, to be developed in consultation with RFS.

8.11.4 Management and mitigation

Recommended mitigation measures to address bushfire risk are summarised in Table 91.

Table 91 Recommended bushfire risk mitigation measures

No.	Recommended mitigation measures	C	O	D

BR1	A Bushfire Management Plan will be prepared for the DPSF covering construction, operations and decommissioning with input from RFS, and include but not be limited to:
	• Complying with the requirements of *Planning for Bush Fire Protection 2006* including:
	  - Identifying asset protection zones
	  - Providing adequate egress/access to the site
	  - Emergency evacuation measures
	• Adequate setbacks included in the design (eg 20m from fenceline before commencement of solar arrays, and 20m setback from wooded areas and 'Vegetation and Heritage Protection Exclusion Zones').
	• Management of site activities with a risk of fire ignition, including all vehicle and plant movements beyond formed roads and trafficable hard stand areas will be restricted to diesel, not petrol vehicles
	• Storage and maintenance of firefighting equipment, including ensuring fire extinguishers are available in all site vehicles
	• Daily monitoring of the bushfire status through the RFS website (http://www.rfs.nsw.gov.au) during the bushfire season and communicate to site personnel
	• Should any fuel or flammable liquids be stored on-site, this material would be stored in a designated area and will be sign-posted 'Fuel Storage Area'. A register will be maintained that confirms the quantities and location of any flammable material stored on-site along with the applicable Material Safety Data Sheet (MSDS).
	• No burning of vegetation or any waste materials will be undertaken on site
	• Implement a bushfire management regime for grass land management
		✓	✓	✓

No.	Recommended mitigation measures	C	O	D
	• Provision of multiple fire-fighting water tanks across the site • Operational procedures relating to mitigation and suppression of bushfire relevant to the solar farm.			
BR2	Prior to solar farm operations, a biodiversity management regime as part of the Biodiversity Management Plan will be developed as part of the OEMP with procedures to maintain a groundcover across the site, whilst managing the fuel load for minimising bushfire risk. A combination of mechanical slashing and grazing will be undertaken and will require monitoring and implementation of adaptive management principles.		✓	
BR3	Methods to adapt the frequency, duration and intensity of grazing and the timing of mechanical slashing during operation of the DPSF will be undertaken to accommodate the prevailing seasonal conditions. The following would be undertaken as part of the OEMP: • Regular inspection across the site will be undertaken following intense rainfall events to check that drainage is stable and localised scouring areas are not appearing. • Adaptive management principles will be driven by the performance measure of maintaining a groundcover rather than agricultural production. For instance, in a bad run of seasons when vegetative growth may be negligible and fuel load reduction is not needed, stock grazing may not be undertaken.		✓	
BR4	The OEMP will include an Emergency Response Plan that details risk control measures for electrical hazards in order to safely mitigate potential risks to firefighters, such as a safe method for shutting down and isolating the solar farm. A copy of the plan would be provided to RFS and a copy stored in an 'emergency information cabinet' on-site.		✓	

8.12 Cumulative impacts

The cumulative impact for the DPSF proposal relates to the combined potential effects from the individual environmental and social issues detailed previously (e.g. construction noise, dust emissions, visual) as well as any potential interaction with other proposals in the local area. Note that cumulative impacts may occur concurrently or sequentially.

A review of the projects proposed within a 50 kilometre radius from the DPSF site has been undertaken and are listed in Table 92. A review of these projects' indicative construction programs (sourced from their project's EIS or project website) has indicated that there are negligible overlaps of the proposed DPSF program with other nearby projects. It is not expected that the DPSF construction program would overlap with other projects in the area, however, there is the potential for currently unknown projects to come online in the future. This may result in cumulative effects in the region generally (as discussed in Section 8.8.3). However, it is considered that any future projects would take account of this cumulative effect in their EIS assessments.

Table 92 Projects within 50 kilometre radius from the DPSF site

Project	Distance from DPSF site	Detail	Correlation to DPSF construction program
Coleambally Solar	~20 kilometres south	• Construction to start in December 2017, with early works September 2017, approximate duration 9 – 12 months. • Commissioning in August 2018 and operation from September 2018.	• Minimal construction overlap. As discussed in Section 8.8.3, it is expected that there will be a smooth transition of labour from the Coleambally Solar project to the DPSF project.
Griffith Solar	About 35 km north	• Construction to start in Jan 2017, approx. 9 months. • Commissioning in Sept 2017 and operation from Oct 2017.	• Unlikely overlap
Riverina Solar	About 40 km north	• Pre-construction works and external site access upgrades underway in September 2017. • EIS indicates a 12 month construction program.	• Unlikely overlap
Euroley Poultry Production Complex (Narrandera Farm)	About 20 km east	• Construction program of 18 months. • Construction commenced in December 2015 with completion in July 2017	• Construction complete – no construction program overlap.
Sandigo Solar	About 50 km east	• Unknown – no EIS available yet.	• Currently preparing SEARs. Unlikely to overlap with DPSF construction.

8.12.1 Potential impacts

Construction

Traffic and dust generation

It is expected that there will be an increase in traffic and dust generation which would have a cumulative visual impact on surrounding properties. During construction of the DPSF, it is expected that up to 700 vehicles per day would access the DPSF site. During construction of the BESS facility, a maximum of 172 vehicles would access the site spaced out over the 3 to 6 month construction period. The visual impact of increased traffic movements and dust would be temporary in nature, occurring over a 12 month construction period.

Accommodation availability

As discussed in Section 8.8.3, there is the potential for impacts to accommodation availability for construction workers due to potential overlapping construction schedules of large projects within the region (refer Table 92). However, based on the below construction program timeline (refer Table 93), it is expected that there would be minimal cumulative effects to accommodation and traffic movements within the vicinity of the DPSF, given no overlaps with large projects within close proximity to the site. However, as indicated in Section 8.8.3, while there is the potential for currently unknown projects to come online in the near future, it is considered that any future projects would take account of this in their EIS assessments for accommodation availability and traffic.

There is the potential for a minor cumulative impact to overall workforce accommodation availability in the wider region due to the combined effects of the DPSF project and other projects in the wider region, including the proposed Inland Rail project. However, in the context of the distances between the DPSF and Inland Rail projects (eg approximately 150 kilometres and more than 1.5 hours' drive apart), it is considered unlikely that construction workers would be travelling more than 100 kilometres or 1 hour to access their workplace. Hence, accommodation within close proximity to Wagga Wagga (for the Inland Rail project) and Darlington Point/Coleambally/Griffith (for the DPSF project) is considered to be sufficiently accessible to those projects individually.

Table 93 Project construction programs within 50 km radius of DPSF site

Project	Jan - Mar 17	Apr - Jun 17	Jul-Sep 17	Oct-Dec 17	Jan-Mar 18	Apr-Jun 18	Jul-Sep 18	Oct-Dec 18	Jan-Mar 19	Apr-Jun 19	Jul-Sep 19	Oct-Dec 19	Jan-Mar 20	Apr-Jun 20	Jul-Sep 20	Oct-Dec 20
DPSF															BESS construction	
Coleambally Solar																
Griffith Solar																
Riverina Solar																
Euroley Poultry Complex																
Sandigo Solar	Unknown program as SEARs for the EIS are currently being prepared.															

Operation

Traffic generation

During operation, a small operations maintenance team using standard vehicles would attend site on a periodic basis, and only a small team would attend site in the event of unexpected maintenance such as inverter or transformer replacement.

Landscape and visual amenity

The operational view of the solar farm may generate a cumulative impact with the existing substation, transmission lines and the proposed solar farm infrastructure.

The security fencing surrounding the site and the solar farm infrastructure would be visible from Donald Ross Drive. It is not expected to affect any residences due to existing vegetation screening and intervening topography. Cumulative visual impacts are anticipated to be manageable through consultation with potentially affected landowners on any treatments required (such as screening to 'break-up' views).

Air quality

With respect to cumulative air quality impacts, there are some emissions sources in the vicinity of the DPSF including poultry farms, with the main emission being ammonia. However, in the context of the minimal expected emissions to be generated by the DPSF during operation, any cumulative impacts would be negligible.

Decommissioning

There would be minimal cumulative impacts expected as a result of the decommissioning phase. For instance, minimal cumulative visual impacts are expected as the site would be returned to the previous agricultural (grazing) landscape.

8.12.2 Management and mitigation

Recommended mitigation measures to address cumulative impacts are summarised in Table 94.

Table 94 Recommended cumulative impact mitigation measures

No.	Recommended mitigation measures	C	O	D
CI1	• In consultation with affected landowners, potential screening vegetation would be considered in certain locations to 'break-up' views of the solar farm.	✓	✓	✓
CI2	• Should there be any changes to the estimated construction programs of the projects noted in Table 92, the Contractor	✓		

No.	Recommended mitigation measures	C	O	D
	would be responsible for consulting with other nearby projects to manage any potential cumulative impacts in terms of accommodation availability in Darlington Point or Coleambally.			

9 Environmental management

9.1 Environmental management strategy

Potential environmental impacts will be avoided, minimised and managed through the environmental mitigation measures that are recommended for the DPSF proposal. The mitigation measures will be consolidated in an Environmental Management Plan (EMP) consisting of a Construction Environmental Management Plan (CEMP), a Biodiversity Management Plan, an Operation Environmental Management Plan (OEMP) and a Decommissioning Environmental Management Plan (DEMP). It is expected that these documents will be prepared in a sequential order, prior to each stage of works.

The plans stated would outline the environmental management responsibilities for key staff, reporting and monitoring requirements, environmental targets and objectives, auditing and review timetables, emergency responses, induction and training requirements, complaint response procedures and management mechanisms to foster continuous improvement.

9.1.1 Construction Environmental Management Plan

The CEMP will document the environmental procedures and controls that would be implemented throughout construction. Consultation requirements with the local community and complaints response processes will also be included.

The CEMP will include various sub-plans to cover specific environmental issues such as the soil and water protection plan, erosion and sediment control plan, noise, waste management plan, bushfire management plan, biodiversity and Aboriginal heritage.

The consolidated actions for inclusion in the CEMP are summarised in Table 95 below.

9.1.2 Operation Environmental Management Plan

The OEMP will be prepared prior to the commencement of the DPSF operations. It will include procedures, reporting, and the allocation of responsibilities designed to minimise environmental impacts. The OEMP will document the environmental procedures and controls that would be implemented to operate the solar farm.

The OEMP will include various sub-plans to cover specific environmental issues such as land management (relating to fuel loads and weeds) and emergency preparedness. The consolidated actions for inclusion in the OEMP are summarised in Table 95 below.

9.1.3 Decommissioning Environmental Management Plan

The DEMP will be prepared prior to the commencement of the DPSF decommissioning process.

9.2 Summary of management and mitigation measures

A summary of all proposed mitigation measures for the DPSF proposal are detailed in Table 95.

Table 95 Summary of management and mitigation measures

No.	Recommended mitigation measures	C	O	D
Biodiversity				
B1	Prepare Biodiversity Management Plan based on the biodiversity management regime as outlined in the CSU study and Section 7.1.3 ('Recommended approach to biodiversity management') and Action B13 (see below) of this report, before commencement of construction. This plan will encompass, but is not limited to: • Measures to be implemented for biodiversity management, including protection of Vegetation and Heritage Protection Exclusion Zones and biodiversity management regime; • Seasonally-based program to monitor and report on the effectiveness of the measures; • Responsibilities for implementation of the plan; and • Plains Grassland monitoring – development of a monitoring plan in consultation with CSU. This should include further baseline surveys prior to construction.	✓		
B2	Engage site workers to provide an environmental induction prior to commencement of on-site works. This induction will encompass ecologically important matters on site and the procedures to protect flora and fauna.	✓		
B3	Sediment and erosion measures should be implemented in accordance with approved guidelines to control any potential sediment runoff (refer Table 74).	✓		
B4	Vegetation and Heritage Protection Exclusion Zones and trees identified to be retained should be clearly marked (e.g. fencing) to ameliorate unnecessary impacts to vegetation.	✓		
B5	Stockpiling of construction materials to be limited to existing cleared areas on-site		✓	
B6	Application of water to stockpile areas during high wind to prevent air quality impacts.		✓	
B7	A suitably qualified ecologist is to conduct pre-clearing surveys before removal of any native vegetation to remove any fauna and mark up hollow bearing trees to be removed. All trees proposed to be removed should be re-checked for hollows prior to clearing.	✓	✓	
B8	A suitably qualified ecologist will be required to be present during hollow-bearing tree removal to relocate any displaced fauna.		✓	
B9	Where possible, dead wood, hollow trunks and tree limbs should be relocated to woodland areas not to be cleared.		✓	
B10	Re-establishment of stabilised surfaces as soon as possible following construction.		✓	✓

No.	Recommended mitigation measures	C	O	D
B11	'Lake Effect' – monitor site for bird injury or mortality, with a search for carcasses under and around areas with solar panels.			✓
B12	The spread of noxious weeds should be managed (e.g. the invasive weed Bathurst Burr should be removed and be suitably disposed of offsite to reduce weed spread).		✓	✓
B13	During the operational phase, the biodiversity management regime will focus on grazing and mowing that will reduce potential fuel load at times that are advantageous to native perennials and inhibiting exotic annual species. The following overarching biodiversity management regime is to be implemented: • During winter graze sheep/mow: primarily this will reduce the level of dry matter from annual growing species for summer fire hazard. The annuals will tend to have a greater palatability/digestibility than the natives at this stage and be preferentially grazed. • Remove sheep/mow mid-August: this will allow annual grass seed heads to emerge evenly. • Mow to 5-10 cm mid September/October when annual grasses flowering: this will prevent seed set of exotic annual species enhancing native abundance as well as reducing combustible load. • Destock/low stocking rate over summer: enhance seed set of perennial native species. • Only mow/graze during fire season if grassland growth will result in average dry matter exceeding 5,000kg/ha DM: this value was taken from the Murrumbidgee Irrigation Area Bush Fire Management Committee in regard to the APZ fuel load in forested areas, in the absence of a defined fuel load for grassland in the RFS guidelines. An adaptive management approach will be adopted whereby the management actions will be adjusted to optimise the grassland growth addressing on-site observations.		✓	
B14	Implement the BOP recommendations as agreed with DP&E/OEH	✓	✓	✓
Traffic and access				
TA1	To enable the swept paths of a B-Double (as shown in Figure 14 and Figure 15) to adequately enter and exit the DPSF site, the site access would be upgraded during the initial stages of construction. This will be addressed during the detailed design phase of the project and included in the construction Traffic Management Plan.	✓		
TA2	A construction Traffic Management Plan will be developed for the project and implemented during construction.	✓		

No.	Recommended mitigation measures	C	O	D
TA3	Edify Energy propose to use a park-and-ride system to transport construction workers to and from the site. A number of options are currently being assessed by Edify Energy to use a parking area within close proximity to the DPSF site. The EPC Contractor would be responsible for operating the transport mode (e.g. bus charter) to and from the site during construction of the DPSF.	✓		
Flooding and hydrology				
FH1	In the event of a flood event during construction, it would be anticipated that construction work would cease until it is determined safe to resume work at the site.	✓		
FH2	An Emergency Response Plan for the site shall include measures of what to do in the event of flood (eg cease work and recommence once it is safe to do so).	✓	✓	✓
Aboriginal cultural heritage				
ACH1	An Aboriginal Heritage Management Policy will apply to the site prior to construction to allow for the management and conservation of Aboriginal heritage in relation to salvage activities and construction activities. The following measures apply as part of the Management Policy: • The proponent will ensure all of its employees, contractors and subcontractors and agents are made aware of and comply with this Aboriginal Heritage Management Policy. • The proponent will appoint a suitably qualified and experienced environmental manager who is responsible for overseeing the activities related to the Aboriginal Heritage Management Policy. • The proponent will appoint a suitably qualified and experienced archaeologist who is responsible for overseeing, for and on behalf of the proponent, the archaeological activities relating to the project. • Where the surface collection of artefacts has been nominated for the impacted site, no construction activities (or fencing, geotechnical investigations, minor clearing, establishing site compounds, adjustment to services/utilities etc) can occur on the lands to be investigated until the relevant surface collection at the nominated site (i.e. Tubbo AFT 01) has been completed. • Prior to the commencement of early works activities (eg fencing, minor clearing, establishing site compounds etc), the Contractor will prepare a construction heritage site map identifying the Aboriginal site requiring the collection of surface artefacts and the Aboriginal sites to be avoided (for all sites in proximity to the project boundary). The	✓		

No.	Recommended mitigation measures	C	O	D
	Contractor's construction heritage site map should be prepared to the satisfaction of Edify Energy. • All employees, contractors, subcontractors and agents carrying out early works activities will undertake a Project induction (including the distribution of a construction heritage site map) to ensure that they have an understanding and are aware of the Aboriginal heritage issues affecting the activity. • Opportunity must be provided to the Griffith Local Aboriginal Land Council to assist with the surface collection of Tubbo AFT 01. • During the surface collection process, the DP&E, as the approval authority, will be consulted. Recovered Aboriginal objects will be transferred in accordance with a Care Agreement or similar agreement to the Griffith Local Aboriginal Land Council. • A written archaeological report documenting the salvage collection must be provided to Edify Energy within a reasonable time in accordance with the Project Approval following the completion of the archaeological program. • The Aboriginal Heritage Management Policy does not authorise any damage of human remains. The project approval through the CHAR process does not include the destruction of Aboriginal remains. If potential human remains are to be disturbed, the proponent must follow the procedures listed under Item ACH2 below.			
ACH2	In accordance with the *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the* Heritage Act 1977 (NSW Heritage Office, 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS, 1997), should the construction activities reveal possible human skeletal material (remains), the following procedure is to be followed: • As soon as remains are exposed, all work is to halt at that location immediately and the Project environmental manager on site is to be immediately notified to allow assessment and management: (i) Stop all activities; and (ii) Secure the site. • Contact police, the discovery of human remains triggers a process which assumes that they are associated with a crime. The NSW Police retain carriage of the process until such time as the remains are confirmed to be Aboriginal or historic • DP&E, as the approval authority, will be notified when human remains are found	✓		

No.	Recommended mitigation measures	C	O	D
	• Once the police process is complete and if remains are not associated with a contemporary crime, contact DP&E. DP&E will determine the process, in consultation with OEH and/or the Heritage Office as appropriate: (i) If the remains are identified as Aboriginal, the site is to be secured and DP&E and all Aboriginal stakeholders are to be notified in writing according to DP&E instructions; or (ii) If the remains are identified as non-Aboriginal (historical) remains, the site is to be secured and the DP&E is to be contacted. DP&E will act in consultation with the Heritage Division as appropriate. The Heritage Division will be notified in writing according to DP&E instructions. • Once the NSW Police process is complete and if the remains are identified as not being human, work can recommence once the appropriate clearances have been given.			
ACH3	Incident reporting requirements in accordance with the Project Approval is to include Aboriginal heritage.	✓		
ACH4	During construction, project design alterations or other changes to the Approved Project may be required (such as an alteration of the current design, the location of ancillary facilities) within the project corridor may result in a reduced or increased impact to Aboriginal cultural heritage. Any change in the overall impact on Aboriginal cultural heritage would need to be assessed to determine consistency in consultation with an archaeologist, with continued involvement of the Aboriginal stakeholders. 1. If a proposed change to the Approved Project is considered to have a neutral or lesser significant impact on Aboriginal cultural heritage than that identified in this document, it would be a consistent impact. If the proposed change is considered to be consistent with the Approved Project, Edify Energy may approve the change with no requirements to seek further approval. However, in certain circumstances, further consultation with Aboriginal stakeholders may still be required. 2. If a proposed change to the Approved Project is considered to have a more significant impact on Aboriginal cultural heritage than as detailed in the Project Approval, it would be considered an inconsistent impact and would require an amendment to the mitigation measures. This would require a modification of the Approved Project and further consultation with Aboriginal stakeholders.	✓		

<table>
<tr><th>No.</th><th>Recommended mitigation measures</th><th>C</th><th>O</th><th>D</th></tr>
<tr><td>ACH5</td><td>The extent to which Edify Energy will continue to consult with Aboriginal stakeholders is dependent on the level of impact:
1. Reduced or neutral impact: if as a result of alterations to the project design a previously identified impact to an Aboriginal heritage item is reduced or neutral, then no further consultation is required. If as a result of alterations to the project design an impact to an Aboriginal heritage item is proposed that results in a reduced impact on the overall heritage significance of the project area, then further consultation with Aboriginal stakeholders will be undertaken. This consultation may entail a phone call and phone log of comments received or the provision of a report for comment (10 working days).
2. Increased impact: Where as a result of alterations to the project design an impact on Aboriginal heritage is considered to be greater than identified by the Approved Project, further consultation will be undertaken. This consultation will either entail a phone call and phone log of comments received or the provision of a report for comment (10 working days).
3. Unknown impacts: Where a proposed change is an area located outside the project boundary assessed as part of the Approved Project, the impact on Aboriginal cultural heritage is considered to be unknown. This area would require preliminary assessment to determine any impacts upon Aboriginal heritage. Should no impacts be identified then no consultation with Aboriginal stakeholders is required. Should potential impacts be identified, consultation with Aboriginal stakeholders will be undertaken. This consultation will entail the provision of a report for stakeholder comment (10 working days) detailing the impacts and mitigation strategies proposed.</td><td>✓</td><td></td><td></td></tr>
<tr><td>ACH6</td><td>Should an unexpected archaeological find be made during construction, the following procedures will be adopted:
• As soon as found, all work is to halt at that location immediately and the Project environmental manager on site is to be immediately notified to allow assessment and management:
(i) Stop all activities; and
(ii) Secure the site.
• Consult with project archaeologist and DP&E on proposed actions.</td><td>✓</td><td></td><td></td></tr>
</table>

No.	Recommended mitigation measures	C	O	D
Land compatibility				
LU1	Regular and ongoing consultation with adjacent landholders would be undertaken to manage land use interactions between the solar farm and adjacent properties.	✓	✓	✓
LU2	Consultation would be undertaken with TransGrid regarding connection to the substation and design of electricity transmission infrastructure.	✓		
LU3	Prepare a pest and weed management plan to manage the occurrence of noxious weeds and pest species across the site during construction and operation. The plans must be prepared in accordance with Murrumbidgee Council and NSW DPI requirements. Where possible, integrate weed and pest management with adjoining landowners. The plan shall include restricting vehicle and machinery movements to formed access tracks and implementing wash-down procedures for vehicles entering and exiting the site.	✓	✓	
LU4	A Bushfire Management Plan will be prepared for the project to be implemented during construction, operation and decommissioning (refer to Section 8.11 for further information on potential bushfire risk).	✓	✓	✓
LU5	A Traffic Management Plan would be implemented during construction, operation and decommissioning (refer to Section 7.2 for further information on traffic and access).	✓	✓	✓
LU6	A Noise and Vibration Management sub-plan to the Construction Environmental Management Plan (CEMP) will be prepared to manage any potential impacts to surrounding land uses (refer to Section 8.2 for further information on noise and vibration management).	✓		
LU7	A Soil and Water Use Management Plan, Erosion and Sediment Control Plan and dust suppression measures will be prepared to manage any potential impacts to surrounding lands (refer to Section 8.4, 8.5, and 8.6 for further information).	✓	✓	
LU8	A Rehabilitation and Decommissioning Management Plan is to be prepared in consultation with NSW Department of Primary Industries and the landowner prior to the commencement of decommissioning. The Rehabilitation and Decommissioning Management Plan is to include: • The design criteria of the final landuse and landform and the indicators to use to guide land back to agricultural production and a timeline for the rehabilitation program. • Potential mitigation and monitoring measures to be adopted for rehabilitation remedial actions.			✓

<table>
<tr><th>No.</th><th>Recommended mitigation measures</th><th>C</th><th>O</th><th>D</th></tr>
<tr><td></td><td>Identification of any land with a cropping history or land with a capability for cropping, so that should any cables/pipes buried at a depth of >500mm remain, there is greater opportunity for agricultural activities to continue over the top once restoration is complete.</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Non-Aboriginal cultural heritage</td></tr>
<tr><td>NA1</td><td>Should any object or item of non-Aboriginal cultural heritage be discovered during construction, the following actions would be undertaken:
The object or item must not be removed or disturbed.
All work at the find location must cease and the item cordoned off.
The Heritage Division (OEH) would be notified of the find for advice if needed, prior to further work being carried out in the vicinity.</td><td>✓</td><td></td><td></td></tr>
<tr><td colspan="5">Noise and vibration</td></tr>
<tr><td>NV1</td><td>Construction works should be undertaken during standard working hours only.
Monday – Friday 7am to 6pm
Saturday – 7am to 1pm
In general, no construction activities will occur over night, on Sundays or public holidays, however exceptions to these hours may be required on limited occasions; for example:
The delivery of materials as requested by the NSW Police Force or other authorities for safety reasons and/or to minimise disruption to local traffic;
Augmentation works to the TransGrid substation, which may require a temporary power outage, such that the impact on power supplies to the local community is minimised; and
Emergency work to avoid the loss of life, property and/or material harm to the environment.
The local council, surrounding landholders and other relevant authorities will be notified of any exceptions prior to the works being undertaken.
Daily operations and maintenance activities by site staff would be undertaken during standard working hours of:
Monday – Friday 7am to 6pm
Saturday – 8am to 1pm
Outside of emergencies or major asset inspection or maintenance programs, night works and work on Sundays and public holidays would be minimised.</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>

No.	Recommended mitigation measures	C	O	D
NV2	The appointed contractor would develop and implement a Construction Noise and Vibration Management Plan (CNVMP) that should include, but not be limited to the following: • Adherence to the standard approved working hours for construction projects • Using natural screening by topography wherever possible to reduce noise impacts • Using site sheds and other temporary structures or screens to limit noise exposure where possible • Installing operational noise barriers as early as possible to provide ongoing screening from construction activities, where possible. • The appropriate choice of low-noise construction equipment and/or methods. • Modifications to construction equipment or the construction methodology or programme. This may entail programming activities to occur concurrently where a noisy activity will mask a less noisy activity, or, at different times where more than one noisy activity will significantly increase the noise. The programming should also consider the location of the activities due to occur concurrently. • Restricting or redirecting movements to reduce flows during peak times. • Community engagement notification and noise monitoring at sensitive receivers, community information programme and a complaints hotline. Maintain open communication channels with nearby receivers, including commercial tenants and residents. • Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise • Site managers to periodically check the site and nearby residences for noise problems so that solutions can be quickly applied. • Avoid the use of radios or stereos outdoors and the overuse of public address systems. • Avoid shouting and minimise talking loudly and slamming vehicle doors. • Turn off all plant and equipment when not in use.	✓		✓
NV3	To reduce the effect on residents of piling noise, nearby residents should be consulted regarding the intended activities associated with the piling process. Should percussive piling be considered, activities to reduce the impact of this activity include: • Use a resilient pad (dolly) between pile and hammer head.	✓		

No.	Recommended mitigation measures	C	O	D
	• Enclosing the hammer head in a temporary acoustic shroud. • Rotary bored or vibro-piling may be used where consistent with the type of pile used and restrictions on soil disturbance. • Piling should not be undertaken outside of standard working hours.			
NV4	Appoint a construction staff member responsible for construction noise and vibration management on site. Undertake construction noise monitoring to alert the contractor of potential exceedances of noise management levels.	✓		✓
NV5	The location of stationary plant (air-compressors, generators, etc) is to be as far away as possible from sensitive receivers.	✓	✓	✓
NV6	Apply the TfNSW Construction Noise Strategy's maximum allowable noise levels for construction equipment to screen machinery adopted for use on site by the construction contractor.	✓		
NV7	Maintain minimum working distances for vibration intensive plant. Where this is not possible, vibration monitoring with real-time alerts should be considered.	✓		
NV8	To manage construction related traffic noise, implement the following measures: • Schedule vehicle routing and movements in order to minimise the impact of road traffic noise within a given period i.e. allow for arrival of workers and equipment deliveries to occur over a longer period to reduce the noise emissions during peak periods. • Reduce the impact of the use of compression brakes when accessing the site, management of speed to allow for minimal use of compression breaking when accessing the site. • Ensure vehicles are adequately silenced and specified for site use. Selection of transport units should be undertaken with the thought to reduce noise emissions. • Install temporary noise barriers to reduce the noise impact at the nearest receivers on Donald Ross Drive. Use of localisation with positioning to allow for the best noise reduction outcomes. • Ongoing consultation with closest sensitive receivers on Donald Ross Drive. Agree acoustic treatments or management measures if construction noise exceeds criteria at these locations. • Considerations for the duration and timing of traffic should be made with community consultation to act in the best	✓		

No.	Recommended mitigation measures	C	O	D
	interests of the affected receivers. Given the temporary nature of construction, the duration and intensity of works should be determined to best suit the affected receivers.			
Visual amenity				
VA1	As part of the detailed design, the materials and colour of the site infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape, including: • Pole mounts will be non-reflective • Security fencing posts and wire would be non-reflective • Screening vegetation and landscaping options will be considered and agreed with adjacent landowners and in discussion with Murrumbidgee Council if required.	✓	✓	
VA2	Dust will be controlled (with the application of mitigation measures detailed in Table 76) in response to visual cues.	✓		✓
VA3	Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at the main component locations). It would be directed away from Kidman Way, so as not to cause light spill that may be hazardous to drivers.	✓	✓	✓
VA4	Areas of soils disturbed by the project would be rehabilitated progressively or immediately post-construction and decommissioning, reducing views of bare soil.	✓		✓
Soils and geology				
SO1	A Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP) would be prepared, implemented and monitored during the construction and decommissioning of the proposed site in accordance with the *Managing Urban Stormwater: Soils and Construction, volume 1, 4th edition* (Landcom, 2014) covering items such as: • Primary erosion and sediment controls shall be installed prior to any site disturbance, vegetation clearance or service installation eg sediment fences etc. • Regularly inspect erosion and sediment controls, particularly following storm and rainfall events • Maintain an inspection register that records monitoring data on the effectiveness of the ESCP, and maintenance record of the erosion and sediment capture measures. • Ensure that machinery arrives on site in a clean, washed condition and is in good working order (to avoid fluid leaks).	✓		✓

No.	Recommended mitigation measures	C	O	D
	• Any machinery leaving site is to be visually checked before leaving the site to ensure it is in a clean condition to avoid tracking of sediment onto public roads. • For excavation activities, separate subsoils and topsoils and ensure that they are replaced in their natural configuration to assist revegetation. • Stockpile topsoil appropriately so as to minimise weed infestation, maintain soil organic matter, maintain soil structure and microbial activity. • In areas of disturbed soil, the site would be progressively rehabilitated as soon as possible after completing works.			
SO2	Prior to commencing construction, soil testing is to be undertaken to determine the clay content, EC and ECC of the soils. This will assist in determining the required gypsum application rates for the purposes of cable trenching in potentially sodic soils (to prevent tunnel erosion).	✓		
SO3	If a potential contamination risk is identified during construction, measures outlined in the CEMP will be adopted such as undertaking a detailed site investigation to characterise the soil before taking further action.	✓		
SO4	To minimise dust generation in disturbed areas during construction and operation, the following measures are recommended: • Use of dust suppression (eg dampening of soils, or use of dust suppression chemical) • Scheduling of works outside the summer period (to avoid wet weather) • Limit construction activity to localised areas on the site • Restricting vehicle movements and speeds on site during dry and windy conditions.	✓	✓	
SO5	During construction, operation and decommissioning, dust would be managed to prevent dust leaving the proposed site.	✓	✓	✓
SO6	A Spill Response Plan would be developed and implemented during construction, operation and decommissioning that would cover: • Activities with the potential for spills (refuelling) would not be undertaken within 50 m of any farm dams and an adequately stocked spill response and containment kit will be available on site. • Appropriately store, handle and use any potential hazardous materials (eg fuel) in accordance with the *Code of Practice for Storage and Handling of Dangerous Goods* (WorkCover NSW, 2005).	✓	✓	✓

No.	Recommended mitigation measures	C	O	D
	• Mitigate the effects of soil contamination by fuels or other chemicals (including emergency response and EPA notification procedures and remediation).			
SO7	A vegetation and land management plan will be developed for the site and will include considerations to address soil erosion. The plan would include monitoring and triggers for action to address issues arising from erosion that develops during operation.		✓	
Air quality				
AQ1	Development and implementation of a management system to respond promptly to any air quality related complaints.	✓	✓	✓
AQ2	The CEMP will seek to minimise and control dust emissions generated from construction equipment including consideration of measures such as: • Use of a water cart (truck) to wet uncovered areas, including access tracks, as appropriate to the conditions of the site. • Stabilisation of any disturbed areas that expose soils and increase erosion risks, including covering of stockpiles (eg placement of artificial covers or revegetate with grass species) and minimising the heights of stockpiles as far as possible. • Include a washdown and/or shakedown station at the entrance to the proposed site to enable sediment to fall-off trucks that are moving from unsealed areas to sealed roads off-site. • Investigate the use of fuel-efficient machinery and vehicles (that generate) low carbon emissions for onsite use. • Restrict vehicle movements and ground disturbance to the minimum area that is safely practicable. • Temporary cessation of some works during excessively dry and windy conditions.	✓		✓
AQ3	Development of protocols to minimise and control dust emissions from construction equipment, vehicles and general operations would be included in the construction, operation, and decommissioning environmental management plans. Measures are to be developed in accordance with Australian Standards and POEO Act requirements.	✓	✓	✓
Water quality				
WQ1	Prior to works commencing, a CEMP will be prepared that will include a soil and water sub-plan that details the erosion and sediment controls that will be employed throughout the construction phase. These measures will be in accordance with the provisions of *Managing Urban Stormwater: Soils and Construction*, volume 1, 4th edition (Landcom, 2014).	✓		

No.	Recommended mitigation measures	C	O	D
WQ2	Place fuel and chemical tanks/containers in locations at least 50 m away from drainage lines and any farm dams that are retained on site. Refuelling activities will be undertaken in impervious bunded areas and will not be undertaken within 50 m of drainage lines and farm dams. An adequately stocked spill response and containment kit will be available on site.	✓	✓	✓
WQ3	All staff shall be trained in spill management through toolbox talks	✓	✓	✓
WQ4	Vehicles shall be maintained according to manufacturer's specifications, with daily checks to ensure fuel, chemical and oil leaks are minimised	✓		✓
WQ5	Inclusion of incident management measures in the CEMP and the Operational Environmental Management Plan (OEMP), including the requirement to notify EPA for incidents that cause material harm to the environment (as per s147-153 of the *Protection of the Environment Operations Act 1997*).	✓	✓	
WQ6	Provide suitable and secured temporary and permanent site facilities to prevent any direct discharge of sewerage to drainage lines. It is expected that the Contractor will arrange a dry or septic system for use during construction. Operational site facilities will use a septic system.	✓	✓	
WQ7	Prior to DPSF operations, a Vegetation and Land Management Plan will be implemented with procedures to maintain a groundcover across the site to minimise soil disturbance, whilst managing the fuel load for minimising bushfire risk. A combination of mechanical slashing and grazing will require monitoring and implementation of adaptive management principles.		✓	
Resource use and waste				
WA1	A Waste Management Plan (WMP) will be developed and implemented during construction, operation and decommissioning. It would include but not be limited to: • Application of the waste hierarchy by identifying opportunities to avoid, reuse and recycle as much as possible during all phases of the project • Topsoil from disturbed areas will be stored for use in future rehabilitation activities onsite • Recovering or recycling materials for reuse or a secondary purpose • Provision for recycling management onsite	✓	✓	✓

No.	Recommended mitigation measures	C	O	D
	• Appropriate requirements for hauling of wastes (such as covered loads) • Disposal of waste at licenced facilities • The Contractor would be responsible for toilet facilities onsite during construction, which would either be a dry or septic system. There would be no direct discharge of sewage. • A septic system will be used during operation with no direct discharge of sewage • Provide adequate disposal facilities for all types of construction and decommissioning waste • Conduct routine checks for litter and rubbish along access tracks and roads and remove to appropriate disposal facilities			
WA2	The WMP shall include a tracking system for all waste leaving the site, identifying the waste classification, quantities and materials to be recycled or disposed of.	✓	✓	✓
WA3	In the event of a spill, appropriate spill management response will be undertaken such as: • Contain the spill • Use an adequately stocked spill kit (with all onsite staff being appropriately trained in its use) • Emergency response systems implemented • Contaminated spill material would be removed offsite by a licenced contractor	✓	✓	✓
Socio-economic				
SE1	Community Consultation Plan that will address (but not be limited to) the following activities: • Updating the community above the progress of the proposal • Informing relevant stakeholders of potential impacts (air quality, noise, traffic issues etc.) • Complaints register and response method	✓	✓	
SE2	The Contractor would liaise with local industry representatives to maximise the use of local contractors, materials etc. wherever possible and provide training programs where required.	✓		✓
SE3	The Contractor would liaise with Murrumbidgee Council and local accommodation providers about accommodation options for staff to minimise the impact on the existing services.	✓		✓

No.	Recommended mitigation measures	C	O	D
SE4	The Contractor would liaise with Murrumbidgee Council regarding any local festivals to manage any potential timing conflicts with local events and seasonal workforce periods.	✓		✓
SE5	A Decommissioning Management Plan (DEMP) would be developed prior to undertaking decommissioning activities that would cover potential impacts such as noise, dust, and traffic management.			✓
Hazardous materials				
HM1	The Darlington Point Solar Farm would manage the fire risks associated with the BESS by: • Installing reliable, automated monitoring and control systems, with alarm and shutdown response capability. • Taking reasonable and safe measures to prevent the risks of external heat effects in the event of a bushfire. • Designing appropriate separation and isolation between battery cubicles, and between the BESS and other infrastructure, in accordance with the manufacturers recommendations, and including gravel set-off areas around the facility. • Compliance with all relevant Australian codes and standards. • Preparation of a BESS-specific fire response plan, in conjunction with the NSW Rural Fire Service. • Installing adequate supplies of firefighting water within close proximity to the BESS facility if required by the BESS-specific fire response plan.	✓	✓	
HM2	Fuels and pesticides/herbicides in use at the site will be stored at the laydown area in appropriately bunded areas designed in accordance with AS1940-2004.	✓	✓	
Electro-magnetic fields				
EM1	All designs shall be in accordance with the *Guidelines for limiting exposure to Timevarying Electric, Magnetic and Electromagnetic Fields* (ICNIRP, 1998) & (ICNIRP, 2010b) and relevant codes and industry best practice standards in Australia.	✓	✓	
EM2	The security system for the site, including safety fencing and closure of gates, shall be maintained throughout the construction and operation, to provide safe exposure distances to the public.	✓	✓	✓
Bushfire risk				
BR1	A Bushfire Management Plan will be prepared for the DPSF covering construction, operations and decommissioning with input from RFS, and include but not be limited to:	✓	✓	✓

No.	Recommended mitigation measures	C	O	D
	• Complying with the requirements of *Planning for Bush Fire Protection 2006* including: - Identifying asset protection zones - Providing adequate egress/access to the site - Emergency evacuation measures • Adequate setbacks included in the design (eg 20m from fenceline before commencement of solar arrays, and 20m setback from wooded areas and 'Vegetation and Heritage Protection Exclusion Zones'). • Management of site activities with a risk of fire ignition, including all vehicle and plant movements beyond formed roads and trafficable hard stand areas will be restricted to diesel, not petrol vehicles • Storage and maintenance of firefighting equipment, including ensuring fire extinguishers are available in all site vehicles • Daily monitoring of the bushfire status through the RFS website (http://www.rfs.nsw.gov.au) during the bushfire season and communicate to site personnel • Should any fuel or flammable liquids be stored on-site, this material would be stored in a designated area and will be sign-posted 'Fuel Storage Area'. A register will be maintained that confirms the quantities and location of any flammable material stored on-site along with the applicable Material Safety Data Sheet (MSDS). • No burning of vegetation or any waste materials will be undertaken on site • Bushfire management regime for grass land management within the APZ • Provision of multiple water tanks across the site • Operational procedures relating to mitigation and suppression of bushfire relevant to the solar farm.			
BR2	Prior to solar farm operations, a biodiversity management regime as part of the Biodiversity Management Plan will be developed with procedures to maintain a groundcover across the site, whilst managing the fuel load for minimising bushfire risk. A combination of mechanical slashing and grazing will be undertaken and will require monitoring and implementation of adaptive management principles.		✓	
BR3	Methods to adapt the frequency, duration and intensity of grazing and the timing of mechanical slashing during operation of the DPSF will be undertaken to accommodate the prevailing seasonal		✓	

No.	Recommended mitigation measures	C	O	D
	conditions. The following would be undertaken as part of the OEMP: • Regular inspection across the site will be undertaken following intense rainfall events to check that drainage is stable and localised scouring areas are not appearing. • Adaptive management principles will be driven by the performance measure of maintaining a groundcover rather than agricultural production. For instance, in a bad run of seasons when vegetative growth may be negligible and fuel load reduction is not needed, stock grazing may not be undertaken.			
BR4	The OEMP will include an Emergency Response Plan that details risk control measures for electrical hazards in order to safely mitigate potential risks to firefighters, such as a safe method for shutting down and isolating the solar farm. A copy of the plan would be provided to RFS and a copy stored in an 'emergency information cabinet' on-site.		✓	
Cumulative impacts				
CI1	In consultation with affected landowners, potential screening vegetation would be considered in certain locations to 'break-up' views of the solar farm.	✓	✓	✓
CI2	Should there be any changes to the estimated construction programs of the projects noted in Table 93 the Contractor would be responsible for consulting with other nearby projects to manage any potential cumulative impacts in terms of accommodation availability in Darlington Point or Coleambally.	✓		

9.3 Environmental licences and approvals

Table 96 provides a summary of the licenses and approvals that have been identified as relevant to the proposed development of the DPSF.

Table 96 Potential licenses and approvals

Instrument	Licence or approval requirement
EP&A Act, Part 4	State Significant development applications require approval from the Minister for Planning and Environment. This EIS has been prepared in accordance with the requirements of the Secretary of the DPE.
EPBC Act 1999	Based on specialist advice, a referral under the EPBC Act to recommend a Not a Controlled Action Particular Matter will be submitted to the DoEE.

Instrument	Licence or approval requirement
Roads Act, section 138	Any works to public or classified roads require consent under this act from the roads authority. Murrumbidgee Council is the roads authority for Donald Ross Drive.
National Parks and Wildlife Act 1974, section 90	An Aboriginal Heritage Impact Permit (AHIP) is unlikely to be required for the DPSF site.
POEO Act, section 48, Environment Protection Licence	An Environmental Protection Licence (EPL) is not required for the DPSF site. Under Schedule 1, clause 17 of the POEO Act lists electricity generation works with a capacity of 30MW or greater as a scheduled activity requiring an EPL. However, solar energy works is excluded from this definition and therefore an EPL for the DPSF is not required.
Electricity grid connection under the NEM Rules	Connection to the existing Darlington Point substation will be obtained under a separate approval process, with TransGrid as the nominated determining authority.

Should any additional approvals or licenses be required for the proposed development of the DPSF, these will be obtained prior to construction, or the relevant activity.

10 Conclusion and justification

10.1 Justification

The design of the proposed DPSF site will be developed in order to minimise environmental, biophysical, economic and social impacts while maximising electricity output to help achieve the strategic goals and targets set by the Australian and NSW governments around renewable energy, climate change and emissions.

The benefits of the DPSF would include:

- Contribution of approximately 275 MW AC producing some 577,000 MWh to the Australian RET
- Provision of a clean energy source, with enough power to supply around 130,000 homes each year for 30 years through the NEM (based on typical NSW household electricity consumption specified by Origin Energy in 2016)
- Assisting the RET and Paris Agreement obligations, as well as NSW's own transition to net zero emissions and accelerate advanced energy technology, including battery storage to firm otherwise intermittent renewable energy generation.
- Provision of around 300 jobs during peak construction and about five full-time jobs during operation, with an emphasis on local content amounting to circa 42% of capital deployed.
- Potential for direct and indirect investment into the Murrumbidgee Shire during construction.
- Edify Energy's development intent is to maximise direct benefits to the local community. Opportunities for additional community benefits would be further explored throughout the planning and development process and ongoing through operations.
- Unlocks available connection capacity in TransGrid's Darlington Point node, which is identified by TransGrid as a robust node with large capacity for additional connections (TransGrid, 2016). There are no alternative brownfield sites (without native vegetation) within reasonable proximity to the TransGrid substation. Therefore, the proposed DPSF site is considered the optimal location for renewable energy generation at the Darlington Point node and meets the primary key criteria for large scale solar site selection (NSW Government, 2017).

It is considered that proceeding with the DPSF project would result in a balanced outcome with significant economic and social benefits, alignment with climate change and energy policy objectives for renewable energy development, and with manageable environmental impacts, which are described throughout this EIS.

The consequences of not undertaking the DPSF project would include the loss of significant economic and social benefits to the Darlington Point region. This would be a lost opportunity for large scale renewable electricity generation feeding into the NEM at Darlington Point, given the lack of other alternative, suitable, and available sites at this node.

This EIS has been prepared outlining the potential impacts of the proposed development of the DPSF and details the measures for inclusion in the project construction and operational environmental management plans in order to minimise social and environment impacts.

10.2 Objects of the EP&A Act

10.2.1 The precautionary principle

The precautionary principle refers to the 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.

This EIS has been prepared using the precautionary principle and appropriate mitigation measures are outlined throughout the EIS and summarised in Section 9 to address all potential impacts identified for the proposal.

10.2.2 Intergenerational equity

Intergenerational equity refers to the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The DPSF would not impact on the health, diversity and productivity of the local environment or communities in a way that would disadvantage future generations.

10.2.3 Conservation of biological diversity and ecological integrity

A biodiversity assessment was carried out to consider potential impacts and develop appropriate mitigation measures as outlined in Section 7.1 and further discussed in **Appendix C**. The project footprint covers approximately 710 ha of the DPSF project area. Due to the nature of a solar farm project, vegetation impacts will include a mixture of:

- Areas of complete removal of vegetation; and
- Areas of minor impacts to vegetation below the solar panels.

As discussed in Section 7.1, the impacts to vegetation, albeit at a level of varying disturbance in accordance with the CSU study, includes:

- 8.14 ha direct impact to Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW (PCT 16) moderate to good condition – moderate;
- 0.16 ha direct impact to Yellow Box – White Cypress Pine grassy woodland on deep sandy-loam alluvial soils of the eastern Riverina and western NSW

South Western Slopes Bioregions (PCT 75) moderate to good condition – moderate;

- 37.7 ha direct impact to Plains Grassland on Alluvial mainly clay soils in the Riverina Bioregion of NSW South Western Slopes (PCT 45) moderate to good condition – moderate;
- 21.06 ha net impact calculated from the CSU study assessment of impact to Plains Grassland under the solar panels.

Vegetation impacts would also reduce habitat for a range of birds and mammals, including threatened species, in the locality and potentially impact on habitat connectivity.

However, as discussed in Section 7.1, **Appendix C** and **Appendix D**, the mitigation measures identified, including a biodiversity offset strategy and biodiversity management regime, would help to offset this loss and conserve the diversity of flora and fauna and sustainability of ecosystems.

A referral to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to recommend a Not a Controlled Action Particular Matter will be submitted to the DoEE in the coming weeks.

10.2.4 Improved valuation, pricing and incentive mechanisms

This EIS has examined the potential environmental outcomes of the DPSF and Edify Energy would adopt the mitigation measures outlined in Section 9 to minimise potential impacts. In doing so, Edify Energy accept the increase in capital and operating costs as a result.

10.3 Conclusion

The DPSF proposal has been developed through consideration of a number of options and alternatives, and consultation with key stakeholders and the community.

The proposed DPSF site has the potential to accommodate up to 275 MW (AC) of solar generated electricity, including the provision, at a future date, for battery technology.

This EIS has considered the existing environment and the potential impact of the proposed development on a number of environmental and social values.

Key environmental issues have been assessed but are considered to be manageable with the application of mitigation measures. Key environmental issues included:

- Biodiversity
- Traffic and access
- Flooding and hydrology

- Cultural heritage
- Land use.

Other environmental issues have been addressed but are considered minor and manageable with the application of mitigation measures. The EIS details the measures for inclusion in the project construction and operational environmental management plans in order to minimise social and environment impacts.

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Appendix A

Site Photographs

Appendix B

Murrumbidgee Council Letter of Support

Appendix C

Biodiversity Assessment Report

Appendix D

CSU Report

Appendix E

Traffic Impact Assessment

Appendix F

Flood impact assessment

Appendix G

Aboriginal Cultural Heritage Assessment Report

Appendix H

Noise and Vibration Assessment

Appendix I

Visual Impact Assessment