# Suntop Solar Farm
# Environmental Impact Statement

transport | community | mining | industrial | food & beverage | energy





**Prepared for:** Photon Energy Australia Pty Ltd

**Client representative:** Robert Ibrahim

**Date:** May 2018
Rev01

pitt&sherry

# Table of Contents


Executive Summary ..... v
1. Introduction ..... 1
   1.1 Project Overview ..... 1
   1.2 The Proponent ..... 1
   1.3 Location ..... 2
   1.4 Purpose and Scope of This Document ..... 11
   1.5 Environmental Assessment Process ..... 11
   1.6 EIS Structure ..... 12
2. Need and Justification for the Project ..... 14
   2.1 Energy Context in Australia and NSW ..... 14
   2.2 Strategic Direction of the Region and the State ..... 15
   2.3 Benefits of the Proposal ..... 16
   2.4 Alternatives Considered ..... 17
3. Proposal Description ..... 20
   3.1 Overview ..... 20
   3.2 Proposal Site ..... 20
   3.3 Suntop Solar Farm ..... 24
4. Statutory Assessment ..... 37
   4.1 Planning Pathway ..... 37
   4.2 Evaluation of the Development ..... 37
   4.3 NSW Legislation ..... 39
   4.4 Commonwealth Legislation ..... 44
   4.5 Other Relevant Policies and Plans ..... 47
   4.6 Summary of Licenses and Approvals ..... 53
5. Stakeholder Consultation ..... 54
   5.1 Overview ..... 54
   5.2 Identified Stakeholders ..... 54
   5.3 Government Agency Consultation ..... 55
   5.5 Aboriginal Consultation ..... 60
   5.6 Mineral Titleholders Consultation ..... 60
   5.7 Community Engagement ..... 62
   5.8 Media ..... 69
   5.9 Summary of Actions ..... 70
   5.10 Changes in Design ..... 72
   5.11 Ongoing Community Consultation ..... 72
6. Environmental Impact Assessment ..... 73
   6.1 Biodiversity (Flora and Fauna) ..... 73
   6.2 Heritage ..... 88
   6.3 Visual ..... 97
   6.4 Noise ..... 131
   6.5 Traffic, Transport and Road Safety ..... 142
   6.6 Land Use ..... 156
   6.7 Surface Water, Hydrology and Groundwater ..... 158
   6.8 Soils, Geology and Contamination ..... 163
   6.9 Bushfire Risk ..... 180
   6.10 Hazards ..... 185
   6.11 Air Quality ..... 190
   6.12 Socio-Economic and Property ..... 192
   6.13 Waste ..... 203
7. Cumulative Impacts ..... 208
8. Environmental Management ..... 212

8.1 Summary of Environmental Mitigation Measures....212
9. Conclusion....222
9.1 Justification for the Development....222
9.2 Objects of the EP&A Act....223
9.3 Ecologically Sustainable Development....224
10. References....227

## List of Figures

Figure 1-1: Location of the Project....3
Figure 1-2: The Subject Land and Site boundaries....5
Figure 1-3: Location of the Site relative to the Subject Land....8
Figure 1-4: Proposal layout in regard to site constraints....9
Figure 3-1: Existing electrical infrastructure in the area....21
Figure 3-2: Existing Environment of Wellington....23
Figure 3-3: Existing Environment showing silos and farm buildings in the distance....23
Figure 3-4: Example of ground mounting arrangements....25
Figure 3-5: Example of Tracking Solar PV panels....25
Figure 3-6: Solar panel layout....26
Figure 3-7: Example inverter station....27
Figure 3-8: Example Substation....29
Figure 3-9: Example security fencing (chain link security fence)....30
Figure 4-1 Existing Site Plan with current Lots....51
Figure 4-2 Proposed new lot layout following subdivision....52
Figure 5-1 Location of Mineral Title boundary intersecting the Site....61
Figure 5-2 Location of sensitive receivers identified through community consultation....66
Figure 6-1 Existing Vegetation....77
Figure 6-2 Existing Environment....78
Figure 6-3 Mature trees on boundaries of south and western corner of Site....78
Figure 6-4 Vegetation to be cleared....83
Figure 6-5 Vegetation to be cleared at intersection....84
Figure 6-6 Previously recorded Aboriginal Sites....92
Figure 6-7 Location of Aboriginal archaeological sites 6.2.1.4 Mitigation / Management Measures....94
Figure 6-8 Typical rural landscape around Wellington – open paddocks, scattered trees, farm structures....100
Figure 6-9 Typical landscape character around Wellington – scattered native trees, crops and pastures....100
Figure 6-10 Royalla solar farm showing colour change that can occur when viewed from the front....103
Figure 6-11 Viewpoints and Impact Rating....112
Figure 6-12 Photomontage viewpoint locations....113
Figure 6-13 Proposed landscape screening as visual mitigation....114
Figure 6-14 VP1 Existing view....116
Figure 6-15 VP1 Likely view post construction....117
Figure 6-16 VP1 Likely view with landscape screening 5 years after construction....118
Figure 6-17 VP6 – View A - Existing view....119
Figure 6-18 VP6- View A – Likely view of proposal post construction....120
Figure 6-19 VP6 -View A– Likely view with landscape screening 5 years after construction....121
Figure 6-20 VP6 – view B - Existing view....122
Figure 6-21 VP6 – view B - Likely view of proposal post construction....123
Figure 6-22 VP6 – view B - Likely view with landscape screening 5 years after construction....124
Figure 6-23 VP 7 - Existing view....125
Figure 6-24 VP 7 - Likely view of proposal post construction....126
Figure 6-25 VP – Suntop Road - Existing view....127
Figure 6-26 VP – Suntop Road - Likely view of proposal post construction....128

Figure 6-27 VP – Suntop Road - Likely view with landscape screening 5 years after construction .....129
Figure 6-28 Sensitive receiver locations (Figure 1 of MAC Noise Assessment, 2018.....134
Figure 6-29 Light and heavy Vehicle access and route to Proposal site.....146
Figure 6-30 Concept design for upgrade works at Renshaw McGirr Way and Suntop Road.....152
Figure 6-31 Concept design for temporary access road.....153
Figure 6-32 Concept design for permanent access road.....154
Figure 6-33 Geology of the Suntop area (Extract from Wellington 1:100000 Geological Map) .....165
Figure 6-34 Soil test pit locations .....171
Figure 6-35 Test Pit Photos.....175
Figure 6-36 Support for and opposition to building wind/solar farm in three proximities – in NSW, within the respondent's local region, and within 1-2km of where the respondent lived.....197

## List of Tables

Table 1-1: Annual Rainfall (mm) (source bom.gov.au- D&J Rural No.065034). .....10
Table 1-2: EIS Structure .....12
Table 2-1: Current Solar Projects (NSW) Source: (DP&E: Resources and Planning, 2016). .....14
Table 2-2: Australian electricity generation, by fuel type (*Source: Department of Industry, Innovation and Science (2016) Australian Energy Statistics, Table O*) .....14
Table 3-1: Main Construction Activities by Stage.....31
Table 3-2: Plant and equipment .....33
Table 4-1 Matters of consideration.....37
Table 4-2 Relevant provisions from the Wellington LEP .....49
Table 4-3 Licences and Approvals .....53
Table 5-1 Summary of Agency Consultation through the development phase .....55
Table 5-2 Key concerns raised by Dubbo Regional Council during consultation .....58
Table 5-3 Moderate concerns raised by Dubbo Regional Council through consultation.....59
Table 5-4 Engagement outcomes of consultation with potentially impacted mineral title holders .....62
Table 5-5 Summary of community engagement performed to date .....63
**Table 5-6 Detailed summary of one on one consultation with sensitive receivers conducted 5th – 6th February** .....67
**Table 5-7 Summary of one on one consultation with sensitive receivers conducted 30th April – 1st May**...68
Table 5-8 Summary of actions taken to date to address key concerns raised.....70
Table 6-1 Mitchell Landscapes in the BDAR Footprint .....74
Table 6-2 EPBC Protected Matters Search Tool Results.....76
Table 6-3 Pre- European Plant Community Types.....79
Table 6-4 Frequency of site types from AHIMS database search.....91
Table 6-5 Historic items within the vicinity of the site.....96
Table 6-6 Level of Impact .....98
Table 6-7 Assessed private viewpoints (all houses) and predicted visual impact levels (Source: Envisage 2018) .....106
Table 6-8 Summary of identified potentially affected private viewpoints.....130
Table 6-9 Construction Equipment Sound Power Levels (Lw) dBA re $10^{-12}$ W .....131
Table 6-10 Operational Equipment Sound Power Levels dBA re $10^{-12}$ W .....132
Table 6-11 Noise Monitoring Location .....135
Table 6-12 Unattended Noise Monitoring .....135
Table 6-13 Noise management levels at residential receivers.....136
Table 6-14 Noise Management Levels .....137
Table 6-15 Intrusiveness, amenity and project noise trigger levels.....137
Table 6-16 NSW Road Noise Policy – Traffic Noise Assessment Criteria.....138
Table 6-17 Predicted Construction Noise Levels .....139
Table 6-18 Predicted Operational Noise Levels .....140
Table 6-19 Predicted Construction Road Traffic Noise Levels.....140
Table 6-20 Existing road environment .....143

Table 6-21 Vehicle movements expected as a result of the proposal .....148
Table 6-22 Intersection sight distances .....149
Table 6-23 Exploration licences currently in force over the proposed solar farm proposal boundary .....156
Table 6-24 Water Licenses and Approvals .....161
Table 6-25 Site Geology Descriptions .....166
Table 6-26 Soil qualities and limitations .....167
Table 6-27 Registered contaminated sites within Wellington (Dubbo LGA) (Source: NSW EPA) .....167
Table 6-28 Soil Sample Descriptions .....168
Table 6-29 Laboratory analysis schedule .....169
Table 6-30 Summary of laboratory results. .....169
Table 6-31 Salinity Rating .....172
Table 6-32 Site Electrical Conductivities (1:5 solution) .....172
Table 6-33 Exchangeable Sodium and Magnesium in the Cation Exchange Complex (%) .....173
Table 6-34 Particle size analysis and K factor .....174
Table 6-35 Revised Universal Soil Loss Equation. .....176
Table 6-36 Average number of days per year of daily Grassland Fire Danger Rating and GFDI categories at 3 pm at Wellington (D&J Rural) .....181
Table 6-37 Number of days in each month of daily Fire Danger Rating and GFDI categories at Wellington (D&J Rural) .....182
Table 6-38 ICNIRP reference levels for 50Hz for occupational and general public exposure to time varying electric and magnetic fields (ICNIRP 2010) .....187
Table 6-39 Example magnetic and electrical field levels (TransGrid N.D, and EMF info) .....187
Table 6-40 Dangerous goods criteria and SEPP 33 thresholds relevant to the construction and operation of the proposal .....188
Table 6-41 Comparison of employment data averages from Wellington, NSW and Australia .....192
Table 6-42 Community services, facilities and Attractions available in Wellington LGA (Dubbo Regional *Council*) .....193
Table 6-43 Expected labour force during different stages of construction .....200
Table 6-44 Potential waste generated on-site during construction and operation .....204
Table 6-45 Material reuse, recycling and disposal facilities which can be used to dispose of waste and recyclables .....206
Table 7-1 Developments that are proposed to be carried out within the Dubbo LGA .....208
Table 8-1 Summary of General Management and Mitigation Measures for Construction and Decommissioning .....212
Table 8-2 Summary of Management and Mitigation Measures for Construction and Decommissioning .....213
Table 8-3 Summary of Management and Mitigation Measures for Operation .....220
Table 9-1 Objectives of the EP&A Act .....223

## Appendices

Appendix A: SEARs
Appendix B: Table of Summary SEARs
Appendix C: Visual Impact Assessment and Landscape Plan
Appendix D: Biodiversity Assessment Reports
Appendix E: Aboriginal Heritage Impact Assessment
Appendix F: Bushfire Risk Assessment
Appendix G: Community & Stakeholder Consultation
Appendix H: Traffic Impact Assessment
Appendix I: Noise Impact Assessment
Appendix J: Draft Land Management Plan
Appendix K: Soil Log Sheets and Laboratory Results

Prepared by: ..... Date: 14 May 2018
David Pritchard

Reviewed by: ..... Date: 14 May 2018
Jessica Berry

Authorised by: ..... Date: 14 May 2018
Malinda Facey

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## Terms and Definitions

| Term / Acronym | Description |
|---|---|
| ABS | Australian Bureau of Statistics |
| AC | Alternating Current |
| AHIMS | Aboriginal Heritage Information Management System |
| AHIP | Aboriginal Heritage Impact Permit |
| APZ | Asset Protection Zone |
| AS | Australian Standard |
| ASS | Acid Sulphate Soils |
| AEMO | Australian Energy Market Operator |
| BCA | *Biodiversity Conservation Act* 2016, replaces the Threatened Species Conservation Act 1995 (TSC Act) as the key piece of legislation that identifies and protects threatened species, populations and ecological communities in NSW. |
| BDAR | Biodiversity Development Assessment Report |
| BIA | Bushfire Impact Assessment |
| BSAL | Biophysical Strategic Agricultural Land |
| CEMP | Construction Environmental Management Plan |
| CNVG | Construction Noise and Vibration Guideline |
| CSEP | Community and Stakeholder Engagement Plan |
| DA | Development Application |
| DC | Direct Current |
| DECC | Department of Environment and Climate Change |
| DoEE | Department of Environment and Energy |
| DP | Deposited Plan |
| DP&E | Department of Planning and Environment |
| DPI | Department of Primary Industries |
| DEC | Department of Environment and Conservation |
| EC | Electrical Conductivity |
| EEC | Endangered Ecological Community |
| EIA | Environmental Impact Assessment |
| EIS | Environmental Impact Statement |
| ELF | Extremely Low Frequency |
| EMF | Electromagnetic Field |
| EPA | Environment Protection Authority |
| EP&A Act | *Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW |
| EP&A Regulations | Environmental Planning and Assessment Regulation 2000. |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process |
| EPL | Environmental Protection Licence |
| ERSED | Erosion and Sediment |
| ESD | Ecologically Sustainable Development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased |
| EWP | Elevated Work Platforms |

| Term / Acronym | Description |
|---|---|
| FM Act | *Fisheries Management Act* 1994 |
| GDE | Groundwater Dependent Ecosystem' |
| GFDI | Grass Fire Danger Index |
| GHG | Greenhouse Gas |
| ICNIRP | International Commission on Non-Ionizing Radiation Protection |
| ICNG | Interim Construction Noise Guideline |
| IER | Index of Economic Resources |
| IEO | Index of Education and Occupation |
| INP | Industrial Noise Policy |
| IRR | Initial Risk Rating |
| IRSD | Index of Relative Socio-Economic Disadvantage |
| IRSAD | Index of Relative Socio-Economic Advantage and Disadvantage |
| ISEPP | State Environmental Planning Policy (Infrastructure) 2007 |
| kV | kilo-Volts |
| LALC | Local Aboriginal Land Council |
| LEP | Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act. |
| LGA | Local Government Area |
| LGC | Large-scale Generation Certificates |
| LLS | Local Land Services |
| LRET | Large-scale Renewable Energy Target |
| LUCRA | Land Use Conflict Risk Assessment |
| MAC | Muller Acoustic Consulting |
| MGA | Map Grid of Australia |
| MNES | Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. |
| MW | Megawatt |
| MWh | Megawatt hours |
| MWp | Megawatt peak |
| NCG | Noise Criteria Guideline |
| NEM | National Electricity Market |
| NEG | National Energy Guarantee |
| NML | Noise Management Level |
| NPI | Noise Policy for Industry |
| NPW Act | *National Parks and Wildlife Act 1974* (NSW) |
| OEH | Office of Environment and Heritage (formerly DECCW) |
| OEMP | Operational Environmental Management Plan |
| OOH | Out of Hours |
| OPGW | Optical Ground Wire |
| PASS | Potential Acid Sulphate Soils |
| PCT | Plant Community Types |
| PEA | Preliminary Environmental Assessment |
| Photon | Photon Energy Australia Pty Ltd<br>(This project will be co-developed by Canadian Solar and Polpo Investment Ltd.) |
| Photon Energy | Photon Energy NV |
| PNTL | Project Noise Trigger Levels |
| POEO Act | *Protection of the Environment Operations Act* 1997 |

| Term / Acronym | Description |
|---|---|
| The "Proposal" | Develop and operate a 170-megawatt (MW) (AC) solar photovoltaic (PV) facility including ancillary works and associated infrastructure at 909 Suntop Road, Wellington, NSW 2820. |
| PV | Photovoltaic |
| REAP | Renewable Energy Action Plan |
| REC | Renewable Energy Certificates |
| RET | Renewable Energy Target |
| RFS | Rural Fire Service |
| RNP | Road Noise Policy |
| Roads and Maritime | NSW Roads and Maritime Services |
| RRR | Residual Risk Rating |
| SEARS | Secretary's Environmental Assessment Requirements |
| SEIFA | Socio-Economic Indices for Areas |
| SEPP | State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act. |
| SDD | State significant development |
| SRD | State and Regional Development |
| SSDA | State Significant Development Application |
| The "Subject Land" | Lots 1, 2 and 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 |
| SWMP | Soil and Water Management Plan |
| TMP | Traffic Management Plan |
| VIA | Visual Impact Assessment |
| WARR Act | Waste Avoidance and Resource Recovery Act |
| WM Act | *Water Management Act 2000* |
| WMP | Waste Management Plan |

# Statement of Authorship

## Submission of Environmental Impact Statement (EIS)

**Part 4, Division 4.1 of *Environmental Planning and Assessment Act 1979***

## EIS prepared by:

| | |
|---|---|
| Name: | Jessica Berry<br>Senior Environmental Consultant |
| Qualifications: | BSc/BA<br>Masters Environmental Management |
| Company: | **pitt&sherry Pty Ltd** |
| Address: | Suite 902, Level 9, 1-5 Railway Street<br>Chatswood NSW 2067 |

---

## Development Application:

| | |
|---|---|
| Proponent Name: | Suntop Solar Farm Pty Ltd |
| Proponent Address: | 204/55 Grafton Street<br>Bondi Junction NSW 2022<br>Australia |
| Land to be Developed: | Lots 1, 2 and 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805<br>Wellington NSW, 2820<br>Dubbo Regional Council Local Government Area |
| Development Description: | Suntop Solar Farm |

---

## Declaration:

I declare that:

1. The statement has been prepared in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.
2. The statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates.
3. That the information contained in this statement is neither false or misleading.

Name: **pitt&sherry** (Operations) Pty Ltd

Signature:



Date: 14 MAY 2018

# Executive Summary

This Environmental Impact Statement (EIS) has been prepared by pitt&sherry on behalf of Suntop Solar Farm Pty Ltd (SSF) to identify and assess the environmental issues associated with the construction, operation, and decommissioning of an up to 170MW (AC) (200 MW DC) photovoltaic (PV) solar farm located approximately 10km west of the Central West township of Wellington (the 'Proposal').

The EIS has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to support a Development Application (DA) for the Proposal. This EIS has been prepared pursuant to the Secretary's Environmental Assessment Requirements (SEARs) for the Proposal issued by the Department of Planning and Environment (DP&E) on 21 September 2017. A copy of the SEARs is included in **Appendix A** and a summary of where these have been addressed in the EIS is included in **Appendix B**.

The Proposal will be located at 909 Suntop Road, Wellington NSW on, Lots 1,2 and part Lot 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (the "Site"). The Site is zoned Primary Production (RU1) under the Wellington LEP 2012.

The solar farm will cover an area of 472 hectares and is estimated to consist of up to 550,000 PV panels installed on a single axis tracking system which will follow the movement of the sun through the course of the day. The PV panels will be fixed on mounting structures which would extend 2.5 to 4m below ground. The maximum height of panels during tracking movement is up to 4m.

In addition to the solar PV panels the Proposal will also include the construction of new access roads into the site from Suntop Road (one permanent and one temporary), installation of electrical infrastructure and other ancillary works including the on-site substation, inverter stations, connection to overhead transmissions lines, fencing and landscaping works. An upgrade to the intersection of Suntop Road and Renshaw McGirr way would also be undertaken to facilitate safe access during construction of the Proposal.

The Site and surrounding land is cleared agricultural land which is currently and has historically been used for grazing of livestock and cropping agriculture. It is located on undulating topography of low rises and long slopes with open gullies. The Mount Arthur Reserve is the largest remaining area of native vegetation in this locality and is located over 5 km to the east of the Site. There are several rural residential receivers located to the immediate north and west of the Site.

The Macquarie River is located approximately 7.7km to the north of the Site. An unnamed first order watercourse runs in an east west direction across the Site and links with Barneys Creek 2.5 km north of the Site. This then flows into the Little River which merges with the Macquarie River in Wellington. There are 8 small constructed agricultural dams within the Site which are currently used for watering livestock along with a series of constructed earth banks which were established many years ago. These reduce the erosion potential on Site and assist with managing surface water flows.

The Site and its surrounds have been significantly disturbed by construction of roads, farming activities (including landform changes), and rural residential dwellings. Vegetation on the Site consists of improved pastures, various crops including wheat under sown with Lucerne, and isolated remnant native trees. Several rows of remnant vegetation are located on the southern and western boundaries in addition to native stands along the edges of Suntop Road. The small amount of remaining native vegetation consists only of trees with no mid-storey or understorey species present.

The key benefit of the Proposal is the production of renewable electricity reducing greenhouse gas emissions and reliance on fossil fuels. The Proposal will contribute to renewable energy generation targets in NSW and nationally, as well as contributing to various international agreements which Australia is a signatory, such as the United Nations Framework Convention on Climate Change and the Paris Agreement. Demand for electricity is increasing and reliable energy supplies are often limited by inadequate energy supply infrastructure. Solar Farms are scalable and can be installed regionally, making this type of infrastructure suitable for assisting in managing the predicted uncertain energy climate and provide added security to the energy supply sector.

The Proposal will also provide socio-economic benefits by generating up to 250 construction jobs during peak construction periods and will support six to ten operational jobs during the 30 year life of the solar farm. It will encourage regional development through expenditure by personnel in the Wellington region during construction.

This EIS describes the key environmental risks related to the Proposal and provides a comprehensive assessment of these risks. The key potential environmental impacts have been identified through assessment of the Proposal scope, review of the SEARs issued by the DP&E, and consultation with relevant stakeholders and the community.

An environmental risk assessment was undertaken as part of this EIS which identified key environmental risks of the Proposal these being:

- Biodiversity
- Aboriginal Heritage
- Visual amenity
- Traffic and Transport
- Erosion and sediment control
- Bush Fire.

A number of features of the Proposal help to mitigate key environmental risks including:

Suitability of the Site:

- The land is largely cleared of native vegetation
- There are few elevated viewpoints on the Site
- There are no major watercourses on the Site
- The Site does not possess suitable habitat for any threatened species.

Implementing buffers including:

- A 15m Asset Protection Zone (APZ) around the perimeter of the Site
- A 10-20m buffer along flowlines
- A 20m buffer around areas of retained vegetation.

Preparation and implementation of appropriate management plans including:

- A Construction Environmental Management Plan (CEMP)
- An Operations Environmental Management Plan (OEMP).

The Proposal footprint has also been adapted within the Subject Land to avoid or minimise the potential environmental impacts.

Key environmental risks are summarised below:

**Biodiversity**
A biodiversity assessment was undertaken by flora and fauna specialists to assess the impacts of the development on biodiversity. The project will require minor land clearing to facilitate the installation of the solar PV panels and upgrade of the intersection at Suntop Road and Renshaw McGirr Way. The Site has historically been predominantly cleared for agricultural use and clusters of native vegetation will be retained along the southern and western boundaries as part of the proposal.

No threatened species or EECs will be impacted on the Site however a small loss of EEC (0.04ha) will occur for the upgrade of the intersection at Suntop Road and Renshaw McGirr Way.

**Aboriginal Heritage**
An Aboriginal Cultural Heritage Assessment was undertaken to assess the impacts on aboriginal heritage and to determine the archaeological potential of the Site. Consultation with Aboriginal stakeholders was undertaken in accordance with the Proposal SEARs.

Three sites of Aboriginal archaeological potential were identified within the study area but outside the proposed footprint of the development. These consisted of two scatters on the edge of a flowline in the south east of the Site, and a tree of cultural significance located to the north of an existing row of trees. These trees will be retained as part of the vegetation management for the Site.

The Wellington Local Aboriginal Land Council (WLALC) were present and participated in the Site assessment. They have supplied a letter stating that they have no objection to the proposal proceeding but stipulated that the three areas need to be protected from impacts during construction. Accordingly, they have requested that these sites be addressed in the Construction Environmental Management Plan (CEMP). No further Aboriginal cultural heritage assessment is warranted for the Proposal and an unexpected Aboriginal heritage finds procedure will be developed prior to construction.

**Visual Amenity**
The Proposal would be visible to 29 potentially affected private viewpoints as well as one public viewpoint being Suntop Road. A Visual Impact Assessment (VIA) was prepared and concluded that one viewpoint had a high impact and three viewpoints had a moderate – high impact. The VIA also concluded that these impacts could be reduced through the implementation of mitigation strategies, such as landscape screening.

**Traffic**
A traffic impact assessment (TIA) was completed to assess traffic impacts and this recognised that during the construction phase of the project, there will be an increase in the number of vehicle movements which have the potential to impact on the local road network. All vehicles (including heavy vehicles) will access the Site using a designated route which currently caters for a large number of heavy vehicles. No specific road safety issues were identified along the haulage route.

The intersection of Renshaw McGirr Way and Suntop Road will be upgraded to accommodate the increased vehicle movements associated with construction of the Proposal. The works will include installation of a sheltered right turn lane from Renshaw McGirr Way into Suntop Road, removal of trees to improve sight distances and the provision of safety barriers.

Suntop Road and Renshaw McGirr Way are part of a local school bus route. Traffic associated with the proposal will be made aware of this and deliveries by heavy vehicles will be scheduled to avoid school bus pick up and drop off times.

**Erosion and Sediment Control**

The construction phase has the potential to increase dust levels from the Site. The use of appropriate land management techniques during construction and the implementation of the mitigation measures specified in Section 8 will reduce potential dust impacts. A Soil and Water Management Plan (SWMP) will be developed as part of the CEMP.

**Bushfire**

A Bushfire risk assessment was completed and concluded that potential ignition sources from construction and decommissioning of the proposal were generally consistent with the existing environment apart from any electrical faults. Similarly, ignitions from electrical equipment is theoretically possible, although unlikely during operation. Working with first responders, a plan has been developed to avoid fire fighter electrocution and fume inhalation in the unlikely event of a fire. The land is not mapped as fire prone land and it has been concluded that these risks can be managed by the mitigation measures specified in Section 8.

Lower risk issues including land use, noise, air quality, waste generation, hazards, and cumulative impacts which have been addressed in Section 6 of the EIS.

Impact avoidance and minimisation measures have been incorporated into the design of the proposal. These measures are considered practical and achievable by the proponent. They are set out for each area of investigation in Sections 6 and summarised in Section 8 of this EIS.

The solar farm is expected to operate for 30 years and at this time SSF would reassess the development and either continue operations, upgrade the infrastructure or undertake decommissioning of the facility. Decommissioning would include removal of all ancillary works, associated infrastructure and remediation of the land (as required) to enable continued agricultural use. However, the substation may remain following decommissioning of the solar farm to continue to service the region.

Mitigation measures have been identified that would be effective in reducing the potential impacts to an acceptable level of environmental risk and will enable the project to be constructed, operated and decommissioned without any impairment to existing or future land uses for the Site.

# 1. Introduction

## 1.1 Project Overview

Suntop Solar Farm Pty Ltd (SSF) is owned by Photon Energy NV (Photon Energy), Canadian Solar Energy Holdings Singapore 4 Pte Ltd (Canadian Solar) and Polpo Investments Ltd (Polpo) (referred to herein as SSF). SSF propose to develop and operate a solar photovoltaic (PV) facility including ancillary works and associated infrastructure with an upper capacity of 170-megawatt (MW) (200MW DC or 170MW AC), at 909 Suntop Road, Wellington, NSW 2820 (Figure 1-1) ("the Proposal").

The facility would operate for a duration of approximately 30 years following which SSF would reassess the viability and in agreement with the landowner either continue operations, upgrade the infrastructure or undertake decommissioning of the facility. Decommissioning would include removal of all ancillary works, associated infrastructure and remediation of the land (as required) to enable continued agricultural use. However, the substation may remain to continue to service the region subject to review by TransGrid.

SSF will manage the development and operation of the Proposal. Canadian Solar will acquire a 51% shareholding, Photon Energy will retain approximately 25% and Polpo will hold the balance of the shares.

The Proposal is a State Significant Development (SSD) under the *State Environmental Planning Policy (State and Regional Development*) 2011 (SRD SEPP). A development application (DA) for the Proposal is required to be submitted under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

## 1.2 The Proponent

The proponent is SSF (ABN 25 619 271 699) which is owned by three companies including Photon Energy, Canadian Solar and Polpo.

**Photon Energy**
Photon Energy is a highly experienced global solar energy solutions and services company covering the entire lifecycle of solar power systems. Photon Energy was founded in 2008 in Prague, Czech Republic and was co-founded by an Australian citizen. The headquarters of Photon Energy are located in Amsterdam, Netherlands and the company has offices in Australia, Hungary and Czech Republic. Photon Energy operates in Australia through wholly owned local subsidiaries. Photon Energy has been a publicly listed company since June 2013 on the NewConnect stock exchange in Warsaw, Poland and in the Free Market on the Prague Stock Exchange, Czech Republic.

Photon Energy is active across the globe and have a proven track record of developing PV projects and building and commissioning solar power plants. Photon Energy provides operations and maintenance services to hundreds of Megawatts peak (MWp) solar power plants worldwide. Photon Energy also manages its own proprietary portfolio of 26 solar power plants in three countries across two continents.

Photon Energy has several projects under construction or completed in Australia including:

- Leeton Solar Farm, NSW – Photon is currently in the process of constructing a 25 megawatt (MW) capacity solar farm in Leeton, NSW
- Leeton Sewage Treatment Plant PV – Photon have constructed a 99-kilowatt peak (kWp) PV facility to power the Leeton Sewage Treatment Plant. The PV system is now in operation and managed by Leeton Shire Council
- Sydney Post Australia – Photon have installed one of the largest rooftop power plants in Australia at the Sydney headquarters of Australia Post. The rooftop power plant has an annual production capacity of 371, 500 Kilowatt hours (KWh)

- BAI Communications (BAI) Muswellbrook – Photon has installed a solar PV system to power one of BAI's television and radio broadcast antennas, located in Muswellbrook NSW.

**Canadian Solar**
Canadian Solar is a global energy provider and leading manufacturer of solar PV modules and developer of solar energy solutions. Canadian Solar was founded in 2001 in Ontario, Canada and is listed on the NASDAQ. The headquarters of Canadian Solar is located in Ontario and the company has business subsidiaries in 20 countries on six continents.

Canadian Solar has several projects under construction or completed in Australia including:

- International Convention Centre (ICC) Sydney – Canadian Solar have installed a large rooftop power plant at the ICC which has an annual production capacity of 545,000 KWh
- Oakey Solar Farm – Canadian Solar is in the process of constructing a 100 MW capacity solar farm in Oakey QLD
- Longreach Solar Farm – Canadian Solar has constructed a 17 MW capacity solar farm in Longreach, QLD
- Normanton Solar Farm – Canadian Solar constructed a 5MW capacity solar farm in Normanton QLD.

**Polpo**
Polpo Investments is an investments company focused on early stage and renewable energy investments. Polpo's founders have decades of experience in developing and operating renewable energy projects in Europe, including wind and solar. Polpo targets markets where traditional electricity generators are aging and likely to be decommissioned in the short term. Polpo seek to identify renewable energy project sites and partner with other local developers to leverage each other's skills to bring projects from greenfield to operating. Polpo Investments was founded in London, United Kingdom (UK) and the headquarters are located in London.

## 1.3 Location

SSF is proposing to construct and operate a solar farm using PV technology with an upper capacity of 170MW(AC) at 909 Suntop Road, located approximately 10 km west of Wellington township in NSW and within the Dubbo Local Government Area (LGA). The area was previously part of the former Wellington LGA, which has recently been amalgamated with Dubbo to form the Dubbo Regional Council. The Wellington Local Environmental Plan (LEP 2012) is still current and applies to the Site.

The Proposal would be located adjacent to Suntop Road, Wellington, NSW, 2820 and contained within, Lots 1, 2 and part Lot 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (the "Subject Land"). The Subject Land totals approximately 517ha. Following subdivision, the Subject Land would total 513ha and the solar farm would occupy approximately 472ha (the "Site") which is equivalent to approximately 92% of the Subject Land.

Ancillary works would also occur in the road reserve at the intersection of Suntop Road and Renshaw McGirr Way (see Figure 1-1).

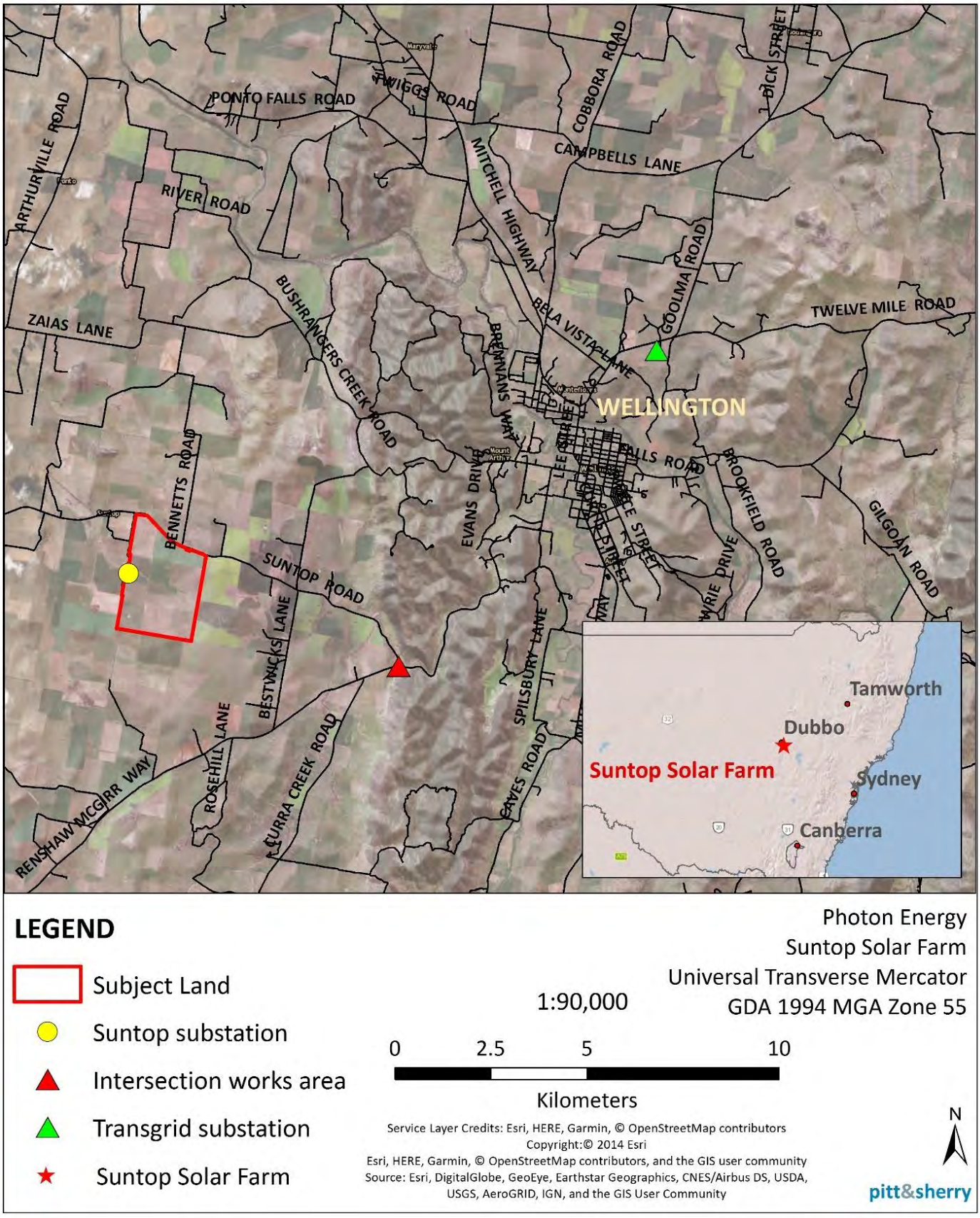



Figure 1-1: Location of the Project

### *Land ownership*

The Proposal would be contained within, Lots 1, 2 and part Lot 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (refer Figure 1-2).

The land is privately owned and SSF will be purchasing the Site from the current landowner.

Ancillary works would also occur in the Dubbo Regional Council road reserve at the intersection of Suntop Road and Renshaw McGirr Way subject to issuing of a works permit under Section 138 of the Roads Act 1993.

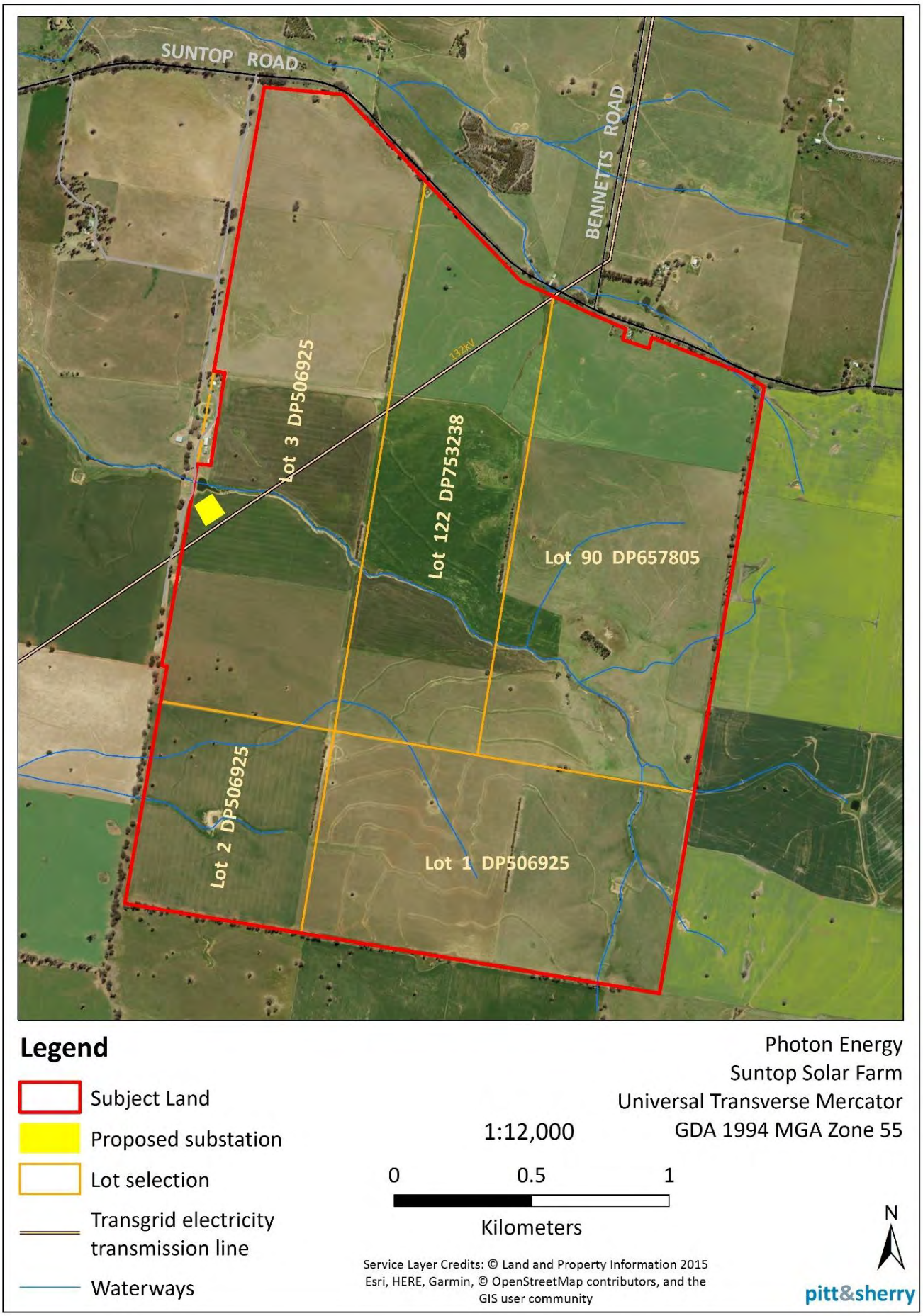



Figure 1-2: The Subject Land and Site boundaries

## *Catchment Description*

The Proposal is located within the Macquarie River Catchment with the closest major water course being the Macquarie River, which is located approximately 7.7km north of the Site.

The Macquarie River is located in the Macquarie – Bogan Catchment and is one of the Murray-Darling Basin's major sub-catchments. The Macquarie-Bogan catchment covers an area of 74,800 square kilometres with the headwaters of the Macquarie River originating in the Great Dividing Range south of Bathurst, where the river flows in a general north-westerly direction until it joins the Barwon River near Brewarrina.

Burrendong Dam to the east of Wellington is located on the Macquarie River and is the largest storage in the catchment with a capacity of 1,190,110 megalitres. The water in this storage is used for a range of uses including irrigation, town water, and stock and domestic supply.

An unnamed creek runs through the Site and flows into Barney's Creek, approximately 2.5km north of the Site (refer to Figure 1-3 and Figure 1-4). This unnamed creek is classified as a first order stream, as it is located at the top of a catchment as a 'headwater' flow. Barney's creek, flows into Little River which is a major tributary of the Macquarie River with the two rivers north of Wellington.

There are 8 agricultural dams within the Site ranging in size from 0.2ha to 0.5ha. The two largest dams are contained in the middle of Lot 2 DP 506925, and the south-west corner of Lot 3 DP 506925. Surface hydrology, landform and soils have been heavily modified by the paddock development and past agricultural use. There are also several man-made agricultural dams in neighbouring plots.

The Site has been classified as groundwater vulnerable under the Wellington LEP, however, the Site has not been identified as flood prone, wetland or riparian land under this LEP. The water course running through the Site is a small first order water course and the topography is undulating which allows surface water to drain from the Site without ponding and causing flooding.

## *Neighbouring Land Uses*

The Site is in an agricultural region and surrounded by cleared agricultural land and rural-residential properties.

The majority of built structures in the region are in the town of Wellington, which is mostly low density residential areas or large lot residences. There is a significant area of dense forest between Wellington and the region of Suntop called Mount Arthur Reserve about 5km east from the Site. Outside the town and surrounding the Site, built structures include sparsely distributed rural-residences which are usually located some distance from roads.

The south, east and west boundaries of the Subject Land are defined by neighbouring agricultural lots with some sections of unnamed, unsealed rural roads and tree-lined fences. Adjoining properties are all rural landholdings of various sizes and are all used for agricultural production including livestock grazing and cultivation for cereal and fodder crops.

There are six rural-residences located with 1km of the Site (refer Figure 5-2):

- Lot 53 DP 753238, located approximately 486m west of the Site (Sensitive Receiver 1)
- Lot 97 DP 753238, located approximately 755m north of the Site (Sensitive Receiver 2)
- Lot 2 DP 983890, located approximately 250m to the north of the Site (Sensitive Receiver 3)
- Lot 92 DP 753238, located approximately 240m north of the Site (Sensitive Receiver 4)
- Lot 51 DP 1082497, located approximately 420m to the east of the Site (Sensitive Receiver 5)
- Lot 90 DP 657805, located immediately north of the Site (Sensitive Receiver 6).

There are also several other properties within 2km of the Site that may be affected due to the flat nature of the landscape and the lack of vegetation screening:

- Lot 17 DP 753246, located approximately 1.9km north-west of the Site
- Lot 1 DP 963275, located approximately 1.8km east of the Site
- Lot 2 DP 842435, Located approximately 1.7km east of the Site
- Lot 50 DP 753238, located approximately 1.1km north of the Site
- Lot 17 DP 753238, located approximately 1.9km north-east of the Site.

The closest residence is located immediately north of the Site on Suntop Road, Sensitive Receiver 6 (refer Section 6.3).

A residence is located on part Lot 3 DP 506925 however this residence is unoccupied and will remain so for the duration of the Proposal.

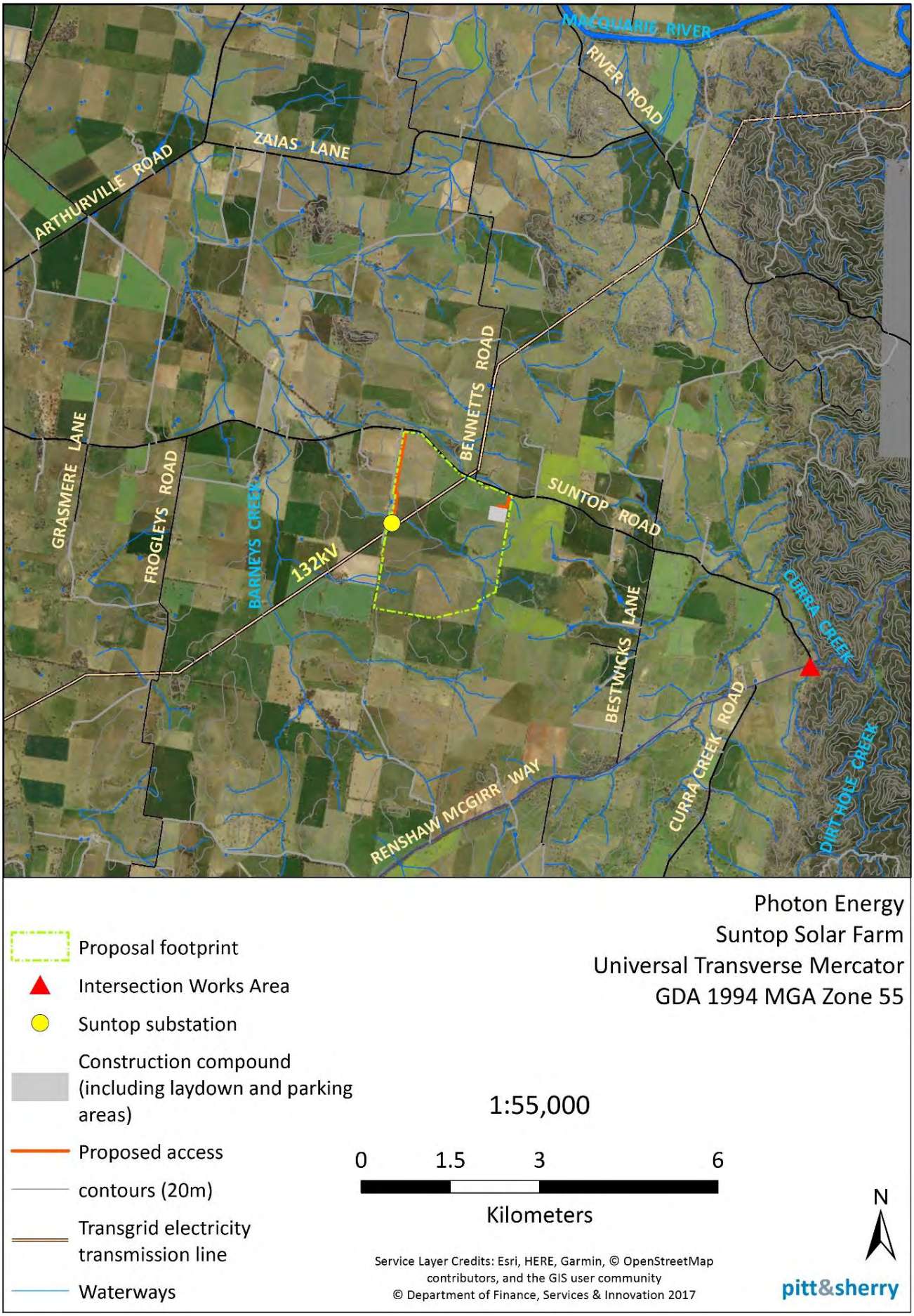



Figure 1-3: Location of the Site relative to the Subject Land

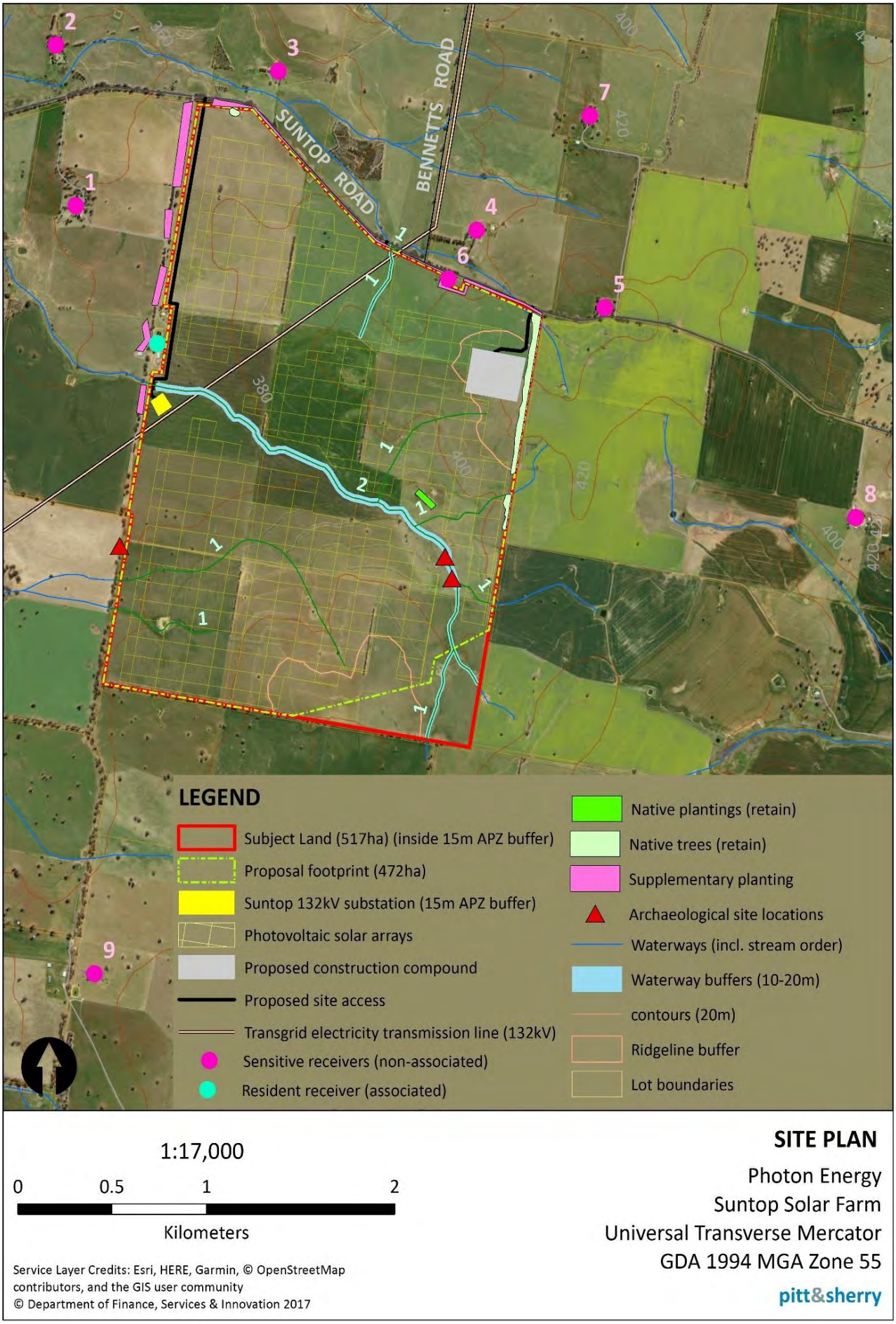



Figure 1-4: Proposal layout in regard to site constraints

### *Conservation Areas*

There are no conservation areas including Endangered Ecological Community (EEC) within the Site.

An EEC was identified at the intersection of Suntop Road and Renshaw McGirr Way and a small part (0.04ha) of this EEC would be impacted by the proposed upgrade. Further assessment is provided in Section 6.1.

The Mount Arthur Reserve, located approximately 5km east of the Site, covers 2,123ha and offers scenic viewpoints as well as picnicking, bushwalking, horse riding and bike riding opportunities. Other places of natural significance include the Wellington Caves Reserve which is approximately 10 kilometres to the south east of Suntop and is on the eastern side of the Bell River, a tributary of the Macquarie River.

### *Climate*

The closest Bureau of Meteorology weather station is in Wellington at D&J Rural (Site No.065034) which is located approximately 10 km to the east of the Proposal. Meteorological data for the Wellington area is outlined in Table 1-1

Table 1-1: Annual Rainfall (mm) (source bom.gov.au- D&J Rural No.065034).

| Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean Solar Exposure (MJ $m^{-2}$) | 26.8 | 23.6 | 20.1 | 15.4 | 11.5 | 9.1 | 10.1 | 13.3 | 17.7 | 22.1 | 24.6 | 26.8 |
| Mean rainfall (mm) | 59.2 | 51.1 | 50.7 | 45.0 | 47.2 | 51.2 | 49.3 | 48.8 | 44.8 | 55.7 | 57.9 | 56.6 |
| Mean number of days of rain ≥ 1mm | 4.6 | 4.3 | 4.3 | 3.9 | 4.9 | 6.3 | 6.3 | 6.0 | 5.2 | 5.5 | 5.2 | 5.1 |
| Mean Max Temperature (°C) | 33.0 | 32.1 | 29.3 | 24.5 | 19.8 | 16.0 | 15.2 | 17.0 | 20.8 | 24.9 | 28.5 | 31.5 |
| Mean Min Temperature (°C) | 17.0 | 16.7 | 14.0 | 9.4 | 5.7 | 3.5 | 2.2 | 2.9 | 5.3 | 8.6 | 12.2 | 15.1 |

### 1.3.1 Key features of the Proposal

The Proposal would comprise the installation of a solar farm with an upper capacity of 170MW AC that would supply electricity to the National Electricity Market (NEM). The power generated would be transmitted via existing overhead powerlines within an existing TransGrid easement to the existing Wellington substation.

The proposal would comprise the installation of an array of solar panels, a 132kV substation, and related infrastructure as follows:

- PV panels mounted on a horizontal single axis tracking structure
- An onsite substation
- A transmission kiosk
- Inverter stations (inverters within containers within blocks of solar PV rows)

- A temporary construction compound
- A storage maintenance container
- A site access road from Suntop Road to the Substation
- Perimeter security fencing
- Upgrade of the intersection of Suntop Road and Renshaw McGirr Way.

Proposal details and further information on these components are outlined in Section 3.

Construction of the Proposal would be expected to take approximately 12 months and the Proposal would be operational for approximately 30 years.

After the initial 30 years, operating period, the solar farm would either be decommissioned, removing all infrastructure and returning the site to its existing land capability, or the PV infrastructure would be upgraded and the site would continue to operate as a solar farm.

The Proposal is fully reversible and would not result in any long-term impacts to the inherent soil fertility, allowing existing farming activities to recommence following decommissioning. This is further discussed in Section 6.6.

### 1.3.2 Capital Investment Value

The capital investment value (CIV) of the proposed development is estimated at $262 million (AUD). A copy of the CIV report was provided to Department of Planning and Environment (DP&E).

## 1.4 Purpose and Scope of This Document

This Environmental Impact Statement (EIS) has been prepared to identify and assess the potential environmental impacts associated with the construction, operation and decommissioning of the Proposal including the solar farm, ancillary works and associated infrastructure.

The EIS will support a DA for the Proposal to be lodged with the DP&E in accordance with Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act*).*

This EIS has been prepared by pitt&sherry on behalf of Suntop Solar Farm in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulatio*n 2000 (EP&A Regulation) and Section 4.15 of the EP&A Act and pursuant to the Secretary's Environmental Assessment Requirements (SEARs) for issued on 21 September 2017. A copy of the SEARs is included in **Appendix A.**

**Appendix B** provides a table of the SEARs as they relate to the Proposal and identifies where the requirements are addressed in the EIS.

## 1.5 Environmental Assessment Process

Under Schedule 1 of the EP&A Regulation, the planning approvals process includes the following key steps:

- Submission of a State Significant Development Application (SSDA) with an accompanying Preliminary Environmental Assessment (PEA) lodged with the Secretary of the DP&E
- The Secretary is to prepare the SEARs in respect of the infrastructure under Schedule 2, Part 2 (3) of the EP&A Regulation
- Preparation and submission of an EIS under Schedule 2 of the EP&A Regulation, addressing the matters outlined in the SEARs.
- Public exhibition of the EIS for a minimum of 30 days

- Preparation of a response to issues raised in submissions to be submitted to the secretary, if required
- Assessment of the application by the DP&E and preparation of the Secretary's environmental assessment report
- Determination of the proposal by the Minister for Planning or their delegate.

Section 4 describes the planning and approvals pathway in greater detail.

## 1.6 EIS Structure

An outline of the structure and content of this EIS is included in Table 1-2.

Table 1-2: EIS Structure

| Chapter | | Content |
|---|---|---|
| N/A | Executive Summary | Key features of the report |
| Chapter 1 | Introduction | Purpose and scope of this document, proposal overview including the proponent, site location and construction & operation, planning pathway |
| Chapter 2 | Strategic Justification and Alternatives considered | Site suitability, energy context in Australia and the National Electricity Market Scheme, strategic direction of the region and state, Proposal benefits, alternatives considered |
| Chapter 3 | Description of the Proposal | Detailed description of the Proposal site and proposed solar farm, including construction, operation and decommissioning |
| Chapter 4 | Statutory Context | Summary of consultation undertaken with Government agencies, stakeholders and the community. |
| Chapter 5 | Stakeholder Consultation | Consideration of the relevant statutory provisions at the commonwealth and state levels, including the principals of ecologically sustainable development |
| Chapter 6 | Environmental Impact Assessment | Risk assessment, detailed assessment of the potential impacts of the Proposal for a range of key environmental aspects. |
| Chapter 6.1 | Biodiversity (Flora and Fauna) | Detailed assessment of the potential impacts of the proposal for a range of key environmental impacts. |
| Chapter 6.2 | Heritage (Aboriginal and Historic) | |
| Chapter 6.3 | Visual Impact Assessment | |
| Chapter 6.4 | Noise Impact Assessment | |
| Chapter 6.5 | Traffic, Transport and Road Safety | |
| Chapter 6.6 | Land Use | |
| Chapter 6.7 | Surface water, Hydrology and Groundwater | |
| Chapter 6.8 | Soils, Geology and Contamination | |
| Chapter 6.9 | Bushfire | |
| Chapter 6.10 | Hazards and electromagnetic interference | |
| Chapter 6.11 | Air Quality | |
| Chapter 6.12 | Socio- Economic | |
| Chapter 6.13 | Waste | |

| Chapter | | Content |
|---|---|---|
| Chapter 7 | Cumulative Impacts | |
| Chapter 8 | Environmental Management | Environmental framework, and consolidated summary of recommended management and mitigation measures. |
| Chapter 9 | Conclusion | Conclusion to the EIS including key findings. |
| Chapter 10 | References | |
| Appendix A | Secretary's Environmental Assessment Requirements | Supporting documentation including the technical specialist reports. |
| Appendix B | Table summarising where SEARs are addressed in the EIS | |
| Appendix C | Visual Impact Assessment and Landscape Plan | |
| Appendix D | Biodiversity Assessment Reports | |
| Appendix E | Aboriginal Heritage Impact Assessment | |
| Appendix F | Bushfire Risk Assessment | |
| Appendix G | Community & Stakeholder Consultation | |
| Appendix H | Traffic Impact Assessment | |
| Appendix I | Noise Impact Assessment | |
| Appendix J | Draft Land Management Plan | |
| Appendix K | Soil Log Sheets & Laboratory Results | |

# 2. Need and Justification for the Project

## 2.1 Energy Context in Australia and NSW

### 2.1.1 Electricity generation in Australia & NSW

Electricity in NSW is generated from a wide range of fuel sources, including black coal, natural gas, coal seam methane gas and to a lesser extent from renewable energy sources such as hydro, wind, biomass and solar (DoEE 2017).

The Australian Energy Update 2017 (*DoEE, 2017*) report highlighted an increase in electricity generation by 2% overall in 2015–16. This growth is largely attributed to increasing demand for electricity and growth in off-grid use, as well as increased residential and commercial demand, mainly for heating. In terms of fuel consumption oil represented the largest percentage of fuel consumed in 2015–16 (37.0%), followed by coal (32%), gas (24.8%) and renewables (6.0%) (*DoEE, 2017*).

NSW has around 20,000 megawatts (MW) of installed electricity generation capacity (including many small generators and roof top PV systems). Table 2-1 provides the number of major existing, under construction and proposed NSW power stations larger than 30MW (*DP&E: Resources and Planning, 2016*).

**Table 2-1: Current Solar Projects (NSW) Source: (DP&E: Resources and Planning, 2016).**

| | Number of Power Stations | Total Capacity (MW) |
|---|---|---|
| Major existing power stations | 54 | 18,740 |
| Projects with Development Approval | 51 | 10,641 |
| Projects in the planning system | 39 | 7,874 |

Australian Energy Statistics recorded that Solar PV use grew by 23.6 % in 2015–16. Table 2-2 provides the Australian electricity generation, by fuel type for this period.

**Table 2-2: Australian electricity generation, by fuel type (*Source: Department of Industry, Innovation and Science (2016) Australian Energy Statistics, Table O*)**

| | 2015 -16 | | Average Annual Growth | |
|---|---|---|---|---|
| | GWh | Share (%) | 2015-16 (%) | 10 years (%) |
| **Fossil Fuels** | **219,283** | **85.2** | **0.4** | **-0.1** |
| Black Coal | 114,295 | 44.4 | 6.2 | -1.6 |
| Brown Coal | 48,796 | 19.0 | -4.3 | -1.2 |
| Gas | 50,536 | 19.6 | -4.5 | 5.3 |
| Oil | 5,656 | 2.2 | -17.2 | 7.7 |
| **Renewables** | **38,146** | **14.8** | **12.1** | **6.8** |
| Hydro | 15,318 | 6.0 | 13.9 | 0.6 |
| Solar PV | 6,838 | 2.7 | 23.6 | 59.1 |
| Wind | 12,199 | 4.7 | 6.4 | 18.7 |

| | 2015 -16 | | Average Annual Growth | |
|---|---|---|---|---|
| | GWh | Share (%) | 2015-16 (%) | 10 years (%) |
| Bioenergy | 3,790 | 1.5 | 5.5 | -0.5 |
| **Total** | **257,429** | **100.0** | **2.0** | **0.6** |

### 2.1.2 National Electricity Market

The Australian Energy Market operator's (AEMO's) 2017 Electricity Forecasting Insight stated that *'forecast growth in maximum demand in the medium to longer term may require investments in generation, network, or demand-side solutions to ensure reliability and security of supply'.*

The three projected scenarios of strong, neutral or weak economic growth, range considerably by almost 70,000 GWh across the three differing scenarios, highlighting the uncertainty of the outlook for grid-supplied electricity. AEMO highlights that this uncertainty can be mitigated through:

- Careful and improved system wide grid planning, accounting for the uncertain future
- Considering projects that can be up-scaled or staged in development
- Reducing political and regulatory uncertainty.

Solar Farms are scalable and can be installed regionally, allowing for this type of infrastructure to be suitable for the predicted uncertain energy climate.

## 2.2 Strategic Direction of the Region and the State

Australia is a signatory to various international agreements relating to climate change and greenhouse gas emissions, such as the United Nations Framework Convention on Climate Change and the Paris Agreement. Both the NSW and the Australian Government have developed renewable energy targets and strategies to meet these targets, reduce greenhouse gas emissions and provide reliable energy to the public. The proposal will contribute to the market aiming to reach NSW and Australian Government targets and international agreements.

Electricity prices are increasing in NSW and Australia due to increased demand and limited existing supply. In many parts of NSW, constraints on energy supply infrastructure result in energy shortages or uncertainty of reliable supply. Renewable energy generated from large scale solar farms in regional areas allow for distributed generation meaning the energy can be generated in the regions it is needed rather than from large fossil fuel power stations situated many miles away. This increases energy efficiency and reduces energy loss that occurs during transmission of electrical energy across powerlines.

### 2.2.1 Australia's Renewable Energy Target

In 2001, the Commonwealth Government introduced the Renewable Energy Target (RET) Scheme to increase the amount of renewable energy being used in Australia's electricity supply. The RET aims to (*DEE, 2016*):

- Produce 33,000 GWh from renewable energy sources by 2020
- Reduce emissions of greenhouse gases in the electricity sector
- Provide for increased energy security through diversifying the energy mix and transitioning to low carbon intensive energy sources.

The Proposal would produce an estimated 379 gigawatt hours (GWh) per year of renewable electricity which would assist in meeting the RET objectives. Additionally, the proposed solar farm will not generate greenhouse gas emissions through the process of energy generation, and would contribute to energy diversity.

### 2.2.2 The National Energy Guarantee (NEG)

The Australian Government has recently introduced its new energy policy the "*National Energy Guarantee*" (NEG) to ensure that reliable, affordable power is available. To achieve this power companies would be required to use a percentage of electricity from sources such as coal and gas to ensure a reliable power supply is available, but also buy a percentage from renewables and efficient power supplies to ensure that Australia meets its international obligations made at the Paris climate change conference. The Proposal will contribute to the renewable energy supply.

### 2.2.3 NSW Renewable Energy Action Plan

The NSW Renewable Energy Action Plan was created to guide NSW's renewable energy development and to support the former national target of 20% renewable energy by 2020. This plan aims to align with Goal 22 of the 'NSW 2021' Plan, to "*contribute to the national renewable energy target by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources*."

The Plan also aims to:

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

The Proposal aligns with Goal 22 of the 'NSW 2021' Plan, as it promotes a renewable energy, will not generate greenhouse gas emissions through the process of energy production and offers a competitive alternative to coal derived energy sources.

### 2.2.4 Paris Agreement

A global agreement to tackle climate change was made in November 2015 at the COP21 conference in Paris. At the Paris COP21 conference, Australia committed to the following:

- Reduce its emissions by 5% below 2000 levels by 2020
- Reducing its emissions to 26-28% below 2005 levels by 2030
- Net emissions in the second half of the century.

Renewable energy helps to reduce emissions associated with electricity generation.

## 2.3 Benefits of the Proposal

The key benefit of the Proposal is the production of renewable electricity contributing to NSW Governments Renewable Energy Action Plan (REAP) and reducing our greenhouse gas emissions and reliance on fossil fuels. On an annual basis, the Suntop Solar Farm will produce enough electricity to meet the needs of approximately 65,000 households.

Additionally, the Proposal will reduce greenhouse gas (GHG) emissions by over 357,000 tonnes of CO2 equivalent per annum. This is roughly equivalent to removing approximately 25,000 cars from the road.

The Proposal would also provide the following benefits:

- Assist in reducing the reliance on fossil fuels in Australia and provide a cleaner and sustainable substitute
- Develop the solar power industry and supply chain in Australia
- Develop Australian intellectual property and expertise in solar power

- Assist with Australia's commitments under national and international agreements
- Diversify sources of income for the agricultural sector, allowing financial resilience for farmers Energy security.

The proposal would also generate regional and local benefits including:

- Generating employment:
  - 250 construction jobs (at peak) as well as indirect supply chain jobs
  - Support up to ten operational jobs
- Encouraging regional development:
  - Employee expenditure in the Wellington region (fuel supply, vehicle servicing, uniform suppliers, hotels/motels, B&B's, cafés, pubs, catering and cleaning companies)
  - Maximising the use of local contractors and equipment hire
  - Increasing local skills and trades through project experience.

## 2.4 Alternatives Considered

### 2.4.1 Alternative site locations

A desktop environmental site analysis was undertaken by pitt&sherry in May 2017 for nine proposed locations across NSW. The desktop assessment aimed to identify environmental aspects that may require additional, detailed and/or specialist assessment, may be impacted significantly or have the potential to impact upon the scope, construction or operation of a solar farm.

The desktop assessment considered a range of environmental aspects via analysis of aerial imagery and desktop search tools including:

- Biodiversity
- Aboriginal and Non-Aboriginal Heritage
- Zoning and Local Environmental Plan provisions (i.e. floodplain, bushfire)
- Surface and ground water resources
- Landscape features
- Access
- Current and previous land use.

The desktop assessment formed part of the site selection process undertaken by SSF which also considered:

- Availability of land
- Access, proximity to and capacity of electrical infrastructure
- Commercial viability.

The site location was considered a preferred location due to:

- The suitability of commercial scale solar electricity generation on the land, in terms of solar yield
- Availability of suitably sized lots
- Aspect of the land (north facing)
- Ease of access to major transport networks such as the Mitchell Highway

- Suitable landscape requiring minimal earthworks
- Locality population density
- Location relevant to natural waterways
- Proximity to and capacity of connection infrastructure (132kV transmission line and Wellington substation).

### 2.4.2 The 'do nothing' option

The consequences of not proceeding with the Proposal would be to forgo the benefits of the Proposal, resulting in:

- The loss of a source of renewable energy that would assist the Australian and NSW Government to reach their targets such as 20% renewable energy by 2020, "*attract renewable energy investment and Proposals, build community support for renewable energy, and attract and grow expertise in renewable energy technology*" (*DPI 2013*)
- The loss of cleaner energy and reduced greenhouse gas emissions
- The loss of additional electricity generation and supply into the Australian grid
- The loss of energy security through diversification of energy sources
- Loss of social and economic benefits through the provision of direct and indirect employment opportunities locally and regionally during construction and operation of the solar farm
- Exposed vulnerability to impacts of climate change to the agricultural industry, such as drought impacting revenue streams.

The '*do nothing*' option may avoid any potential environmental impacts associated with the proposal however, as outlined in Section 9, no significant environmental impacts have been identified. It is considered the benefits of the Proposal significantly outweigh any potential environmental impacts whilst contributing to ecologically sustainable development.

### 2.4.3 Alternative layout options

The design and configuration of the Proposal has taken into account the environmental and social considerations of the locality including:

- Identifying and avoiding/mitigating any environmental constraints including:
  - Avoiding existing clusters of trees to retain native vegetation on Site
  - Avoiding riparian zones to avoid potential impacts upon waterways, biodiversity and aboriginal heritage
  - Moving the substation further away from Suntop Road to avoid potential impacts upon sensitive receivers
  - Removing solar panels from two ridges on the Site to reduce the potential visual impacts upon sensitive receivers to the east of the Site
- Implementing buffer distances including:
  - A 200m buffer from the nearest residence
  - A 20m buffer from Suntop Road
  - A 20m buffer around areas of retained vegetation
  - An asset protection zone (APZ) of 15 m around the entire perimeter of the solar farm footprint, and 20 m for areas abutting the areas of remnant trees and the substation

- 20m buffer around the unnamed creek and 10m buffer for two of its tributaries and dams on the Site.

### 2.4.4 Size of proposal

The Proponent has undertaken extensive grid modelling to determine the optimal size of the solar farm, to ensure constraint free operation and dispatch into the NEM. Through the finalisation of the connection application planning process, SSF will continue to liaise with TransGrid. This will ensure the final plant layout and size is adequate for the existing grid infrastructure.

### 2.4.5 The preferred option

The preferred option is detailed in Section 3.

# 3. Proposal Description

## 3.1 Overview

The construction of the Proposal is estimated to consist of up to 550,000 PV panels which will be installed on a single axis tracker system across the Site.

The single axis tracker system would consist of groups of east-west facing PV modules tilted at +/- 60° angle (each approximately 2m x 1m in area) on mounting structures approximately 2m in height and in rows approximately 11m apart. The mounting structure would be piled steel posts that would extend between 1.6m to 4m below ground depending on geological conditions. The maximum height of panels during tracking movement is up to 4m.

The following works and infrastructure would be required to support the construction and operation of the solar farm:

- Construction of two access roads (one permanent and one temporary) for all access and egress for the Site and substation
- Installation of Electrical infrastructure including:
  - A 132kV Substation
  - Inverters to collect and convert DC to AC
  - Cabling and other electrical infrastructure (e.g. security systems)
- A maintenance compound and buildings
- Fencing, landscaping and environmental works on Site
- Upgrade works at the intersection of Suntop Road and Renshaw McGirr Way.

Power generated by the facility will be transmitted via existing 132kV transmission lines, in an easement owned by TransGrid that traverses the Site and extends through to the Wellington substation approximately 15 kilometres to the north.

A tee off connection will be used to connect directly into the existing grid located on Site. A tee off connection is a type of electrical connector that allows connection to existing transmission or distribution networks.

The operational life of the solar farm is expected to be approximately 30 years at which point the panels are either replaced and operations continue or removed and the site is decommissioned and rehabilitated as required.

## 3.2 Proposal Site

The Subject Land, as described in Section 1.3, totals approximately 517 hectares in area and is currently used for agriculture including cropping (e.g. wheat and lucerne) and grazing by sheep. Following subdivision, the solar farm would occupy 472 hectares out of 517 hectares (equivalent to approximately 92%) with grazing land to continue to occur across all of the Subject Land. Ancillary works would also occur in the road reserve at the intersection of Suntop Road and Renshaw McGirr Way.

There is an existing TransGrid easement that runs across the Site from the eastern boundary of Lot 122 DP 753238, through the northern boundary of the Site, and exits through the western boundary of Lot 3 DP 506925 refer to Figure 3-1. This easement contains existing TransGrid 132kV powerlines on wooden pole structures connecting to the Wellington substation approximately 15km to the north-east of the Site.



Figure 3-1: Existing electrical infrastructure in the area

Suntop Road is a local road managed by Dubbo Regional Council which runs along the northern boundary of the Site. The south, east and west boundaries of the Subject Land are defined by neighbouring agricultural lots.

All vehicles would access the Site from Suntop Road, a sealed, two-way local road. Suntop Road joins Renshaw McGirr Way about 6.5km east of the Site. The Mitchell Highway (A32) joins McGirr Way about 9 km further east of the Site. All vehicle access will be via this route.

Two new access roads (one permanent and one temporary) would be constructed leading south into the Site from Suntop Road. A permanent access road would be constructed along the western boundary and a temporary construction access road in the south east corner of the Subject Land. Additionally, the intersection of Suntop Road and Renshaw McGirr Way would be upgraded. Further details regarding intersection upgrades and traffic management are outlined in Section 6.5.

The Site comprises a series of barb wire fenced paddocks which have been largely cleared for agricultural purposes including cropping (e.g. wheat and lucerne) and sheep grazing. On the western side of the property are several built structures including a residence (unoccupied), agricultural sheds and storage silos. The land associated with these structures will be subdivided as part of the Proposal so that they can continue to be used by the current landowner and as such will not form part of the Site.

Mature native trees occur along the western boundary of the Subject Land. A few remnant trees are scattered within the paddocks over exotic ground covers. Several linear tree plantings occur along parcel boundaries within the Site and provide marginal fauna habitat, but limited flora conservation value due to the presence of exotic groundcovers. A detailed Biodiversity Assessment has been prepared as part of this EIS (refer section 6.1) which provides further details on existing vegetation and biodiversity.

Surface hydrology, landform and soils have been heavily modified by agricultural use. Numerous contour banks direct surface runoff into farm dams. There are 8 dams within the Site ranging in size from 0.2ha to

0.5ha. There is one 2nd order waterway (unnamed) that flows east to west through the centre of the Site, and two 1st order waterways (unnamed) lacking banks or channel structure in the southern half of the Site. The Site drains into the Little River, a major tributary of the Macquarie River.

The Site has been classified as groundwater vulnerable under the Wellington LEP.

### 3.2.1 Surrounding Locality

The Proposal is located within an agricultural region approximately 10 km west of the town of Wellington in the central west slopes and plains region of New South Wales.

Wellington is the closest town to the Proposal and covers an area of 4,113 km$^2$. The population of Wellington was 4,077 in the 2016 Census (*ABS 2016*). The main industries are aged care residential services (6.1%), correctional and detention services (5.5%), takeaway food services (5.3%), supermarket and grocery stores (4.7%) and local government administration (4.5%) (*ABS 2016*).

Settlement of the area dates from 1823, with the land used as an agricultural station, other land uses included growing wheat and grazing sheep. During the 1850's Wellington felt the benefits of gold mining. Prior to European settlement the Wiradjuri people occupied the area. No Heritage items have been listed within 1km of the Site (Wellington LEP 2012).

The majority of built structures in the region are in the town of Wellington which is mostly low density residential areas or large lot residences. Outside the township, built structures include sparsely distributed rural-residences which are usually located some distance from roads.

Residences in proximity to the Site generally occur on large rural properties used for agriculture predominantly grazing and some limited cropping activities. There are 6 residences located within 1km of the Proposal and are depicted in Section 6.3.

The Site has sealed road access along Suntop Road from the Mitchell Highway which is approximately 9 kilometres east of the Site. Wellington has a small airfield that does not support commercial flights and is utilised by private light aircraft. This is located approximately 10 km to the north west of Wellington. Commercial flights are available from Dubbo Airport which is approximately 65 km north of the Site.

Mount Arthur Reserve, a significant area of dense forest and hills between Wellington and the Site sits about 5km north-east of the Proposal. A region within the neighbouring eastern lots, of approximately 350ha has been identified as Karst landscape. A Karst landscape is characterised by the presence of underground cavern networks created from the dissolution of bedrock by surface water or groundwater. Further detail on the soils and geology for the Site are contained in Section 6.8.

The closest major water course is the Macquarie River, located approximately 7.7km north of the Site, which flows north-west into the Murray-Darling Basin. Other waterways and man-made agricultural dams lie in neighbouring and nearby farm lands.

The environment around the Site is dominated by cleared agricultural land which is the dominant industry in the region. Figure 3-2 and Figure 3-3 show the rural nature of the Site and the surrounding land.



Figure 3-2: Existing Environment of Wellington



Figure 3-3: Existing Environment showing silos and farm buildings in the distance

## 3.3 Suntop Solar Farm

### 3.3.1 Key infrastructure components

The proposal would consist of the following elements:

- Solar Components including:
  - Up to 550,000 PV panels on mounting structures that enable the panels to track the sun (known as "single axis trackers")
  - Electrical connections and inverter stations (where the inverters are within containers within the solar PV arrays)
  - Underground cabling / collection circuits.
- Electrical infrastructure including:
  - Transmission kiosk
  - A 132kV Substation
  - 33kV switchgear
- An access road
- Upgrade of intersection of Suntop Road and Renshaw McGirr Way
- Ancillary facilities and construction compounds
- Perimeter security fencing
- Two maintenance storage containers.

During the construction period, some additional temporary facilities would be located within the Site and may include:

- Material laydown areas
- Construction site offices
- Parking area.

Further details have been provided below for indicative key infrastructure components however the detailed design including suppliers for all components would be confirmed during the construction contract Request for Proposal (RFP).

**Solar Components**

The solar modules will consist of a mounting system, PV solar panels and cabling. The support structures for mounting the PV panels will stand up to 2m high with steel posts as foundations. Piles would be driven or screwed in to the ground using pile drivers to a maximum depth of 1.6m to 4m depending on geological conditions.

The Proposal will comprise of up to 550,000 PV panels, using a single axis tracking system, facing east-west and tilted 60° along the north-south axis. The PV modules (2m x 1m) will consist of 72 high efficiency monocrystalline cells with glass and aluminium frames. The mounting structures will be constructed in rows with approximately 11m spacing between the rows to facilitate movement of the panels and provide access for maintenance.

The modules will be arranged in strings and connected to inverters located adjacent to PV arrays. The PV arrays will be fitted with an earthing and lightning protection system connected to the main earth link. All PV modules would be installed in accordance with the relevant Australian Standards including AS 5033.

Figure 3-4 and Figure 3-5 provide an indication of what the proposed solar modules would look like. An indicative layout of the PV panels is shown in Figure 3-6.



Figure 3-4: Example of ground mounting arrangements



Figure 3-5: Example of Tracking Solar PV panels

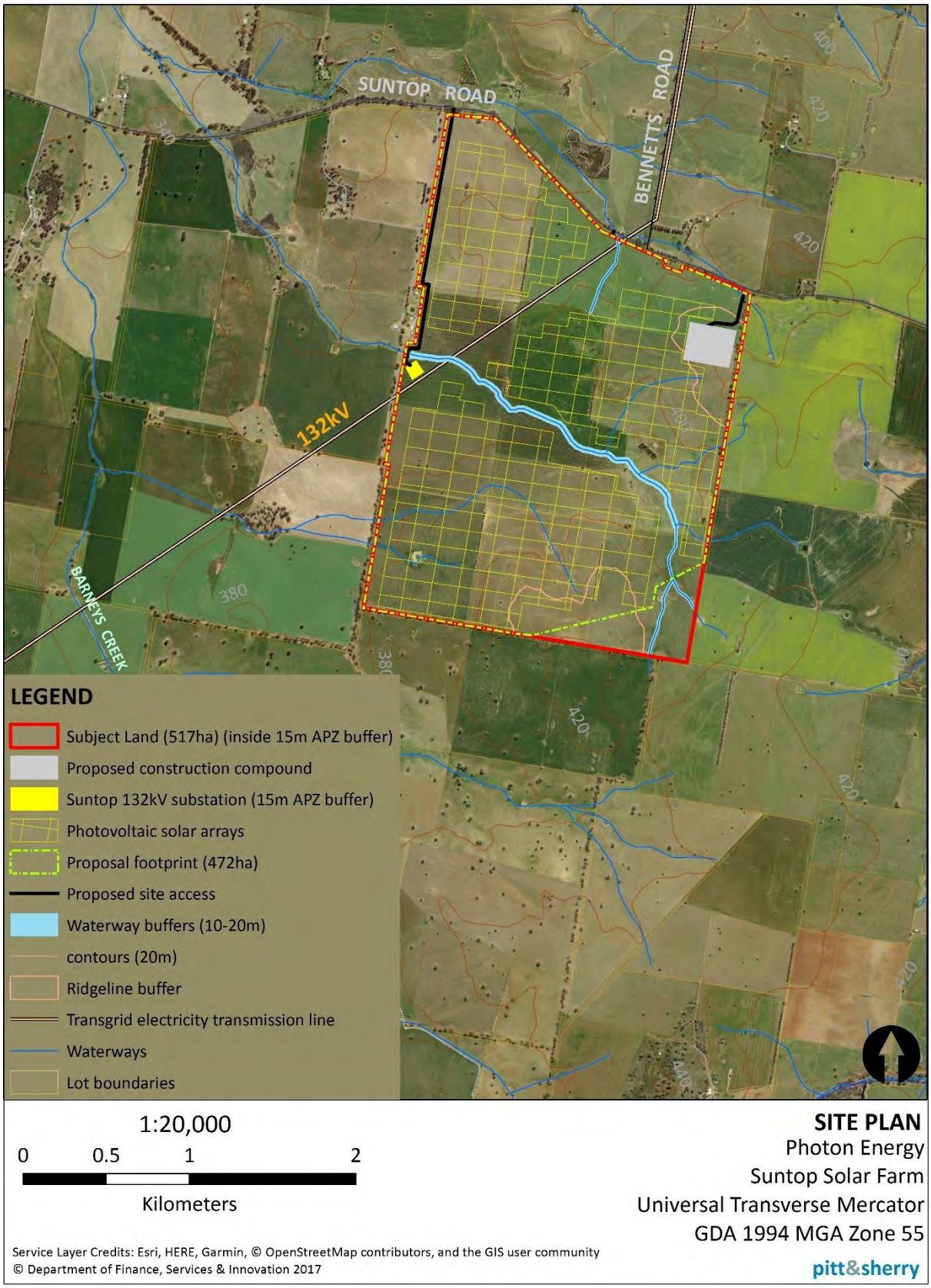



Figure 3-6: Solar panel layout

**Electrical connections and inverters**

Electrical cabling would be attached beneath the modules and would connect the individual PV modules to each other. Groups of panels will be connected to each other by underground cables. Inverter stations will be located centrally to groups of approximately 10,000 PV panels and would be located within the solar PV arrays.

Inverter stations collect electricity from an area of panels, convert it from direct current (DC) to alternating current (AC). The energy is conveyed from the inverter station to the transformer to be located within the substation via electrical cabling.

Each inverter station will house 2-3 inverters and will be fitted with an overvoltage protection device at each DC and AC input/output. This would result in approximately up to 60 inverter stations across the Site.

The type of inverters to be installed across the site would be one of the following options:

- Approximately 40 x 4.92 MW Ingeteam CON40 inverter station (Dimensions: 12.2m (l) x 2.4m (w) x 2.9m) – housed in a 40' container
- Approximately 59 x 3.20 MW Ingeteam CON20 inverter station (Dimensions: 6.1m (l) x 2.4m (w) x 2.6m) – housed in a 20' container.

The inverter stations would be delivered as a fully containerised solution. These stations will be installed on a concrete foundation, slightly elevated above the ground to enable the installation of the AC and DC cabling (Figure 3-7) and fitted with:

- 118 Inverters (2 inverters for the CON20 inverter station or 3 inverters for the CON40 inverter station)
- Cable glands
- Transformer
- Oil retention safety tank
- HV switchgear
- Cooling fans.



Figure 3-7: Example inverter station

**Electrical Cabling**

The majority of electrical cabling required for the Proposal would be installed underground and is considered high voltage (>1kV) and as such would be installed at a depth of approximately 1.2m (in accordance with AS 3000 and AS 3008) (subject to detailed design) including all DC power cabling connecting the panels. All underground cabling would be installed in accordance with the relevant Australian Standards including mechanical protection in accordance with AS 3000.

Any low voltage cabling required for auxiliary loads on site may be installed at a depth of between 500-600mm (subject to detailed design). Some electrical cabling may be above ground to enable crossing of waterbodies on Site.

Prior to excavating the cable trench, the topsoil would be stripped and stockpiled for use in the rehabilitation of the trench following the cable installation. A sand bed will be placed in the trench before and after laying of the cables, followed by additional backfilling with excavated material.

**Substation**
A new 132 kV substation would be established on the western boundary of Lot 3 DP 506925.

The substation footprint is approximately 60m x 80m is size and set back 1.6km from Suntop Road. The substation switchyard would include a transformer, 33kV switchgear building and auxiliary services building. The substation will connect directly to the existing 132kV transmission line traversing the Site. An example of a similar substation can be seen in Figure 3-8.

The new substation would include (subject to detailed design):

- 1 x 132kV 188MVA transformer
- 33kV switchgear building
- Auxiliary services building
- Elevated busbar
- A lightning protection system
- Circuit breakers
- Disconnectors
- Current transformers
- Voltage transformers
- Diesel Generators
- Communications pole with microwave dish and antennas.

A chain link fence with upper barbed strands approximately 3m high would be installed around the substation to maintain security of the site and ensure safety for the public and the ongoing agricultural activities surrounding the substation. The substation would have a 20m asset protection zone (APZ) in accordance with TransGrid design and safety standards.

The substation would be constructed on a concrete pad, approximately 60m x 80m, and the concrete pad will be raised off the ground to mitigate risks of flood waters affecting safe and reliable operation of the substation. Consistent with existing TransGrid substation designs, gravel will be placed around the substation equipment and fence to restrict vegetation growth and provide a safe working environment in accordance with Australian Standards (AS 2067, AS 1025.1 and 1025.2). The substation will include 33kV switchgear which controls the flow of electricity within an electrical system to prevent overloads and short circuits, and to de-energize circuits for testing and maintenance.

The connection will be made directly from the Substation to the existing overhead transmission lines on the Site.

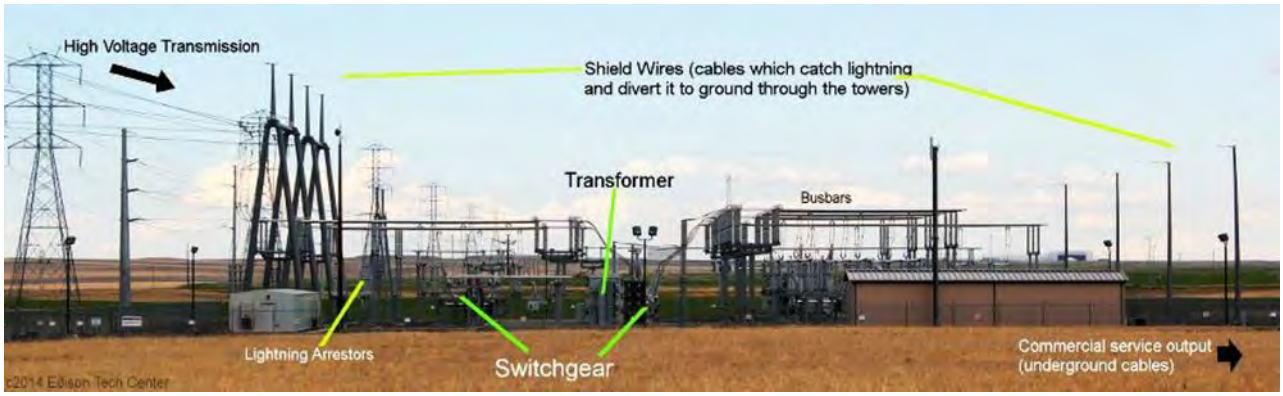


Figure 3-8: Example Substation

**TransGrid Infrastructure Works**

The Proposal would require connection to electrical infrastructure within an existing TransGrid easement at the south-western side of Lot 3 DP 506925 within the Site.

The connection will be made to the existing overhead transmission line. This connection is subject to TransGrid detailed design however it is assumed that any new infrastructure to carry powerlines from the substation to the 132kV transmission line would consist of timber or spun concrete poles (similar to surrounding infrastructure).

**Access Roads**

A new access road to the Site will be constructed from Suntop Road along the western boundary of the Site (Lot 3 DP 506925) and will provide access to the substation. This will connect with an existing farm access road (running parallel to the top of an existing dam wall). A concept design for the access road is provided in **Appendix I.**

During detailed design and site investigation the existing sections of this access road will be reviewed to determine suitability for heavy vehicle access. If the existing formation is not considered suitable further works may be required such as strengthening and widening of the crest of the dam wall to allow widening of the road and reducing the approach and departure angles.

A temporary access would also be created from Suntop Road in the vicinity of the north-eastern corner of the Site (Lot 90 DP657805). This would provide access to the Site carpark and construction compound during construction.

During operations, access would also be required between the modules and inverter stations onsite for maintenance, however this would not need to be constructed access or delineated roads due to the low frequency of access.

All access and maintenance roads would be maintained throughout the construction and operation of the solar farm. The temporary access road on Lot 90 DP 657805 would be remediated to previous conditions at the end of the construction period.

**Intersection Upgrade**

The intersection of Suntop Road and Renshaw McGirr Way would be upgraded to meet AUSTROAD Guidelines, Dubbo Regional Council Engineering Standards and a safe intersection stopping distance (SISD) for 100km/h including:

- Removal of 19 trees to improve sight distances and facilitate upgrade works
- Installation of crash barriers on either side of Suntop Road at the intersection with Renshaw McGirr Way
- Rural Basic Right turn treatment to widen the should of Renshaw McGirr Way to allow through vehicles to pass to the left of the turning vehicles.

A concept design for the intersection upgrade is provided in **Appendix I**.

**Ancillary facilities and construction compound**

The proposed works will require the installation and use of a compound site and a construction laydown area to be located in the north-eastern portion of the Site on Lot 90 DP 657805 (Figure 3-6).
Temporary ancillary facilities associated with the compound site would include:

- Construction offices (one 12m x 3m site office, four 12 x 3m break rooms)
- Parking area
- Staff amenities
- CCTV (Security purposes).

**Perimeter Security Fencing**

The perimeter of the site would be fenced with security fencing at least 1.8m high with 24/7 surveillance cameras. The fence would be designed to ensure adequate access and exit points are provided during both the construction phase and ongoing operational life of the Proposal. An example is provided in Figure 3-9.



Figure 3-9: Example security fencing (chain link security fence)

**Operations**

Once operational the Solar Farm will be monitored and operated remotely therefore requiring minimal on-site maintenance personnel. A small area will be maintained for parking of utility vehicles during operation of the solar farm. Two 40' shipping containers for storage of maintenance equipment will be permanently situated within the Site on the compound areas used during construction.

### 3.3.2 Construction and Commissioning

***Construction Activities***

The construction and commissioning phase is expected to last approximately 12 months. The main construction activities are outlined in Table 3-1.

Table 3-1: Main Construction Activities by Stage

| Stage | Main activities |
|---|---|
| Site Establishment | • Installation of security measures including fencing<br>• Establishment of site compound, material layout and equipment wash down areas<br>• Ground preparation<br>• Installation of environmental controls in accordance with a detailed Construction Environmental Management Plan (CEMP)<br>• Vegetation clearing<br>• Targeted clearance of low laying vegetation around trenching areas<br>• Pile driven installation of PV mounting structures to minimise disturbance to existing ground cover<br>• Establishment of tree and vegetation protection measures as required<br>• Establishment of additional sedimentation and erosion controls as required. |
| Preliminary civil works | • Setting up foundations for the substation and inverter stations<br>• Drainage works (as required)<br>• Intersection upgrade works. |
| Install PV systems and cables | • Installation of steel post and rail foundation system for the solar panels<br>• Installation of PV panels and DC wiring beneath the panels<br>• Installation of electrical cabling including trenching for underground cabling and installation of inverter stations. |
| Construction of 132kV substation | • Site Establishment and clearing (if required)<br>• Bulk earthworks<br>• Detailed civil works including earthing, foundations<br>• Erection of steelwork, equipment, demountable buildings and transformers<br>• Electrical connections<br>• Install new poles<br>• Transmission line stringing for new conductor and OPGW from substation to existing 132 kV transmission line. |
| Intersection Works | Widening and trees<br>• Set up traffic control for safe working and traffic management and crew facilities<br>• Mark out and remove trees and clear away |

| Stage | Main activities |
|---|---|
| | • Excavate road edge area to be constructed for widening<br>• Prepare formation and lay drainage where required<br>• Construct road formation in layers and compact<br>• Install permanent signage.<br>• Remove traffic control, make good and open new road area.<br><br>Culvert protection<br>• Set up traffic control for safe working area, and set up crew facilities<br>• Set out support post positions<br>• Prepare foundations for posts and set in place<br>• Fit W or similar type barrier on posts<br>• Erect permanent road signage as required<br>• Remove traffic control and make good. |
| Rehabilitation and Commissioning | • Testing of electrical infrastructure<br>• Removal of temporary construction facilities and rehabilitation of disturbed areas<br>• Landscaping works based on the Landscape Plan (refer **Appendix C**). |

### *Earthworks*

While extensive earthworks are not proposed, some land forming (including localised cut and fill areas) may be undertaken to achieve more consistent gradients beneath the PV modules. Additionally, earthworks are required for trenching works and shoulder widening at the intersection of Suntop Road and Renshaw McGirr Way.

Ground disturbance, resulting from earthworks would be minimal and limited to:

- The installation of the piles supporting the solar panels, which would be driven into the ground to a depth of approximately 1.6m to 4m (depending on geological conditions)
- Concrete or steel pile foundations for the inverter stations, substation and maintenance storage containers
- Trenches up to 1.2m deep for the installation of cables
- Disturbance within the construction laydown area including works to flatten the surface. The construction laydown area will likely be lined with gravel over the top, this will be removed when the construction phase is complete.
- Establishment of temporary staff amenities for construction
- Construction of perimeter security fencing
- Vegetation clearance - groundcover and scattered paddock trees on Site and at the intersection of Suntop Road and Renshaw McGirr Way
- Shoulder widening at the intersection of Suntop Road and Renshaw McGirr Way.

The ground disturbance from pile foundations is estimated to equate to less than 1% of the total site area. Additional ground disturbance would result from trenches for cabling and footings for another infrastructure and vegetation removal.

Panels within the solar array area would sit above the ground and existing ground cover would be maintained underneath the panels.

### *Construction Hours and Duration*

Construction hours for the Proposal will be in accordance with the Interim Construction Noise Guidelines (ICNG) recommended standard hours as detailed below:

- Monday to Friday – 7am to 6pm
- Saturdays – 8am to 1pm
- Sundays or Public Holidays – No construction.

No audible out of hours or night works are proposed excluding emergencies. In the event construction is required outside of these hours, approval from relevant authorities and notification to the community would be undertaken.

## *Resourcing Requirements*

**Water**

Water use during construction would be limited to staff amenities (temporary portable toilets) and dust suppression. Water for dust suppression would be sourced on site from existing dams or trucked onto site. A diluted organic polymer agent is proposed to be used to reduce the quantity of water required for dust suppression activities.

Potable water would be trucked to the Site on as needs basis and stored within temporary water tanks at the staff amenities area.

**Labour**

It is estimated that up to 250 construction personnel would be required on site during peak construction period. Construction supervisors and construction labour force, made up of labourers and technicians are intended to be hired locally, where possible.

**Plant and equipment**

A range of plant and equipment would be used during construction including earth-moving equipment for civil works, cable trenching equipment, trucks, all terrain forklifts and mobile cranes.

The final list of plant and equipment would be determined by the construction contractor/s. An indicative list of plant and equipment is provided in Table 3-2

Table 3-2: Plant and equipment

| Equipment | Quantity | Model Type |
|---|---|---|
| Pile Driver | 10 | Gayk HRE 1000 or similar |
| All terrain fork-lift (tele handler) | 10 | Manitou MHT-X or similar |
| All terrain utility vehicle | 10 | John Deere XUV560 or similar |
| Backhoe | 5 | New Holland LB90B or similar |
| Excavator | 4 | Cat C13 ACERT or similar |
| Bulldozer | 4 | Cat C9.3 ACERT or similar |
| Scraper | 2 | Open Bowl Scrapers or similar |
| Roller | 4 | Vibratory Soil Compactors |
| Winches | 4 | Attached to medium sized dozers or similar |

| Equipment | Quantity | Model Type |
|---|---|---|
| Flatbed truck | 5 | Isuzu FVZ 1400 or similar |
| Mobile crane | 1 – 2 | KATO NK550VR or similar |
| Elevated work platforms | 1 | Bravi Lui 460 Elevated Work Platform 280kg Capacity or similar |
| Semi-trailers and tipper trucks | 5 | Roadwest End tipper or similar |
| Tree chipper | 1 | Vermeer AX19 or similar |

***Traffic volumes and requirements***

Section 6.5 provides an indication of the total overall one-way traffic movements anticipated throughout the construction and operational periods. The final traffic haulage route and number would be further detailed in the traffic management plan.

***Materials***

It is anticipated that PV infrastructure and associated materials would be transported via road from either Newcastle or Port Botany. This will include:

- Galvanized steel and Aluminium solar support structures
- Up to 550,000 Crystalline silicon solar PV panels with Aluminium frame
- 118 Inverters
- Substation components
- 2 x maintenance storage shipping containers
- Copper and Aluminium interconnection cabling
- Chain link perimeter fence with lockable access gates and three barbed wires at the top (1.8m in height)
- CCTV security system
- Crash barriers and road signs.

Materials associated with earthworks would likely include:

- Gravel / crushed rock to seal the access roads
- Liner with a gravel cap to seal the construction laydown area
- Sand for the bedding of cables that are to be buried throughout the Site
- Materials for shoulder widening including road sub base, concrete, road base, bitumen and gravel
- Drainage pipes, bedding shingle, geotextile
- Topsoil.

### 3.3.3 Operation

The construction phase of the proposal is anticipated to commence in the first quarter of 2019 and subsequently operational phase is anticipated to commence in the first quarter of 2020. Once operational, activities would include daily operations and maintenance.

This would include:

- Remote 24/7 on-line monitoring
- Scheduled visual inspections and general maintenance
- Repair and cleaning operations of the PV arrays (as required)

- Replacement of equipment and infrastructure (as required)
- Land management monitoring and activities including:
  - Maintenance of groundcover vegetation
  - Livestock management
  - Weed control
  - Erosion and Sediment control
  - Pest and vermin control.

The site will be monitored for security by a local security contractor and this will include 24 hour response should a security event occur.

***Hours of Operation***

The solar farm will generate electricity during daylight hours throughout the year. Daily operations and maintenance by site staff would be undertaken during standard working hours of:

- Monday – Friday 7am to 6pm
- Saturday - 8am to 1pm

Emergency response, inspections and maintenance activities may be required to be undertaken out of hours or night works, however these would be minimised where practicable.

Electricity would be produced by the solar panels during daylight hours and as such may continue to produce electricity outside of standard hours during summer months (i.e. longer days).

There would be no permanent night lighting operating on the Site. The substation will contain lighting to be utilised only during emergency response.

***Resourcing Requirements***

During the operational phase the proposal will support up to ten operational jobs. Minimal operational plant and equipment will be required for operation of the facility including ad hoc maintenance vehicles (Utility Vehicle Mazda BT-50 or similar) and other equipment associated with the activities outlined above.

On some occasions, such as during a major substation shutdown, additional maintenance staff may be required on site. During operation of the solar farm, water would be required for stock watering and vegetation management which would be supplied from existing on site dams plus existing bore water. When required water may also be trucked onto site. The water demands of the solar farm operation are small and likely to be less than the commensurate with the current demands from agriculture on the Site.

Emergency firefighting water would be stored in a tank (approx. 50,000L) located adjacent to the maintenance storage containers.

### 3.3.4 Decommissioning

The solar farm has an operational timeline of approximately 30 years following which the infrastructure would be reviewed and either:

- Updated - the plant would be updated for continued use (with the need for any additional approvals or modifications to approvals considered at this time); or
- Decommissioned - the plant will be permanently removed.

Should the decision be made to remove the plant, then the Site would be returned as close as possible to its existing condition and will be decommissioned as per standard solar plant isolation and disconnection procedures. Key elements of proposal decommissioning would include:

- The PV arrays would be removed, including the foundation posts
- Materials would be sorted and packaged for removal from the site for recycling or reuse. Much of the solar PV panels would be recyclable
- All equipment would be removed and materials recycled or reused, wherever possible
- All posts and cabling, and stabilising infrastructure (concrete footings) would be removed and recycled
- All areas of soil disturbed during decommissioning would be rehabilitated with the aim of meeting the existing (pre-construction) land capability
- Traffic required for decommissioning would be similar in type but considerably less in quantity than that required for the construction phase.

The substation may remain in place to service the locality subject to review of viability by TransGrid.

# 4. Statutory Assessment

## 4.1 Planning Pathway

Under Schedule 1, Part 20 of the *State Environmental Planning Policy (State and Regional Development) 2011* electricity generating works with a capital investment value of more than $30million, or a capital investment of more than $10million and located in an environmentally sensitive area of State significance, are deemed State Significant Developments (SSDs). The Proposed solar farm exceeds the $30million capital investment value, and is therefore declared SSD.

The proposal to construct and operate the Suntop Solar Farm requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). In accordance with section 4.12 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), a SSD requires an Environmental Impact Statement (EIS) to be submitted in tandem with the development application.

On 23 August 2017, the proponent submitted a Preliminary Environmental Assessment along with a request to the Secretary for the Secretary's Environmental Assessment Requirements (SEARs), as required by clause 3 of Schedule 2 of the EP&A Regulations. In formulating the environmental assessment requirements, requests were sent to relevant public authorities and agencies to inform the key issues raised in Section 6. The SEARs were issued to SSF on the 21 September 2017 refer **Appendix A** and are summarised in **Appendix B** including cross reference to where it has been addressed within this EIS.

This EIS complies with the requirements prescribed within the SEARs, and the environmental assessment requirements contained in Schedule 2 of the EP&A Regulations.

Part 4, Section 4.37 of the EP&A Act designates the Minister for Planning and Infrastructure as the approval authority for SSD however section 2.4 of the EP&A Act enables the Minister to delegate the consent authority function to the Independent Planning Commission (IPC), the Secretary or to any other public authority.

## 4.2 Evaluation of the Development

Section 4.15 of the EP&A Act applies to the determination of development applications for a SSD. Under Section 4.15, the consent authority is required to consider a number of matters when determining a development application under Part 4 (EP&A Act). These matters are listed in Table 4-1 and assessed in terms of their relevance to the proposal.

**Table 4-1 Matters of consideration**

| Provision | Relevance to the Proposal |
|---|---|
| Any environmental planning instrument | Relevant environmental planning instruments (EPIs) are discussed in Section 4.5. They include:<br>• *State Environmental Planning Policy (State and Regional Development) 2011*<br>• *State Environmental Planning Policy (Infrastructure) 2007*<br>• *State Environmental Planning Policy (Rural Lands) 2008*<br>• *State Environmental Planning Policy No. 55 – Remediation of Land*<br>• *Wellington Local Environmental Plan 2012* |
| Any proposed instrument that is or has been the subject of public consultation under the EP&A Act | There are no draft instruments relevant to the proposal |

| Provision | Relevance to the Proposal |
|---|---|
| and that has been notified to the consent authority | |
| Any development control plan | Clause 11 of the State and Regional Development (SRD) SEPP 2011 prescribes 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 under Section 93F | There are no planning agreements that have been entered into, or proposed, with regards to this proposal. |
| The regulations (to the extent that they prescribe matters for consideration) | Clause 92 of the EP&A Regulation requires consideration of:<br>• The Government Coastal Policy, for development application in certain local government areas<br>• The provisions of AS 2601 for development applications involving the demolition of structures<br>• The provisions of a subdivision order and a development plan for development of land that is subject to a subdivision order.<br><br>None of the above-mentioned developments are proposed in the Suntop Solar Farm.<br><br>• The provision of development under *the Dark Sky Planning Guideline.*<br>This Planning guideline was originally applied to the Dubbo Council LGA as it was within the prescribed distance from the Sidings Springs Observatory at Coonabarabran.<br>Prior to the amalgamation of Wellington and Dubbo LGA's, this guideline did not apply to areas within the Wellington LGA.<br>The development does not involve installation of lights that will be operational all night. Emergency lighting and sensor lights will be installed to assist with any emergencies. The type of light globe and their orientation will be in accordance with this guideline. |
| 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 | The Proposal is not within an area mapped as a Coastal Zone under the *Coastal Protection Act 1979*.<br>Therefore, any additional considerations under this act are not relevant to the Proposal. |
| 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 proposal, including environmental (built and natural), social and economic impacts in the locality, are detailed in Section 6 of the EIS. This EIS demonstrates that the environmental impacts of the proposal have, wherever feasibly possible, been avoided, minimised or mitigated through careful proposal design and detailed mitigation measures summarised in Section 8.1. |
| The suitability of the site for the development | The suitability of the Site for the proposal is discussed in Section 2.4. |
| Any submissions made in accordance with this Act or the regulations | The proponent is committed to address any submission made in relation to the Suntop Solar Farm. Consultation with stakeholders that has been undertaken during the planning stages are summarised in Section 5 |
| The public interest | The proposal is in the interest of the public for the following reasons: |

| Provision | Relevance to the Proposal |
|---|---|
| | • It will assist in the reduction of greenhouse gas emissions to further combat climate change<br>• It will provide a source of clean electricity generation<br>• It will directly contribute to aiding Australia in meeting the RET<br>• It will create localised economic benefits for the region, including employment, stimulation of local business' and diversification of land use, developing new skills in a growing industry.<br><br>A Community and other Stakeholder Engagement Plan (CSEP) was prepared and the outcomes of consultation undertaken in accordance with the plan is provided in Section 5. This plan aims to inform the community and stakeholders about the proposal and their role in providing input into the assessment and development process. |

## 4.3 NSW Legislation

### 4.3.1 Environmental Planning and Assessment Act 1979

*The Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal piece of legislation covering assessment and determination of development proposals in NSW. It aims to encourage the proper management, development and conservation of resources, environmental protection and ecologically sustainable development. The development assessment and approval system in NSW is set out in Parts 4 and 5 of the EP&A Act.

As noted in Section 4.1, the Proposal is classified as SSD in accordance with the State and Regional Development (SRD) SEPP and development consent is being sought under Part 4 of the EP&A Act.

The relevant objectives under the EP&A Act for this development are to:

- To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources
- To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment
- Encourage the promotion of and co-ordination of the orderly and economic use and development of land
- Encourage the protection of the Environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats
- To promote good design and amenity of the built environment
- Provide increased opportunity for public involvement and participation in environmental planning and assessment.

These objectives have been considered throughout the site selection and environmental assessment process. This Proposal aims to promote the orderly and economic use of land through the provision of utility services (power generation). During the site selection process, the location and design of the solar farm were considered, such that it would avoid protected areas and generally minimise the use of natural and artificial resources. Stakeholder consultation and engagement with the community began as early as feasible, to allow for public involvement and participation throughout the environmental assessment process.

**Authorisations not required for approved SSD**
Section 4.41 of the EP&A Act identifies authorisations that are not required for approved SSD. These are:

- Concurrence under Part 3 of the *Coastal Protection Act 1979* of the Minister administering that Part of that Act
- A permit under sections 201, 205 or 219 of the *Fisheries Management Act 1994*
- An approval under Part 4, or an excavation permit under Section 139, of the *Heritage Act 1977*
- An Aboriginal heritage impact permit (AHIP) under Section 90 of the *National Parks and Wildlife Act 1974*
- A bush-fire safety authority under Section 100B of the *Rural Fires Act 1997*
- A water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the *Water Management Act 2000*.

**Authorisations required for approved SSD**
Under Section 4.42 of the EP&A Act, certain approvals that may normally be required for carrying out certain development "*cannot be refused if it is necessary for carrying out State significant development that is authorised by a development consent…*", these being:

- An aquaculture permit under Section 144 of the *Fisheries Management Act 1994*
- An approval under Section 15 of the *Mine Subsidence Compensation Act 1961*
- A mining lease under the *Mining Act 1992*
- A production lease under the Petroleum (Onshore) Act 1991
- An environment protection licence under Chapter 3 of the Protection of the Environment Operations Act 1997 (for any purposes referred to in section 43 of that Act)
- A consent under section 138 of the Roads Act 1993
- A licence under the Pipelines Act 1967.

### 4.3.2 Environmental Planning and Assessment Regulations 2000

The EP&A Act and the EP&A Regulation provide the overarching structure for planning in NSW.

Clause 256P of the EP&A Regulation requires an accurate estimate of the capital investment value (CIV) of the development. A copy of the CIV report and the letter of landowner consent was provided to DP&E.

Division 6 (clauses 82 to 85B) specifies the conditions for public participation in SSD proposals. The Proposal and accompanying information (including this EIS) will be placed on public exhibition by DP&E for at least 30 days and the public must be appropriately notified of the application. Preparation of a response to issues raised in submissions to be submitted to the secretary, if required.

Clause 92 of the EP&A Regulations requires that the consent authority must consider certain matters when determining development applications (refer Section 4.3.2).

Clause 228 of the EP&A Regulation lists the factors that must be taken into account concerning the impact of an activity on the environment. These factors have been considered during preparation of the EIS.

Schedule 2 of the EP&A Regulation provides the requirements of Environmental Impact Statements, which provide the basis for the Secretary's Environmental Assessment Requirements (SEARs) issued for proposals. The relevant sections in the EIS are referenced against each of the SEARs in **Appendix B**. Clause 6 and 7 of Schedule 2 specifies the form and content requirements of the EIS.

### 4.3.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the Environmental Protection Authority (EPA) and includes provisions relating to the protection of the environment.

One of the objectives of the Act is to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development. There are serious offences under this Act for causing pollution of air, noise, water or land and obligations to notify Office of Environment and Heritage (OEH) when a "pollution incident" occurs that causes or threatens "material harm" to the environment. Suntop Solar Farm and the construction contractor would ensure that the construction, operation and decommissioning of the Proposal is managed to prevent pollution and any "pollution incidents" would be notified in accordance with the Act.

Section 48 of the POEO Act requires an Environmental Protection Licence (EPL) for premises which a scheduled activity is carried on. Scheduled activities are defined in Schedule 1 of the POEO Act. General electricity works, as described in Clause 17 of Schedule 1, requires an EPL where the activity has the capacity to generate more than 30 MW of electrical power. Wind power and Solar power are excluded from the definition of 'General electricity works,' hence an EPL is not required under the POEO Act for the proposed Solar Farm.

The POEO Act and *POEO (Waste) Regulations 2014* specify the legal requirements for the management of waste. There are serious offences under the POEO Act for the unlawful transportation and deposition of waste (Section 143). Waste management should be undertaken in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) such as ensuring that resource management options are considered against a hierarchy (avoidance, reuse, reprocess, recycle, energy recovery and disposal). Waste aspects of the Proposal are covered in Section 6.13.

### 4.3.4 Roads Act 1993

*Roads Act 1993* (Roads Act) provides for the classification of roads and for the declaration of the Roads and Maritime Services (Roads and Maritime) and other public authorities as roads authorities for both classified and unclassified roads.

The objectives of the Roads Act 1993 are to set out the rights of the public to access and use public roads, to establish procedures for opening and closing public roads, to provide for the classification of roads, to confer function of carrying out road work on Roads and Maritime Services (Roads and Maritime) and on other roads authorities and to regulate the carrying out of various activities on public roads.

Section 138 of the Roads Act requires consent be obtained prior to disturbing or undertaking work in, on or over a public road.

Consultation with Dubbo Regional Council and Roads and Maritime have been undertaken as outlined in Section 5. Further consultation will be undertaken during detailed design.

Proposed works associated with access to the Site is summarised in Section 6.5.

### 4.3.5 Local Land Services Act 2013

The *Native Vegetation Act 2003* was repealed on 25 August 2017. Legislation now governing the clearing of native vegetation is the *Local Land Services Act 2013*, and the *Biodiversity Conservation Act 2016*.

The *Local Land Services Amendment Act No 64*, Division 3 prescribes the regulation of clearing of native vegetation in regulated rural areas. In Section 60O of the Amendment, clearing of native vegetation in a

regulated rural area is authorised under Part 4 of the AP&A Act 1979. As development consent is being sought under Part 4 of the EP&A Act, authorisation for clearing of native vegetation is not required.

### 4.3.6 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BCA Act) aims to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The BCA Act replaces the *Threatened Species Conservation Act 1995* (TSC Act) as the key piece of legislation that identifies and protects threatened species, populations and ecological communities in NSW.

Under the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* this proposal is to be assessed in accordance with the Framework for Biodiversity Assessment (FBA), given the SEARs have been issued and the field data has been collected under the FBA.

As the proposal is a SSD and the Planning Agency Head and/or Environment Agency Head have not specified that the proposal is unlikely to have any significant impact on biodiversity values, as such a flora and fauna assessment has been prepared as part of the EIS.

Three days of comprehensive field survey were undertaken on the 29th November 2017, 15th January 2018 and 8th May 2018 by FloraSearch of Orange. One threatened ecological community (TEC) listed under the BC Act and the EPBC Act is considered to once have occupied the Site, but this has been reduced by clearing to a few scattered paddock trees. The site is predominantly vegetated with common pasture species or cultivated annual crops such as wheat. A roadside remnant of the Box Gum Woodland EEC was identified adjacent Renshaw McGirr Way within the proposed intersection upgrade footprint.

A Biodiversity Development Assessment Report (BDAR) has been prepared (refer Section 6.1 and **Appendix D**).

### 4.3.7 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides the basis for the legal protection and management of Aboriginal sites within NSW. The Director-General of the National Parks and Wildlife Service (NPWS) is responsible for the management of all national parks, historic sites, nature reserves, reserves, Aboriginal areas and State game reserves listed under the NPW Act. The Director-General is also responsible for the protection and care of native fauna and flora throughout NSW.

The Site is not in or in close vicinity to a protected area, as defined in the NPW Act and the provisions of the Act have been considered and addressed in Section 6.1.

Part 6 of the NPW Act provide statutory protection for Aboriginal objects and places.

An assessment of the potential to impact Aboriginal Heritage is provided in Section 6.2.1 and **Appendix E** and includes the management and mitigation measures that will be implemented as part of the Proposal to ensure protection of any existing or un-expected Aboriginal heritage finds.

It is noted that under Section 4.41 of the EP&A Act, an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act is not required for a SSD.

### 4.3.8 Crown Lands Act 1989

The *Crown Lands Act 1989* ensures that Crown land is managed for the benefit of the people of New South Wales. The *Crown Lands Act* 1989 provides for the administration and management of Crown Land in the eastern and central divisions of NSW. Crown land may not be occupied, used, sold, leased, dedicated,

reserved or otherwise dealt with unless authorised by this Act or the *Crown Land (Continued Tenures) Act* 1989. The Minister may grant a "*relevant interest*" such as a lease, licence or permit, over Crown Land for the purposes of any infrastructure, activity or other purpose that the Minister thinks fit.

There is a Crown Road (paper Road) located on the western boundary of Lot 3 DP506925. This road forms part of land to be subdivided as part of the Proposal as described in Section 4.5.6 and as such would be retained by the existing landowner. It will not be located on the Site for this Proposal. There is no other Crown Land associated with the Site.

### 4.3.9 Heritage Act 1977

The *Heritage Act 1977* provides for the conservation of items of environmental heritage in NSW. The Act defines heritage as items or places that are of state and/ or local heritage significance and include: places, buildings, works, relics, moveable objects and precincts. As part of NSW heritage protection and management the Act establishes a register including an inventory and list to protect the listed items.

According to the Office of Environment and Heritage, no items of state significant heritage have been found on the site, as listed in the NSW Heritage and Conservation Register.

An assessment of impact to Heritage is provided in Section 6.2.

### 4.3.10 Rural Fires Act 1997

The *Rural Fires Act* 1997 (Rural Fires Act) provides for the preparation, mitigation and suppression of bush and other fires in local government areas and to provide protection of persons, infrastructure and environment, economic, cultural, agricultural and community assets from damage arising from fire.

The requirement to obtain a Bushfire Safety Authority under s100B of the *Rural Fires Act* 1997 is triggered for developments on bushfire prone land for a 'special fire protection purpose', which does not include the development of a solar farm. On the basis that the proposal is SSD, and is not listed as a 'special fire protection purpose', this approval will not be required in accordance with Section 4.41 of the EP&A Act.

Additionally, a search of the Rural Fire Service (RFS) was conducted on 12th April 2018 which concluded that the Site is not mapped as fire prone land (RFS 2017). An assessment of bush fire impacts is provided in Section 6.9 and **Appendix F**).

### 4.3.11 Water Management Act 2000

The objectives of the *Water Management Act* 2000 (WM Act) are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. The provisions of the WM Act are being progressively implemented in NSW, repealing various other pieces of legislation in the process. Under this Act, licences and approvals are required for certain activities and works, including dewatering excavations and groundwater interference.

The Proposal is within the area applicable to the *Water Sharing Plan for the Macquarie and Cudgegong Regulated Rivers Water Source 2016*, prepared in accordance with the provisions of the WM Act. The plan includes rules for protecting the environment, water extractions, managing licence holders' water accounts, and water trading in the plan area.

The water source in respect of this Plan is that between the banks of all rivers, from the upstream limit of Windamere Dam water storage downstream to the junctions of the Macquarie River and its effluent rivers with the Barwon River. This plan does not apply to water contained within aquifer water sources underlying the area or to water on land adjacent to this water source.

The proposal does not involve extraction of groundwater for commercial purposes such as irrigation or industrial use, however, some water may need to be accessed for continued stock and domestic purposes

The region surrounding the Site is not mapped within the Department of Primary Industries 'high priority Groundwater Dependent Ecosystem' (GDE) map.

### 4.3.12 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve native fish stocks and key habitats to conserve the biological diversity of aquatic fauna and flora. The FM Act also intends to promote viable commercial fishing, aquaculture industries and recreational fishing opportunities. Threatened species, populations and ecological communities, and key threatening processes are listed in the FM Acts' Schedules.

Section 192 of the FM Act claims that a habitat protection plan may be determined for the protection for critical habitat declared under Part 7A. The proposed site location is not identified by the Department of Primary Industries Register of critical habitat.

An unnamed creek runs through the Site and flows into Barney's Creek, approximately 2.5km north of the Site. This unnamed creek is classified as a first order stream, as it is located at the top of a catchment as a 'headwater' flow. Flows in this waterway are intermittent and would be unlikely to be able to support viable populations of fish.

### 4.3.13 Biosecurity Act 2015

The *Biosecurity Act 2015* aims to provide modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. The *Biosecurity Act 2015* replaces the *Noxious Weeds Act 1993* as the key piece of legislation that identifies and manages State and regional priorities for weeds in New South Wales, Australia.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. According to this Act, any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Upon inspection of the strategic weed management plan for the Wellington, no listed priority weed species have been identified to exist on the Site.

## 4.4 Commonwealth Legislation

### 4.4.1 Environment 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 (DoE) and provides a legal framework to protect and manage nationally important flora, fauna, ecological communities and heritage places defined as '*matters of national environmental significance*' (MNES). An action that "*has, will have or is likely to have a significant impact on a matter of National Environmental Significance"* (MNES) may not be undertaken without prior approval from the Commonwealth Minister, as provided under Part 9 of the EPBC Act.

A referral must be made for actions that are likely to have a significant impact on the following matters protected by Part 3 of the EPBC Act:

- World heritage properties
- National heritage places
- Wetlands of International importance

- Listed nationally threatened species and ecological communities
- Listed migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions including uranium mining
- Water resources in relation to coal seam gas or large mining development.

### *World Heritage Properties*

The Site does not contain any World Heritage Properties and is not in close proximity to any such area. On this basis, the Proposal will not impact upon any World Heritage Property either directly or indirectly.

### *National Heritage Places*

The Proposal Area does not contain any National Heritage Places and is not in close proximity to any such area. On this basis, the Proposal will not impact upon any National Heritage Place either directly or indirectly.

### *Wetlands of International Importance (declared RAMSAR Wetlands)*

The Proposal Area is not located within Wetlands of International Importance and is not in close proximity to any such area. On this basis, the Proposal will not impact upon any Wetlands of International Importance (declared RAMSAR Wetlands) either directly or indirectly.

### *Great Barrier Reef Marine Park*

The Great Barrier Reef Marine Park does not occur within or near to the Proposal Area. On this basis, the Proposal will not impact upon any areas of the Great Barrier Reef Marine Park.

### *Commonwealth Marine Areas*

The Site is not located within a Commonwealth Marine Area and is not in close proximity to any such area. On this basis, the Proposal will not impact upon any Commonwealth Marine Area.

### *Listed Threatened Ecological Communities*

Two Threatened Ecological Communities listed under the EPBC Act have been recorded within a 20km radius of the Proposal. These are;

- White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland.
- Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.

As detailed, the Site has been cleared of the majority of native vegetation. The Proposal involves the removal of a very small number of isolated paddock trees and some disturbance to groundcover during construction. The removal of this vegetation is unlikely to impact any threatened ecological communities.

Works associated with the intersection upgrade at Suntop Road and Renshaw McGirr Way will include removal of 0.04ha of Box-Gum Woodland EEC.

### *Nationally Listed Threatened Species*

A total of 27 threatened species listed under the EPBC Act have been recorded or have suitable habitat within a 10km radius of the Proposal.

Of the listed threatened flora species, none are likely to occur on the Site. All the species are wide ranging and would be unlikely to be exclusively reliant on-site habitats for their life cycle requirements.

Of the 19 threatened fauna species, five have the potential to occur (Regent Honeyeater, Swift Parrot, Painted Honeyeater, Corben's Long-eared Bat and the Grey-headed Flying Fox). The main type of impact on fauna that would occur as a result of the Proposal would be the removal of native trees. The small number of trees to be removed are in poor condition, isolated and do not possess habitat features such as hollows. In addition to this, the fauna impact assessment conducted for the Site identified that no threatened fauna is likely to be affected to the point that a local population would be placed at risk of extinction (see **Appendix D**).

#### *Nationally Listed Migratory Species*

A total of 12 migratory species listed under the EPBC Act have been recorded or have potential suitable habitat within a 10km radius of the Proposal.

No migratory species listed under the EPBC Act was recorded nearby the Subject Land during the current surveys. The Proposal is unlikely to significantly impact any listed migratory species under the EPBC Act, as the Site does not possess any important habitat that would be used by migratory species.

#### *Nationally Listed Marine Species*

A total of 16 marine species listed under the EPBC Act have been recorded or have potential suitable habitat within a 10km radius to the Proposal. However as there is no suitable habitat onsite for these marine species no potential impact has been identified.

### 4.4.2 Native Title Act 1993

The *Native Title Act* 1993 recognises that Aboriginal people have rights and interests to land and waters which derives from their traditional laws and customs. Native title may be recognised in places where Indigenous people continue to follow their traditional laws and customs and have maintained a link with their traditional country. It can be negotiated through a Native Title Claim, an Indigenous Land Use Agreement (ILUA) or future act agreements.

An ILUA is an agreement between a native title group and other parties who use or manage the land and waters. The ILUA process allows for negotiation between indigenous groups and other parties over the use and management of land and water resources, and the ability to establish a formal agreement. An ILUA is binding once it has been registered on the Native Title Tribunal 's Register of Indigenous Land Use Agreements.

Searches of the National Native Title Register, the Register of Native Title Claims, and Native Title Applications Registration Decisions and Determinations, in March 2018 identified no current applications or determinations within Dubbo Regional Council LGA (Wellington area) that are relevant to the Site.

Section 6.2.1 outlines management and mitigation measures that will be implemented as part of the Proposal to ensure protection of any un-expected Indigenous heritage finds.

### 4.4.3 Renewable Energy (Electricity) Act 2000

The *Renewable Energy (Electricity) Act* 2000 aims to;

- Encourage the generation of electricity from renewable sources
- Ensure renewable energy sources align with the principals of Ecologically Sustainable Development
- Reduce GHG emissions produces by the electricity sector.

- Solar energy is listed as an eligible renewable energy source under Section 17 of this Act.

The proposed Solar Farm aligns with the aims of *the Renewable Energy (Electricity) Act*, such that it will generate significant quantities of renewable energy, whilst emitting negligible GHG emissions. The principles of Ecologically Sustainable Development have been addressed in Section 9.3.

## 4.5 Other Relevant Policies and Plans

### 4.5.1 State Environmental Planning Policy (State and Regional Development) 2011

Under Schedule 1, Part 20 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) electricity generating works with a capital investment value of more than $30million or a capital investment of more than $10 million and located in an environmentally sensitive area of State significance are deemed state significant developments.

The solar farm has an estimated capital investment value greater than $30 million and is therefore classified as '*state significant development*'. Under Part 4, clause 39 of the EP&A Act, an Environmental Impact Statement (EIS) must be prepared and submitted to Department of Planning and Environment (DP&E) for approval. The EIS has been prepared in accordance with the SEARs issued by DP&E.

### 4.5.2 State Environmental Planning Policy (Infrastructure) 2007

*State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) aims to enable the efficient delivery of infrastructure across NSW, provide a consistent planning regime for infrastructure, providing greater flexibility in the location of infrastructure and service facilities and identifying the environmental assessment category into which different types of infrastructure and services development fall.

Clause 34(7) of the SEPP provides that development for the purpose of '*solar energy systems*' may be carried out with consent on any land, except as prescribed by sub clause 34(8). The solar farm is located within a Rural Landscape (RU1) zone and is permissible with consent under the ISEPP.

Clause 45 of the ISEPP will also apply as the Site intends to connect with existing transmission lines that traverse the boundary of the Site and as such has the potential to affect an electricity transmission line.

Clause 104 of ISEPP refers to traffic generating developments. Schedule 3 lists the types of developments that must be referred to Roads and Maritime Services (Roads and Maritime). Clause 104 also applies to developments that have the capacity to accommodate 200 or more vehicles. Clause 104 does not apply as traffic generated is below the trigger and Schedule 3 does not include electricity generating works.

### 4.5.3 State Environmental Planning Policy (Rural Lands) 2008

*State Environmental Planning Policy (Rural Lands) 2008* aims to identify Rural Planning Principles to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State. This Policy encourages the identification and protection of natural resources, having regard to maintaining biodiversity, the protection of native vegetation, the importance of water resources and avoiding constrained land. Local Environmental Plans developed by councils with land relevant to this Policy must consider a list of Rural Planning Principles stated within Part 2 Clause 7 of this Act.

Part (a) of Clause 7 states that councils should consider '*the promotion and protection of opportunities for current and potential productive and sustainable economic activities in rural areas*.' The proposed Solar Farm complies with this Clause as this development will provide socioeconomic benefits during the duration of the Proposal, as well as agricultural land use opportunities (grazing) occurring throughout the Proposal life cycle, and subsequent to decommissioning.

The proposal complies with the SEPP objectives as it still facilitates agricultural land use through sheep grazing and has considered land use conflicts by completing a land use risk assessment (Section 6.6)

Schedule 2 of this State Environmental Planning Policy does not list any land that is considered State significant agricultural land, therefore this site is not considered to be state significant agricultural land.

### 4.5.4 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

This policy recognises the importance of mining, petroleum production and extractive industries to NSW. This policy aims to:

- Provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State
- Facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources
- Establish a gateway assessment process for certain mining and petroleum (oil and gas) development:
  - To recognise the importance of agricultural resources, and
  - To ensure protection of strategic agricultural land and water resources, and
  - To ensure a balanced use of land by potentially competing industries, and
  - To provide for the sustainable growth of mining, petroleum and agricultural industries.

Identify if the land is located on or near:

- State or regionally significant resources of minerals, petroleum, or extractive materials
- extraction related activities on surrounding land which will be affected
- biophysical strategic agricultural land
- any mining licences.

A very small section of the south-western corner of the Site is subject to Exploration Licence 8463 (EL8463). Consultation with the Licence holder has taken place as required under the SEARS and is detailed in Section 5 of the EIS.

### 4.5.5 State Environmental Planning Policy No. 44 – Koala Habitat Protection

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline. This policy achieves this aim by:

- Requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat
- Encouraging the identification of areas of core koala habitat
- Encouraging the inclusion of areas of core koala habitat in environment protection zones.

Three of the remnant eucalypt species on and around the Subject Land are recognised as secondary Koala food trees (OEH, 2018e), these being, Inland Grey Box, Fuzzy Box and White Box. The last of these is listed as a Koala feed tree in Schedule 2 of SEPP 44. However, the Site does not have an extant Koala population (Biosphere Environmental Consultants, 2018) and is not classified as 'core' Koala habitat, therefore a SEPP 44 plan of management is not required.

### 4.5.6 Wellington Local Environment Plan (2012)

The Proposal is located within the Dubbo Local Government Area (LGA) and the relevant local planning instrument is the Wellington Local Environmental Plan (LEP) 2012.

**Subdivision of land**
SSF has a purchase agreement with the landholders for Lots 1, 2 and part Lot 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 including a vacant residence.

A subdivision of Lot 3 DP 506925 is proposed as part of the purchase agreement, such that the current Landowner can continue to operate separately from the proposed solar farm (Lot 1). The existing Lot layout is provided in Figure 4-1 and the subdivision proposed by SSF is shown in Figure 4-2.

The subdivision comprises:

- Lot 1 - formerly a 4ha portion of Lot 3 DP 506925 comprising an access road and farm buildings; and
- Lot 2 – the remaining 513ha of Lot 3 DP506925 plus Lots 1 and 2 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 including agricultural paddocks and a vacant residential building.

No new dwelling entitlement will be attached to either of the newly created lots, and the current dwelling will be attached to the larger of the two lots to comply with the Wellington LEP.

The Wellington LEP designates the Site as 'AF' on the Lot Size Map Sheet LSZ_004, where the minimum lot size is 400ha. Section 2.6 of the Wellington LEP states that the size of any lot resulting from subdivision of land to which this clause applies is not to be less than shown on the Lot Size Map.

The smaller of the two new lots will not be compliant with this clause. However, Section 4.38 of the EP&A Act allows the consent authority to grant development consent to a State Significant Development which may be partly prohibited by an environmental planning instrument. Accordingly, development consent may be granted, inclusive of this subdivision.

As the proposal will be assessed under Part 4 of the EP&A Act the consent and land use provisions of the LEP do not apply. Relevant provisions of the LEP to the development are listed in Table 4-2.

Table 4-2 Relevant provisions from the Wellington LEP

| Relevant objectives | Relevance to the Proposal |
|---|---|
| Land use zones | The LEP designates the site of the proposed works is zoned as Primary Production (RU1).<br>The objectives of this zone are:<br>• To encourage sustainable primary industry production by maintaining and enhancing the natural resource base<br>• To encourage diversity in primary industry enterprises and systems appropriate for the area<br>• To minimise the fragmentation and alienation of resource lands<br>• To minimise conflict between land uses within this zone and land uses within adjoining zones<br>• To provide for a range of tourism-related uses that support the agricultural industry or are compatible with agricultural uses.<br><br>The Proposal is generally compliant with these objectives as it: |

| Relevant objectives | Relevance to the Proposal |
|---|---|
| | • Is an ecologically sustainable rural land use which provides socio-economic benefits to the region, generates renewable energy and enables limited agricultural use of the Site to continue<br>• Is complementary to surrounding land uses<br>• Is highly reversible and will not impact the future productivity of the land.<br><br>Electricity generation is not listed among developments which are permitted consent for this zone however, under clause 34(7) of the ISEPP the Proposal is permissible with consent. |
| Heritage conservation | The objectives of this clause are to:<br>• Conserve the environmental heritage of Wellington.<br>• Conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views.<br>• Conserve archaeological sites.<br>• Conserve Aboriginal objects and Aboriginal places of heritage significance.<br><br>The Site contains three items of Aboriginal cultural significance which are located outside the proposed footprint for development. The Wellington Local Aboriginal Land Council (WLALC) have supplied a report outlining their agreement to the proposal with the recommendation of protecting these items through their inclusion and listing in a Construction Environmental Management Plan (CEMP). Refer to Section 6.2 and **Appendix E**. |
| Bush fire hazard reduction | The land of the proposed site is not mapped as bush fire vulnerable.<br>Potential impacts are addressed in Section 6.9. |
| Essential services | Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the development are available:<br>• The supply of water<br>• The supply of electricity<br>• The disposal and management of sewage<br>• Stormwater drainage or on-site conservation<br>• Suitable road access.<br>The development will not require a water supply or sewage disposal and management. These services will be transported onto and off the site temporarily during construction.<br><br>A permanent 50,000L water tank will be located near the substation for fire-fighting purposes. The development will supply electricity and will not impact existing storm water drainage.<br><br>Road access is addressed in Section 6.5. |

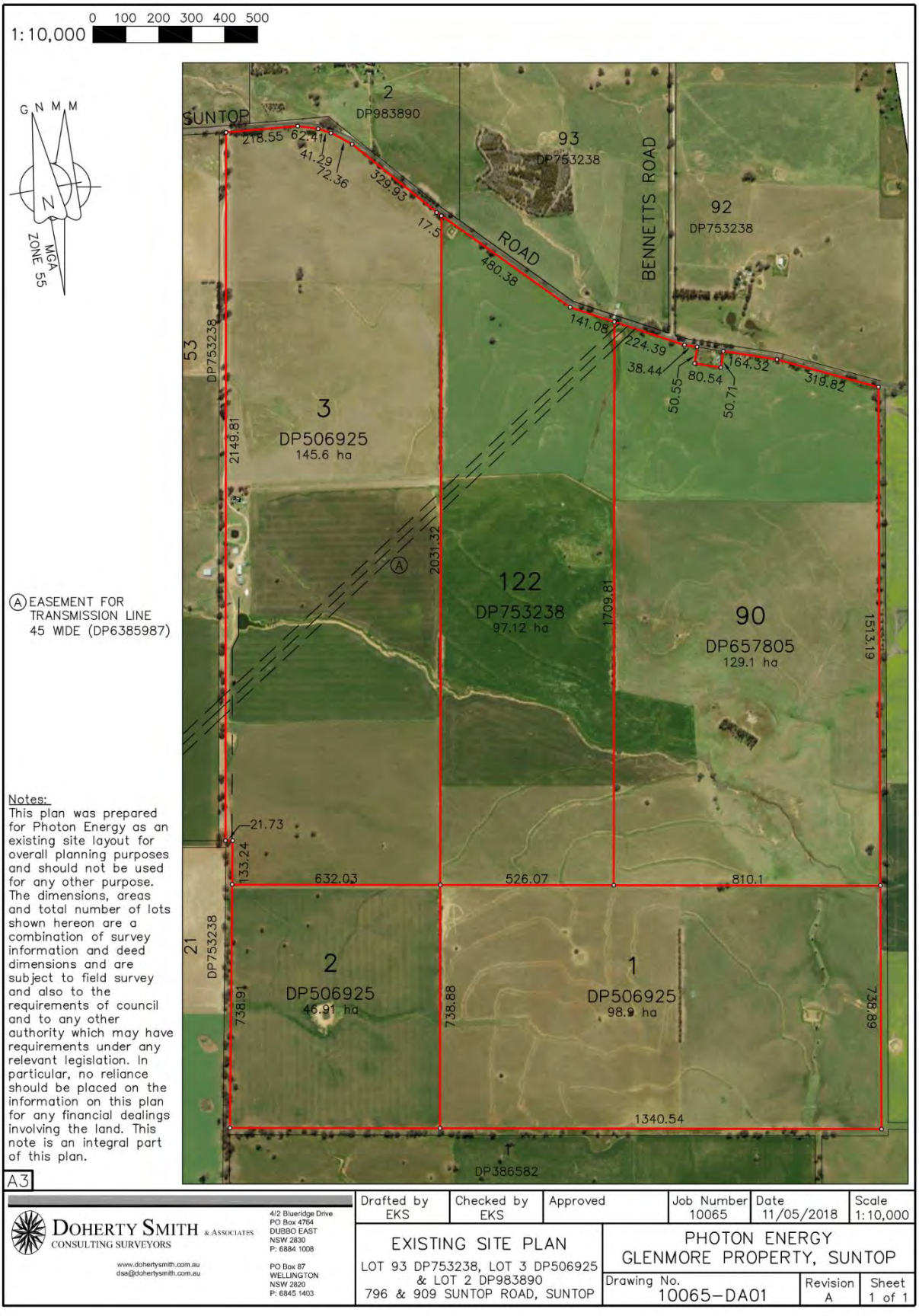



Figure 4-1 Existing Site Plan with current Lots

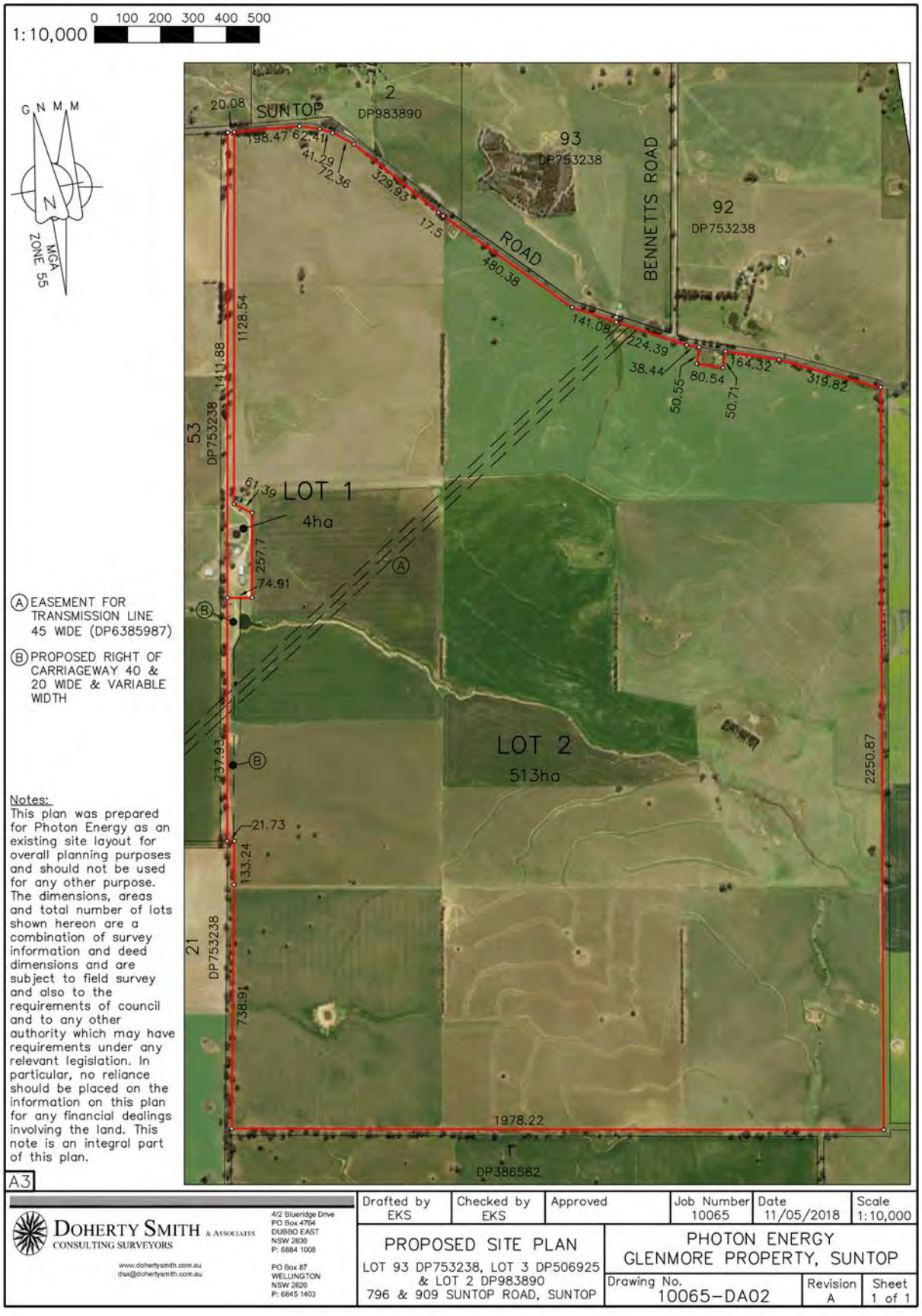



Figure 4-2 Proposed new lot layout following subdivision

## 4.6 Summary of Licenses and Approvals

Table 4-3 provides a summary of the licenses and approvals required for the proposed Suntop Solar farm.

**Table 4-3 Licences and Approvals**

| Legal Instrument | License or Approval |
|---|---|
| *EP&A Act 1997* – Part 4 | Development consent is required under Part 4 of the EP&A Act. |
| *Roads Act 1993* | Section 138 approval for work within a public road, Suntop Road access. |

# 5. Stakeholder Consultation

## 5.1 Overview

A Community and Stakeholder Engagement Plan (CSEP) was prepared in November 2017 in accordance with *The Community and Stakeholder Engagement Draft Environmental Assessment Guidance Series June 2017* (Draft Guidelines) prepared by DP&E. The CSEP documented the objectives of engagement, identification of relevant stakeholders, as well as the community and potential issues associated with the development. The CSEP also included an implementation plan which was updated as required through the duration of the community and stakeholder engagement. Table 6 from the CSEP outlines the implementation plan, which has been the guiding document used throughout stakeholder engagement (**Appendix G**).

The objectives of the CSEP included:

- Developing a process for listening to the community and stakeholders regarding concerns over the development
- Providing information of the proposed development including the rationale
- Identifying stakeholders and engaging with them
- Providing the community and other stakeholders with the opportunity to inform design, where required
- Seeking feedback and comments on the proposed development
- Identifying engagement requirements through the EIS, Submission, Determination and post approvals stage of the proposed development.

The following is a summary of the engagement undertaken with stakeholders and the community. As a result of the engagement several elements of design were reconsidered and incorporated into the final design (refer to Section 5.10).

## 5.2 Identified Stakeholders

The following stakeholders were identified:

- Adjacent landholders (referred to as Sensitive Receivers see Figure 5-2)
- Suntop community (via a community meeting)
- Dubbo Regional Council
- Government Agencies including:
  - Department of Planning and Environment (DP&E)
  - Office of Environment and Heritage (OEH)
  - Department of Primary Industries (Water & Lands)
  - Department of Resources and Geosciences
  - Roads and Maritime Service
  - Rural Fire Service
- Neighbouring Industry
  - Civil Aviation Safety Authority (CASA)
  - TransGrid
- Mineral Titleholders
- Wellington Local Aboriginal Land Council (LALC).

## 5.3 Government Agency Consultation

pitt&sherry undertook further consultation with relevant government agencies, subsequent to consultation conducted by DP&E. This consultation aimed to seek additional guidance from relevant authorities and clarify items identified in the SEARs.

Table 5-1 Summary of Agency Consultation through the development phase

| Stake holder | Date | Details of Engagement | Key Aspects | Outcomes |
|---|---|---|---|---|
| DP&E | 19/12/ 2017 | Meeting<br>A review of the seven Photon Solar projects were presented to DP&E, including Suntop. | • Substation location<br>• Traffic – potential traffic through Wellington and the potential for a mustering point in Wellington.<br>• Cumulative Impacts. | It was discussed with DP&E that SSF would address council's advice to locate the substation away from Suntop Road, to minimise visual impact. pitt&sherry updated DP&E on the ongoing discussions with council and the traffic impact specialist around the potential for road upgrades. After consideration of potential mustering points, it was decided to exclude B doubles so there is no need for a mustering point. DP&E also raised that they require each specialist report to address cumulative impacts, specifically relating to multiple solar projects being constructed in the region. |
| | 14/02/ 2018 | Meeting<br>Update of progress on each property. Including Suntop. | • General project update. | Information regarding key issues i.e. traffic and road upgrades |
| Roads and Maritime Services | Octob-er 2017 | Phone calls & Emails<br>Ongoing<br>RMS Manager of Land Use Assessment | • Impact of construction through truck movements on the road network<br>• Access to the property<br>• Intersection performance, specifically upgrades required for Renshaw McGirr Way and Suntop Road<br>• Potential reflection of the solar panels causing driver nuisance | The potential transport route was assessed in Traffic Impact Assessment (TIA).<br><br>It is considered the potential traffic impact on the Mitchell Highway and Renshaw McGirr Way will be minimal. Refer to **Appendix H** for the TIA. Access to the property via local roads was discussed with Dubbo Regional Council on multiple occasions (**Appendix G**).<br>The intersection between Renshaw McGirr Way and Suntop Road has been discussed with Roads and Maritime and Dubbo Regional Council, proposed upgrades are outlined in **Appendix H**. |

| Stake holder | Date | Details of Engagement | Key Aspects | Outcomes |
|---|---|---|---|---|
| | | | • Driver code of conduct, and protocol for drivers travelling long distances to and from site (driver fatigue)<br>• Impact on road safety, including to pedestrians, cyclists and any bus routes impacted.<br>• Details on road upgrades or Road Safety Audit if required. | Due to the distance from Suntop Road, reflection causing a nuisance to drivers is not considered to be an issue.<br><br>A traffic management plan will be developed as part of the CEMP. The driver code of conduct is provided in the TIA (refer **Appendix H**). It specifically addresses driver fatigue management and hours of vehicle movements. Following consultation with Dubbo Regional Council & the community, SSF are assessing the feasibility of vehicle movement exclusion times during school start/ends times.<br><br>A Road Safety Audit has not been identified as being required for this proposed development. |
| SES Macquarie Headquart-ers | 03/05/ 2018 | Letter Requesting a response to proposed development (see **Appendix G**). | • Review the potential development impacts on community emergency management arrangements for flooding. | No response from SES has been received as of 7/5/18. |
| OEH | Ongoi-ng | Phone calls Heritage specialist liaised with OEH to inform Aboriginal consultation process and outcomes.<br><br>Phone calls Pitt&sherry discussed with the North West Regional operations Division of OEH to request the removal of All conditions under the | • Aboriginal cultural heritage items have the potential to occur on site<br>• Water (potential impact on hydrology and water quality) and soils (potential for acid-sulphate soils)<br>• Flooding – impact of the proposed development on existing flood behaviour | The Aboriginal Heritage specialist has addressed concerns raised by OEH. Aboriginal Heritage Impact Assessment, located in **Appendix E** of the EIS.<br><br>Section 6.7 and Section 6.8of the EIS addresses the proposed developments' potential impacts and mitigation methods for hydrology and soils.<br><br>pitt&sherry confirmed with OEH Senior Conservation Planning Officer that Sections 10 – 14 (Attachment A Standard Environmental Assessment Requirements) would not be required for the Suntop Solar EIS. Correspondence is provided in **Appendix G**. |

| Stake holder | Date | Details of Engagement | Key Aspects | Outcomes |
|---|---|---|---|---|
| | | **'Flooding and Coastal Erosion'** section of Attachment "A" Standard Environmental Assessment Requirements (27/02/2018) | | |
| DPI Wellington | Ongoing | Phone DPI Wellington: Asked for comment on salinity issues in district. | • Impact on change of land use to salinity. | pitt&sherry contacted the Principal Salinity Officer at DPI – Wellington. Commented that if the site is sown to improved pastures and actively grazed, this would have a positive impact on salinity levels in this area. |
| Water NSW (Dubbo Office) | Ongoing | Phone Advice surrounding existing Bores on site | • Bore location on site, and potential for new Bores to be drilled in adjacent property. | Discussions with the Water Regulation Officer confirmed that the three bores identified by pitt&sherry were the only registered bores near the proposed site location. |
| RFS | 22/11/2018 | Bushfire impact specialist consulted with the RFS, to be advised on fire history, resources, mitigation measures and fire suppression. | • Grass/cropping fire impacts<br>• Potential hazards to firefighters<br>• Vehicle access and defendable space<br>• Impacts on community emergency management arrangements | The Bushfire specialist has addressed concerns raised by RFS during consultation within the Bushfire report, **Appendix F**. The contact with RFS was via phone and face to face at their Office. |
| TransGrid | 09/10/2017<br><br>17/10/2017<br><br>24/10/2017 | Meeting **Pitt&sherry** met with TransGrid to discuss substation design<br><br>Letter Request for Information<br><br>Letter TransGrid response to RFI<br><br>Multiple Emails | • Location of the substation<br>• Capacity of the current infrastructure to receive proposed volts<br>• Cumulative impacts | Continual engagement with TransGrid, has allowed for them to provide input throughout the design process. This has mitigated the potential for the final solar farm design to not align with the expectations of TransGrid. |

| Stake holder | Date | Details of Engagement | Key Aspects | Outcomes |
|---|---|---|---|---|
| | | Were exchanged as further information as required | | |
| Civil Aviation Safety Authority (CASA) | 16/01/ 2018 | Letter Request to comment on the proposal | Ensure that the solar PV panels are safe and pose no risk to pilots, air traffic controllers, or airport operations. | **pitt&sherry** received an unofficial email response on 22/01/2018, saying there are no concerns with the proposed development.<br><br>Refer to **Appendix G**. |

## 5.4 Dubbo Regional Council

SSF and pitt&sherry have held four meetings with Dubbo Regional Council to discuss the development. Meetings have been held at the Dubbo Regional Council offices with the following council representatives:

14 September 2017

- Darryll Quigley – Statutory Planning Services Team Leader
- Attended by representatives from Photon Energy only.

23 November 2017

- Shannon Starr – Economic Development Officer
- Josie Howard – Manager Economic Development and Marketing
- Darryll Quigley – Statutory Planning Services Team Leader
- Musarrat Khan – Senior Development Engineer.

6 February 2018

- Darryll Quigley – Statutory Planning Services Team Leader
- Musarrat Khan – Senior Development Engineer
- Steven Clayton – Manager Transport and Emergency.

30 April 2018

- Musarrat Khan – Senior Development Engineer.

Table 5-2 includes the key concerns raised by Dubbo Regional Council from their response to the SEARs and subsequent consultation.

Table 5-2 Key concerns raised by Dubbo Regional Council during consultation

| Key concern | Outcome of Engagement |
|---|---|
| Identification of all safety concerns for all proposed routes. | Assessment of all proposed routes have been provided in the Traffic Impact Assessment (TIA), **Appendix H.** There have been multiple iterations of the TIA to incorporate council and Roads and Maritime feedback. A key outcome of this |

| Key concern | Outcome of Engagement |
|---|---|
| | discussion has been the proposed upgrade of the intersection of Renshaw McGirr Way and Suntop Road. The concept design is located in **Appendix H**. |
| Degradation of the condition of Suntop Road due to increased traffic. | A dilapidation survey of Suntop Road will be carried out before construction. |
| Local employment, accommodation and transport. Including the cumulative impact of annual events and other proposed developments. | Opportunities for local employment and accommodation have been addressed within the Socio-Economic Impact Assessment, Section 6.12.<br>All attempts will be made to hire local resources for undertaking the construction. If this is not possible, skilled employment will be sourced from further afield, most likely Dubbo / within the Region. Some of the temporary workers will stay in Wellington and be transported to site each day.<br>The Council Economic Development Officer discussed opportunities for involved local industries through industry breakfasts. SSF will participate in these to source local contractors and labour. |
| Sourcing skilled workers. Potential opportunities for sponsorship in workforce training programs. | SSF is coordinating with the Economic Development Officer at Dubbo Regional Council to understand how to best engage with the local community on future employment opportunities. Photon has engaged Skillset and coordinated with the Infrastructure Capability Network on other projects in the State, and intends to follow this process if the proposal is approved. |
| Noise and dust during construction | Dust mitigation has been addressed within the Traffic Impact assessment, Section 6.5. Noise impacts and mitigation measures have been assessed in the Noise Impact Assessment in Section 6.4, **Appendix I.**<br>Mitigation will include, standard construction hours, a water truck on site to wet down the site if required, and coordinated drilling activities to minimise impact. |
| Substation and panel locations | Dubbo Regional Council expressed their favour in the substation location positioned on the western boundary away from Suntop Road, to minimise visual impacts. The council also suggested that panels are not installed on the ridges of hills located within the Site.<br>In response to this, the substation was moved to the south west side of the property. A new access road will be constructed for trucks transporting materials and maintenance crews.<br>Some parts of the ridge line will be excluded from panels although a construction and parking area will be temporarily used that is on a ridge line. |
| Vegetation screening located on road verge | Notification and request for comment on verge planting was raised on 27/04/2018 to Musarrat Kahn, who suggested contacting the Manager of Horticultural Services. Request for comment was sent to the Manager Horticultural Services at Dubbo Regional Council on proposed planting of sections of the Suntop Road verge (07/05/2018). Follow up phone call was made 12/05/2018, and over the phone advice received. Awaiting a written response as of 24/05/2018. |

Consultation with Dubbo Regional Council revealed other concerns to be addressed within the assessment of environmental impacts. Concerns and how they were addressed by pitt&sherry are outlined in Table 5-3 below.

Table 5-3 Moderate concerns raised by Dubbo Regional Council through consultation

| Concern | Outcome |
|---|---|
| Location of shipping containers visible from Suntop Road | Shipping container location will be located at the construction laydown area (Figure 3-9). This area is located approximately 150 – 200m away from Suntop Road and is located behind a slight ridge line. This is a temporary construction area and will be removed after the Proposal is built. |
| Construction traffic impact on the local School bus run. | Council had been contacted by community members voicing their concerns regarding heavy vehicles driving the same route as the local school bus during construction. SSF has agreed to minimise truck movements through these periods. |
| Bush fires as a result of construction activities such as welding; angle grinding etc. | All bushfire related impacts of construction activities during the development have been covered in the Bushfire Impact Assessment Report, **Appendix F**. |

## 5.5 Aboriginal Consultation

The Wellington Local Aboriginal Land Council (WLALC) completed a site inspection on 26th February 2018, and again on 14th May 2018 with Matthew Kelleher from Kelleher Nightingale. The WLALC identified a mature tree within the study area that has cultural significance to local Aboriginal people. The survey also identified two archaeological sites situated within the central eastern part of the proposed site along the creek line. These items are not located within the proposed works footprint. The WLALC had no objections to the proposed solar farm development provided that impacts are avoided to the identified archaeological sites and the culturally significant tree. The Heritage Impact Assessment is discussed in Section 6.2.

## 5.6 Mineral Titleholders Consultation

As requested by DP&E in the SEARS, Table 5-4 outlines the engagement outcomes of consultation with potentially impacted exploration licence holders, quarry operators and mineral title holders. Lachlan Resources Pty Ltd was identified as a potentially impacted exploration licence holder, as their licence EL8463 intersects a section of the Proposal, see Figure 5-1-1.

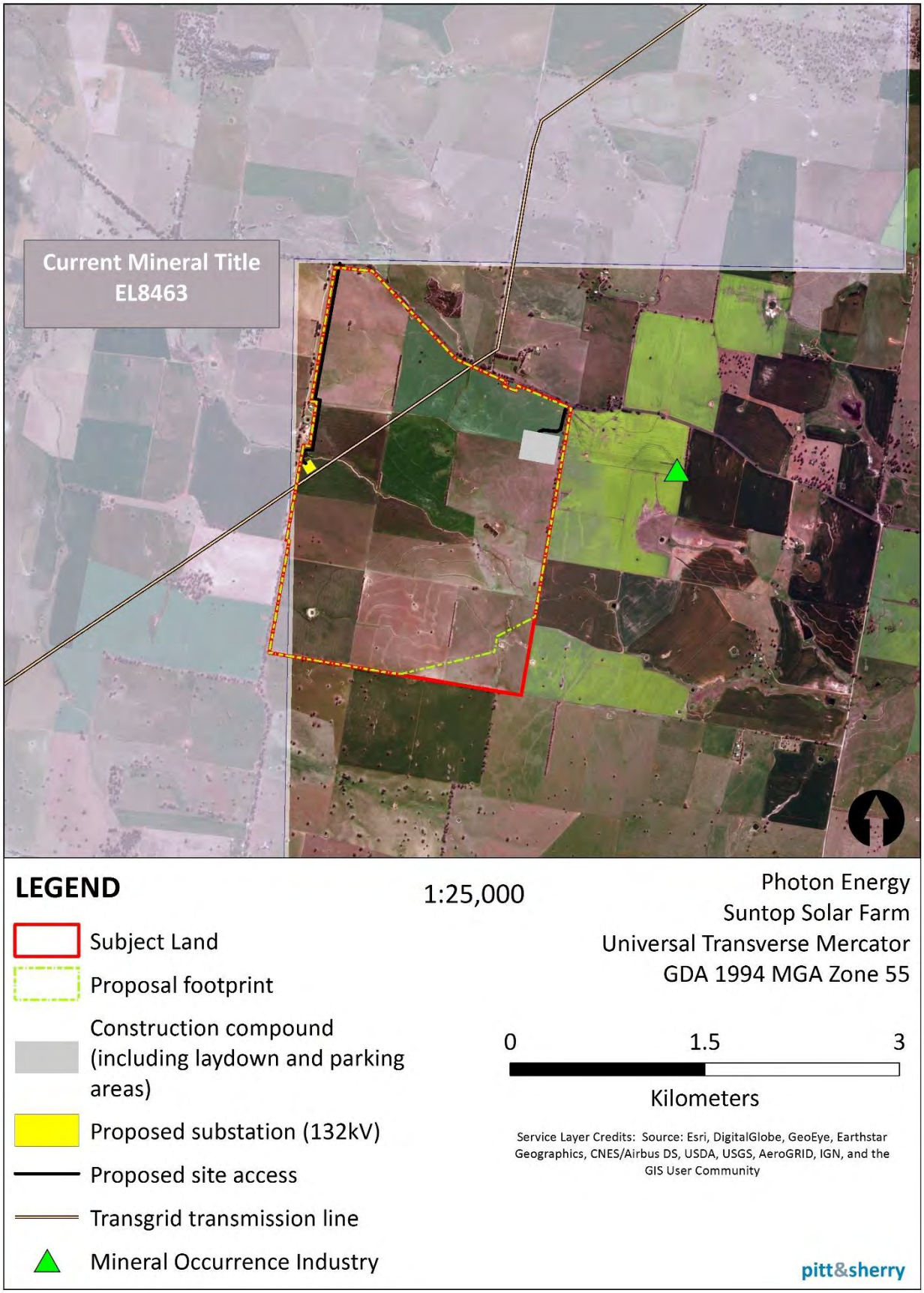



Figure 5-1 Location of Mineral Title boundary intersecting the Site

Table 5-4 Engagement outcomes of consultation with potentially impacted mineral title holders

| Title Holder | Outcome of Engagement |
|---|---|
| Lachlan Resources Pty Ltd | Attempts to contact Lachlan Resources revealed that the company had been acquired by KPMG. pitt&sherry contacted KPMG (15/11/2017), who explained that Lachlan Resources is going through a DOCA (Deed of Company Arrangement). This will be finalised in January 2018, upon finalisation the assets of the company will be owned by 'Ascent capital'.<br>pitt&sherry sent an email to Ascent Capital (29/11/2017) asking for comment on the proposal, see **Appendix G**. pitt&sherry contacted Ascent Capital on 16/05/2018 to reveal that a different company Emmerson Resources Ltd now held the licence. Emmerson Resources were contacted on 17/05/2018, and have provided a letter response outlining that they see no impact on any of their current or future proposed activities (**Appendix G**). |

## 5.7 Community Engagement

The CSEP documents the methodology for community engagement in Table 6, see **Appendix G**. During the progression of the Proposal, the engagement methodology was adapted to maximise outcomes. Table 5-5 provides a summary of the engagement conducted to date across multiple communication platforms, highlighting concerns. Figure 5-2 provides indication of the sensitive receivers consulted with during this process.

In addition to stakeholders identified within the CSEP, other receivers were identified by undertaking the following actions:

- Development of an attendance register at Community meeting on the 30th of August 2017
  - Attendance register allowed for the collection of contact details for interested community members, for future direct updates
  - 21 attendees at the community meeting provided their contact details
  - From this list, contact details for six out of the nine sensitive receivers identified as moderately visually impacted or above were obtained. This allowed for one on one meetings with these receivers to be organised. Other receivers identified were contacted via letter drop.
  - The list of community members who attended the original meeting on 30th of August, were overlaid with the sensitive receivers from the visual assessment. This then gave a more accurate reflection of the residents potentially impacted by the proposed development and those interested in the proposed development
- Updates provided by the Suntop Solar website (http://www.photonenergy.com.au/current-projects/suntop-solar-farm/), and the option for contact through the website as well as a dedicated hotline (1300 881 045), also allowed for interested community members to voice their queries and/or concerns
- pitt&sherry contact details were provided during one on one meetings with impacted receivers (listed in Table 5-6). These contact details have since been shared with community members through word of mouth, offering the community another mechanism to provide input
- Development of a project update. Copies of this were given to residents, as well as emailed to community members who have provided their contact details to receive updates (**Appendix G**).

Table 5-6 provides a detailed summary of the concerns raised for each of the sensitive receivers visited during one on one consultation (5th – 6th February 2018). Table 5-7 provides a detailed summary of the second round of one on one consultation conducted 30th April – 1st May 2018. During this round of consultation

photomontages, a draft landscape plan and an updated site footprint were provided for discussion with the sensitive receivers.

Over the course of the consultation period to date, 21 community members were present during the community consultation, 24 residents within the locality of the site were contacted either through letters, emails or phone calls, and 6 neighbouring residents (4 land owners) have participated in a group or one on one meeting. A summary is provided in Table 5-5.

**Table 5-5 Summary of community engagement performed to date**

| Stakeholder | Communication method | Date | Community Responses |
|---|---|---|---|
| General Community | Newspaper Advertisement | 30/08/2017 | One advertisement has been posted by Photon Energy in the Wellington Times. The post invited members of the community to participate in the community meeting to be held the evening of the 30th August. |
| General Community | Community Meeting Arthurville Rural Fire Station | 30/08/2017 | 21 local residents attended the initial meeting. A presentation was given by SSF on the proposed development. Feedback from the residents included questions around use of B-Double trucks during school bus pick up and drop off hours. Meeting Minutes are provided in **Appendix G**. |
| Adjacent Landholders | Email | 24/01/2018 | Request for meeting was sent to sensitive receivers 1, 3 and 6, who had provided their contact details at the community meeting (Figure 5-2). A response was received by receiver 6 to organise a meeting time. |
| | | 25/01/2018 | Response received from receiver 1 to confirm meeting time. |
| | | 1/02/2018 | Request for meeting sent to receiver 4. |
| | | 5/02/2018 | Rescheduling of meeting for receiver 1, due to clash with council proposed meeting time. |
| | | 6/03/2018 – 8/03/2018 | Notification sent to receivers 1, 2, 4, 6 of Geotechnical survey occurring on site during the week of the 13th March 2018. |
| | | 12/03/2018 – 13/03/2018 | Receiver 1 request for clarification on updates made to the proposal. Raised concern that the wider community needed further information.<br>Request for meeting sent to receivers 1, 2, 4, 6 for proposed site visit during 22 – 23rd March. Response received by receivers 1 and 6 to confirm times. |
| | | 20/03/2018 | Apologies sent to receivers 1, 2, 4, 6 for no longer being able to attend meeting, with aim to re-organise after Easter Break. |
| | | 23/03/2018 | Project update emails sent to receivers 1, 2, 3, 4, 6 as well as all community members who registered their emails during the community meeting. This included an attached update, provided in **Appendix G**. |

| Stakeholder | Communication method | Date | Community Responses |
|---|---|---|---|
| | | 16/04/2018 | Receiver 1 enquired about site progress. pitt&sherry responded with new proposed dates for rescheduled meetings. |
| | | 19/04/2018 – 24/04/2018 | Request for meetings sent to receivers 1, 2, 4, 6. Meeting times organised with receivers 1 and 6. |
| | | 3/05/2018 | Summary of one on one meeting notes sent to receivers 1, 4 and 6. |
| Adjacent Landholders | One on One | 06/02/2018 | Photon and pitt&sherry met with sensitive receiver 6, 2, 4, and the landowners for receiver 1. Table 5-6 provides a detailed summary of the concerns raised by these receivers. |
| | | 01/05/2018 | Photon and pitt&sherry met with sensitive receivers 1, 4, and 6. Table 5-7 provides a detailed summary of the concerns raised by these receivers. |
| Adjacent Landholders | Letter | 20/12/2017 | A letter was sent to all registered attendees (21) of the community meeting detailing a project update. This letter included a summary of work achieved to date, as well as an anticipated timeline for the next steps in accordance to the approval pathway. Letter provided in **Appendix G**. |
| | | 24/01/2018 | Letters sent to receivers 2, 5 and 7 requesting meeting for week of the 5th of February. |
| | | 01/05/2018 | Letter sent to receiver 5 and 7 notifying them that their property has been included in the noise assessment and that we would like to discuss the outcomes of the assessment. No response was received by either receiver. |
| Adjacent Landholders | Phone Call | 22/11/2017 | Photon contacted receivers 8 and 9 to introduce Photon Energy and the proposed Suntop Solar Farm. Explained that visual consultants had identified their property and homestead as a potential sensitive receiver being impacted visually.<br>Both receivers did not express any concerns regarding the Proposal. |
| | | | Photon received contact details for receiver 7 through the landowner of the Site. Photon attempted to contact receiver 7 leaving a voicemail and follow up text message describing the proposal and requesting if further information is required. No response was receiver from receiver 7. |
| | | 31/01/2018 – 01/02/2018 | pitt&sherry contacted receiver 2, 3 and 4 to follow up from email request for meeting. Receiver 3 expressed that they had no concerns with the development and were content to not have further discussions. Receiver |

| Stakeholder | Communication method | Date | Community Responses |
|---|---|---|---|
| | | | 2 expressed no concerns with the development. Receiver 4 organised a meeting time to discuss further. |
| | | 06/02/2018 | pitt&sherry received a call from receiver 2, expressing that they would like a meeting and scheduled a time for a discussion. |
| | | 13/03/2018 | pitt&sherry contacted receiver 1 to follow up email exchange regarding wider community consultation. |
| | | 15/03/2018 | pitt&sherry contacted receiver 4 to confirm a meeting time. |
| | | 20/03/2018 | Receiver 2 contacted pitt&sherry to receive update on the meeting that was then rescheduled. |
| | | 19/04/2018 – 24/04/2018 | pitt&sherry contacted receiver 2 to confirm the rescheduled dates, left voicemail. |
| | | 26/04/2018 | pitt&sherry contacted receiver 3 to provide an update on the proposal, and inform receiver 3 that their property is likely to experience a slight increase in noise (from 45dB to 51dB) during the construction period. Receiver 3 thanked pitt&sherry for the call but did not express any concern with the new information. |
| | | 30/04/2018 | Receiver 2 contacted pitt&sherry to confirm that they did not require a second meeting, but would like to remain updated on the project. |
| | | 23/05/2018 | Pitt&sherry contacted receiver 9 to ask for an email address, such that the receiver could be notified on when the public exhibition period begins. Receiver 9 made note that they do not believe they were contacted before this point, and provided email address to ensure they receive updates. |

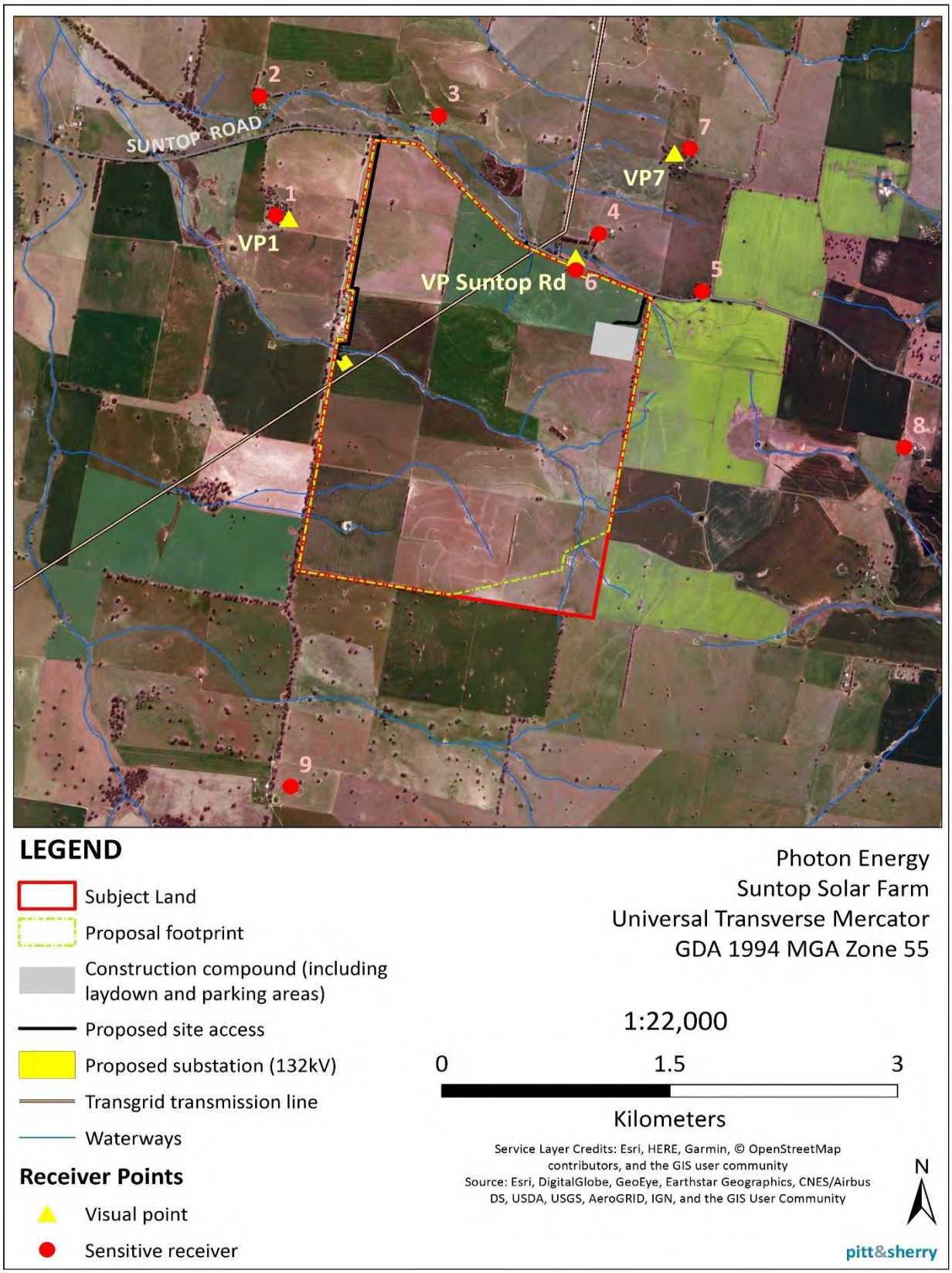



Figure 5-2 Location of sensitive receivers identified through community consultation

Table 5-6 Detailed summary of one on one consultation with sensitive receivers conducted 5th – 6th February

| Sensitive Receiver | Concerns Raised |
|---|---|
| 6. | **Visual:** Resident expressed concern around visual impacts. Vegetation screening as a form of visual mitigation and dust control was discussed, and resident expressed that they would be interested in screening.<br>**Noise & Traffic**: Resident expressed moderate concern for the noise of the proposed development as well as the increase in heavy vehicle traffic. It was discussed that a noise impact assessment and traffic impact assessment are being undertaken and that pitt&sherry will update the resident with the outcomes during the second round of consultation. |
| 1. | Property owners of receiver 1 currently have tenants in the residence but live locally.<br><br>**Water supply:** Residents expressed concern that access to the shared easement for the water supply located on the proposed site would be restricted during construction and the pipes may be broken through construction impacting on their water supply.<br><br>**Access road:** Residents and the current landowner for the Site have an agreement in place to share the existing access road running along the western edge of the Site. Expected increase in traffic to the access road may impede on their agricultural practices, including moving stock. They also expressed concern regarding degradation of the access road condition.<br><br>**Visual:** Residents are very concerned about the visual impact of the development on their outlook. Vegetation screening as mitigation was discussed.<br><br>**Power supply**: Residents receives their power from infrastructure located on the Site. Concern was raised that construction may interfere with access to this power.<br><br>**Traffic during construction**: Residents expressed concern regarding the frequency of heavy vehicles on Suntop Road, and how that will impact dust, road quality and the school bus run.<br><br>**Substation location**: Residents expressed their preference for the substation to be located towards Suntop Road. They were not in favour of the proposed substation location located on the western border of the Site.<br><br>**Glint / glare from the panels:** Residents expressed concern regarding the glare on from the panels during different parts of the day.<br><br>Overall residents expressed that they were not supportive of the proposal. |
| 4. | **Substation location**: Resident expressed their preference for the substation to be located away from Suntop Road.<br><br>**Local employment**: Resident was interested in understanding employment opportunities.<br><br>Overall resident expressed that they were not concerned with the proposal. |
| 2. | **Visual:** Resident expressed concern around visual impacts from the road, rather than the property. Vegetation screening as a form of visual mitigation and dust control was discussed, and resident expressed that they would be interested in screening.<br><br>**Substation location**: Resident expressed their preference for the substation to be located away from Suntop Road. |

| Sensitive Receiver | Concerns Raised |
|---|---|
| | Resident expressed that they would like to be kept informed about when the public exhibition period opens. |

Table 5-7 Summary of one on one consultation with sensitive receivers conducted 30th April – 1st May

| Sensitive Receiver | Concerns Raised & Discussed |
|---|---|
| 6. | **Visual:** Resident was shown the photomontages taken from two angles at the front of their property. Resident was pleasantly surprised by the distance the panels now were from their house (150-200m) rather than at the border of their fence. The resident expressed after discussing the landscape plan, they were happy to have the vegetation screening within Sensitive Receiver 6 boundary. Ongoing engagement is required through the detailed design period to discuss species selection and program for planting (subject to approval).<br><br>**Site access:** The resident was shown the updated Site footprint including the access road located to the east of their property, where the proposed construction laydown area would be. The resident expressed that they were not overly concerned with the proposed access route due to the dense vegetation they had on the eastern border of their property.<br><br>**Noise & Traffic**: Outcomes from the noise impact assessment were shared with the resident. It was explained that there would be a slight audible increase in noise during the construction period (12 months) but would not be heard over ambient noise during operation.<br><br>Overall the resident was pleased to hear that the substation location was away from their property, and that the vegetation screening proposed would mitigate most of their view of the Site. |
| 1. | **Insurances:** Residents raised concern regarding insurance implications in case they start a fire due to normal agricultural operations. Photon agreed to discuss with their insurance company. The Residents would like some certainty around legal obligations.<br><br>A Bushfire Assessment was completed as part of the EIS. This includes Asset Protection Zones (APZ's) to minimise risk. Refer to **Appendix F**.<br><br>**Water supply:** Residents expressed concern that access to the shared easement for the water supply located on the proposed site would be restricted during construction and there was a risk that the pipes may be broken, limiting their water supply. Photon responded by offering to take reasonable measures to locate an adequate water supply on the residents' property, such that they did not have to rely on the existing bore.<br><br>Residents were also concerned about salinity issues being transferred from the proposed site to their agricultural land.<br><br>**Access road:** Following on from the meeting in February, Photon has assessed the access to the property and have completed a concept design for a new access road to run in parallel to the east of the existing access road. The new access road would cross into the existing access road at the back of the farm sheds and cross the dam. This is designed to allow access to the substation for construction and maintenance purposes. |

| Sensitive Receiver | Concerns Raised & Discussed |
|---|---|
| | The residents expressed that they were unhappy with this proposal as it will still interfere with moving stock. The design of the new access track will be completed through detailed design. This will include further discussions with the landholders on the frequency and duration of stock movements to minimise conflict.<br><br>**Visual:** Residents are very concerned about the visual impact of the development on their outlook. Photomontages were shown to the residents, they expressed their concern regarding the availability of water to maintain vegetation screening.<br><br>**Traffic during construction**: Residents expressed concern regarding the frequency of heavy vehicles on Suntop Road, and how that will impact dust, road quality and the school bus run. It was discussed that the results of the traffic impact assessment are being review by Roads and Maritime and Dubbo Regional Council. As documented in the Traffic Impact Assessment, SSF will attempt to minimise truck movements in key school drop off and pick up times (**Appendix H**).<br><br>**Substation location**: Residents expressed their extreme disappointment and dissatisfaction with the location of the substation due to the visual impact.<br><br>Overall the residents do not approve of this proposal. |
| 4. | **Visual:** Resident was shown the photomontages taken from a viewpoint on Suntop Road, in front of their property. It was explained that discussions with the council would be undertaken to seek approval for planting on the public road verge to mitigate view of the solar panels from the road.<br><br>**Site access:** The resident was shown the updated Site footprint including the access road located to the east of their property, where the proposed construction laydown area would be. The resident expressed that they were not concerned with the proposed access route.<br><br>**Noise & Traffic**: Outcomes from the noise impact assessment were shared with the resident. It was explained that there would be a slight audible increase in noise during the construction period (12 months) but would not be heard over ambient noise during operation.<br><br>**Local employment**: Resident was interested in understanding employment opportunities. It was explained that if the proposal is approved, SSF would work with local contractors and agencies to hire locally wherever possible.<br><br>Overall, resident did not express an objection to the proposal. |

## 5.8 Media

Two articles featuring the Suntop Solar Farm were published by the Wellington Times during preparation of the EIS, dated 30/10/2017 and 30/12/207.

Community members also expressed their opinions on the proposed development through social media platforms, such as Facebook and the Suntop Solar Farm website (http://www.photonenergy.com.au/current-projects/suntop-solar-farm/)

## 5.9 Summary of Actions

Table 5-8 below outlines the actions taken to date as a response to the concerns raised by Suntop community members during consultation. As consultation is an ongoing process, actions will continue to be performed during the remainder of the submission process.

Table 5-8 Summary of actions taken to date to address key concerns raised

| Concern | Actions | Response to key issues |
|---|---|---|
| Visual Impact | Following the February one on one consultation, Photon commissioned four photomontages to be completed. Photomontage locations were chosen in consultation with the sensitive receivers to ensure accurate representation of impact.<br><br>During the April/May one on one consultation photomontages and proposed vegetation screening landscape plans were shown to receivers. The proposed solar footprint was revised to reduce the number of panels located on high points across the site.<br><br>Solar footprint was shifted 150-200m away from the property boundary parallel to Suntop Road, reducing visual impacts.<br><br>Location of the substation was changed reducing the visual impact of multiple residents on Suntop Road, as well as the wider community who uses the road. | Refer to the Visual Impact Assessment in **Appendix C**.<br><br>Visual mitigation is being proposed by landscape screening. This is documented in the landscape plan, as a part of the Visual Impact Assessment.<br><br>Consultation will be sought from neighbouring residents during the detailed design if the proposal is approved. |
| Road condition & upgrades | A copy of the Traffic Impact Assessment (TIA) was sent to Dubbo Regional Council for review. Council sent the TIA to Roads and Maritime for comment.<br><br>Roads and Maritime commented that they did not support a temporary reduction in speed limits and an intersection upgrade was likely required. | An intersection upgrade for Renshaw McGirr Drive and Suntop Road is now proposed. The concept design can be found in Section 6.5. |
| Construction Noise | Consultation with sensitive receivers prompted a review of the Noise Impact Assessment, to ensure concerns raised have been addressed.<br><br>Receivers 1, 3 -6 were identified as having an audible noise increase during the construction period.<br><br>It should be noted that pile driving for geotechnical reasons was undertaken in | The Noise Impact Assessment has addressed concerns through implementation of construction restrictions such as strict operating hours. See **Appendix I.**<br><br>The potential noise impact was discussed with Receivers 1-6. |

| Concern | Actions | Response to key issues |
|---|---|---|
| | mid-March 18. The residents were sent an email to inform them of the works. There was no commentary about noise or other impacts associated with the pile driving when completing the one on ones. | |
| Air Quality: Construction Dust | Consultation with sensitive receivers prompted a review of the Traffic Impact Assessment, to ensure concerns raised have been addressed. | The Traffic Impact Assessment has addressed concerns through ensuring a water truck to be on site to wet down construction area, if required. See **Appendix H** |
| Traffic during construction: Trucks along the local roads during school bus pick up and drop off times. | Consultation with sensitive receivers prompted a review of the Traffic Impact Assessment, to ensure concerns raised have been addressed.<br><br>SSF is considering putting in restrictions to vehicle operation hours between school pick up and drop off times. | The Traffic Impact Assessment has addressed concerns through ensuring vehicles are required to access the Site within standard construction hours. See **Appendix H**<br><br>SSF will make all reasonable attempts to minimise truck movements during school pick up and drop off times. |
| Bushfire risk: Equipment in use during construction, and/or operational electrical infrastructure causing a fire | Consultation with sensitive receivers prompted a review of the Bushfire Impact Assessment, to ensure concerns raised have been addressed.<br><br>Bushfire impact specialists have consulted with the RFS to be advised on fire history, resources, mitigation measures and fire suppression. | The Bushfire Impact Assessment has addressed concerns through implementation of an asset protection zone of 15m. A buffer around the solar footprint boundary will also be required, as well as equipment on site for fire protection.<br><br>See **Appendix F.** |
| Local Employment | Discussions with the Dubbo Regional Council and the community prompted a review of the Socio-economic and Property Chapter in the EIS (Section 6.12).<br><br>SSF will endeavour to employ local contractors and labour, utilising the Local Contract Network and Skillset. | The Socio-economic and property chapter has addressed local employment opportunities through ensuring the Proponent commits to liaising with local industry representatives to maximise the use of local contractors, manufacturing facilities and materials |
| Site Access | Photon worked with the property owner of the Site, as well as receiver 1 to address concerns regarding the use of the current access road on the eastern boundary of the Site.<br><br>It was determined that a new access road on the Site would be developed from Suntop road to the substation location. | Concept designs for a new access road to be developed can be found in **Appendix H**. |

| Concern | Actions | Response to key issues |
|---|---|---|
| Water Supply | Photon worked with the property owner of the Site, as well as receiver 1 to address concerns regarding access to a freshwater bore on the Site.<br><br>It was determined that SSF would take reasonable measures to locate and commission an adequate water source on receiver 1's property to remove reliance on the current bore. | SSF will undertake reasonable efforts to locate an adequate water supply. |

## 5.10 Changes in Design

Through the development of the Proposal several changes were made to optimise preliminary design and minimise impact on the local community.

These changes included:

- Relocating the substation away from Suntop Road to reduce visual impacts
- Upgrades at the intersection of Suntop Road and Renshaw McGirr Way. A concept plan can be found in **Appendix H.** The upgrades will facilitate safe access during construction and provide a long-term community benefit
- Creating a 150-200m buffer from Suntop Road to reduce visual impacts
- Reducing the number of panels located at the highest points of the Site to reduce visual impacts

## 5.11 Ongoing Community Consultation

SSF are committed to continual engagement with members of the community and interested stakeholders. This will be achieved through maintaining the current platforms for contact such as the enquiries hotline (1300 881 045) and Suntop Solar Farm website. An email notifying the dates of public exhibition will be distributed to all community members who registered at the community meeting, as well as to the residents identified through the community consultation process.

# 6. Environmental Impact Assessment

This chapter introduces and describes the key environmental risks and provides a comprehensive assessment of these risks related to the Proposal.

Each potential environmental impact was systematically reviewed with reference to: the current scope of the Proposal; the SEARs issued by DP&E; the findings and recommendations (for management and mitigation measures) from the specialist reports; other documentation; as well as consultation with relevant government agencies and neighbouring landowners.

The environmental risk analysis informs the scope of the EIS by ensuring all potential environmental impacts are identified and that the EIS is focused on the key risk areas. A detailed assessment of the key risks has been completed in Section 6 below. It responds to the following SEARs requirements:

"*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*".

The environmental risks analysis identified several key environmental issues, aligning with those identified within the SEARs. These issues were:

- Biodiversity
- Aboriginal Heritage
- Visual amenity
- Noise
- Traffic
- Erosion and sediment control
- Bush Fire.

## 6.1 Biodiversity (Flora and Fauna)

A Biodiversity Assessment Report (BDAR) was completed in accordance with the Biodiversity Assessment Method (BAM) (OEH, 2017a) established under the *Biodiversity Conservation Act 2016* (BC Act). The BDAR investigated the potential impacts of the proposal on flora and fauna on the Site (refer **Appendix D**). This included information collected from field assessments of the existing flora and fauna and the potential for the site to provide potential habitat for threatened species.

The BDR was prepared by Dr Colin Bower (FloraSearch), who is an accredited assessor under section 6.10 of the BC Act (assessor accreditation number BAAS18048).

### 6.1.1 Assessment Methodology

In accordance with the BAM (OEH, 2017a) the *Biodiversity Assessment Method Calculator* (BAMC or the Credit Calculator) was used for this assessment. This is an online application that allows the assessor to apply the BAM at a site to provide a consistent method of assessing potential impacts on biodiversity. It does this by providing a scientific and repeatable calculation of how biodiversity impacts need to be offset to achieve a "no net loss" of biodiversity.

As specified by the BAM (OEH, 2017a), three stages of assessment are outlined in the BDAR:

- Stage 1 summarises the biodiversity values of the BDAR Footprint that are entered into the Credit Calculator (e.g. landscape features, native vegetation and threatened species)
- Stage 2 assesses potential impacts on biodiversity, describes impact avoidance and mitigation measures and determines offset requirements (Section 3); and
- Stage 3 describes the Biodiversity Offset Strategy.

Due to the small area of native vegetation to be impacted by the proposal the Site assessment used the *Streamlined Assessment Module* of the BAM. The native vegetation on the Site comprises scattered remnant paddock trees and several linear plantings of native trees. The total area of the plantings is 1.13ha, which is above the minimum threshold (1.0ha) for application of the Biodiversity Offsets Scheme, and below the 5ha maximum area limit for application of the streamlined assessment module (BAM, Appendix 2 [OEH, 2017a]) on a site with a minimum Lot size of 40ha. Accordingly, the BDAR followed the requirements of the BAM streamlined assessment module (OEH, 2017a), which is applied in two parts;

- The streamlined assessment module for the plantings
- the paddock tree module for
  - 25 paddock trees proposed to be removed from the Site
  - Up to 10 additional roadside trees on Renshaw McGirr Way.

### *Database Searches*

A desktop review of relevant spatial ecological datasets was conducted to identify vegetation communities mapped for the Subject Land as well as locations of threated flora species that have been previously recorded in the Wellington locality. This included a search of the:

- Mitchell Landscapes regional vegetation mapping
- OEH Atlas of NSW Wildlife database
- Commonwealth Department of the Environment (DotE) EPBC Protected Matters database.

Details of the Mitchell Landscapes within the BDAR Footprint are listed in Table 6-1. The BDAR Footprint is predominantly within the Nangar Ranges Mitchell Landscape (OEH, 2018a)

**Table 6-1 Mitchell Landscapes in the BDAR Footprint**

| Landscape Name | Percentage Cleared Estimate | Area (ha) | Percent (%) of BDAR Footprint Covered by Landscape |
|---|---|---|---|
| Nangar Ranges | 84 | 408.3 | 94.3 |
| Macquarie Alluvial Plains | 78 | 24.7 | 5.7 |

Similar desktop searches were conducted to determine the fauna that are likely to occur in the vicinity. The searches included the:

- Office of Environment and Heritage (OEH) Threatened Species Profiles database (Wellington region)
- OEH Atlas of NSW Wildlife database
- Commonwealth Department of the Environment (DotE) EPBC Protected Matters database
- Birdlife Australia database.

To complete the data requirements for the BAM in relation to threatened flora and fauna, three other data sources were searched. These included the:

- BAM online calculator which lists the ecosystem credit species and species credit species generated by the BAMC from the BioNet databases using inputs on Interim Biogeographic Regionalisation for Australia (IBRA) subregion, Site location and vegetation integrity (OEH, 2018d)
- BioNet website which includes searches of the NSW Atlas of Wildlife, NSW State Forests, Australian Museum and Royal Botanic Gardens Sydney databases (BioNet, 2018b). The search area comprised a 20 × 20km square centred on the study area. This search returned a list of threatened species records from within the search area and are listed in **Appendix D**
- Commonwealth Department of the Environment and Energy (DoEE) website – Protected Matters Search Tool (PMST) (DoEE, 2018a). The search area comprised the same 20 × 20km square as for the BioNet search. The PMST uses actual records and habitat modelling to return a list of 'protected matters' that are known or predicted to occur in the search area, including threatened species, migratory species, ecological communities, wetlands of international significance, and national and world heritage properties.

### *Search Results*

The BAMC returned 16 ecosystem credit species all being fauna species, and 14 species credit species, four flora and 10 fauna species (refer **Appendix D**). Four fauna species are dual ecosystem and credit species.

The BioNet database search returned records of one flora species, the Sandhill Spider Orchid (*Caladenia arenaria*) and one fauna species, the Glossy Black Cockatoo (*Calyptorhynchus lathamii*), close to the Site that were not identified by the BAMC.

The PMST search returned 8 potentially occurring flora species, and 21 fauna species. Assessment of these species is required to determine whether there is any obligation to refer the Proposal to the Commonwealth Department of the Environment and Energy (DoEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The total numbers of potentially occurring threatened species identified by the searches are 12 flora and 34 fauna species (refer **Appendix D**).

### *Commonwealth Matters of National Environmental Significance (MNES)*

An EPBC protected matters report was undertaken by pitt&sherry in September 2017 (20km buffer of the development site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the development site. The assessment has been undertaken in accordance with the Commonwealth Significant Impact Assessment Guidelines (DoE 2013) which lists a suite of significant impact criteria to assist in determining whether there is likely to be a significant impact on Matters of National Environmental Significance (MNES) and thus whether a referral to the Commonwealth DoEE is required.

Results of the protected matters search are provided in Table 6-2 below.

Table 6-2 EPBC Protected Matters Search Tool Results

| MNES | Number of MNES identified within a 20km buffer from the subject site |
|---|---|
| World Heritage Properties | None |
| National Heritage Places | None |
| Wetlands of International Importance | None |
| Great Barrier Reef Marine Park | None |
| Commonwealth Marine Area | None |
| Listed Threatened Ecological Communities | 2 |
| Listed Threatened species | 27 Threatened species<br>6 flora species<br>21 fauna species (6 mammals, 9 birds, 4 fish, 2 reptiles) |
| Listed Migratory Species | 12 |

Based on the search results, the proposal would not impact upon any world heritage properties, national heritage places, Commonwealth marine areas nor the Great Barrier Reef Marine Park given their absence in the vicinity of the subject site.

### *Review of previous studies*

No previous fauna or flora studies have been conducted on the Site and surveys on adjoining and neighbouring lands include only the occasional opportunistic surveys that have been undertaken with sightings of threatened flora and fauna species (as evident on NSW Bionet Wildlife database).

## 6.1.2 Existing Environment

The Proposal is located entirely within the New South Wales, South Western Slopes Bioregion and Upper Slopes Sub-region of the IBRA and the Dubbo Regional LGA.

Access is via Suntop Road which runs across the northern boundary of the Site and this like many rural roads in the Wellington district is vegetated with a mix of scattered mature native trees, introduced and native grass species and common agricultural weed species. The native trees remaining along the main access corridor just outside the western boundary of the Site and along Suntop Road are mainly Inland Grey Box (Eucalyptus microcarpa) with some White Box and Fuzzy Box.

The native vegetation beside watercourses and on lower slopes at the intersection of Suntop Road and Renshaw – McGirr Way is dominated by *Eucalyptus melliodora* with occasional *Eucalyptus blakelyi*.

The paddocks on site have been cleared for agricultural purposes with the remaining native vegetation being limited to narrow linear plantings along several fence lines within the site, isolated scattered mature trees and narrow clumps of very scattered mature trees along the southern and western boundaries. The existing vegetation is shown in Figure 6-1. The Site and its immediate surrounds do not possess any native vegetation corridors that link to other sites and are isolated in terms of connectivity. Figure 6-2 and Figure 6-3 show the extent of previous clearing and examples of the remaining vegetation on Site.

There is an unnamed watercourse that bisects the Site in an east -west direction and this only carries water after rain events. Given the slope of the topography to the west, the creek does not have any standing ponds with inflows draining into a small farm dam near the western boundary. The watercourse is fed by several small drainage depressions and constructed grassed waterways which are connected to earth rollover banks that have been constructed to control surface water flows and reduce the erosion potential on site. None of the flowlines have any riparian vegetation growing along them while the dam has several scattered clumps of water tolerant species such as sedges and reeds growing on sections of its margin.

The above observations suggest that three Plant Community Types (PCTs) are likely to have occurred on the Site prior to its clearance (Table 2) (BioNet, 2018a). The three PCTs include:

- PCT 201-Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion
- PCT 267 - White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion
- PCT 266 -White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion.

All of these PCTs represent Threatened Ecological Communities, however, no structurally or floristically representative remnants of these PCTs remain on the Site.

A roadside remanent of the Box-Gum Woodland EEC dominated by Yellow Box (*Eucalyptus melliodora*) was identified at the intersection of Renshaw McGirr Way and Suntop Road.



Figure 6-1 Existing Vegetation



Figure 6-2 Existing Environment



Figure 6-3 Mature trees on boundaries of south and western corner of Site

## *Survey Results*

The flora survey was conducted over three days on the 29th November 2017, 15th January 2018 and 8th May 2018. This consisted of walking and driving around the site and conducting various analysis and recording the species on site and its present condition. A fauna survey was also undertaken by Biosphere Environmental Consultants Pty Ltd on 22nd November 2017.

Areas of potential habitat value were identified and then traversed by foot. As most of the site consisted of cleared paddocks, there were relatively few areas left that could provide potential habitat for native fauna. During the course of the site investigation, any fauna observed or heard calling were noted, as was indirect evidence that may suggest the presence of a native species (e.g. scratch marks on trees, faecal droppings, chew marks, tracks and burrows).

Threatened fauna listed under the *NSW Fisheries Management Act 1994* are not discussed further as the survey determined that no habitat exists for threatened fish species on the site.

**Flora Survey Results**

The small stands of native vegetation recorded on the Site are likely to represent a mosaic of these 'best fit' Plant Community Types (PCTs). In addition to this, the native vegetation being assessed is comprised of very small scattered plantings of native eucalypts, some of which are endemic to the location. The PCT which best fits the Site is listed as PCT 267 and it is considered likely to have been the dominant PCT on the Site pre-European settlement. PCT267 is listed as the flowing community:

- White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion.

Table 6-3 details the predicted pre- European Plant Community Types on the site.

**Table 6-3 Pre- European Plant Community Types.**

| Vegetation Formation | Vegetation Class | PCT | | Dominant tree species | Justification | Threatened Ecological Communities |
|---|---|---|---|---|---|---|
| | | No. | Name | | | |
| Grassy Woodlands | Western Slopes Grassy Woodlands | 201 | Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion. | *Eucalyptus conica, E. microcarpa E. melliodora* | The north-western tip of the Site is mapped as part of the Macquarie Alluvial Plains Mitchell Landscape (OEH, 2018a), which is habitat for PCT201. | *Fuzzy Box Woodland on alluvial Soils of the South-Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions Endangered Ecological Community (BC Act)* |
| | | 267 | White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the | *E. albens E. microcarpa Callitris glaucophylla* | The three-dominant species of PCT 267 are the dominant trees remaining on | *White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological* |

| Vegetation Formation | Vegetation Class | PCT | | Dominant tree species | Justification | Threatened Ecological Communities |
|---|---|---|---|---|---|---|
| | | No. | Name | | | |
| | | | NSW South Western Slopes Bioregion. | | and close to the Site, making PCT 267 a good fit for the lower parts of the site, excluding the north west corner. | *Community (BC Act)* and *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community* (Environment Protection and Biodiversity Conservation Act 1999 [EPBC Act]). |
| | | 266 | White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion. | *E. albens Brachychiton populneus E. blakelyi* | The higher parts of the Site appear to have been dominated originally by White Box with some Kurrajong. | |
| | | 277 | Blakely's Red Gum – Yellow Gum grassy tall woodland in the NSW South Western Slopes Bioregion | *E. melliodora E.blakelyi E.bridgesiana* | The native vegetation beside watercourses and on lower slopes at the intersection of Suntop Road and Renshaw McGirr Way is dominated by *E.melliodora* with occasional *E.blale;yi* best matching PCT277 | |

There are 28 scattered remnant paddock trees which comprise:

- Fuzzy Box (*Eucalyptus conica*) – a clump of 3 trees (not to be removed)
- White Box (*Eucalyptus albens*) – 8 scattered trees on the higher parts of the Site (to be removed)
- Kurrajong (*Brachychiton populneus*) – 2 trees (to be removed)
- White Cypress Pine (*Callitris glaucophylla*) – 15 scattered trees in the south west corner of the Site (to be removed).

There are up to 10 roadside trees that will be removed on Renshaw McGirr Way.

The remaining vegetation found in the very small planted areas on the Site range from 0.02 ha to 0.4 ha. The plantings all have very large perimeter to area ratios, being long and narrow, mostly only two trees wide, with a lack of mid-storey. The ground cover is very sparse or absent and comprises mainly exotic species.

Three introduced species regarded as High Threat Exotic weeds under the BAM (OEH, 2018a) were recorded on the Site, these being Khaki Weed, Bathurst Burr and Saffron Thistle. None of these are listed as Priority Weeds under the *NSW Biosecurity Act 2015* or as Weeds of National Significance by the Australian Weeds Committee.

**Fauna Survey Results**
The fauna assessment did not identify or locate any of the listed threatened species. The survey included targeted searches for threatened fauna species that could potentially occur on the site and their habitats.

The following habitat features were identified during the site assessment:

- Hollow-bearing trees (totalling 10 scattered paddock trees)
- Semi-permanent / ephemeral wet areas (second order stream)
- Waterbodies (including one small farm dam per paddock, varying between 0.2 and 0.5 ha in size).

A total of 26 species of vertebrate fauna were recorded during the survey and are listed in **Appendix D**. This included 21 species of bird (one of which was non-native), two exotic species of mammal, three species of reptile but no species of frog or fish.

The remaining trees within the Site are scattered and very isolated and in poor condition due to the previous and existing site disturbances. As a result, they offer little habitat to the listed species. The tree plantations on site contain mixed species and being relatively young have not developed hollows or other habitat features for threatened fauna.

Several mature Western Grey Box (*Eucalyptus microcarpa*) trees occur were recorded on the perimeter of the site. This species is regarded as a secondary food tree for koalas (OEH 2017a). No evidence was found of koalas in the trees and these trees are too remote from any other potential koala habitat which would prevent koalas being able to reach them. In addition, the remnant tree patches are quite small, highly exposed and totally surrounded by cleared paddocks.

### 6.1.3 Assessment of Potential Impacts

**Threatened Ecological Communities**
Two threatened ecological communities (EEC) may occur or are likely to occur within a 20km search area however, based on the survey results these EEC do not resemble the remnant native vegetation stands identified onsite. These native vegetation stands on site are highly disturbed with no mid-storey and an exotic groundcover. The remaining trees are in average health due to impacts associated with the high edge to area ratio of the clumps. Being long narrow stands of vegetation limits the amount of buffering and protection which surrounding vegetation can provide. This makes stands such as this more susceptible to impacts from both natural and man-made impacts.

The stands of trees on the perimeter of the Site are being retained and protected as part of the Proposal and will provide limited habitat for mobile species moving through the area. Vegetation removal is going to be limited to a number of scattered individual trees within the middle of the Site. These trees possess very limited habitat features and do not provide any value in relation to connectivity due to their isolation from other substantial areas of native vegetation. In view of this, no threatened ecological communities would be impacted by the proposal.

Remnant woodland of the Box-Gum Woodland EEC was identified at the intersection of Suntop Road and Renshaw McGirr Way and 0.04ha will be lost to achieve the proposed intersection upgrade works.

**Listed Threatened Species**
No threatened flora species, populations or critical habitat listed under the BC Act or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were identified during the Site survey, or during a fauna survey.

No suitable habitat was considered to be present on the Site for any of the threatened flora species identified by the BAM Credit Calculator as having potential to occur, and five ecosystem credit fauna species were considered to have a low potential to use the limited resources on the Site; the Little Lorikeet, Swift Parrot, Regent Honeyeater, Scarlet Robin and Flame Robin.
No credit fauna species were considered to have potential to utilise the Site owing to a lack of breeding resources and one threatened ecological community (TEC) listed under the BC Act and the EPBC Act is considered to have once occupied the Site, but this has been reduced to a few scattered paddock trees.

Additionally, no threatened fauna species were recorded on the Subject Land during the survey.

**Wetlands of International Importance**
The nearest wetland of international importance is over 300km upstream (Macquarie Marshes). Given the distance to this wetland, there will not be any impact from this Proposal.

**Migratory species**
A total of 12 migratory bird species listed under the EPBC Act have been recorded within the locality or predicted to occur however none of these bird species were identified during the fauna survey.

**Impact to Koalas**
Schedule 2 of the *State Environmental Planning Policy No. 44 (Koala Habitat Protection*) list specific "feed trees" that are known to be used by Koalas. One of the most important factors influencing the distribution and numbers of koalas in any area is the presence and density of their food tree species.

Three of the remnant eucalypt species on and around the Site are recognised as secondary Koala food trees (OEH, 2018e), these being Inland Grey Box, Fuzzy Box and White Box. The last of these is listed as a Koala feed tree in Schedule 2 of SEPP 44. However, the Site does not have an extant Koala population and therefore is not 'core' Koala habitat so that a SEPP 44 plan of management is not required.

In addition to this, the Site already has a barrier in the form of a boundary fence and there are no historic or current observations of koalas within or near the site. The stands of vegetation are already isolated making it extremely difficult for koalas to reach them as koalas will generally not move across more than 200m of open ground. If koalas could reach the remnant areas of vegetation they would be unable to remain there long-term due to the poor condition of the existing trees.

### *Avoidance measures*

The site survey was conducted to complete the flora and fauna impact assessment and to identify site constraints to guide detailed design. Following the site survey, the site layout has been revised to avoid impacts on the native vegetation on the northern perimeter of the site and existing narrow stands of vegetation along the southern and western boundaries. The vegetation proposed to be cleared is shown on Figure 6-4, this also illustrates the existing vegetation that will be retained along the perimeters to assist with visual screening and the buffer zones proposed along the flowlines and dams.
Specific impact avoidance measures include:

- Measures to avoid damage to patches of mature native perimeter trees on all boundaries of the Site
- Avoidance and protection of the block of planted native eucalypts
- The retention and avoidance of three Fuzzy Box trees adjacent to the northern boundary of the Site (Figure 6-5).

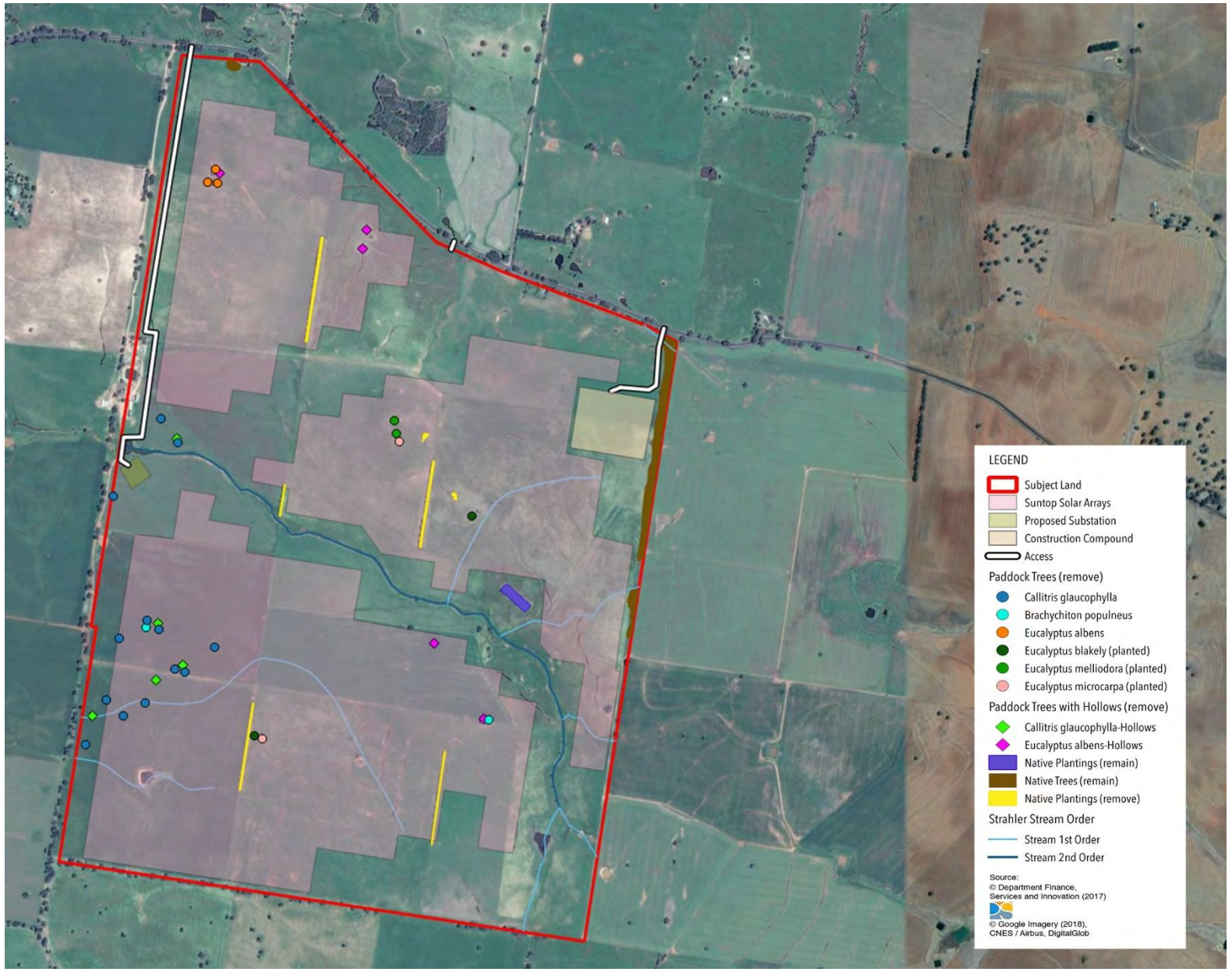



Figure 6-4 Vegetation to be cleared




Figure 6-5 Vegetation to be cleared at intersection

### *Construction*

Direct biodiversity impacts that must be managed during construction and decommissioning include:

- Clearing of native vegetation, and removal of dead wood and dead trees which in turn may cause:
  - Loss of tree food sources and reduced foraging habitat
  - Loss of nest sites
  - Loss of habitat connectivity
  - Increase edge effects
- Introduction and/ or spread of noxious weeds and pathogens
- Disturbance of fauna during construction due to light, noise and air quality impacts generated by vehicles, equipment and construction activities
- Fauna mortality or injury
- Entrapment of fauna in trenches
- Increase in predation by feral animals
- Erosion of disturbed areas leading to sedimentation and dust affecting any downgradient habitat (see Section 6.8).

Removal of vegetation will not interfere with habitat connectivity as the trees to be removed are few in number and widely spaced. Most of the habitats within the Subject Land are already impacted by edge effects (light, noise, dust, etc.) associated with the establishment of agricultural land. The PV panels will provide greater ground coverage than currently exists which should assist in reducing the occurrence of wind-blown dust.

There will be some increase in noise and air quality impacts during the construction of the solar farm. However, these will be limited to the construction period and once construction is complete, both noise and dust levels will be reduced. No additional artificial lighting is proposed during the construction of the solar farm.

Nocturnal species, species with low mobility, territorial species and some ground-dwelling species (such as lizards and snakes) are particularly susceptible to injury or death during construction and clearing. However, clearing works would be minimal and the area has been deemed to have low habitat value.

It is also possible that some fauna may be disturbed or become trapped within trenches, pits or other enclosed areas. Fauna may also be impacted by increased traffic volumes however wildlife mortality on roads would be limited as a result of the Proposal, given all the existing roads are currently in operation with relatively low vehicle speed limits, and no new roads would be created.

The main type of impact on fauna that could occur as a result of the Proposal include damage to potential water bird habitat near a dam in Lot 3 DP 506925, and damage to some of the Western Grey Box as a result of vehicle movements about the site. All of the other land to be used for the solar farm is land that has been cleared for agriculture and is devoid of woodland or native grasslands.

**Part 7 assessment (5 Part Test)**

Under Section 7.3 of the new BC Act, proponents must apply the test of significance to "*determine whether the proposed activity is likely to significantly effect on threatened species or ecological communities, or their habitats*".

An impact assessment under Part 7 of the BC Act (referred to as the 5-part test of significance) has been undertaken for BC Act-listed Threatened species and ecological communities recorded or predicted to occur

in the Subject Land, and have the potential to be directly or indirectly impacted upon as a result of the proposed works (refer **Appendix D**).

The seven-part test concluded that the proposal is not expected to have a significant effect on subject species and communities and thus the preparation of a Species Impact Statement is not deemed to be required.

Vegetation screening works for the proposal (refer **Appendix C**) will provide an opportunity to add biodiversity value to the Site.

No impacts in addition to those mentioned for construction are anticipated during the decommissioning phase.

### *Operation*

The following impacts have been considered as having potential to occur during operation:

- Microclimate impacts under the PV array (shading, ground cover decline, water availability, temperature, humidity and erosion)
- Weed growth and spread
- Movement barrier and collision hazard created by perimeter fencing
- Vehicle collision risks to fauna
- Impacts of habitat connectivity
- Noise from the sub-station.

Tracking panels will reduce potential microclimate impacts as the vegetation underneath the PV arrays will be exposed to the sun at certain parts of the day. Changes to water availability to land and vegetation underneath the PV arrays is not expected due to lateral movement of surface water from adjacent rain-exposed areas.

Ground disturbance as well as vehicle movement on and off Site has the potential to contribute to the spread of weeds. A Weed Management Plan will also be developed as part of the CEMP to prevent unwanted vegetation becoming established on the Subject Land.

As the site has negligible habitat value, the potential to create a barrier to movement is unlikely to be significant to any local fauna over time. Some isolated collisions with fencing may occur, however, this is considered to be a low risk and it is not anticipated that collisions with fencing will constitute a significant impact.

Operational vehicle movements will be limited and vehicle speed limits will be set to reduce risk of collision with fauna.

Noise impacts will be highly localised to the Site and will not be a factor that will negatively impact on native fauna. Other specific mitigation measures are listed in Section 6.1.4.

Construction and operation of the proposal would result in the loss of:

- 1.25 ha of eucalypt plantings and 6 isolated planted native trees
- 0.04ha of Box-Gum Woodland
- 25 remnant paddock trees and up to 10 isolated roadside trees.

No threatened ecological communities, populations, flora or fauna species meet the criteria for Serious and Irreversible Impacts as a result of the Project (OEH, 2018f)

***Biodiversity Credit Report***
The biodiversity credit report of the BAMC indicated that the plantings, which were assumed to represent PCT267 in order to run the calculator, are valued at 20 credits.

Paddock trees for removal were assessed according to Appendix 1 of the BAM (2017a), which valued them at 27.75 credits.

The total credit liability for the Project is 47.75 credits.

***Offset***
SSF will choose to acquit this liability of 47.75 credits by making a lump sum payment of equivalent value to the Biodiversity Conservation Trust Fund.

### 6.1.4 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| B1 | A 10-m buffer shall be established between the perimeter of the remnant vegetation stands and the works footprint. |
| B2 | Erect barriers to protect remnant perimeter trees, planting in Paddock 12 and Fuzzy Box clump in Paddock 1 |
| B3 | The works (e.g. plant, material stockpiling) should not encroach into remnant vegetation and buffer areas. |
| B4 | A clearing protocol will be developed to ensure any potential impacts to native fauna are minimised during vegetation removal, this will include supervised removal of trees with hollows by a trained wildlife carer. |
| B5 | A Land Management Plan which will be developed (refer **Appendix J**) and will be incorporated into an overall construction environmental management plan (CEMP). This will include weed management, animal pest management and monitoring as well as an induction for all employees and contractors detailing the trees that are protected on Site. |
| B6 | Trenches should be backfilled as soon as possible to minimise the chance of fauna becoming trapped. Any trench sections left open for greater than a day would be inspected daily, early in the morning and any trapped fauna removed. The use of ramps or ladders to facilitate trapped fauna escape is recommended. |
| B7 | Speed limits should be set to 20km per hour on internal roads and tracks. |
| B8 | A Vegetation Management Plan will be developed and incorporate tree protection measures to conserve the trees around the perimeter of the Site. |
| B9 | Enhancement of buffer zones around the perimeter of the site to include additional planting of replacement trees for those lost due to the clearing of the paddocks |
| B10 | Any works surrounding the dam located on the western boundary of the site will include implementation of appropriate erosion and sediment controls to prevent silt build up in the dam. |
| **Operational Mitigation Measures** | |
| B11 | The OEMP will include:<br>• The land management plan – which will have a procedure or plan for monitoring vegetation cover and composition and allow for adaptive management<br>• The weed management plan – which will include weed monitoring and control<br>• Vehicle speed limits, to reduce risk of collision with fauna<br>• Prohibition of domestic pets on site. |

## 6.2 Heritage

### 6.2.1 Aboriginal Cultural Heritage

An Aboriginal Cultural Heritage Assessment was undertaken by Kelleher Nightingale Consulting (Kelleher Nightingale) to determine the archaeological significance of the site (see **Appendix E**). A summary of the key findings of this assessment are outlined below.

#### 6.2.1.1 Assessment Methodology

The assessment employed a regional approach, taking into consideration resource availability within the area (water and stone raw materials), the landscape of the Subject Land (landforms, water resources, soils, geology etc.) and the regional archaeological patterning identified by past studies.

The report has been prepared in accordance with:

- *The Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010a)
- *The Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b).

The assessment was undertaken in consultation with Wellington Local Aboriginal Land Council (WLALC) who also participated in two field surveys. The Site lies within the boundaries of the WLALC.

The following tasks were undertaken as part of the assessment:

- A Desktop Assessment including a review of Aboriginal Heritage Information Management System (AHIMS) for known archaeological sites
- A review of local environmental information (topographic, geological, soil, geomorphological and vegetation descriptions) to determine the likelihood of archaeological sites and specific site types, prior and existing land uses and site disturbance that may affect site integrity
- A review of previous cultural heritage investigations to determine the extent of archaeological investigations in the area and any archaeological patterns
- The development of a predictive archaeological statement
- Identification of human and natural impacts to the Subject Land
- Consultation with the WLALC
- A site inspection with the WLALC to both the Site and the intersection of Renshaw McGirr Way and Suntop Road.
- The Subject Land was traversed by pedestrian survey in a series of transects. Site locations were plotted using handheld GPS units, mapped and photographed, including landform context and site contents
- The development of mitigation and conservation measures in consultation with the registered Aboriginal stakeholders.

#### *Desktop Assessment*

A search of AHIMS was conducted on 5 March 2018 to identify registered (known) Aboriginal sites or declared Aboriginal places within or adjacent to the Subject Land, referred to as the study area (Figure 6-6).
The AHIMS Web Service database search was conducted with the following coordinates (GDA, Zone 55):

- Eastings: 0660300 to 0682700
- Northings: 6381900 to 6405250.

Other sources of information including heritage registers and lists were also searched for known Aboriginal heritage in the vicinity of the Subject Land. These included:

- Wellington LEP 2012
- State Heritage Register
- State Heritage Inventory
- Commonwealth Heritage List
- National Heritage List
- Australian Heritage Places Inventory
- Historic Heritage Information Management System (HHIMS).

### *Review of Previous Archaeological Work*

Several archaeological surveys and test excavations have been carried out across the region. The majority of previous assessments were associated with infrastructure developments.

### *Archaeological Potential*

Archaeological potential in the local area has been affected by various factors, primarily the extent of historical disturbances. Extensive land clearing activities would have removed mature native vegetation and therefore directly impacted on the preservation of culturally modified trees. Agricultural activities such as cultivation would have also affected the presence of subsurface cultural material through disturbances to the upper soil horizons.

Spatial and stratigraphic movements of cultural material could be expected, but these processes do not remove or destroy archaeological material. Some post- depositional movement of cultural material can also be expected due to erosion, especially on hillslope landforms and fluvial processes along stream channels. Construction of farm buildings, artificial dams, irrigation channels and installation of fences has also caused ground disturbance and may have removed and/or displaced soils containing cultural material.

## 6.2.1.2 Existing Environment & Archaeological Context

### *Aboriginal Settlement*

The Wellington area is within the Wiradjuri territory. Wiradjuri is the largest Aboriginal language group in NSW and means “people of the three rivers”, referring to the Macquarie, Lachlan and Murrumbidgee rivers (NPWS 2003:121). Local movement of people was associated with several purposes which included, hunting and gathering, social activities and ceremonial gatherings. Resources were utilised seasonally when family groups would be drawn to the riverine environment and would have camped nearby. In times of less abundance, visits to an area would generally be short and associated with a particular activity. This implies that areas around permanent and reliable water sources, such as rivers and larger creeks were revisited periodically over time, while smaller ephemeral creeks were visited only seasonally but not necessarily returned to regularly. Ridgelines and crests were also visited as passing corridors with very short or transient occupation events.

### *Landscape Features*

Aboriginal heritage items are often associated with particular landscape features as Aboriginal people used these features in their day-to-day lives or for cultural ceremonies. A common element that influences occurrence of sites is proximity to water. Oral history and archival investigation has also demonstrated that many of the historic, social and spiritual aspects of Aboriginal culture share a common theme with rivers, creeks and waterholes.

Aboriginal heritage artefacts such as Aboriginal scarred trees, and stone tools have been found in other locations along the Macquarie River. The Subject Land however, is located over 7km from the River landscape within a highly disturbed intensive agricultural environment.

### *Soils and Geology*

Soil type would determine the state of preservation of cultural material with the higher preservation rate in deep alluvial deposits and in areas with limited previous surface and ground disturbance.

Soils within the study area comprise the Arthurville (ar) soil landscape as mapped by NSW Soil and Land Information System (Murphy and Lawrie 1998:158-60). This Soil Landscape occurs on gently undulating rises and undulating low hills which are underlain by the Canowindra Porphyry and Hanover Formation. Topographically it lies between 280 and 560 metres above sea level, with slopes gently inclined at 2-6% and the local relief ranging between 20 to 80 metres. The drainage lines are approximately 1-2 kilometres apart, and colluvial and alluvial deposits are derived from the parent rock. Soils are Red- Brown Earths with some Yellow Podzolic-Solodic soils in depressions and on lower slopes. Soils consist of hard setting dark reddish-brown fine sandy loam occurring as upper topsoil (Horizon A1), overlying light yellowish-brown fine sandy loam occurring as lower topsoil (Horizon A2). Subsoils consist of reddish brown medium clays and reddish brown clays. The soils are susceptible to erosion particularly during and after cultivation or when the percentage of ground cover is low. They are well drained and slightly acidic to neutral with a variety of salts in varying levels throughout the landscape, these occur in low levels within drainage lines and depressions.

Characteristics of the Arthurville Soil Landscape indicate they would be prone to preserve archaeological material as they are hard setting sandy loams formed in situ by weathering of the parent rock material. In areas that have been subject to recent land use activities such as agricultural practices, cultural material could be moved and no longer be in its original context while not being removed entirely.

Previous land use modifications within the Subject Land include land clearing for cropping and grazing, informal vehicle tracks, cultivation, construction of dams, fences and other infrastructure such as grain silos. All of these land use practices would have displaced any possible Aboriginal cultural material and removed modified or scarred trees.

### *Archaeological Potential*

The assessment found that whilst the regional environment provided resources, including water, flora and fauna and raw stone materials, the Site has limited water resources and it is likely that this would have made the area less attractive to Aboriginal people when more preferred sites would be located closer to the Macquarie River and its flood plain. Land clearance for agricultural purposes, including removal of trees, would have impacted on the topsoil and would have mixed the deposits, therefore possibly exposing any possible subsurface cultural material and causing a loss of archaeological context. The entire Subject Land was assessed as having low archaeological potential.

The following predictive statements can be made:

- Archaeological sites are likely to consist of open artefact scatters and/or isolated finds on the elevated, well-drained landform units, and scarred trees within areas of remnant mature vegetation
- It can be expected that silcrete, quartz, quartzite, chert and volcanics will be the most commonly encountered artefact raw material
- Clearance of the majority of original vegetation lessens the likelihood of identifying culturally modified trees, but old growth trees may be present in the Subject Land and have the potential to display scars of Aboriginal origin
- Archaeological sites are more likely to be identified in areas that have been subject to less intensive disturbance

- The identification of archaeological sites is likely to be affected by visibility of the ground surface, but successful assessment of areas of potential archaeological deposit can be made based on landform and other environmental factors such as distance to water.

### *Database searches*

The AHIMS search concluded that there are 47 Aboriginal sites or places recorded within the search area, however none were recorded within the Site. The review of other sources did not identify any items of Aboriginal heritage value listed within the Subject Land.

The distribution of recorded Aboriginal sites within the search area is shown on Figure 6-6 and the frequencies of site types (site context/features) within the AHIMS database search area is listed in Table 6-4

Table 6-4 Frequency of site types from AHIMS database search

| Site Context | Site Features | Number | % |
|---|---|---|---|
| Open Site | Modified Tree (Carved or Scarred) | 17 | 36.2 |
| | Artefact Scatter | 9 | 19.2 |
| | Restricted Site | 8 | 17 |
| | PAD; Artefact Scatter | 3 | 6.4 |
| | Grinding Groove | 2 | 4.3 |
| | Burial | 2 | 4.3 |
| | Stone Quarry; Stone Arrangement | 1 | 2.1 |
| | Stone Arrangement; Stone Quarry; Artefact Scatter | 1 | 2.1 |
| | Shell Midden; Artefact Scatter | 1 | 2.1 |
| | Hearth; Artefact Scatter | 1 | 2.1 |
| | Ceremonial Ring; Artefact Scatter | 1 | 2.1 |
| | Aboriginal Ceremony and Dreaming; Stone Arrangement | 1 | 2.1 |
| TOTAL | | 47 | 100 |

No previously recorded sites were situated within or adjacent to the study area. Six AHIMS registered Aboriginal sites were located within three kilometres of the study area, including modified (scarred) trees, a grinding groove site, three artefact scatters and one isolated artefact.

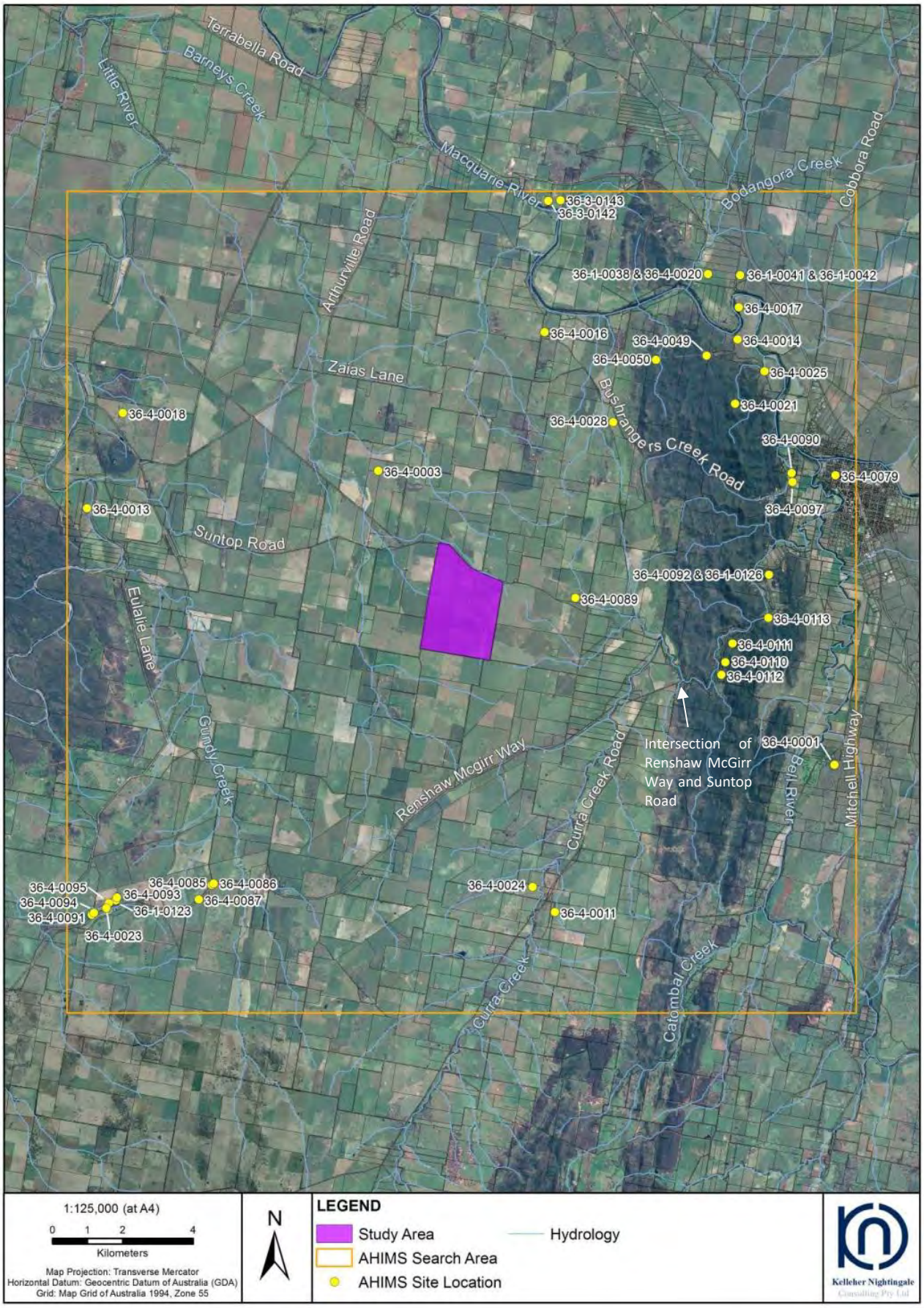



Figure 6-6 Previously recorded Aboriginal Sites

### 6.2.1.3 Assessment of Potential Impacts

WLALC was consulted at the commencement of the Proposal and invited to participate in a site inspection. Two site inspections were conducted, one to assess the Site on 26/02/2018, and another to assess the area for the proposed upgrades to Renshaw McGirr Way and Suntop Road, 14/05/2018. The archaeological field survey conducted by Kelleher Nightingale and the WLALC, identified three heritage sites within the study area, see Figure 6-7. The sites are all outside the Proposal footprint and will not be impacted by the proposal. The items are listed as:

- Aboriginal archaeological sites, Suntop IF 1 and Suntop IF 2, two isolated artefacts identified along a creek bank and retained within the riparian corridor; and
- Culturally significant tree as identified by the WLALC, situated outside the proposed solar farm footprint on the western boundary.

The study area exhibited low archaeological potential due to combinations of archaeologically unfavourable topography, agricultural activity and various forms of disturbance to the land. These factors indicate that there is a low probability of unexpected finds during construction particularly as landform features such as flowlines will be buffered.

Proposed works associated with the solar farm development, including intersection upgrade will not impact on identified areas of Aboriginal cultural heritage significance. The culturally significant tree will be retained in its current setting along the western boundary of the study area and the two isolated finds will be retained within the riparian corridor of the central drainage line.

Provided the identified Aboriginal archaeological sites and culturally significant tree are avoided, the proposed construction and operation of the Suntop Solar Farm and upgrade works to the intersection of Renshaw McGirr Way and Suntop Road would not impact on Aboriginal heritage. The WLALC have stated their concurrence with the Proposal as long as these sites are afforded appropriate protection and the protection measures are to be detailed in the Construction Environment Management Plan (CEMP). In accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* the proposed activities can proceed with caution.

It is recommended that the identified site locations (Suntop IF 1, Suntop IF 2 and culturally significant tree) should be included within the CEMP for the Suntop Solar Farm. It is considered no impact to Aboriginal heritage will occur as a result of the proposed Suntop Solar Farm.

In the event of an unexpected find of an Aboriginal heritage item (or suspected item), the safeguards specified below would be implemented to avoid or minimise any potential impact on Aboriginal heritage items uncovered during the proposed works.

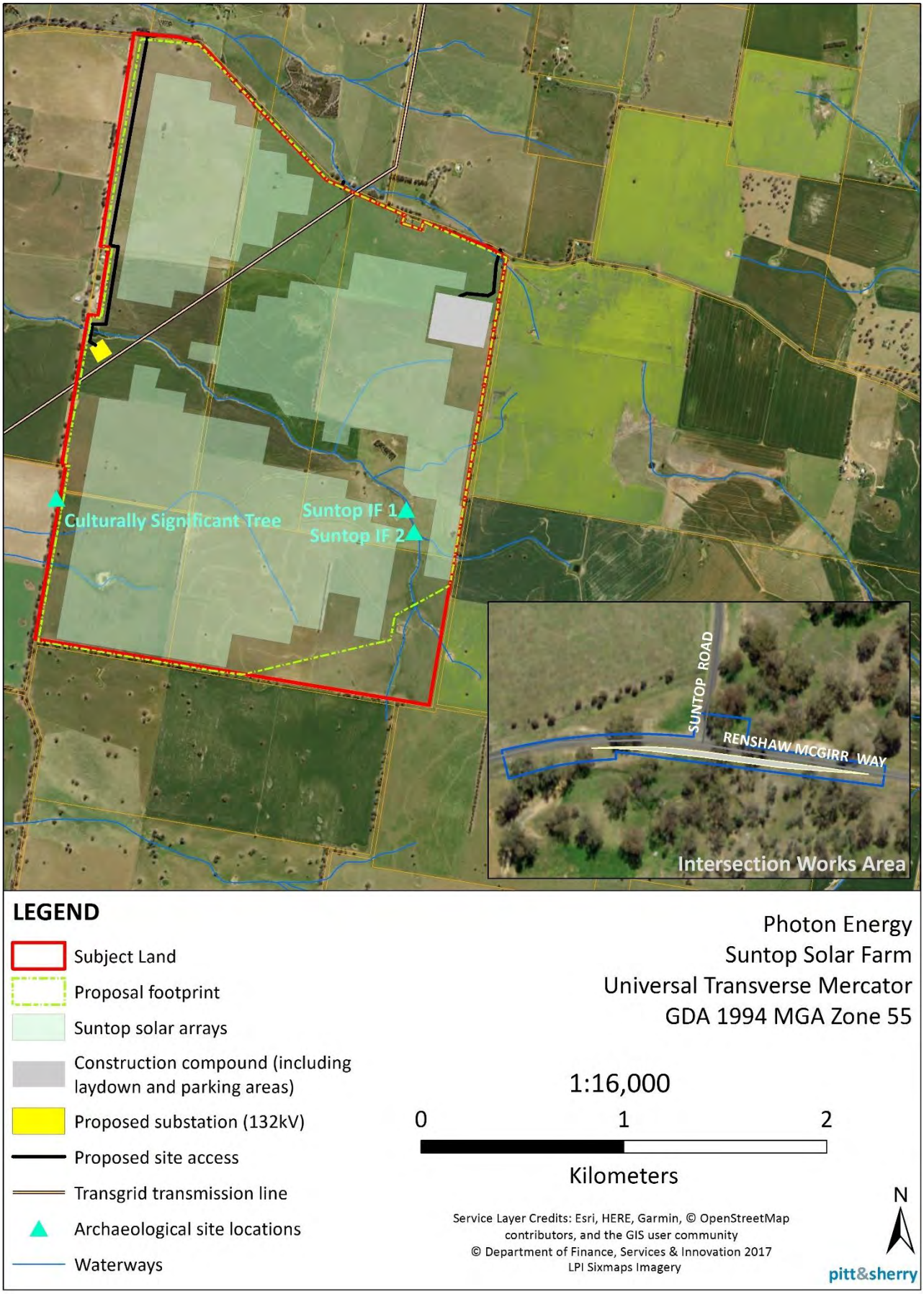



Figure 6-7 Location of Aboriginal archaeological sites

### 6.2.1.4 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| AB1 | An Unexpected Finds Protocol which addresses unexpected aboriginal heritage finds will be included in the Construction Environmental Management Plan to be completed by the construction contractor. |
| AB2 | The Unexpected Finds Protocol will form part of the site induction and must be viewed by all relevant employees and contractors before working on site. |
| AB3 | Aboriginal archaeological sites, Suntop IF 1 and Suntop IF 2, (two isolated artefacts identified along a creek bank) and a Culturally significant tree (all outside the footprint), should be addressed in the CEMP to ensure protection. |
| AB4 | If suspected Aboriginal objects, such as stone artefacts are identified during works, works must cease within 10m of the affected area and an archaeologist called in to assess the finds. If the finds are found to be Aboriginal objects, the OEH must be notified under section 89A of the NPW Act. Appropriate management or avoidance should be sought if Aboriginal objects are to be moved or harmed. |
| AB5 | In the extremely unlikely event that human remains are found, works should immediately cease and the NSW Police are to be contacted. If the remains are suspected to be Aboriginal, the OEH may also be contacted at this time to assist in determining appropriate management. |

## 6.2.2 Historic Heritage

### 6.2.2.1 Assessment Methodology

A desktop study was undertaken to identify any historic heritage (Non-indigenous) items or places in proximity to the Subject Land. The desktop study included a review of the following resources:

- Wellington Local Environmental Plan 2012
- Australian Heritage Database
- Australian Heritage Places Inventory
- NSW State Heritage Register
- EPBC Protected Matters Search (World Heritage Properties and National Heritage Places).

A survey of the Site was undertaken on 22nd November 2017 by pitt&sherry to identify any evidence of structures or items that may have heritage significance. A summary of the investigations and key findings of this assessment are summarised in this chapter.

### 6.2.2.2 Existing Environment

The Proposal is located approximately 10km south-west from the Wellington town centre where the majority of historic heritage items in the area are located.

#### *Historical setting*

Prior to European settlement the area was home to the Wiradjuri people who had lived and moved through the district for at least 20,000 years. European explorers such as John Oxley reached the area in 1817. One of the first major settlements within the region was a convict agricultural station, the 'Wellington Convict

and Mission Site – Maynggu Ganai[1]' which shaped Wellington as the centre of ongoing contact between the Wiradjuri and British settlers west of the Blue Mountains (1820). Within three years of establishing the settlement, approximately 300 acres of surrounding land had been cultivated, marking the beginning of this region's major land use as agricultural (pastoral). The convict station later became the first inland Aboriginal mission in Australia and is an early example of the forced institutionalisation of Aboriginal children.

Wellington was officially gazetted in 1846. In 1840 a private village known as Montefiores was established on the northern side of the Macquarie River with Cobb & Co using the village as a coach stop. Wellington became a municipality in 1879 with the railway reaching the town in 1890, the local population reached 1340 in 1881 and mining operations had ceased in the district by 1914. The now former Wellington Shire Council was established in 1949. The region of Suntop has not been identified as historically significant, and limited information is readily available regarding its history.

### *Heritage Items*

The results of the database searches indicate that there are no heritage items or areas listed under the NSW Heritage Register, Commonwealth Heritage Register or Register for the National Estate within the vicinity of the Proposal Area.

The heritage items listed in these registers are located approximately 10 km or more from the Proposal (refer Table 6-5) in the town of Wellington. The Wellington LEP lists one item in proximity to the intersection of Renshaw McGirr Way and Suntop Road.

Table 6-5 Historic items within the vicinity of the site

| Register | Item Name | Item ID | Significance level | Location | Distance from the Site |
|---|---|---|---|---|---|
| World Heritage List | None identified | N/A | N/A | N/A | N/A |
| National Heritage List | None identified | N/A | N/A | N/A | N/A |
| Commonwealth Heritage List | None identified | N/A | N/A | N/A | N/A |
| NSW State Heritage Register | Wellington Post Office | 01415 | Local | 21 Maughan St Wellington | 10.5km |
| NSW State Heritage Register | Wellington Convict and Mission Site | 01859 | Local | Curtis St Wellington | 10km |
| NSW State Heritage Register | John Fowler 7nhp steam Road Locomotive | 01867 | State | 9 Amaroo Drive Wellington | 11 km |
| NSW State Heritage Register | Blacks Camp | 01865 | Local | University Road Wellington | 13km |
| Wellington LEP | Mount Arthur Reservoir | I58 | Local | 100 Brennans Way | 8.6km |
| Wellington LEP | Macquarie Farm – (former Wellington Police Station) | I53 | Local | 1 Lay Street | 8.7km |
| Wellington LEP | Mountain View homestead | I68 | Local | 646 Mountain Valley Road | 8.8km |
| Wellington LEP | Camelford Park | I67 | Local | 8745 Mitchell Highway | 8.8km |

[1] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5051556

| Register | Item Name | Item ID | Significance level | Location | Distance from the Site |
|---|---|---|---|---|---|
| Wellington LEP | Road Formations (Three Eras) | I17 | Local | 737 Renshaw McGirr Way | 200m from intersection 5km for Site |

The survey of the Site undertaken on 22nd November 2017 revealed no existing or relict structures or items of potential heritage significance within the Site or ancillary works areas. Historical aerial photographs of the site were unavailable.

#### 6.2.2.3 Assessment of Potential Impacts

Database assessments and the site assessment did not identify any items of heritage significance within or near the site and one items of heritage significance near the intersection of Renshaw McGirr Way and Suntop Road.

This item (Road Formations-Three Eras) is located approximately 200m from the intersection on Lot 2 DP 519851. This is private property and would not be impacted by the proposed intersection upgrade works.

The Proposal is not expected to directly impact on any non-indigenous heritage values. Due to the distance from the nearest heritage item, impacts from vibration and earthworks will not impact on any heritage items. Similarly, due to the distance from listed heritage sites there are no expected impacts to views associated with heritage items from the Proposal.

No historic heritage impacts in addition to those mentioned for construction are anticipated during the decommissioning phase.

No operational impacts to items of historic heritage value are expected as a result of the proposal. As such no operational mitigation measures are proposed.

#### 6.2.2.4 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| H1 | An Unexpected Finds Protocol which addresses unexpected non-indigenous heritage finds will be included in the Construction Environmental Management Plant to be completed by the construction contractor. |
| H2 | The Unexpected Finds Protocol will form part of the site induction and must be viewed by all relevant employees and contractors before working on site. |
| H3 | If an item (or suspected item) of heritage is discovered during construction, all work in the area of the find will cease immediately and the Unexpected Finds Protocol implemented including notifying an officer from the Heritage branch of OEH immediately (in accordance with section 146 of the *Heritage Act 1977*) and seeking advice for management of the object. |

## 6.3 Visual

A Visual Impact Assessment (VIA) was undertaken by Envisage Consulting (Envisage) to investigate the potential visual impacts of the Proposal (see **Appendix C**). The summary of the key findings of this assessment are outlined below.

### 6.3.1 Assessment Methodology

The impact methodology used in the VIA has been based on experience with other large-scale infrastructure projects, and visual assessment guidelines used by government authorities in Australia and internationally:

- *'Environmental Impact Assessment Guidance Note – Guidelines for Landscape Character and Visual Impact Assessment'*, 2013, NSW Roads and Maritime Services
- *'Visual Landscape Planning in Western Australia',* 2007, Western Australian Planning Commission
- The United Kingdom's widely used '*Guidelines for Landscape and Visual Impact Assessment*,' 2013, The Landscape Institute and Institute of Environmental Management and Assessment
- '*Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands*', 2013, United States Department of the Interior
- *'Guide to Evaluating Visual Impact Assessments for Renewable Energy Projects'*, 2014, Sullivan and Meyer, for United States Department of the Interior.

An initial step in the assessment was to identify potentially-sensitive viewing locations such as residences, and publicly accessible areas such as towns and local roads. Sensitive viewpoints were verified via aerial mapping and during the site inspection which occurred on the 22nd November 2017.

Two main types of visual impacts are assessed in this report:

1. Effect on the landscape character – the overall impact of the Proposal on an area's character and sense of place.
2. Effect on key viewpoints – the day to day visual effects of the Proposal on people's views.

The level of impact to landscape character and viewpoints is based on the combination of two criteria – 'sensitivity' and 'magnitude of change', defined by Roads and Maritime (2013) as:

- Sensitivity - The sensitivity of a landscape character zone or view and its capacity to absorb change. In the case of visual impact this also relates to the type of viewer and number of viewers
- Magnitude - The measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer.

The specific criteria used to determine sensitivity and magnitude of change are outlined in Section 2.3 of the VIA (refer **Appendix C**).

The combination of sensitivity and magnitude provides the predicted impact rating of the effect on landscape character for a project, or visual impact for surrounding viewpoints, as shown in Table 6-6 (as adapted from Roads and Maritime, 2013).

**Table 6-6 Level of Impact**

| Matrix of relationship between sensitivity and magnitude | | | | | |
|---|---|---|---|---|---|
| | Magnitude | | | | |
| Sensitivity | | High | Moderate | Low | Negligible |
| | High | High | Moderate-high | Moderate | Negligible |
| | Moderate | Moderate-high | Moderate | Low-moderate | Negligible |
| | Low | Moderate | Low-moderate | Low | Negligible |
| | Negligible | Negligible | Negligible | Negligible | Negligible |

### 6.3.2 Existing Environment

The Site borders Suntop Road along its northern boundary with an existing 132KV transmission lines traversing the property in a roughly north -south alignment. There is an existing residence (unoccupied at present), agricultural sheds, fences, water tanks, silos and farm equipment located near the western boundary of the property which will be subdivided from the Site. The Site is located in a rural area with predominantly cleared mixed farms that provide a vista typical of the Wellington area refer Figure 6-8.

Separating Suntop and Wellington, and located approximately 5 km to the north of Suntop, is the Mount Arthur Reserve, a 2,123ha Crown Reserve set aside for Public Recreation and Environmental Protection. The Reserve lies within the northern most section of the Catombal Range and takes in three main peaks - Mounts Arthur, Wellesley and Duke - rising to 563m above sea-level. The Reserve is recognised on the Register of the National Estate for its natural values. A large portion of the Reserve has been protected in various forms since 1913.

West of the Reserve, land in the Suntop area has been developed for agricultural purposes and is primarily used for crops (wheat and canola) and grazing (sheep and cattle). Large paddocks of improved pastures, crops, rural residences, large farm sheds, stores of grain and stock feed, trucks and harvesters are common throughout the area.

Land in the vicinity is undulating. There are numerous small creeks and the nearest river is the Macquarie River at Wellington. The area can experience extremes in temperature. So far in 2017, the hottest temperature recorded has been 45 degrees and the coldest was -4.5 degrees. During harvesting, dust plumes are common.

Suntop is home to approximately 70 residents. Two local roads - Suntop Road and Renshaw McGirr Way - provide connection to the main NSW road and rail network.

The dominant background colours common to the area are the colours of the crops (seasonally changing from bright greens to pale, muted yellows), grazing pastures (light, bright greens to light browns and yellows), scattered tall vegetation (dark grey-green), soil (red-brown), surrounding vegetated ridges (soft deep blue) and occasional patches of exposed rocks (greys).

There are no local sources of large-scale artificial lights that would be associated with an industrial premises or commercial facility operating at night. Farm sheds and associated farming infrastructure are made of sheet metal, concrete or timber. Some surfaces, including galvanised iron roofs and silos, are highly reflective, while power lines and tall transmission lines cross the paddocks and run along the local roads.



Figure 6-8 Typical rural landscape around Wellington – open paddocks, scattered trees, farm structures



Figure 6-9 Typical landscape character around Wellington – scattered native trees, crops and pastures

### 6.3.3 Assessment of Potential Impacts

**Avoidance measures**

The initial visual site inspection was conducted to inform the VIA, to identify sensitive receivers and to identify site constraints to inform design. Following the site inspection, the site layout was revised to accommodate appropriate buffer distances from residents and road users on Suntop Road. The footprint was excluded from two ridgelines located on the eastern and southern sections of the Site to reduce impacts to receivers in these directions.

**Visual Intrusion**

A primary concern about renewable energy is visual intrusion. Potential concerns in relation to visual intrusion include:

- Scale
- Glare
- Light refraction
- Geometric Pattern
- Risks to Aviation
- Risk to road users
- Movement
- Sky lining
- Ancillary structures.

Each of these concerns have been addressed in **Appendix C** to determine potential visual impacts associated with these aspects. Potential impacts relevant to the solar farm are discussed below.

**Scale**

Industrial scale solar farms such as the Proposal can occupy very large land areas, have regular, strong geometry, and can on occasions be visible over long distances. However, depending on the Proposals' layout and contrast, in some cases they may appear to be like natural features, while in other cases, they may lack sufficient visual detail to be identified positively as solar facilities. Additionally, solar facilities have visual advantages in that they are generally low to the ground, have low visual contrast, and can appear as shadows from a distance.

The solar footprint of the Proposal will occupy 472ha of land, on a moderately undulating landscape. It has been identified that at least some part of the solar footprint would be seen from 29 private viewpoints. Photomontages have been prepared for selected viewpoints surrounding the Site and provide an illustration of the scale of the Proposal (**Appendix C**).

**Glare**

The Solar PV modules proposed to be installed at Suntop are different to those used with concentrated thermal solar power which utilises mirrors to reflect the sun to one point concentrating the sunlight as they are designed to absorb the light rather than reflect it.

The NSW Government Discussion Paper: *Planning for Renewable Energy Generation – Solar Energy* (April 2010) states: '*The potential for glare associated with non-concentrating PV systems which do not involve mirrors or lenses are relatively limited*'.

Other infrastructure on site such as metal structures associated with the substation and PV panel steel mounting frames have the potential to produce glare or glint impacts, however any impacts caused would be minor due to their small size, low surface area and location away from highly visible areas.

**Light refraction**

A 'mirage' effect — glittering or shimmering — can be sometimes observed at PV facilities. The effect is similar to the shimmering seen over a bitumen road on a hot day and occurs because the surface of the panels is hotter than the air around it. The 'mirage' effect can make the colour above the panels appear brighter and bluer. The 'mirage' effect is not bright enough to cause discomfort and is likely to be only observed during certain times of day and from certain viewing positions.

Given the position of the Site in the landscape and the relatively low vehicle numbers using Suntop Road, this effect would only be visible on days during the warmer months and for a short period from vehicles passing the Site. The implementation of the mitigation measures listed in Section 8 will reduce any potential impacts from light refraction.

**Geometric Pattern**

The viewer position in relation to the patterning of the PV modules also affects the appearance of the facility as viewer position determines which side of the facility is in view and which angle of the solar farm is seen.

**Risks to Aviation**

As the infrastructure is relatively low to the ground with the tallest structure measuring approximately 22m the development would not pose a risk to aviation. The solar facility is approximately 18km from the Wellington aerodrome and is not aligned with any other runways. Due to the small size of the aerodrome, it does not support commercial flights and is only used periodically for local light aircraft. The photovoltaic solar panels would appear dark grey from an aircraft and would not constitute a glare or reflectivity hazard.

**Risk to Road Users**

When driving past PV modules in rows perpendicular to the road, the colour of the panels could also change rapidly from black (when viewed from the south) to various shades from blue to white, lightening in appearance as the vehicle passes the facility. The rapid change in viewer position results in abrupt changes in angle and pattern of the panels. This visual change would only be seen if looking directly down the rows when travelling past at speed and would be momentary.

Figure 6-10 shows the colour change in relation to viewer position. When viewed from the front, the panels appear lighter in colour – with shades of blue to white. Looking at the back, the panels appear black as they cast shadow. The tracking panels will face north and track from east to west, so they will face the north-east in the morning, to the north-west by the afternoon.

As mention in the section above potential glare/reflectivity generated from on-site infrastructure towards public roads is limited.



Figure 6-10 Royalla solar farm showing colour change that can occur when viewed from the front.

**Movement**

The solar PV panels will be mounted on a horizontal single axis tracking structure which will slowly follow the daily movement of the sun in a 120 degree turn from the north-east in the morning, to the north-west in the afternoon. As such a greater number of potential viewpoints will see the face of the PV panels although they will be exposed to this face for a shorter period of time than if the panels were fixed in that position. The movement is usually very slow and not apparent in short-duration views.

**Sky lining**

Sky lining occurs when structures are placed on ridgelines, summits, or other locations where they would be silhouetted against the sky. This elevated position would mean that a structure would be visible from larger distances. In this instance, the solar panels are to be installed on side slopes away from any prominent crests or ridgelines, therefore sky lining is not considered to be an issue for the development. There are two low rises on the southern and eastern boundaries and these areas have specifically been avoided and will not have solar panels constructed on them which will also reduce the potential for the sky lining effect to occur.

**Ancillary structures**

The Proposal will require a number of ancillary structures such as inverter stations, electricity cables and the substation. The colour of these structures may contrast with the PV panels and draw the eye. As such colour, should be considered during detailed design.

The transmission infrastructure proposed for the development would increase the density of electrical infrastructure in the area. However, the Proposal would be generally consistent with existing transmission infrastructure in the immediate vicinity of the Proposal, and would largely occur in an existing electricity easement. Furthermore, TransGrid's electrical infrastructure has been present in the area for a significant period of time and has the capacity to absorb the visual amenity changes without marked impact to potential receptors.

## *Construction*

There are two main types of visual impacts generated by the proposal which are:

- Impact to landscape character of the site and the surrounding area
- Visual impact to the surrounding viewpoints, both public and private.

**Impact to Landscape Character**
The overall landscape character is rated as having a moderate sensitivity:

- The landscape is an attractive rural landscape common throughout the Central West Slopes and Plains agricultural area
- The patterning of the area is dominated by geometrical patterns and a patchwork of colours ranging from the black soils, green pasture to golden crops
- The surrounding area is sparsely populated with there being a small number of permanent residential viewers and the nearest road, Suntop Road, providing only local access to residents in this area.

During construction, there would be a number of heavy construction vehicles to deliver materials and equipment and also a higher number of light vehicles for worker transport. Construction machinery would be present in different parts of the site however considering the prevalence of farm infrastructure and machinery this change would be relatively compatible.

The overall magnitude of change to landscape character during construction is low:

- The closest public views would be from Suntop Road, and the additional visual changes associated with the construction machinery, truck movements and a site compound would be of a short timeframe and temporary nature
- The private viewpoints located within 1km of the Site will experience visual changes associated with construction machinery and increased traffic. The location of the site compound away from Suntop road and existing vegetation screening reduces the visual impact of the temporary compound. The impact to private viewpoints located north of the Site will be highest during installation of panels within the northern area of the solar footprint
- The moderate sensitivity ranking, combined with the low magnitude of change during construction, leads to an overall low-moderate level of impact.

Due to the short term and minor nature of works associated with the intersection upgrade the potential to impact on landscape character and viewpoints is considered negligible.

## *Operation*

**Impacts to Landscape Character**
During operations, there would be visual impacts to road users on Suntop Road and surrounding private properties which are assessed below. The PV panels have the potential to be a visual feature within the surrounding landscape. However, due to the height of the PV panels and the selective placement of them on Site the possibility of viewing the entire Site from an elevated view would be reduced, and therefore any change to the landscape character would not be easily perceived when viewing the landscape as a whole.

The magnitude of change to landscape character during operation is rated as moderate due to the following factors:

- The Site is on undulating terrain and is not visually prominent
- The nearest public viewpoint within 1km is Suntop Road and there are no elevated viewpoints frequented by many viewers, therefore it would not become the dominant feature of the scene in general

- Its scale and colour would produce some contrast; however, it is not substantially incompatible with the geometric patterning and colour of the prevalent landscape.

The moderate sensitivity ranking, combined with the moderate magnitude of change post-construction, leads to an overall moderate level of impact.

**Impact to Viewpoints**

*Public Viewpoints*

The majority of the viewpoints assessed are from private residences. The closest recreational and scenic resource in the area is in the Mount Arthur Reserve and does not provide public viewing points.

The only ground-level public locations with views of the Proposal are from Suntop Road and Bennetts Road. Bennetts Road is an unsealed road providing local access to several properties to the north of Suntop while Suntop Road is the main public vehicular access through the Suntop area. Suntop Road has been assessed as a single viewpoint (VP Suntop Road), as the visual experience from the road is linear.

There would be a limited potential for views of the Proposal from aircraft using Wellington Airstrip, which is situated some 18km to the north. It is likely that some airborne viewers would find the solar (PV) farm interesting to look at, yet others may feel it reduces the quality of the landscape character. Nevertheless, it is considered that the overall visual impact would be low.

In summary, the assessment of impact to public viewpoints finds there is one public viewpoint with a moderate impact (Suntop Road).

All remaining ground-level viewpoints have a low impact rating. Visual impact from the air has been assessed as low.

*Private Viewpoints*

Fifty-seven potential viewing points (VP) were initially investigated during the site inspection (22 November 2017). Identification (ID) numbers were allocated to identify each viewpoint.

Access to four of the closest private properties was possible during the site inspection. For the remainder of properties, visibility was determined from the closest public access to each viewpoint and desktop analysis of aerial and topographic mapping.

Site verification determined that 29 viewpoints (of the 57 investigated) may see some sections of the proposed solar farm.

In summary, the assessment of impact to private viewpoints finds there is:

- 1 private viewpoint (VP) with a high impact (VP6)
- 3 private viewpoints with a moderate-high impact (VP1, VP3, VP4)
- 3 private viewpoints with a moderate impact (VP2, VP5, VP7).

All remaining viewpoints have a low impact rating.

Table 6-7 provides a detailed assessment of potential visual impacts from surrounding private viewpoints, with those viewpoints and the predicted visual impact level identified in Figure 6-11 and Figure 6-12. Proposed vegetative screening for visual mitigation is depicted in Figure 6-13.

Works associated with the intersection upgrade are considered to have negligible impact on landscape character and viewpoints as the intersection due to the minor nature and the introduction of standard road elements that already exist at the location.

Table 6-7 Assessed private viewpoints (all houses) and predicted visual impact levels (Source: Envisage 2018)

| Viewpoints | Analysis (on base case of no landscape screening) | Distance to nearest and furthest view of panels | Approximate extent of Site potentially seen | Position in relation to panels | Sensitivity (Criteria In VIA Appendix C) | Magnitude of Change (Criteria in VIA Appendix C) | Impact level | Visual Screening Proposed (Y/N) | Revised impact Level (where relevant) |
|---|---|---|---|---|---|---|---|---|---|
| VP1 - Lot 53 DP 753238, approximately 490m from the Site boundary | In close proximity to panels<br>The viewpoint is a private home with mostly unimpeded views<br>A moderately large proportion of solar farm seen<br>A side view of the panels seen<br>Unlikely to see Substation | 500m - 3.25km | Less than half (40%) | West | High | Moderate | Moderate-high | Yes<br>Extent of panels likely to be seen could be reduced via screen planting along western boundary of the Site | Moderate |
| VP2 – 898 Suntop Road, Suntop (Lot 97 DP 753238), approximately 780m from the Site boundary | In close proximity to panels<br>The view is from a private home; however, vegetation obstructs much of the view<br>A moderate proportion of the solar farm possibly seen, although likely to be obstructed to a large degree by existing vegetation, potentially reducing the view substantially<br>Front view of the panels seen. Potentially see temporary mirage effect<br>Unlikely to see Substation | 790m - 4km | Less than half (30%) | North-west | High | Low | Moderate | Yes<br>Planting at the northern and western boundary would reduce views into the Site | |
| VP3 - 796 Suntop Road, Suntop (Lot 2 DP 983890), approximately | Is in close proximity to Site entry and panels<br>The viewpoint is a private home with mostly unimpeded views | 170m - 2km | Less than a quarter of Site (20%) | North-west front view | High | Moderate | Moderate-high | Yes<br>Views could be reduced via screen planting along the northern 'Suntop Road' boundary | Moderate |

| Viewpoints | Analysis (on base case of no landscape screening) | Distance to nearest and furthest view of panels | Approximate extent of Site potentially seen | Position in relation to panels | Sensitivity (Criteria In VIA Appendix C) | Magnitude of Change (Criteria in VIA Appendix C) | Impact level | Visual Screening Proposed (Y/N) | Revised impact Level (where relevant) |
|---|---|---|---|---|---|---|---|---|---|
| 160m from the Site boundary | Has a front view of the panels (therefore, more likely to experience changes in colour appearance of the panels during day and potentially see temporary mirage effect)<br>A relatively small proportion of the Site would be seen<br>Likely to see Substation | | | | | | | | |
| VP4 – 14 Bennetts Road, Suntop (Lot 92 DP 753238), approximately 270m from the Site boundary | The viewpoint is in close proximity<br>The panels would be viewed from the front (therefore, more likely to experience changes in colour appearance of the panels and possibly mirage effect)<br>However, trees between property and solar farm likely to limit views<br>A relatively small area of the solar farm would be seen<br>Unlikely to see Substation | 280m - 1.5km | Less than a quarter of Site (15%) | North | High | Moderate | Moderate - high | Yes<br>Views could potentially be reduced via screen planting along the northern 'Suntop Road' boundary | Moderate |
| VP5 – Lot 51 DP 1082497, approximately 380m east of the Site boundary | The viewpoint is in close proximity<br>However, trees between property and solar farm may limit views | 420m - 1.5km | Less than a quarter of Site (5%) | North-east | High | Low | Moderate | Yes<br>Views into the Site would potentially reduce via planting along the northern 'Suntop Road' boundary | |

| Viewpoints | Analysis (on base case of no landscape screening) | Distance to nearest and furthest view of panels | Approximate extent of Site potentially seen | Position in relation to panels | Sensitivity (Criteria In VIA Appendix C) | Magnitude of Change (Criteria in VIA Appendix C) | Impact level | Visual Screening Proposed (Y/N) | Revised impact Level (where relevant) |
|---|---|---|---|---|---|---|---|---|---|
| | The private home would have a front view of the panels (therefore, colour change of the panels may be noticeable and possibly mirage effect)<br>A relatively small proportion of the Site would be seen<br>Unlikely to see Substation | | | | | | | | |
| VP6 – Lot 90 DP 657805, immediately north of the Site | Located immediately north of the Site, on the southern side of Suntop Road<br>Although a relatively small proportion of the Site would be seen, the Proposal would occur on three sides of the property<br>The predominant view would be of the front of the panels – colour changes and mirage effect possible from this location<br>Unlikely to see Substation | 10m – 1.5km | Less than a quarter of Site (15%) | North | High | High | High | Yes<br>Impact could be reduced by implementing the proposed buffer between the property and the proposed solar panels to allow for a wide planting area around the property. Screen planting could be introduced on the three sides of the property bordering the Site | Moderate |
| VP7 – 582 Suntop Road, (Lot 50 DP 753238), approximately 950m north of the Site | Is in close proximity<br>Would see a front view of panels over a moderately large proportion of the Site<br>Private house in elevated position, although direct views from the house are not possible | 1km - 3.25km | Less than a half of the Site (30%) | North | Moderate | Moderate | Moderate | No<br>Planting along Suntop Road would not be seen from this viewpoint due to its elevation above the Site. | |

| Viewpoints | Analysis (on base case of no landscape screening) | Distance to nearest and furthest view of panels | Approximate extent of Site potentially seen | Position in relation to panels | Sensitivity (Criteria In VIA Appendix C) | Magnitude of Change (Criteria in VIA Appendix C) | Impact level | Visual Screening Proposed (Y/N) | Revised impact Level (where relevant) |
|---|---|---|---|---|---|---|---|---|---|
| | Unlikely to see Substation | | | | | | | Attempts to undertake consultation with this receiver were unsuccessful. | |
| VP Group A - ID16, ID15, and ID 31 | More distant from Proposal (over 2km) with small proportion of the Site potentially visible<br>Northern (front) views of the panels – possibly distant mirage effect<br>However, existing vegetation likely to reduce potential viewing area<br>Views of the substation unlikely | 2.5 – 8.25km | Less than a quarter (5% - 40%) | North to North-west | Low | Low | Low | No | |
| VP Group B – ID34, ID55, ID56, | More distant from Proposal (over 5km) with large extent of Site potentially visible<br>North-western views of the panels – therefore possibly see distant colour changes of panels<br>However, existing vegetation likely to reduce potential viewing area<br>Views of the substation unlikely<br>Solar farm unlikely to be prominent in the view | 6.75 – 10km | Over half of Site (80-90%) | North-west | Low | Low | Low | No | |
| VP Group C – ID20, ID30 | More distant from the Site (over 5km) with only small proportion of the Site potentially seen | 7 – 8.5km | Less than a quarter of Site (10%) | North-east to north west | Low | Low | Low | No | |

| Viewpoints | Analysis (on base case of no landscape screening) | Distance to nearest and furthest view of panels | Approximate extent of Site potentially seen | Position in relation to panels | Sensitivity (Criteria In VIA Appendix C) | Magnitude of Change (Criteria in VIA Appendix C) | Impact level | Visual Screening Proposed (Y/N) | Revised impact Level (where relevant) |
|---|---|---|---|---|---|---|---|---|---|
| | Northern (north-east to north-west) views of panels<br>Distance likely to negate colour effects<br>Substation would not be seen<br>Solar farm unlikely to be prominent in the view | | | | | | | | |
| VP Group D – ID13, ID32, ID35, ID38, ID41, ID42 | More distant from the Site (over 2km)<br>A moderate to large proportion of the Site possibly seen with side or rear view of panels<br>Views likely to be obscured by trees<br>Substation unlikely to be seen<br>Solar farm unlikely to be prominent in the view | 2.25 – 11.5km | Over a half of the Site (40-90%) | West and south | Low | Low | Low | No | |
| VP Group E – ID26, ID28, ID46, ID47, ID37 | Distant from the Site (over 4km)<br>Small proportion of the Site possibly seen with side or rear view of panels<br>View likely to be obscured by existing trees<br>Solar farm unlikely to be prominent in the view | 4.5 – 9.75km | Less than a quarter of the Site (>5-15%) | West and south | Low | Low | Low | No.<br>Preventing panel installation over the two highest ridges within the Site will eliminate views or reduce views from these viewpoints. | |
| VP Group F - ID40, ID50, ID52 | Distant from the Site (over 5km) | 6.75 – 9.25km | 20-30% | South and west | Low | Low | Low | No | |

| Viewpoints | Analysis (on base case of no landscape screening) | Distance to nearest and furthest view of panels | Approximate extent of Site potentially seen | Position in relation to panels | Sensitivity (Criteria In VIA Appendix C) | Magnitude of Change (Criteria in VIA Appendix C) | Impact level | Visual Screening Proposed (Y/N) | Revised impact Level (where relevant) |
|---|---|---|---|---|---|---|---|---|---|
| | Moderately large proportion of the Site seen with side or rear view of the panels seen<br>Substation would not be seen<br>Solar farm unlikely to be prominent in the view | | | | | | | | |
| VP Suntop Road (linear viewpoint) | Travellers using Suntop Road pass immediately to the north of the site<br>Close proximity<br>Front views of the panels would be seen and colour changes may be noticed when driving past the Site<br>Views are temporary<br>A relatively small proportion of the site seen<br>Unlikely to see Substation | 20-600m | 15% | North | Moderate | Moderate | Moderate | Yes<br>Views into the Site likely to reduce via planting along the northern 'Suntop Road' boundary | |

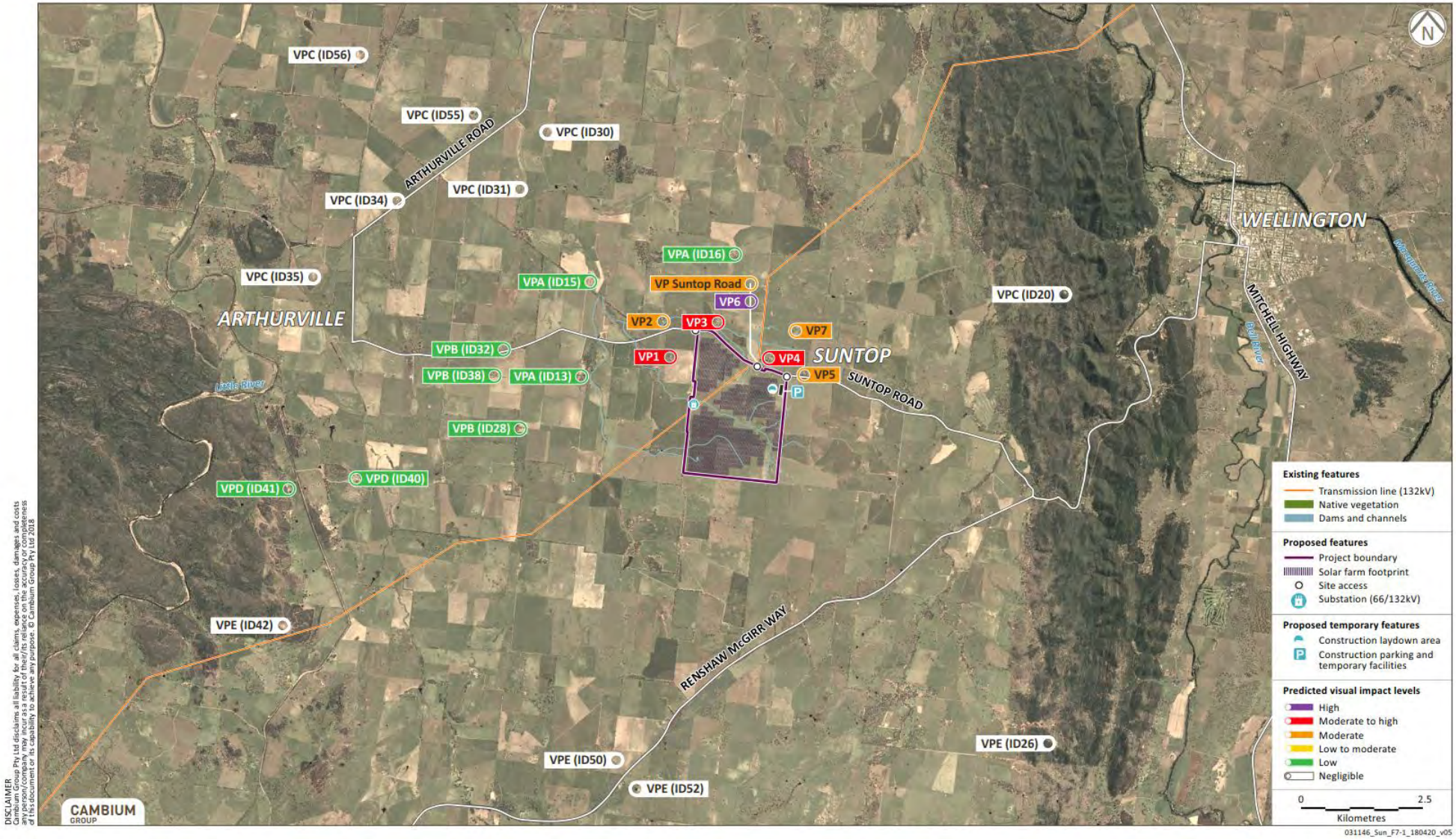



Figure 6-11 Viewpoints and Impact Rating




Figure 6-12 Photomontage viewpoint locations

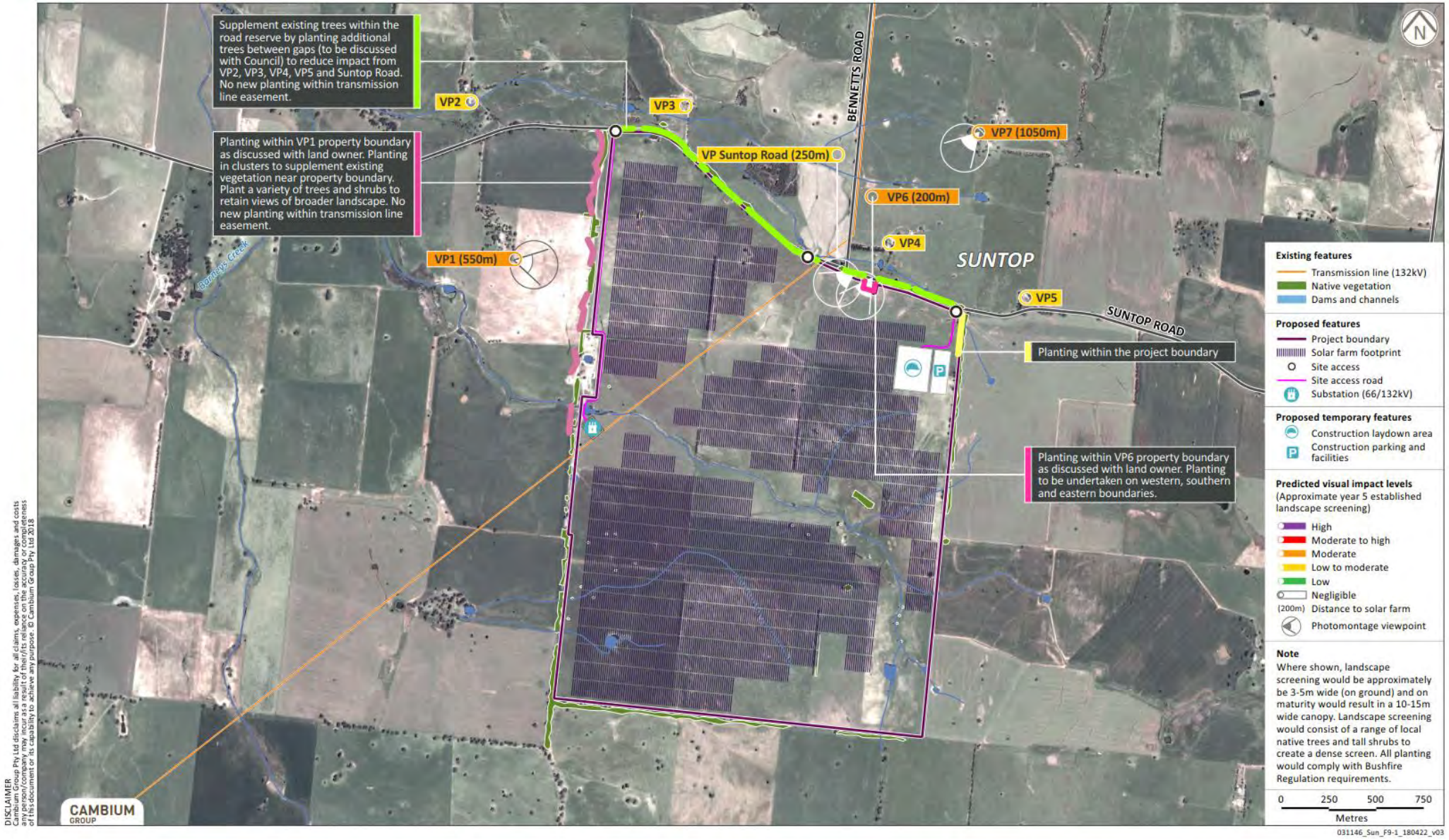



Figure 6-13 Proposed landscape screening as visual mitigation

### *Photomontages*

Photomontages have been prepared for VP1, VP6, VP7 and VP Suntop Road (refer Section 8 of **Appendix C**). The selected viewpoints were based on the potential level of visual impact and concerns raised by landowners. The photomontages represent a momentary point in time, and for consistency illustrate the position of the panels at approximately 9.00am in the morning, mid-summer, when the tracking panels would be oriented east (+60 degrees).

VP1 is a private residence on an elevated ridge approximately 490m west of the western Site boundary. Direct views from the VP1 residence are not possible, however the Site can be seen from the paddock immediately east of the residence, this is the only viewpoint that could potentially see the substation.

VP6 is located immediately north of the proposed solar farm, on the southern side of Suntop Road. It is the closest private residence to the Site. The property is lower in elevation than the surrounding slopes of the Site and the outlook is toward Suntop Road.

VP7 is a private residence approximately 950m north of the Site. Direct views from the house to the Site are not possible, however, the Site can be seen from the paddock immediately south-west of the residence.

VP Suntop Road is a linear viewpoint. Suntop Road passes immediately to the north of the Site. Views from Suntop Road are in close proximity of the proposed solar farm, however, are temporary and for short-periods.




Figure 6-14 VP1 Existing view




Figure 6-15 VP1 Likely view post construction




Figure 6-16 VP1 Likely view with landscape screening 5 years after construction




Figure 6-17 VP6 – View A - Existing view




Figure 6-18 VP6- View A – Likely view of proposal post construction




Figure 6-19 VP6 -View A– Likely view with landscape screening 5 years after construction




Figure 6-20 VP6 – view B - Existing view




Figure 6-21 VP6 – view B - Likely view of proposal post construction




Figure 6-22 VP6 – view B - Likely view with landscape screening 5 years after construction




Figure 6-23 VP 7 - Existing view




Figure 6-24 VP 7 - Likely view of proposal post construction




Figure 6-25 VP – Suntop Road - Existing view




Figure 6-26 VP – Suntop Road - Likely view of proposal post construction




Figure 6-27 VP – Suntop Road - Likely view with landscape screening 5 years after construction

A summary of the levels of impact for each private viewpoint is given in Table 6-8.

Table 6-8 Summary of identified potentially affected private viewpoints

| Impact level | Number of viewpoints | Residential/private viewpoints identified as potentially impacted |
|---|---|---|
| High impact | 1 | VP6 |
| Moderate – high impact | 3 | VP1, VP3, VP4 |
| Moderate impact | 3 | VP2, VP5, VP7 |
| Low impact | 22 | As per Figure 6-9 |

### 6.3.4 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| V1 | Minimise impact through use of siting and design features<br>Group ancillary facility structures where possible to minimise sprawl<br>Stabilise new access tracks formed within the Site required for operations, but do not seal with bitumen or other dark coating |
| V2 | Minimise and repair ground disturbance<br>Minimise grading across the Site and undertake the minimum levelling necessary to install panel supports<br>Rehabilitate exposed ground surfaces as soon as possible |
| V3 | Implement Concept Landscape Plan, which includes visual screening. (refer **Appendix C**). |
| V4 | Minimise vegetation removal and retain existing trees and other native vegetation by including:<br>• Temporary fencing around vegetation<br>• Demarcating area as a no-go zone. |
| V5 | Retain as much existing grass cover beneath solar panels as possible. |
| V6 | Progressively stabilise disturbed area with pasture grasses. |
| **Operational Mitigation Measures** | |
| V7 | Minimise impact through use of siting and design features.<br>Signage required at the Site should be of sufficient size to be readable at driver height within short range (0-20m) and contain only information sufficient for basic facility and company identification, for safety, navigation, and delivery purposes. Large scale signage will not be installed. |
| V8 | Avoid Night Sky Impacts.<br>Permanent evening lighting will be limited to compulsory lighting required for the substation. Substation lighting will be turned on if an intrusion is detected or if staff are on site undertaking works outside of daylight hours.<br>Amber colour lights will be used rather than bluish-white lighting. |
| V9 | An OEMP will be prepared for the Proposal and will incorporate a complaints management process. |
| V10 | Monitor performance of screen planting areas six-monthly for first three years then annually. Replant as necessary if plants die, and supplement planting with alternative species if plants are not adapting to the Site. |

## 6.4 Noise

A Noise Assessment (NA) was undertaken by Muller Acoustic Consulting Pty Ltd (MAC) to investigate the potential acoustic impacts of the Proposal (see **Appendix I**). A summary of the key findings of this assessment are outlined below.

The report was prepared in accordance with the following policies and guidelines where relevant:

- NSW DECCW Interim Construction Noise Guideline 2009 (ICNG)
- NSW EPA Industrial Noise Policy 2017 (INP)
- NSW EPA Road Noise Policy 2011 (RNP)
- Standards Australia AS 2436–2010(2016) (AS2436) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance sites
- Standards Australia AS1055–1997 (AS1055) – Description and Measurement of Environmental Noise
- Standards Australia AS IEC 61672.1–2004 (AS61672) – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990™ (AS1259) – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device
- Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard – Electroacoustics – Sound Calibrators.

### 6.4.1 Assessment Methodology

A quantitative noise assessment has been undertaken in accordance with the ICNG. The quantitative assessment method involves predicting noise levels and comparing them with the levels in the ICNG which have been reproduced in Table 6-17 to Table 6-19.

The initial step in the assessment was to identify potentially-sensitive receivers. Sensitive receivers were verified via aerial mapping and during the site inspection which occurred on the 22nd November 2017.

To quantify existing background noise levels, long-term unattended and short-term operator attended noise measurements were performed at representative receptor located near the Proposal between Wednesday 22nd November 2017 to Thursday 30 November 2017. Background noise levels are given in Section 6.4.2

Noise modelling was used to determine the impact of project noise emissions to neighbouring receivers for typical construction activities and operations.

Noise emission data and assumptions used in this assessment are summarised in Table 6-9.

Table 6-9 Construction Equipment Sound Power Levels (Lw) dBA re $10^{-12}$ W

| Noise Source/Item | Utilisation % | Quantity | Lw/Item | | Total Lw |
|---|---|---|---|---|---|
| | **TRENCHING & EARTHWORKS** | | | | |
| Backhoe | 100 | 1 | 104 | | 104 |
| Light vehicle | 50 | 2 | 76 | | 76 |
| **Total – Trenching & Earthworks** | | | | | **104** |
| | **PILING** | | | | |
| Piling Rig (Hydraulic) | 100 | 1 | 113 | | 113 |
| Tele-handler | 80 | 1 | 106 | | 105 |
| Light Vehicle | 50 | 1 | 76 | | 73 |

| Noise Source/Item | Utilisation % | Quantity | Lw/Item | | Total Lw |
|---|---|---|---|---|---|
| **Total – Piling** | | | | | **114** |
| | **ASSEMBLY** | | | | |
| Mobile Crane/ HIAB | 100 | 1 | 104 | | 104 |
| Tele-handler | 100 | 1 | 106 | | 106 |
| Light vehicle | 50 | 2 | 76 | | 76 |
| Hand tools/power tools | 25 | 1 | 102 | | 96 |
| Welder | 25 | 1 | 105 | | 99 |
| **Total – Assembly** | | | | | **109** |
| | **TRANSPORT (On site)** | | | | |
| Heavy vehicle | 100 | 1 | 104 | | 104 |
| Tele-handler | 100 | 1 | 106 | | 106 |
| **Total – Transport** | | | | | **110** |

Operational noise predictions were modelled for a typical worst case operational scenario over a 15-minute assessment period based on the operational assumptions and sound power levels in Table 6-10.

Table 6-10 Operational Equipment Sound Power Levels dBA re $10^{-12}$ W

| Noise Source / Item | Activity | Quantity | Lw/Item | Total Lw |
|---|---|---|---|---|
| PV Panel Tracking Motor1 | All tracking motors in operation 1 minute per 15-minute period | 12380 | 78 | 102 |
| Transmission Kiosk – each consisting of the following | | | | |
| Inverter | Constant | 69 | 75 | 99 |
| Transformer | Constant | 69 | 70 | 94 |
| Capacitor Battery | Constant | 69 | 75 | 99 |
| Transmission Kiosk – Total | Constant | 69 | 79 | 102 |
| Substation | Constant | 1 | 90 | 90 |
| Light vehicle | 2 vehicles arrive and depart from site (5 minutes duration) | 2 | 76 | 79 |
| Note 1: Tracking motor is situated underneath the PV panel, -5dB attenuation applied to account for shielding provided by the panel.<br>Note 2: Modifying factor penalty of +5dB added for low frequency and tonality.<br>Note 3: -5dB applied to account for power station/ kiosk vented enclosure. | | | | |

### 6.4.2 Existing Environment

**Surrounding area**

From observations whilst on site, the noise environment at existing residential receptors is best described as 'rural' in accordance with the INP, being an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels.

**Potentially affected sensitive receivers**

A total of 17 sensitive receivers were identified as having the potential to be affected by noise. The identified receivers are presented in Figure 6-28.

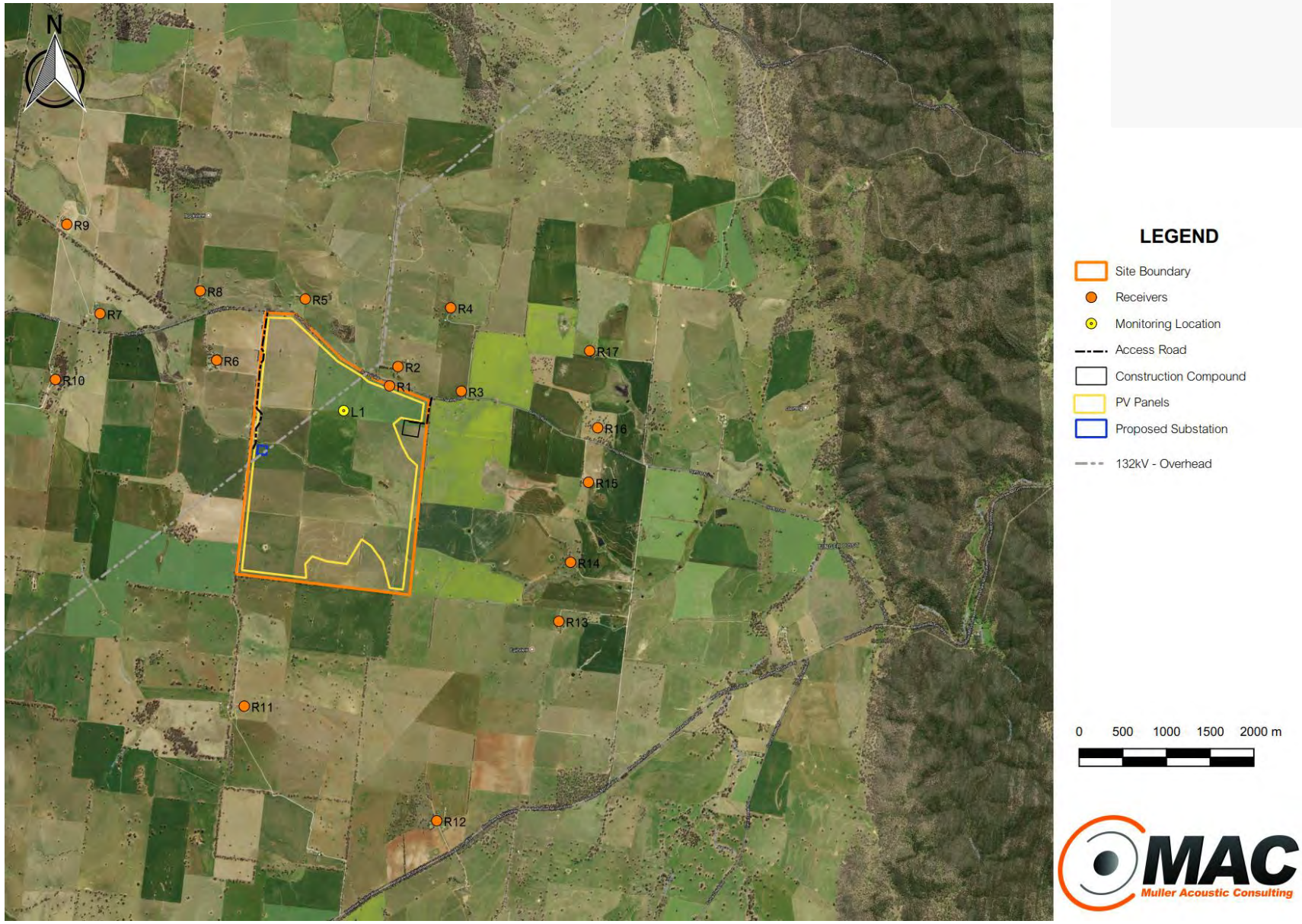



Figure 6-28 Sensitive receiver locations (Figure 1 of MAC Noise Assessment, 2018

**Background noise levels**

Criteria for the assessment of construction and operation noise are usually derived from the existing noise environment of an area. To quantify existing noise levels, long-term unattended and short-term operator attended noise measurements were performed at a representative receptor located near the Proposal, this location is presented in Table 6-11 and Figure 6-28.

Noise measurements were carried out using a Svantek Type 1, 977 noise analyser from Wednesday 22 November 2017 to Thursday 30 November 2017 to measure the existing road traffic noise and the background and ambient noise environment in the vicinity of the Proposal site.

Table 6-11 Noise Monitoring Location

| ID | Unattended Noise Monitoring Locations | Site Description | Coordinates (MGA 56) | |
|---|---|---|---|---|
| | | | Eastings | Northings |
| L1 | Project Site | Off Suntop Road | 672143m E | 6394263m S |

The results of the unattended noise measurements, including derived RBLs are summarised Table 6-12

Table 6-12 Unattended Noise Monitoring

| Unattended Noise Monitoring Location | Time Period | Measured background Level RBL $LA_{90}$, dBA | Measured Ambient Noise Level LAeq, dBA |
|---|---|---|---|
| L1 Project Site | Day | 26 | 66 |
| | Evening | 26 | 59 |
| | Night | 26 | 59 |
| Note: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am | | | |

Based on the relevant section of the INP Guidelines, where background noise levels are less than 30dB(A), the minimum applicable background noise level is recommended to be set at 30dB(A). Therefore, this minimum background noise level has been adopted for all receiver locations nominated during the night time assessment period.

As there is a potential for construction road traffic noise impacts, road traffic noise was assessed at the noise monitoring location L1 – Off Suntop Road.

## 6.4.3 Criteria

### *Construction Noise Criteria*

In NSW, noise impacts arising from construction activities are managed in accordance with the ICNG. According to the guideline, a quantitative assessment of noise impacts is warranted when works are likely to impact an individual or sensitive land use for more than three weeks in total. Table 6-13below (reproduced from Table 2 of the ICNG) sets out the noise management levels for residences and how they are to be applied.

Table 6-13 Noise management levels at residential receivers

| Time of Day | Management Level LAeq (15 minutes) * | How to Apply |
|---|---|---|
| Recommended standard hours:<br>Monday to Friday 7 am to 6 pm<br><br>Saturday 8 am to 1 pm<br><br>No work on Sundays or public holidays | Noise affected<br>52 + 10 dB | The noise affected level represents the point above which there may be some community reaction to noise.<br><br>Where the predicted or measured LAeq (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.<br><br>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly noise affected<br>75 dB(A) | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br><br>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:<br>• 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)<br>• 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<br><br>Evening 47 dB(A)<br>Night 42 dB(A) | A strong justification should typically be required for works outside the recommended standard hours.<br><br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br><br>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.<br><br>For guidance on negotiating agreements see Section 7.2.2 of the ICNG. |
| * 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. | | |

Construction Noise Management Levels (NMLs) for construction activities at all residential receivers are 45dB LAeq,15min (RBL +10dB). Although construction activities are only planned for standard hours, the relevant NML standard construction hours and out of hours' periods are summarised in Table 6-14.

Table 6-14 Noise Management Levels

| Location | Assessment Period | RBL, dBA | NML dB LAeq, 15 min |
|---|---|---|---|
| Residential Receptors | Day (Standard hours) | 35 | 45 (RBL + 10 dBA) |
| | Evening (OOH Period 1) | 30 | 35 (RBL + 10 dBA) |
| | Night (OOH Period 2) | 30 | 35 (RBL + 10 dBA) |

**Operational Noise Criteria**

The Industrial Noise Policy (INP) sets out noise criteria to control the noise emission from industrial noise sources. Mechanical and operational noise from the development shall be addressed following the guideline in the INP.

The calculation is based on the results of the ambient and background noise unattended monitoring, addressing two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria).

The intrusiveness criterion can be summarised as LAeq, 15 minute ≤ RBL background noise level plus 5 dB(A) (refer Table 6-15). The Project Noise Trigger Levels (PNTLs) is the lower of either the Intrusiveness Noise Level or the PANL (refer Table 6-15).

The amenity criterion and project amenity noise levels (PANL) defines the acceptable noise levels that will protect against noise impacts such as speech interference, community annoyance and to some extent sleep disturbance, these are outlined in Table 6-16.

Table 6-15 Intrusiveness, amenity and project noise trigger levels

| Receiver | Time Period[1] | Measured RBL dB $LA_{90}$ | Adopted RBL[2] dB $LA_{90}$ | Intrusiveness Noise Level dB LAeq, 15 min | Recommended Amenity Noise Level dB LAeq, period | PANL dB LAeq, 15 min[2] | PNTL dB LAeq, 15 min |
|---|---|---|---|---|---|---|---|
| All Residential Receivers | Day (7am to 6 pm) | 26 | 35 | 40 | 50 | 53 | 40 |
| | Evening (6 to 10pm) | 26 | 30 | 35 | 45 | 48 | 35 |
| | Night (10pm to 7am) | 26 | 30 | 35 | 40 | 43 | 35 |

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.
Note 2: Includes a +3dB adjustment to the amenity period level to convert to a fifteen-minute assessment period as per Section 2.2 of the NPI.

### *Road Traffic Noise Criteria*

Road traffic noise impact is assessed in accordance with the NSW Road Noise Policy (RNP) (DECC 2011). The criterion (Table 3 – Road Traffic Noise Assessment Criteria for Residential Land Uses) divides land use

developments into different categories and lists the respective criteria for each case. The category that is relevant to the proposal is listed in Table 6-16

Table 6-16 NSW Road Noise Policy – Traffic Noise Assessment Criteria

| Road Category | Road Name | Type of project / land use | Assessment Criteria | |
|---|---|---|---|---|
| | | | Day (7am – 10pm) | Night (10pm – 7am) |
| Freeway/arterial/sub-arterial road | Renshaw McGirr Way | Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments | 60dBA LAeq, 15hr external | 55dBA LAeq, 9hr external |
| Local Roads | Suntop road | Existing residences affected by additional traffic on existing local roads generated by land use developments | 55dBA LAeq,1hr external | 50dBA LAeq,1hr external |
| Note: For road noise assessments, the day period is from 7am to 10pm (i.e. there is no evening assessment period as there is with operational noise). Night is from 10pm to 7am. | | | | |

For this assessment, the 'local road' category, as specified in the RNP, was adopted for Suntop Road, and 'sub arterial road' category for Renshaw McGirr Way. The functional classification of Renshaw McGirr Way is a 'Collector Road" in accordance with the Roads and Maritime Services Noise Criteria Guideline (April 2015). However, the Road Noise Policy does not provide separate noise criteria for Collector Roads and applies the sub-arterial category to all roads that are not classified as local roads.

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered, however, the relative increase criteria are not applicable to local roads and Suntop Road is classified as a local Road.

### 6.4.3 Assessment of Potential Impacts

#### *Construction*

Construction activities would result in temporary increase in localised noise levels, particularly for sensitive receivers located close to the proposal site or along the haulage route Construction would be carried out within standard construction hours (i.e. Monday to Friday 7 am to 6 pm; Saturday 8 am to 1 pm; No work on Sundays or public holidays) with no out of hours' work proposed. The key noise generating activities that will occur are listed below:

- Earthworks involving trenching for cabling
- Piling of panel supports
- Assembly of the panels.

It is envisaged that all three-key noise generating activities would occur simultaneously at up to 10 locations across the Site, along with substation construction, vehicle movements on the site and deliveries of material to site.

Table 6-17 presents the maximum noise levels from each construction scenario that are likely to be experienced at the nearby affected receiver locations during the construction works. The results show that the works do not comply with the NMLs at 5 residential receptors for the day period.

Table 6-17 Predicted Construction Noise Levels

| Receiver ID | Description | Highest Predicted Construction Noise Level<br>dB LAeq,15min | NML Standard Hours<br>dB LAeq,15min | Comply |
|---|---|---|---|---|
| R01 | 675 Suntop Road | **56** | 45 | **No** |
| R02 | 14 Bennetts Road | **51** | 45 | **No** |
| R03 | 586 Suntop Road | **46** | 45 | **No** |
| R04 | 582 Suntop Road | 42 | 45 | Yes |
| R05 | 796 Suntop Road | **51** | 45 | **No** |
| R06 | 1834 Arthurville Road | **48** | 45 | **No** |
| R07 | Lot 17 1094 Suntop Road | 37 | 45 | Yes |
| R08 | 898 Suntop Road | 43 | 45 | Yes |
| R09 | Lot 86 1094 Suntop Road | 29 | 45 | Yes |
| R10 | 69 Frogleys Road | 32 | 45 | Yes |
| R11 | 1570 Renshaw McGirr Way | 37 | 45 | Yes |
| R12 | 1420 Renshaw McGirr Way | 29 | 45 | Yes |
| R13 | 193 Bestwicks Lane | 34 | 45 | Yes |
| R14 | 233 Bestwicks Lane | 36 | 45 | Yes |
| R15 | 433 Suntop Road | 35 | 45 | Yes |
| R16 | 440 Suntop Road | 34 | 45 | Yes |
| R17 | 18 Ringwood Road | 32 | 45 | Yes |

Construction noise emissions are anticipated to satisfy relevant NMLs at most receivers, however, the noise levels are predicted to exceed the NMLs at several receivers along Suntop Road (R1, R2, R3, R5, R6). The Proposal is committed to managing noise emissions within the community and will adopt suitable procedures to minimise noise emissions. These are listed in the Mitigation Measures listed in Section 6.4.4

### *Operation*

The operational noise predictions have been modelled for a worst-case scenario over a 15-minute period including noise generated from tracking motors, inverter stations, the substation and light vehicles required for operation. Light vehicles and machinery are already used onsite and within the surrounding area so noise levels associated with the operation of the solar farm should have similar or less than current noise levels.

Noise levels were predicted at each assessed receptor assuming receiver heights of 1.5m above ground level. Table 6-18 summarises the predicted operational noise levels which are demonstrated to comply with the PNTLs at all residential receptors. A detailed maximum noise level assessment is not required as predicted noise levels for night time operations do not exceed the maximum noise level screening criterion of 40dB LAeq,15min and/or 52dB LAmax.

Table 6-18 Predicted Operational Noise Levels

| Receiver ID | Description | Predicted Operational Noise Level dB LAeq,15min | Limited Night time PNTL dB LAeq,15min | Compliant |
|---|---|---|---|---|
| R01 | 675 Suntop Road | 32 | 35 | Yes |
| R02 | 14 Bennetts Road | 26 | 35 | Yes |
| R03 | 586 Suntop Road | 22 | 35 | Yes |
| R04 | 582 Suntop Road | 19 | 35 | Yes |
| R05 | 796 Suntop Road | 25 | 35 | Yes |
| R06 | 1834 Arthurville Road | 23 | 35 | Yes |
| R07 | Lot 17 1094 Suntop Road | 15 | 35 | Yes |
| R08 | 898 Suntop Road | 19 | 35 | Yes |
| R09 | Lot 86 1094 Suntop Road | <15 | 35 | Yes |
| R10 | 69 Frogleys Road | <15 | 35 | Yes |
| R11 | 1570 Renshaw McGirr Way | <15 | 35 | Yes |
| R12 | 1420 Renshaw McGirr Way | <15 | 35 | Yes |
| R13 | 193 Bestwicks Lane | <15 | 35 | Yes |
| R14 | 233 Bestwicks Lane | <15 | 35 | Yes |
| R15 | 433 Suntop Road | <15 | 35 | Yes |
| R16 | 440 Suntop Road | <15 | 35 | Yes |
| R17 | 18 Ringwood Road | <15 | 35 | Yes |

The assessment indicates that operational noise predictions for relevant noise criteria would be satisfied at all receivers. Notwithstanding this, it is recommended that the proponent actively minimise potential noise emissions from the Proposal.

**Road Traffic**

During construction, traffic generated by the project would include employee/subcontractor vehicles and delivery vehicles. During the peak construction period, the traffic volume over a typical day for standard construction hours is expected to be 40 heavy vehicles (semi - trailers) movements and 140 light vehicle movements per day (including mini buses for employee transport). Road traffic noise calculations are based on the parameters adopted for average and peak flows of traffic to and from the Site.

Predicted LAeq,1hr noise levels from Proposal related construction traffic at the closest receptor on Suntop Road were assessed and detailed in Table 6-19. The results indicate that Proposal construction traffic noise levels would comply with the relevant RNP criteria.

Table 6-19 Predicted Construction Road Traffic Noise Levels

| Road Name | Nearest Offset Distance to Receiver | Predicted Noise Level | RTN Criteria | Comply |
|---|---|---|---|---|
| Suntop Road site access | 23m | 48dB LAeq,1hr | 55dB LAeq,1hr | Yes |
| Suntop Road | 65m | 49dB LAeq,1hr | 55dB LAeq,1hr | Yes |
| Renshaw McGirr Way | 30m | 54dB LAeq,15hr | 60dB LAeq,15hr | Yes |

**Sleep disturbance**
Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are only expected to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

**Intersection Upgrade**
The works to be undertaken for the intersection upgrade are expected to be of general low (noise) intensity and a short duration. The nearest receivers are more than 200 metres away. Given the existing background noise environment, a construction noise management level of 45dBA for standard construction hours would be expected. Typical equipment noise levels of a sound power of 110dBA would result in noise levels at the nearest receiver of approximately 50dBA. Given that this noise level is less than 10dB above the NML, there is no requirement for additional mitigation measures in accordance with the Roads and Maritime Construction Noise and Vibration Guideline.

**Summary**
The Noise Assessment (NA) demonstrates that construction noise levels will satisfy relevant NMLs at all the assessed noise receivers, with the exception of those identified along Suntop Road. The rise in noise levels would be most prevalent when noise intensive works are being conducted near these locations. The implementation of mitigation measures such as localised barriers, scheduling and respite would contribute to minimising noise emissions at these receivers and the potential impacts would be of short duration and of a temporary nature.

Operational noise levels are predicted to satisfy the project noise trigger levels at all assessed receivers. The noise assessment demonstrates that the road noise criteria as specified in the RNP will be satisfied at all receivers on the proposed transport route.

No noise impacts in addition to those mentioned for construction are anticipated during the decommissioning phase.

### 6.4.4 Mitigation/ Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| N1 | Prepare a construction noise management protocol for site to manage noise emissions. |
| N2 | Implement a formal complaint handling procedure to manage any potential concerns from the community. This will include:<br>• Details of a readily accessible contact person.<br>• A well-documented process that includes an escalation procedure so that (if required) there is a path to follow should the complainant not be satisfied.<br>• Details regarding setting up a complaint register.<br>Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits |
| N3 | Works are to be carried out during standard work hours (i.e., 7am to 6pm Monday to Friday; 8am to 1pm Saturdays).<br>Any construction outside of these normal working hours would only be undertaken in the event of an emergency or with prior approval from relevant authorities. For non-emergency works outside standard hours, residents and other sensitive land use |

| Reference | Mitigation Measures |
|---|---|
| | occupants should be informed of the works between 5 and 14 days before commencement. |
| N4 | Toolbox and induction of personnel prior to start of shift to discuss noise control measures that may be implemented to reduce noise emissions to the community, construction hours and nearest sensitive receivers. |
| N5 | All plant should be shut down when not in use. Plant to be parked/started at farthest point from relevant assessment locations |
| N6 | Avoid the operation of noisy equipment near noise sensitive areas and where possible, loading and unloading would be conducted away from sensitive areas. |
| N7 | Noise levels will be considered when procuring equipment. |
| N8 | All plant is to utilise a broadband reverse alarm in lieu of the traditional hi frequency type reverse alarm. |
| N9 | Ongoing community consultation for residences within close proximity of the works. The information would include details of:<br>• The proposed works and when these will occur<br>• The duration and nature of the works<br>• Details of what to do should they have a noise complaint<br>• Updates on the progress of works |
| N10 | Where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (e.g. unloading and laydown areas) |
| N11 | Limiting and scheduling the number of work areas along the northern boundary for piling, trenching and assembly activities to minimise noise levels at receptors along Suntop Road. |
| **Operational Mitigation Measures** | |
| N12 | Complete a one-off noise validation monitoring assessment to quantify emissions from site and to confirm emissions meet relevant criteria. |
| N13 | Prepare an operational noise protocol that can be implemented to address any community concerns regarding noise emissions for future operations of the Proposal. |

## 6.5 Traffic, Transport and Road Safety

A Traffic Impact Assessment (TIA) was undertaken by Seca Solution to investigate the potential traffic impacts of the Proposal (see **Appendix H**). A summary of the key findings of this assessment are outlined below.

### 6.5.1 Assessment Methodology

The assessment included:

- A site visit to assess the existing condition of the local road network
- Traffic surveys taken during the AM and PM period at a key intersection on 22nd November 2017
- Review of the local road network, with regard to road safety, intersection controls, any access constraints and any concerns over access to the regional road network
- Identifying access concerns or road upgrades potentially required
- The review of potential impacts from the temporary increase in heavy vehicle flows along the local and regional roads for the various stages of the development.

### 6.5.1 Existing Environment

The site is located with road frontage to Suntop Road only. The existing road environment related to the proposal is described in Table 6-20.

Table 6-20 Existing road environment

| Road | Local/ State Road | Width/ Movements | Condition | Speed Limit | Connection |
|---|---|---|---|---|---|
| Suntop Road | Local | 6m wide Two-way traffic movements as required | Sealed | 100km/h | Renshaw – McGirr Way connects with Suntop Road to the east via a T intersection with Renshaw – McGirr Way the priority road. |
| Renshaw – McGirr Way | Local | 7m wide Two-way traffic movements | Sealed road | 100km/h | Connects with Showground Road and Bushrangers Creek Road to the east via a T intersection with Bushrangers Road/Showground Road being the priority road. |
| Show ground Road | Local | 7m wide Two-way traffic movements | Sealed Road | 50 – 80 km/h | Joins with Bushrangers Creek Road at the intersection of Renshaw – McGirr Way. |
| Mitchell Highway | State | 7m wide Two-way traffic movements | Sealed road | 100 - 110 km/h | Connects with Showground Road on the outskirts of Wellington. |

**Existing Traffic Volumes**
Traffic volumes in the immediate vicinity of the subject site are very low, reflective of the rural environment.

Suntop Road provides access to rural land holdings and does not provide a direct access for through traffic movements nor does it provide access to a town or village. Accordingly, traffic flows on this road are considered to be less than 100 vehicles per day two-way. Renshaw McGirr Way similarly carries low traffic flows but does provide local access to Yeoval. Whilst it would carry higher traffic flows than Suntop Road it is still considered that it would carry less than 500 vehicles per day two-way.

As part of the regional road network, the Mitchell Highway carries higher traffic flows that are associated with both local and regional demands. The Roads and Maritime Services web page for traffic count data shows that in 2017 the 2-way traffic flow south of Wellington was 2,428 vehicles per day (count I.D 6170) with 23% heavy vehicle content. The traffic data shows that the split in traffic flows north and south in this location are even, as to be expected.

Observations on site during a typical morning peak period (22nd November 2017) shows that the current road network in the vicinity of the subject site and Wellington operates very well with minimal delays and congestion. The route proposed to be used for the Proposal carries low traffic flows and operates with no delays except for those associated with drivers slowing down at the various intersections. The only delays noted were along the Mitchell Highway through the centre of Wellington, mainly associated with semi-trailers and B-doubles manoeuvring through two roundabouts on the Mitchell Highway in Wellington.

### 6.5.2 Assessment of Potential Impacts

**Proposed haulage and traffic routes**

Traffic movements associated with the construction, operation and decommissioning of the Proposal include transport of materials to/from the site and transport of workers to/from the site. The Proposal will require the delivery of the construction materials and other specialist equipment from Newcastle or Sydney with the access route via:

- Newcastle or Sydney metropolitan regional road network
- M1 Motorway to Hunter Expressway (Sydney source)
- Hunter Expressway / New England Highway
- New England Highway to turn off for the Golden Highway
- Golden Highway to Dubbo
- Mitchell Highway from Dubbo to Wellington.

These roads all form part of the road freight routes within the State road network and all currently carry heavy vehicle movements for the full length of the routes. These routes will be documented as the Haulage Route for all delivery vehicles to enter and exit the site for the vehicles associated with haulage of construction equipment to the site.

These roads carry a high number of heavy vehicles, associated with local and regional agricultural demands. These agricultural demands are seasonal in nature and occur 24 hours a day often involving night travel and operations. There are a number of farms in the general locality of the Site as well as in the wider Wellington area that use these local and regional roads during these seasonally high demand periods.

For the regional road network including the Mitchell Highway, Golden Highway and New England Highway / Hunter Expressway, the total traffic flows will remain well within acceptable limits and as such will continue to operate to a good level of service for all road users.

The traffic flows along the local roads providing access for the heavy and light vehicle movements associated with the Proposal are currently very low based on-site observations. The additional 70 light vehicle movements (per direction) associated with staff movements and 20 daily truck movements (per direction) will have a minimal and acceptable impact upon the operation of these local roads during construction. Once operational, the traffic movements will be much lower due to the lower number of staff based on site and as such, the impact will be negligible.

There is minimal background traffic growth in this location. The Roads and Maritime Service count data from the station south of Wellington on the Mitchell Highway (Station I.D. 6170) shows traffic flows of 2,428 in 2017 and 2,380 in 2015, representing an increase of around 0.7% per annum. Other counts along the regional road network show similar or lower increases.

Public vehicle access within the work site during the construction works will not be permitted with site access off Suntop Road being via a locked gate. There will be no pedestrian access to the site for the general public and there are no pedestrian paths in the locality of the site or expected demands for pedestrian access to the Proposal.

There is no school within the general locality of the site and the majority of the heavy vehicle route proposed, however, a school bus run does utilise Suntop Road in the morning and afternoon and provides a pick up and drop off service for school aged children living along Suntop Road. On the regional and state road network, all school zones will be delineated in accordance with RMS Guidelines with reduced speed limits in accordance with normal NSW road rules.

There will be no impact upon public transport services with no diversions required and no bus stops will be impacted upon by the proposal and there will be minimal impact for emergency vehicles and heavy vehicles with no diversions required.

It is considered that the heavy vehicle route (as shown in Figure 6-29) can safely accommodate the additional traffic movements associated with the Proposal. The heavy vehicle route within Wellington will be included within the Driver's Code of Conduct and will form part of the inception meeting for all staff and drivers.

The decommissioning haulage route will be determined towards the end of the operational period of the Proposal as the road infrastructure may change. The indicative decommissioning haulage routes are the same as the construction haulage routes.

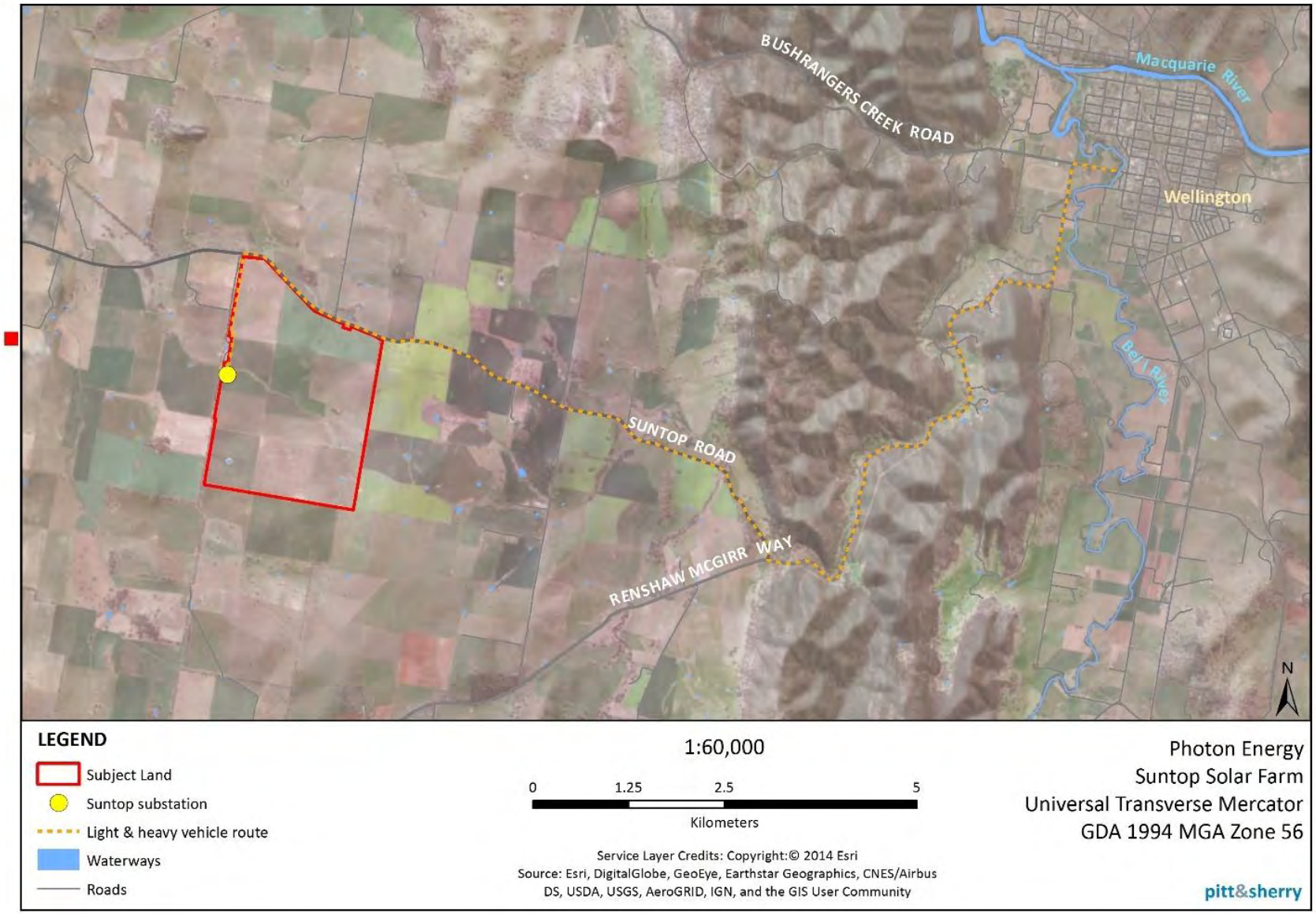



Figure 6-29 Light and heavy Vehicle access and route to Proposal site

**Site Access**
Access to the site will be facilitated by two new access roads. A new permanent access road off Suntop Road (near western boundary) and a temporary access in the north east corner of the Site also off Suntop Road. The temporary access road will be used to access the construction compound and site parking (north east corner of the Site). The temporary access road would be utilised by light vehicles associated with staff working on site and heavy vehicles associated with delivery of materials and removal of waste.

To facilitate safe turning movements in and out of the site, existing full width seal on Suntop Road will be maintained.

The access roads will be sealed for the first 30 metres to allow for safe construction, operational and decommissioning traffic movements and to reduce potential for dust and erosion. The remaining section of access road will be constructed of suitable compacted gravel and a shaker device will be installed to ensure dust and other material is removed from vehicles and not tracked onto Suntop Road.

### *Construction*

The potential traffic, transport and road safety impacts associated with construction of the proposal relate primarily to the increased numbers of large vehicles on the road network which may lead to:

- Increased collision risks (other vehicles, pedestrians, stock and wildlife)
- Damage to road infrastructure
- Associated noise and dust which may adversely affect nearby receivers
- Disruption to existing services (school buses, cyclists, pedestrians)

**Increased Vehicle Numbers**
Staffing requirements will vary over the 12-month construction period. Approximately 250 people are expected during peak periods with a lower level outside peak construction periods. The staff will be sourced locally where appropriate with some specialist and project management staff being temporarily located in Wellington.

Suntop Solar Farm propose to use the same methodology to maximise local staff participation in the Proposal as they have for other sites in Australia which includes holding a community information session and creating an Expressions of Interest (EOI) for interested local suppliers and contractors. Staff will be encouraged to car pool as appropriate with other staff transferred to and from the site via mini coaches to reduce vehicle demands. Due to the size of the site footprint, these same vehicles will also be used on site to move staff across the site.

Alternatives such as walking and cycling to site were considered. Cycling to the site could be an option for the proposal as the site is within 45 minutes of the Wellington town centre. Cyclists can ride on the road due to low traffic flows and can park bikes on site as required. However, walking is not considered appropriate due to the relatively remote location of the site, no footpaths available in the locality and excessive travel time which is estimated to be over 2 hours.

The level of heavy vehicles accessing the site will vary throughout the Proposal timeframe. At the beginning of the Proposal there will be a requirement for some earthwork moving equipment to construct the access tracks and some minor earthworks across the site as required. This may require a scraper or bull dozer which will be transported to site on a low loader. This machinery will remain on site for the duration of the earthworks portion of the Proposal construction work. Once the earthworks have been completed, the balance of the construction work will commence. All plant will be located on site and will therefore be only required to access the site once for the construction works.

The vehicle numbers associated with the construction work are relatively low and it is considered that the movement of vehicles in and out of the site for construction works can occur in a safe manner. No limitation on truck access times is considered appropriate for the project due to the journey length between the port and the subject site. The vehicles as they are approaching the site will be spread out ensuring the impact is not occurring all together and with unloading of vehicles taking up to 30 minutes or more, trucks exiting the site will also be spread out.

Light vehicle movements associated with staff travelling to Site for construction are estimated at 70 vehicle movements inbound and outbound. This has been estimated based upon 250 staff (the peak labour force) for construction and a vehicle occupancy rate of four people per vehicle (assumed based upon carpooling and the use of a mini bus e.g. Toyota Coaster). The majority of these will be inbound movements in the morning bringing workers to the site with these vehicles then remaining on site for the full day before leaving at the end of the working day. It is expected that there will be limited light vehicle movement outside of these periods, other than support staff e.g. office staff or visitors to the site.

A summary of the anticipated vehicle movements, excluding the above staff movements, is provided in Table 6-21 below.

**Table 6-21 Vehicle movements expected as a result of the proposal**

| Phase | Purpose | Vehicle Type/ Trailer Type | No. of one-way vehicle movements |
|---|---|---|---|
| Site Set-Up and Demobilisation | Portacabin delivery and removal | Low loader | 20 |
| | Skip delivery and removal | Low loader | 40 |
| | Generator delivery and removal | Semi-trailer | 4 |
| | General deliveries | Semi-trailer | 40 |
| | Crane mobilization and demobilization | Crane | 4 |
| | Water tank delivery and removal | | 4 |
| Roads and hardstands | Delivery of imported capping for road laydowns and crane hardstands | Truck and dog | 500 |
| | Plant delivery and removal: excavators, compactors drill rig | Low loader | 40 |
| | Concrete deliveries for maintenance container hardstands | Concrete agitator | 120 |
| Generating Equipment | Tool container delivery and removal | Low loader | 4 |
| | Module deliveries | Semi-trailer | 2000 |
| | Mounting structure and pile deliveries | Semi-trailer | 1600 |
| | Inverter Station deliveries | Low loader | 40 |
| | DC cabling trays and combiner boxes | Semi-trailer | 400 |
| AC Cable Installation | AC Cable delivery | Semi-trailer | 400 |
| | Backfill material delivery | Dump Truck | 1800 |
| Plant Delivery and removal | Telescopic handler and excavator | Low loader | 50 |
| Overhead Line | Conductor delivery | Semi-trailer | 25 |
| | Pole deliveries | RAV | 6 |
| | Pole dressing delivery | Semi-trailer | 2 |
| Other | Miscellaneous deliveries | Light vehicle | 40 |
| | Monitoring equipment fibre SCADA servers etc | Truck | 2 |
| | Waste Collection | Truck | 400 |
| | Consumables (Oil and Fuel) | Truck | 40 |
| | | TOTAL | 7,581 |

Based upon the vehicle movements outlined in Table 6-21 the heavy vehicle movements associated with peak construction periods are estimated to be in the order of 42-57 inbound and outbound movements per day depending on the duration of the overall construction period of 9-12 months. The number of heavy vehicles during peak periods will depend on the stage of construction and potential for overlapping of these stages of work.

Average heavy vehicle movements will be in the order of 20 inbound and outbound movements per day.

At all times the heavy vehicle movements will be spread across the working day. For the delivery of components such as the solar panels, trucks will be arriving from either the Port of Sydney or the Port of Newcastle with the travel time being over 5 hours, this will see a spread of arrival times across the day with no concentration of heavy movements expected.

**Parking arrangements**

All parking will be contained on site within a temporary construction parking and temporary facilities area adjacent to the site office and construction laydown area.

All staff vehicles will be able to park within the site adjacent to the site office with no external parking demands. The construction park area will allow for up to 70 vehicles to park within this compound area. The size of the overall site footprint however will allow for all construction staff vehicles to park on site. As part of the Proposal construction it is proposed to maximise the local workers content (from Wellington and Dubbo) and car-pooling will be encouraged as part of these trips. Shuttle bus arrangements from Wellington will also be arranged for non-local staff reducing the vehicle numbers and parking requirements.

**Increased Collision Risk**

As part of the Proposal work, there will be an increase in the number of heavy vehicle movements associated with the construction work which will impact along the local road network along the haulage route. The major road safety impact is associated with traffic entering and exiting the Solar Farm site off Suntop Road as well as their impact upon the operation of intersections along the haulage route.

The vehicle numbers associated with the construction work are relatively low and it is considered that the movement of vehicles in and out of the site for construction works can be conducted in a safe manner.

**Intersection sight distances**

The intersection sight distances from four key intersections along the primary haulage route are shown in Table 6-22. Traffic control Plans have been developed for the intersection of Renshaw McGirr Way and Suntop Road, and for the access points from Suntop Road into the Site. These are included with the Traffic Impact Assessment (TIA) in **Appendix H**.

Table 6-22 Intersection sight distances

| Intersection | Speed Limit | Austroads Guidelines (sight visibility requirement) | Sight distance measured onsite | Upgrade works required |
|---|---|---|---|---|
| Showground Road and Renshaw McGirr Way | 60 km/h | 114 m minimum | >200 m | No upgrade required. |
| Renshaw McGirr Way an Suntop Road | 100 km/h | 225 m | 130-150m | Tree removal.<br>Shoulder widening.<br>Crash barriers. |
| Site Access and Suntop Road | 100km/h | 248 m | >300 m | Two new access (one permanent and one |

| Intersection | Speed Limit | Austroads Guidelines (sight visibility requirement) | Sight distance measured onsite | Upgrade works required |
|---|---|---|---|---|
| | | | | temporary) to be constructed. |

**Damage to Road Infrastructure**
The increase in traffic and heavy vehicle movement could impact the condition of roads on the haulage network. Along the Mitchell Highway the impact is expected to negligible due to the existing capacity of the road network. Local roads in the locality are already subject to heavy vehicle movements from agricultural activities and general haulage, however, should any additional damage occur as a consequence of the proposal this will be rectified.

With regards to any emergency repairs required, the contractor on Site would contact the relevant authorities and will ensure the road is safe. Repairs will be made in accordance with the relevant authority standard and approved council contractors.

**Disruption to Farming**
There are a number of farms in the general locality of the site as well as in the wider Wellington area however, coordination of construction traffic with seasonal agricultural haulage is not necessary considering the level of additional vehicles associated with construction and the existing capacity of the road network.

**Disruption to Existing Services**
There are no pedestrian paths around the Subject Land, and pedestrian movements are not expected due to the distance of the Site to Wellington Township. As such no impacts for pedestrians are expected as a result of the Proposal.

There is no school within the general locality of the Subject Land however a section of the haulage route along Renshaw McGirr Way and Suntop Road forms part of the local school bus run. As part of the employee and site induction for all heavy vehicle drivers this school bus route will be highlighted so that drivers are aware of a potential school bus over this section. The Proposal will also seek to minimise truck movements between 08:00 – 09:00 and 15:00 – 16:00 during school days to avoid school bus pick up and drop off times.

It is noted that the light vehicles associated with the staff movements will typically occur in the morning prior to this school bus inbound movement and staff leaving the site at the end of the day will be after the return of this school bus run and as such are not expected to have any interaction. Once on the regional and state road network all school zones will be delineated in accordance with RMS Guidelines with reduced speed limits in accordance with normal NSW road rules. All drivers associated with the Proposal construction work will adhere to the road rules as applicable.

Associated noise and dust impacts from traffic are assessed in Section 6.4 and Section 6.8.

No traffic impacts in addition to those mentioned for construction are anticipated during the decommissioning phase however this will be reviewed as part of the TMP for decommissioning given that circumstances are likely to change between construction and decommissioning.

### *Operation*

Post construction, the traffic numbers generated by the Proposal are very low, with a maximum on-site workforce of 10 people. There will not be any need for regular heavy vehicle access to the site once the solar farm is operational.

**10 Year Horizon**
The major impact of the Proposal is during the construction phase which will be approximately 12-months. The impact of this construction phase has been assessed based on current traffic flows.

For the 10-year horizon, the traffic that will be that associated with the proposal will be vehicles required to access the site for on-going maintenance and operation of the facility. Up to 10 staff will conduct maintenance and ad-hoc repair work on the site once the facility is operational, and it assessed that the impact on the local road network from these staff movements will be very low.

### *Proposed Road Improvements*

The intersection of Suntop Road and Renshaw McGirr Way would be upgraded to meet AUSTROAD Guidelines and a safe intersection stopping distance (SISD) for 100km/h including:

- Removal of 10 trees to improve sight distances and facilitate upgrade works
- Installation of crash barriers on either side of Suntop Road at the intersection with Renshaw McGirr Way
- Rural Basic Right turn treatment to widen the should of Renshaw McGirr Way to allow through vehicles to pass to the left of the turning vehicles

A concept design for the upgrade works is provided in Figure 6-30 and **Appendix H**.

A concept design for both the permanent and temporary new access roads from Suntop Road into the Site are provided in Figure 6-31 and Figure 6-32 respectively.

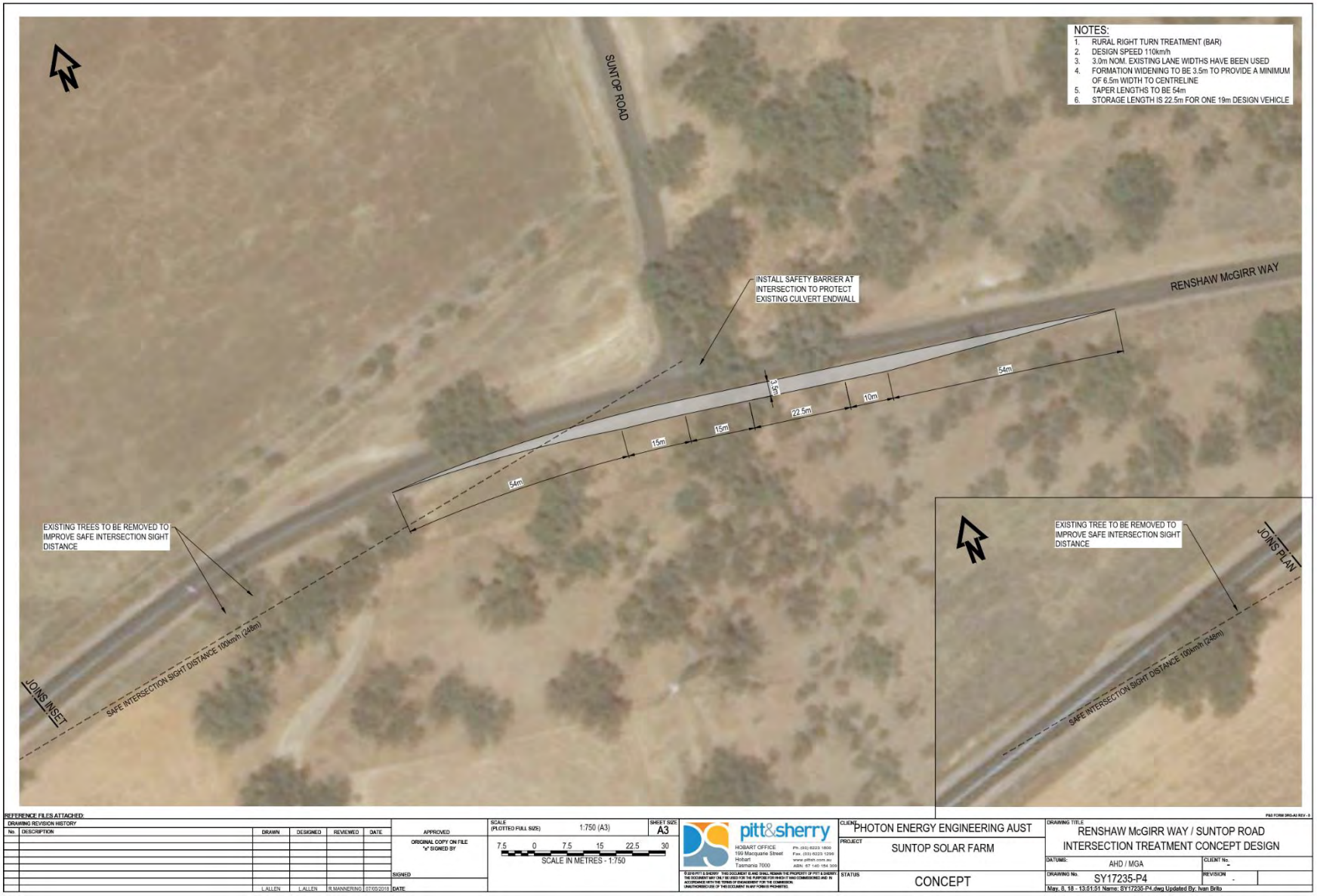



Figure 6-30 Concept design for upgrade works at Renshaw McGirr Way and Suntop Road

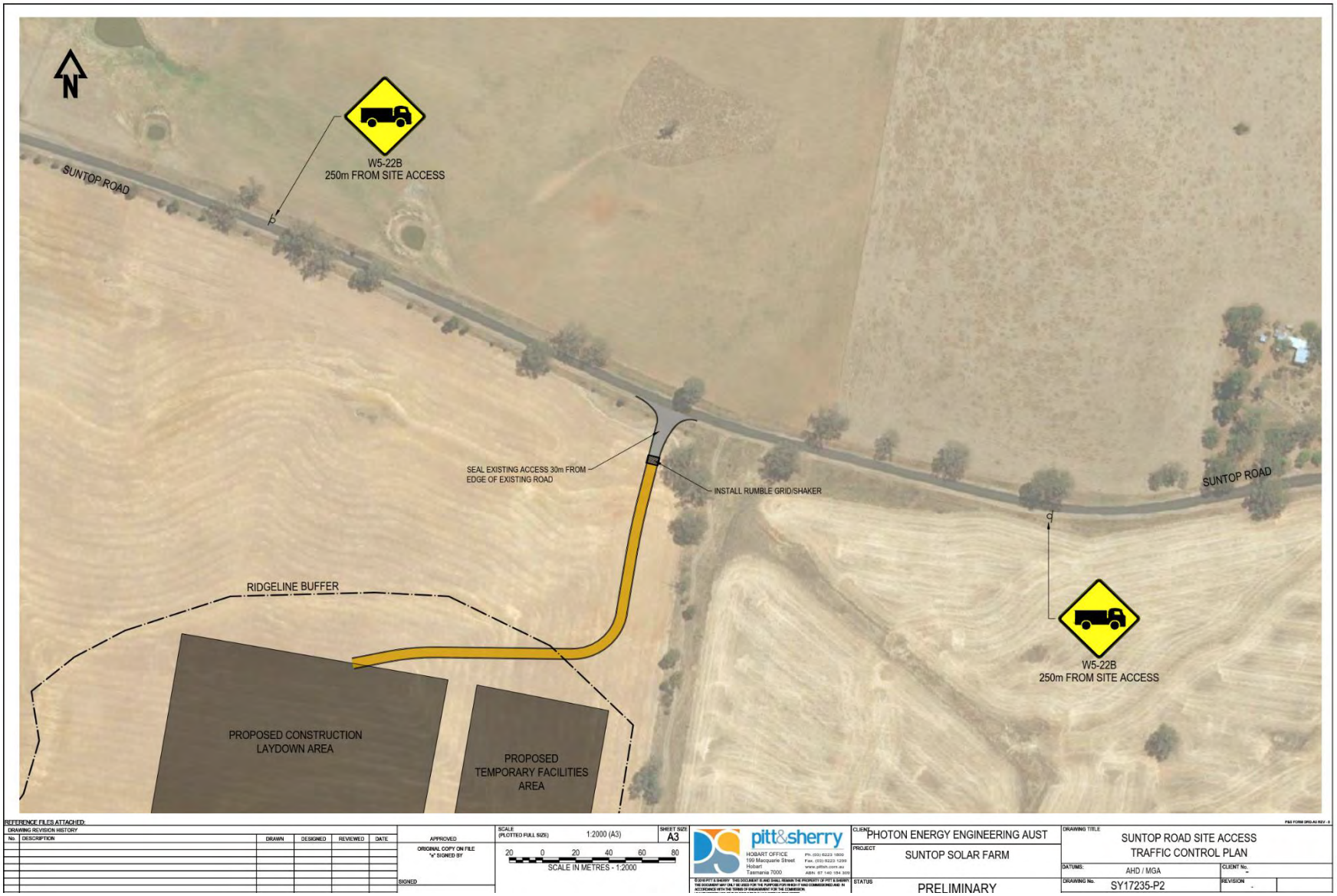



Figure 6-31 Concept design for temporary access road

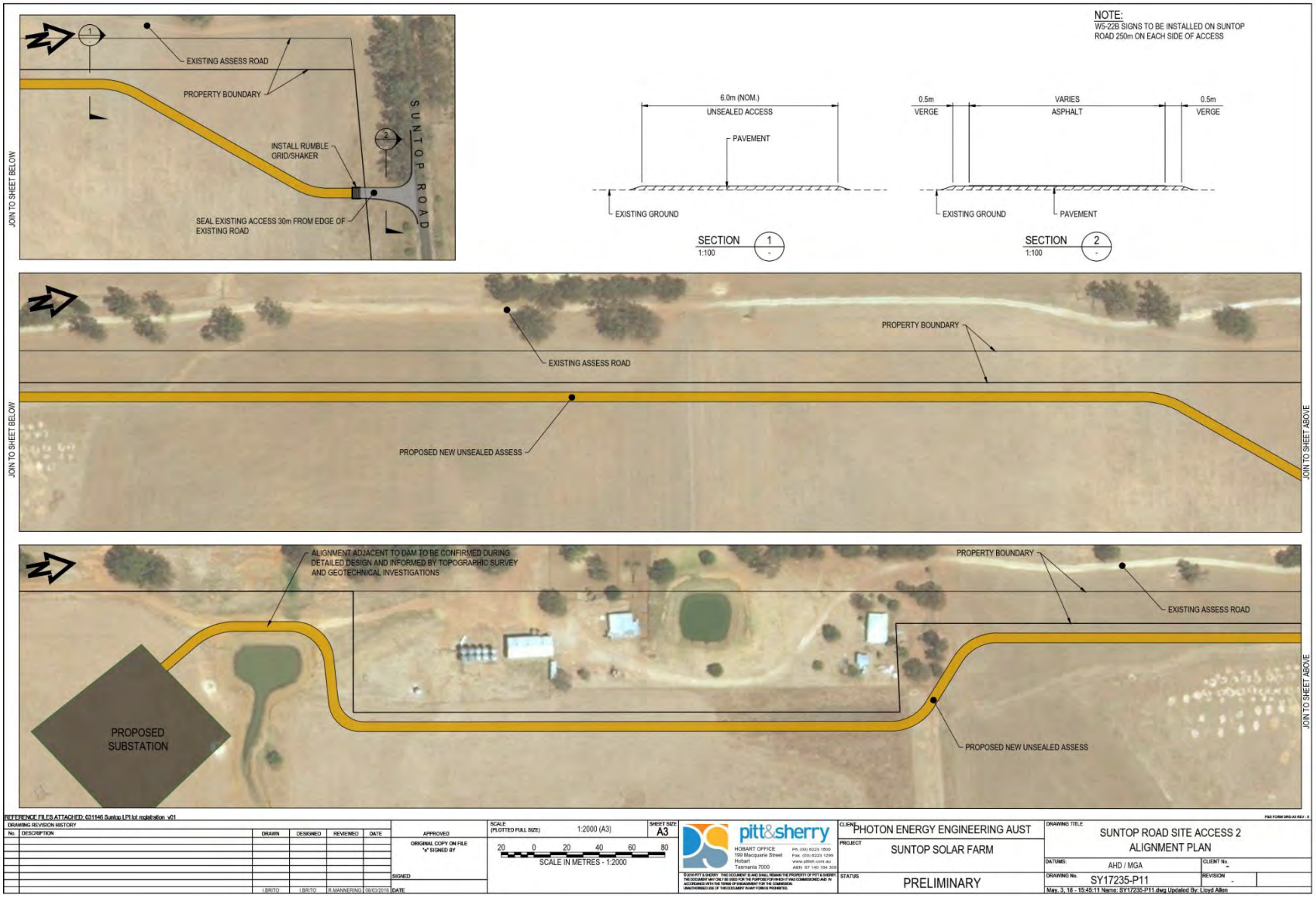



Figure 6-32 Concept design for permanent access road

### 6.5.3 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| T1 | The proposed road improvements, as stated above, and any ancillary road works should be completed prior to the construction of the proposal. |
| T2 | A Traffic Management Plan (TMP) for construction shall be developed in accordance with Roads and Maritime Guidelines and the Australian Standard AS1742.3. The plan would include:<br>• The designated routes of construction traffic to the site<br>• A map of the primary access routes highlighting critical locations<br>• Drivers Code of Conduct<br>• Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction<br>• Scheduling of deliveries<br>• Community consultation requirements<br>• Any restrictions on traffic movements (such as residential areas, school pick-up and drop-off times)<br>• Traffic controls (speed limits, signage, etc.)<br>• A complaint handling procedure / register<br>• An induction process for vehicle operators. |
| T3 | All Proposal personnel will be provided training on the requirements of the TMP through site inductions, toolbox talks or specific training |
| T4 | The heavy vehicle route will be included within the Driver's Code of Conduct and will form part of the project inception meeting for the project for all staff and drivers. This will include informing all drivers of school bus pick up, and drop off times along the route. |
| T5 | Traffic control will be provided in accordance with the approved construction TMP to manage traffic movements (vehicular, cycle and pedestrian) during construction and maintain the flow of traffic within the site and on surrounding public roads |
| T6 | Traffic management controls will be communicated to appropriate stakeholders which will include the local community in the site vicinity via a letter box drop |
| T7 | Directional signage will be installed to direct construction traffic, and warn other motorists of construction traffic. This signage is positioned in accordance with the approved Traffic Control Plans. |
| T8 | All employees, subcontractors and suppliers will comply with the speed limits within the worksite, which are as follows:<br>• 40 km/h on formed roads<br>• 20 km/h during foggy/dusty conditions with headlights on<br>• 10 km/h when passing pedestrians. |
| T9 | Develop a protocol which will be provided for undertaking dilapidation surveys and making any necessary repairs following construction.<br>The dilapidation surveys will assess the existing condition of Suntop Road prior to construction and identify any damage once construction is complete.<br>Should any damage be identified the road will be repaired in line with Council standards. |

| Reference | Mitigation Measures |
|---|---|
| T10 | A dilapidation survey will be completed along Suntop Road prior to upgrades on this road and after the works are complete. A dilapidation survey protocol is provided in **Appendix H**. |
| T11 | A Traffic management plan (TMP) for decommissioning will be developed as part of the decommissioning management plan. This will include a decommissioning haulage route. The indicative decommissioning route provided in this EIS will be reviewed prior to the start of decommissioning. |

## 6.6 Land Use

This section assesses the potential impact on property and land use within the study area as a result of the proposal. The assessment presented in this section draws on desktop information, observations from the site inspection and responds to the relevant SEARs.

### 6.6.1 Existing Environment

**Existing Land Use**
The site and the surrounding land are zoned RU1 Primary production under the Wellington LEP 2012.

The site is privately owned and currently used for agricultural purposes including cropping (cereal crops) and grazing of sheep.

The locality is dominated by rural properties which are mostly cleared of native vegetation and used for a variety of agricultural enterprises including cropping and grazing of livestock (cattle and sheep). Land uses around the footprint comprise of road infrastructure (e.g. road pavement on Suntop Road and vacant land located within the road reserve), utility easements (comprised of overhead electricity supplies), rural residential and other privately-owned rural property. The land to the south, east and west of the Site are used for grazing and rotational cropping. The land to the north of Suntop Road is also consist of cleared agricultural land and several rural residences.

**Mineral Resources**
A search of Department Resources and Energy's MinView database found a small portion of the south west corner of the site is covered by a current Mineral Title. This is described in Table 6-23. Exploration licences entitle the holders to carry out exploration and prospecting for minerals within the specified area.

Table 6-23 Exploration licences currently in force over the proposed solar farm proposal boundary

| Mineral Title/ Licence Number | Owner | Type of Title or Licence |
|---|---|---|
| EL8463 | Lachlan Resources Pty Ltd<br>PO Box 1573<br>WEST PERTH WA 6872 | Minerals Exploration licence (Metallic minerals (Group 1)) |

Consultation with proposal site mineral titleholders for the proposal is outlined in Section 5

### 6.6.2 Assessment of Potential Impacts

**Nature of the proposed land use change**
The proposal will result in a change from cropping agriculture to electricity generation accompanied by grazing agriculture. The major activities associated with the land use change are:

- Purchase of the Site for a Solar Farm

- Site establishment and preparation for construction including minor vegetation clearing
- Installation of steel frames, PV panels, and underground cabling
- Construction of a 132kV substation and connection to an existing transmission line
- Operation of the facility for approximately 30 years
- Routine and ad-hoc maintenance work.

The change in land use is mitigated by several factors:

- The Proposal will rest the soils and allow the chemical and physical structure to improve while the solar farm is in operation
- The Proposal has a reversible nature as it can be easily decommissioned and rehabilitated returning the land to its former agricultural use at the end of the operational period.

**Compatibility of proposed land use and adjoining activity**
Adjoining activities to the proposed solar farm are limited to cleared agricultural land and rural residences. Solar farms and agriculture can be seen as both compatible, incompatible or compatible with implementation of appropriate mitigation measures.

The following aspects of the Proposal are considered compatible with agriculture and the rural environment:

- When groundcover is established under and around the solar panels the land can be used for sheep grazing as well as energy production
- The panels will provide shade, which will provide shade for animal comfort and wellbeing during warmer months
- Once operational the Proposal has limited environmental impacts and any environmental impacts are unlikely to migrate offsite and impact neighbouring land uses
- The land required for the Proposal will be wholly contained within the Subject Land and existing electricity easements
- The proposal is not expected to impact or sterilise surrounding land from routine agricultural practices
- The land can be rehabilitated to ensure no future land use conflicts. The Proposal will not impact future agricultural land uses on the proposal site or adjacent lands
- Diversification of land use providing sustainable income for the landowners
- The solar farm allows the land to rest and recover from intensive agricultural practices.

The following aspects are considered incompatible with agriculture and the rural environment:

- Introduces changes (new built environment elements) to the existing landscape character and scenic values
- Risk of weed infestation.

**BSAL**
The land within the site is not mapped as Biophysical Strategic Agricultural Land (BSAL) and therefore the proposal will not have any long-term impact on prime agricultural land. Temporary loss of the site for agricultural production would occur for the life of the proposal, approximately 30 years.

During the operational phase of the Proposal a land management plan will be employed (refer **Appendix J**) so that upon decommissioning the land will be available for agricultural use. If the Site is to be decommissioned after the operating period, the Site would be returned to being used solely for agricultural purposes and Site would either be leased or placed on the market and sold.

The area of disturbance will be minimal as no large areas of reshaping or excavation are proposed and piledriving will be used to install the pre-fabricated mounting structures.

**Intersection Upgrades**
The upgrades to be undertaken at the intersection of Renshaw McGirr Way and Suntop Road will result in temporary construction in an active road corridor. Operational use at this intersection will be a continued use of current operations as a road and would provide safety improvements for the community using this intersection.

### 6.6.3 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| L1 | Managed grazing will be used to maintain the height of ground cover during operation of the solar farm. |
| L2 | If operations cease and the Site is to be decommissioned, a remediation plan will be compiled and implemented. |
| L3 | Implement the Landscape Plan (refer **Appendix C**) |
| L4 | All pesticides will be used in accordance with the *Pesticides Act 1999*, such that only registered pesticides are used based on label instructions that are designed to minimise impacts on surrounding land |
| L5 | All the infrastructure will be removed upon decommissioning with the possible exception of the substation, transmission lines to the substation and access road to the substation. |
| **Operational Mitigation Measures** | |
| L6 | An OEMP will be prepared for the Proposal and will incorporate:<br>• The land management plan including a weed management<br>• Ongoing landscaping commitments |

## 6.7 Surface Water, Hydrology and Groundwater

This chapter summarises the site hydrological conditions and provides an assessment of potential impacts on surface water and groundwater. The surface water drainage conditions are described and an assessment provided of potential impacts on surface water drainage patterns. The flood potential of the site is described based on available flood information and the likely flood interactions with the Proposal assessed. Groundwater conditions are described based on desktop searches, existing published data (where available) and site observations. Potential groundwater interactions and impacts are assessed. Potential impacts of the Proposal have been identified and assessed for the construction and operation of the Proposal, and mitigation measures developed to address specific risks.

This chapter addresses the requirements of the SEARs, in particular the following matters:

- Surface water and groundwater conditions
- Identification of riparian land and groundwater dependent ecosystems
- Water requirements and supply arrangements for the Proposal
- Existing licensed groundwater users
- Potential hydrological impacts during construction and operation
- Management and mitigation measures to minimise potential hydrological impacts

### 6.7.1 Assessment Methodology

#### *Surface Water*

Surface water drainage patterns were identified using published resources such as the Department of Lands 1:25,000 topographic map series and recent aerial photography available from Google Earth. Site survey information and observations provided additional information on natural waterways, flowlines and water storages such as farm dams that exist on site.

Given the site is relatively distant from the nearest natural watercourse, this being the Macquarie River approximately 7.7km to the north of the property, a qualitative water quality assessment was undertaken that includes identification of appropriate water quality protection measures.

#### *Groundwater*

Information on existing groundwater resources was compiled from published information including the Department of Primary Industries (Office of Water) water monitoring network, online maps and the Wellington LEP to determine groundwater vulnerability in this locality. A qualitative groundwater assessment is presented in Section 6.7.2.

### 6.7.2 Existing Environment

#### *Surface Water drainage*

The Proposal is located within the Macquarie River Catchment with the closest major water course being the Macquarie River, which is located approximately 7.7km north of the Site (Figure 1-3).

The Macquarie River is located in the Macquarie – Bogan Catchment and is one of the Murray-Darling Basin's major sub-catchments. The Macquarie-Bogan catchment covers an area of 74,800 square kilometres with the headwaters of the Macquarie River originating in the Great Dividing Range south of Bathurst, where the river flows in a general north-westerly direction until it joins the Barwon River near Brewarrina.

The major NSW cities and towns relying on the rivers in the Macquarie catchment include Bathurst, Orange and Oberon upstream of Burrendong Dam, and Dubbo, Wellington and Nyngan on the Macquarie River below Burrendong Dam. Mudgee, Peak Hill, Narromine, Warren, Lithgow, and Brewarrina also draw their water from rivers in the catchment. Burrendong Dam to the east of Wellington is located on the Macquarie River and is the largest storage in the catchment with a capacity of 1,190,110 megalitres. This storage water a range of uses including irrigation, town water, stock and domestic use.

There is a creek / flowline (unnamed) that runs through the Site in an east to west direction and flows into Barney's Creek, approximately 2.5km to the north of Site. This creek (unnamed) is classified a first order stream, as it is located at the top of a catchment as a 'headwater' flow. Barney's Creek, flows into Little River which is a major tributary of the Macquarie River.

The Site has a large amount of low "rollover "banks which can be driven over and are regularly cultivated. These serve to reduce velocities of surface water flows and reduce the erosion potential of these flows. These structures follow the contour and water which follows the banks discharge into a series of small farm dams located across the Site.

The intersection of Suntop Road and Renshaw McGirr Way encompasses a portion of an unnamed second order north flowing tributary of Curra Creek which is approximately 100 metres north of the study area. Curra Creek flows north east for approximately 6 kilometres before joining Bell River and Macquarie River near Wellington. The second order tributary runs beneath Renshaw McGirr Way through a culvert and no water was present in the drainage line during the site inspection (15 May 2018).

Under the Wellington LEP (2012), the Site has not been identified as flood prone, wetland or riparian land. The unnamed water course running through the Site is a small first order stream and at the intersection a second order tributary and the topography is undulating which allows surface water to drain from the Site without ponding and causing flooding. Accordingly, development on the site will not impact on any flood prone land.

### *Groundwater*

The Proposal is located within the Lachlan Fold Belt groundwater zone which comprises of fractured rock aquifers. The aquifers associated with this geology have a low to moderate level of connection to surface water sources and they also have a low impact on instream flows in this area. It has been determined that it can take years to decades for surface water and groundwater to interact in these areas.

A search of the Department of Primary Industries (Office of Water) groundwater database identified three groundwater bores in the vicinity of the Site with one located on the southern side of the Site and two located on the northern side of Suntop Road. These varied in depth from 25 – 30m with a standing water level of 15m.

The Wellington LEP (2012) has mapped this Site as part of a groundwater vulnerable area. Under this planning scheme the objectives of this designation are as follows:

- To maintain the hydrological functions of key groundwater systems
- To protect vulnerable groundwater resources from depletion and contamination as a result of development.

This is done by considering:

- The likelihood of groundwater contamination from the development (including from any on-site storage or disposal of solid or liquid waste and chemicals)
- Any adverse impacts the development may have on groundwater dependent ecosystems
- The cumulative impact the development may have on groundwater (including impacts on nearby groundwater extraction for a potable water supply or stock water supply)
- Any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

### *Groundwater Dependent Ecosystems*

The site has not been mapped by the BoM as a containing a Groundwater Dependent Ecosystem.

### *Water use and Access Licenses*

The current owners detail that water from a bore is accessed for the Site and the adjoining landholders to the west for stock and domestic purposes, and a series of small farm dams provide water for livestock. A check of records indicate that the existing bore is not currently licensed with WaterNSW. As part of the property purchase, SSF have negotiated to maintain access to this bore.

Negotiations have also taken place between SSF and the adjoining neighbours who also currently access this bore. To allow continued water access for the adjoining property, the establishment of new bore on their property is being investigated.

Table 6-24 summarises the existing water access licenses and water use approvals at and adjacent to the property.

Table 6-24 Water Licenses and Approvals

| Approval | Location | Type | Use |
|---|---|---|---|
| **GW056551** | Lot 3 DP 506925 | Bore | Basic Rights |

### 6.7.3 Assessment of Potential Impacts

#### *Water Quality*

**Construction**
Construction activities with the potential to impact upon surface water flows include those with the potential to disturb soils and lead to sediment runoff. During construction, the soils will be subject to disturbance associated with site preparation, access and construction activities. However, due to the distance from any major watercourses near the Site and the staged construction program leading to progressive stabilisation of disturbed soils, any potential erosion and water quality impacts to nearby waterways from the Proposal are considered low. These are capable of being managed through implementation of conventional erosion and sediment controls along with the continued use of the existing erosion control structures.

The major flowlines on the Site will be afforded protection by the implementation of a buffer along them which will ensure vegetative cover is retained to assist in maintaining water quality. The dams will also have a buffer area maintained around them with the exception of one very small dam in the southern section of the Site which is proposed to be filled in.

Works at the intersection of Suntop Road and Renshaw McGirr may occur in close proximity to the existing culverts however Curra Creek is located approximately 100m to the north east of the works area.

**Operation**
Day to day activities would revolve around routine monitoring of the solar farm performance, undertaking required maintenance activities and managing the ongoing agricultural activities, none of which involve significant land disturbance, use of hazardous chemicals or other activities that could impact water quality.

#### *Water use*

**Construction**
Construction of the proposal will require limited potable water for staff amenities. Potable water would be trucked to the Site on an as needs basis and stored within temporary water tanks at the staff amenities area.

During construction, there is a need for non-potable water mainly for dust suppression. The volume of non-potable water required during construction may reach up to approximately 50,000 L/day, during hot windy weather conditions that lead to maximum dust suppression demand. Conversely, during cool or wet conditions the water demand would be minimal. Based on an estimated average daily water demand of 25,000 L/day throughout the construction period, this equates to an annual water use of less than 10 ML.

Water for dust suppression during construction would be sourced from runoff water collected in the dams on site. Water for the intersection upgrade works and should any additional water for the Site be required it will be sourced through a local contractor and delivered to Site by water truck.

**Operation**
During operation, water would be required for stock watering and vegetation management. Water for these purposes is proposed to be supplied from the existing dams and bore. Water may also be required for panel cleaning on an ad hoc basis. The water demands of the solar farm operation are small and likely to be less than the commensurate with the current demands from agriculture on the Site.

### *Groundwater and Groundwater Dependent Ecosystems*

**Construction**

Impacts to groundwater during construction are considered unlikely due to the depth of groundwater anticipated across the site. The closest groundwater bores indicate a standing water level exceeding 15m. Excavation on site will not exceed 4m associated with pile driving for the mounting structures and open trenching will not be deeper than about 1.2 m. As such, works on site are not anticipated to intercept or impact upon groundwater.

Works associated with the intersection upgrade are likely to consist of shallow excavation and are unlikely to impact on groundwater.

**Operation**

During operation, there is no planned increase on groundwater abstraction and hence no change to groundwater conditions are expected because of the proposal. Consequently, the proposed solar farm would not impact on groundwater resources directly or indirectly.

It has been documented that groundwater in some section of this district can be slightly saline. It has also been documented that some of the gullies and lower lying areas are most susceptible to salinity if water tables are able to rise without control.

A salinity specialist from the NSW Local Land Services at Wellington was consulted in relation to this issue on the 8th May 2018. Advice received indicated that the establishment of perennial pastures and the managed grazing of livestock would assist in lowering groundwater levels due to the uptake of infiltration water by the growing pasture plants. The infiltration rates would also be lower than those that currently occur when the soil is exposed after cultivation.

The management of the Site will be subject to a Land Management Plan, and this will document measures for pasture management.

## 6.7.4 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| SW1 | A Soil and Water Management Plan (SWMP) will be prepared and implemented by the Contractor as part of the CEMP, this will include use of onsite water for dust mitigation measures. |
| SW2 | Minimise the footprint of disturbance at any one time by implementing progressive construction and remediation works |
| SW3 | Design solar panel arrays to allow sufficient space between panels to establish and maintain ground cover beneath the panels and assist in reducing potential sediment impacts on water quality |
| SW4 | Ensure all refuelling activities are undertaken in a bunded area at least 40m from any waterways. |
| **Operational Mitigation Measures** | |
| SW5 | Implement the Land Management Plan to ensure at least 80% groundcover is restored and maintained (Refer **Appendix J**) |

## 6.8 Soils, Geology and Contamination

An assessment of soils, geology and contamination has been undertaken for the Proposal. Information on the existing environment was obtained through a combination of desktop searches, site observations and a soil survey. Potential impacts of the Proposal have been identified and assessed for the construction and operation of the Proposal, and mitigation measures developed to address specific risks.

This chapter addresses the requirements of the SEARs, in particular the following matters:

- Geology and landform
- Existing soil conditions
- Potential soil contamination
- Soil and landscape suitability, and limitations to development
- Potential soil impacts during construction and operation
- Management and mitigation measures to minimize potential impacts on soils.

### 6.8.1 Existing Environment

#### *Landform*

The study area is located in the Central West subregion with the main rivers in this subregion being the Macquarie, Castlereagh and Bogan rivers all of which are tributaries of the Murray-Darling Basin. This subregion extends from the plains around Dubbo across to the low-lying plains of the Macquarie and Castlereagh rivers and to the north west to the Barwon River. The Site lies within the Macquarie River catchment system and the Macquarie River is located approximately 7.7 km north of the study area, see Figure 1-3. One second order drainage line flows east–west through the central part of the study area, which empties into Barneys Creek approximately two kilometres west of the study area. Barneys Creek is a tributary of Little River that empties into the Macquarie River, approximately 20 kilometres north west of the study area.

The Wellington Valley is divided by the Little, Bell and Macquarie rivers and their various creeks and tributaries which generally run in south east to north west direction. Elevated highpoints within 10 kilometres of the Site include Mount Duke (540m, Mount Arthur (525m AGD) and Bushrangers Hill (406m AGD). Mount Arthur is part of the Mt Arthur Reserve which is located approximately five kilometres east of the study area and this is one of the last areas of remnant vegetation in the Wellington area.

Landform elements consist mostly of hillslopes and stream channels. The landform pattern has very low relief (9-30m) and very gentle to steeper slopes along with erosional stream channels that are usually closely spaced and form integrated channel networks. The hillslopes are generally gently inclined between 2 to 6 % with steeper slopes affected by sheet erosion when left unvegetated.

#### *Geology*

The Site lies within the eastern part of the Lachlan Fold Belt and this consists of north to north westerly trending Cambrian to Early Carboniferous sedimentary and volcanic rocks which have been subject to folding. A variety of granites are present in the area and generally occur as a central basin which is surrounded by hills which have formed from contact with metamorphic rocks. The granites can also occur as elevated plateau features such as rock outcrops or tors. The valleys between ranges of this area are usually either granite or softer material such as shale, phyllite or slate.

The Wellington 1:100,000 Geological Series Sheet (Department of Planning and Environment (DP&E)) has mapped the area as 'Scuc' – Canowindra volcanics (Garnetiferous quartz-feldspar-cordierite porphyritic lava, tuff, ashtone, ignimbrite) and Scuh – Hanover Formation (massive siltstone and chert).

The geology at the intersection of Suntop Road and Renshaw McGirr Way comprises Garra Formation (Dgg) and Curra Creek Conglomerates (Dtcu). The Garra Formation is an Early Devonian Volcanic that outcrops on shallow valleys and low broad ridges and is comprised of fossiliferous limestone that formed under shallow marine conditions. The Curra Creek Conglomerates form part of the Late Devonian Catombal Group and overly Garra Formation geologies. The Curra Creek Conglomerates were formed from the high-energy deposition of alluvial fans from the east.

The Department of Primary Industries (Office of Water) water monitoring database lists two groundwater bores near the Proposal Site. The Geologists Log revealed a shallow to medium topsoil thickness (0m-1m), a clay B horizon (1m – 3m) and a granite bedrock, with an intermediate weathered profile between hard granite and clay B horizon (3m – 25m).

A region within the neighbouring eastern lots, of approximately 350ha has been identified as Karst landscape. A Karst landscape is characterised by the presence of underground cavern networks created from the dissolution of bedrock by surface water or groundwater. The geology mapping for this area as shown on Figure 6-29 indicates that the geology of the area would not produce karst landscapes. The proposed construction activities on site will be shallow in their nature and will not go to a depth that would impact on karst if it was to occur beneath the Site. The proposal will not impact on any karst landscape in this area.

The geology of the Site is categorized as shown in Figure 6-33 and described in Table 6-25.

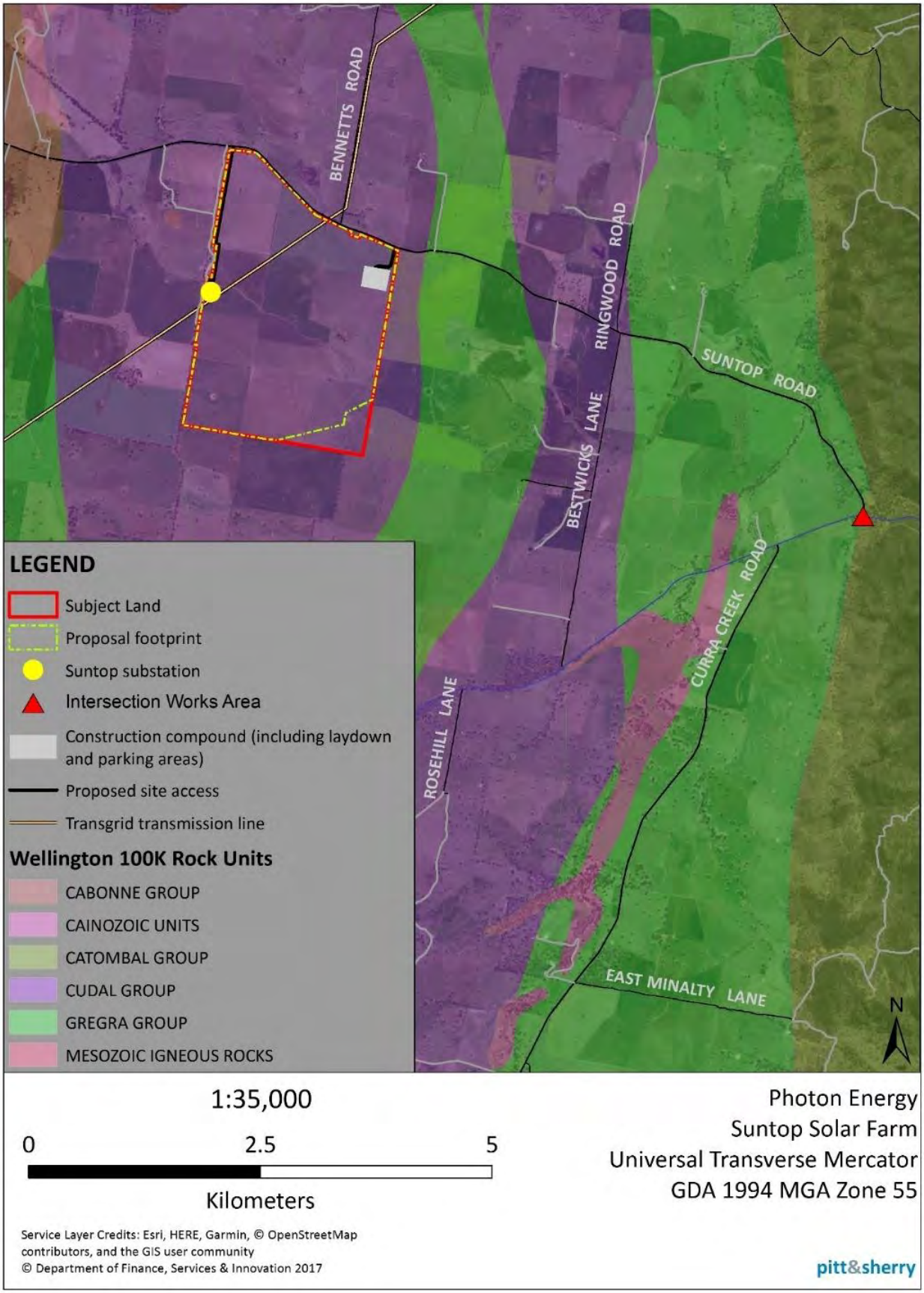



Figure 6-33 Geology of the Suntop area (Extract from Wellington 1:100000 Geological Map)

Table 6-25 Site Geology Descriptions

| Symbol | Name | Description |
|---|---|---|
| Scuc | Canowindra Volcanics | Garnetiferous quartz-feldspar-cordierite porphyritic lava, tuff, ashtone, ignimbrite |
| Scuh | Hanover Formation | Greenish-buff almost massive siltstone with some purple siltstone and chert near base |
| Dgg | Garra Formation | Fossiliferous limestone with minor cherty and volcaniclastic sandstone, fissile shale and marly siltstone, with minor rare tuff. |
| Dtcu | Curra Creek Conglomerates | Red-purple conglomerate, minor interbedded red-purple sandstone and siltstone. |

## *Soil Landscape*

Soils at the Site have been mapped as being in the Arthurville Soil Landscape and as detailed in the DLWC Dubbo 1:250000 Sheet (1998). This is an area of approximately 682 km$^2$ and the soils are predominantly Red-brown Earths with some Yellow Podzolic-Solodic soils being present. The majority of soils on cleared land have been extensively disturbed by agricultural activities such as clearing for grazing of sheep and cattle, and rotational cultivation for the growing of cereal crops such as wheat, oats and canola, and fodder crops such as lucerne.

Murphy *et.al* (1998) describe the soils chemical fertility of this soil landscape as moderate with common deficiencies such as Nitrogen, Phosphorous and Sulphur. The surface soils also exhibit some areas of slight acidification and aluminium toxicity. The physical fertility is generally moderate, with some of the lighter textured surface soils being subject to structural degradation which can have consequences of higher runoff, increased erosion and surface sealing. The subsoils, particularly the Red-brown Earths are well structured and this has the benefits of allowing large amounts of root growth.

The erosion hazard has been described as moderate to high given the long slopes, especially when the soils have been cultivated or the amount of groundcover is low. The soils on site do not indicate that substantial amounts of salts are present in this part of the landscape. A review of the Wellington LEP 2012 did not indicate that the Site is at risk of acid sulphate soils or salinity. A review of the eSpade indicates that the subject Site is not currently mapped as being a risk area for ASS.

Based on the site geomorphology, drainage and observed soils, it is highly unlikely that ASS/PASS would exist or pose a problem at or near this Site. The activities proposed on the Site will have a minimal impact in relation to disturbance of ASS or PASS. The, majority of works will occur in the upper 800mm of soil and there is minimal risk of disturbing or exposing PASS to oxidation.

The soils on the Site are classified as being Class III Rural Land Capability. This gives them a general rating of being suitable for cropping and for the construction of dams and other erosion control earthworks including banks and waterways.

Table 6-26 details the qualities and limitations for soils found in the Arthurville Soil Landscape.

Table 6-26 Soil qualities and limitations

| Qualities | Limitations |
|---|---|
| Complex soils | Long slopes (high erosion hazard) |
| Fertile | Some gravel lenses on lower slopes (can lead to leaking earth structures e.g. dams) |
| Productive arable land | |
| Rural Land Capability III | |

Soils at the intersection of Suntop Road and Renshaw McGirr Way have been mapped as Tillings Lane Soil Landscape and as detailed in the DLWC Dubbo 1:250000 Sheet (1998). This is an area of approximately 77km2 and the soils are predominantly red-brown earths. This landscape is formed from in situ, colluvial and alluvial parent rock. Soil salinity problems are not present in this landscape and the soils are erosional due to long slopes particularly in tilled conditions or with poor cover

### *Potential contamination*

A search of the NSW contaminated land register was conducted on 19th March 2018. This register contains three sites in the Dubbo Regional Council LGA and these are all within the township of Wellington, and are former or existing Service Station sites (Refer Table 6-27).

Table 6-27 Registered contaminated sites within Wellington (Dubbo LGA) (Source: NSW EPA)

| Suburb | Address | Site Name | Distance from the site |
|---|---|---|---|
| Wellington | 124-128 Lee Street | Former Caltex Service Station | 10km |
| Wellington | 35A Maxwell Street | BP Wellington Service Station | 10km |
| Wellington | 35A Maxwell Street | BP Wellington Service Station | 10km |

Land uses which generally lead to an area being deemed contaminated land include heavy industry and intensive agriculture. The subject land has previously been used for cultivation and grazing of livestock. Both these land uses present a low risk of contamination from fuels, herbicides, pesticides and other farm chemicals.

## 6.8.2 Soil Survey and Analysis

### *Soil Survey*

To identify broad land capability and soil constraints a soil survey was undertaken on the Site. A desktop analysis was conducted to determine approximate sites for the soil survey to be undertaken. This analysis considered the site in terms of topography, drainage, access and possible variation of soil types to ensure the samples were representative of the site.

The soil survey included:

- Excavation of six test pits using a shovel and crowbar to expose the soil profile to a depth of approximately 500mm
- Completion of a test pit log sheet to record attributes of each soil layer in the field, including layer depth, field texture, colour, structure and other relevant data. A photo was taken of each soil profile. These are included in Figure 6-35 and the soil log sheets are included as **Appendix K**
- Collecting a representative sample (approx. 1kg) of each soil layer. Samples were placed in sealed plastic bags and labelled appropriately

- Analysing soils to assess soil fertility and a range of general constraints to land development.

Figure 6-34 shows the approximate location of the test pits in relation to the solar farm boundary.

No soil testing was undertaken at the intersection of Suntop Road and Renshaw McGirr Way due to the small scale of the works to occur at this location.

### *Soil Description*

As previously described the topography of the site is undulating with the Site being used for grazing of livestock and cultivation for dryland crops including wheat and other cereals. The soils observed are typical of the slopes and plains associated with the Macquarie Valley around Wellington. As is the case with many soils used for cultivation and growing of crops, soil fertility and structure can be depleted over a period of years.

The following general observations were made:

- The site soils can be characterized as red brown earths and some smaller areas of yellow podzolic
- Soils on site display a moderate amount of shrink / swell in response to moisture
- The site presents a moderate to high hazard for rill and gully erosion
- Sheet erosion may be exacerbated by surface sealing when left unvegetated, this can lead to reduced infiltration and increased runoff
- Wind erosion may be experienced when soils are left bare or fallow between cultivation cycles

Table 6-28 provides a brief summary of the soil materials sampled.

Table 6-28 Soil Sample Descriptions

| Sample Name | Sample Depth | Description |
|---|---|---|
| TP1/1 | 0 – 150 mm | Sandy loam, grey - brown |
| TP1/2 | 150 – 450 mm + | Sandy loam, yellowish brown |
| TP2/1 | 0 -200 mm | Sandy loam, dark brown |
| TP2/2 | 200 – 500 mm + | Sandy loam, reddish brown |
| TP3/1 | 0 -200 mm | Sandy loam, reddish brown |
| TP3/2 | 200 – 400 mm+ | Light sandy clay loam, reddish brown |
| TP4/1 | 0 -200 mm | Sandy loam, reddish brown |
| TP4/2 | 200- 450mm+ | Sandy loam, light reddish brown |
| TP5/1 | 0- 100mm | Sandy loam, light brown |
| TP5/2 | 100 – 400mm + | Medium heavy clay, light brown |
| TP6/1 | 0 – 100 mm | Sandy clay, light brown |
| TP6/2 | 100- 400mm + | Medium clay loam, light brown |

### *Soil analysis*

A number of representative soil samples were sent to the NSW Department of Primary Industries laboratories in Wollongbar and Scone for analysis of a range of physical, chemical and fertility indicators.

Table 6-29 lists the schedule of analysis and a brief summary of the results is provided in Table 6-30 and the following sections. Certificates of analysis containing the complete laboratory results are contained in **Appendix K**. The laboratory provides a number of different packages which test for various suites of chemical traits of the soil. As indicated the cropping package was chosen for six of the sites sampled. The cropping package includes an analysis of the following:

- pH (water)
- Ph ($CaCl_2$)
- EC (water)
- Available phosphorous (Colwell)
- Phosphorous buffer index
- Available sulfur ($KCl_{40}$)
- Exchangeable cations
- Walkley & Black organic carbon
- Total Nitrogen

The remaining sites were tested for pH (water) and EC and six of the samples were also sent to another laboratory for K factor (erodibility) testing.

Table 6-29 Laboratory analysis schedule

| Sample ID | Horizon | Depth mm | K factor (incl PSA and OC) | pH (water) EC | Cropping Package |
|---|---|---|---|---|---|
| TP1/1 | A | 100 | X | | X |
| TP1/2 | B | 300 | X | | X |
| TP2/1 | A | 100 | X | | X |
| TP2/2 | B | 300 | | X | |
| TP3/1 | A | 100 | | X | |
| TP3/2 | B | 300 | | X | |
| TP4/1 | A | 100 | X | | X |
| TP4/2 | B | 400 | | X | |
| TP5/1 | A | 50 | X | | X |
| TP5/2 | B | 300 | X | | X |
| TP6/1 | A | 50 | | X | |
| TP6/2 | B | 300 | | X | |
| Note – "X" denotes the sample was analysed | | | | | |

Table 6-30 Summary of laboratory results.

| Factor | Units | Maximum | Sample No. | Minimum | Sample No. |
|---|---|---|---|---|---|
| pH (Water) | pH units | 6.8 | TP5/1 | 5.3 | TP1/1 |
| pH ($CaCl_2$) | pH units | 6 | TP5/1 | 4.4 | TP2/1 |
| Electrical Conductivity | dS/m | 0.2 | TP1/1 | 0.021 | TP3/2 |
| Sulfur ($KCl_{40}$) | mg/kg | 11 | TP5/1 | <2 | TP1/2 |
| Bray Phosphorus | mg/kg | 140 | TP5/2 | 1.1 | TP1/2 |
| Organic Carbon | % | 1.1 | TP4/1 TP5/2 | 0.28 | TP1/2 |
| Total Nitrogen | % | 0.13 | TP2/1 TP4/1 | 0.04 | TP1/2 |
| Aluminium | cmol(+)/kg | 0.32 | TP1/1 TP2/1 | < 0.1 | TP1/2 |
| Calcium | cmol(+)/kg | 17 | TP5/1 | 3.2 | TP1/2 |

| Factor | Units | Maximum | Sample No. | Minimum | Sample No. |
|---|---|---|---|---|---|
| Potassium | cmol(+)/kg | 1.8 | TP1/1 | 0.39 | TP1/2 |
| Magnesium | cmol(+)/kg | 4.1 | TP5/1 | 0.4 | TP1/2 |
| Sodium | cmol(+)/kg | 0.07 | TP5/1 | <0.03 | 4 pits |
| CEC (effective) | cmol(+)/kg | 22 | TP5/1 | 4 | TP1/2 |
| Calcium/ Magnesium | | 12 | TP4/1 | 4 | TP5/1 |
| Percent Aluminium Saturation | % of ECEC | 6 | TP2/1 | 2 | TP4/1 |
| Exchangeable Calcium | % of ECEC | 81 | TP4/1<br>TP5/2 | 62 | TP1/1 |
| Exchangeable Potassium | % of ECEC | 25 | TP1/1 | 3.7 | TP5/1 |
| Exchangeable Magnesium | % of ECEC | 19 | TP5/1 | 6.7 | TP4/1 |
| Exchangeable Sodium Percentage | % of ECEC | 0.54 | TP4/1 | 0.32 | TP5/1 |

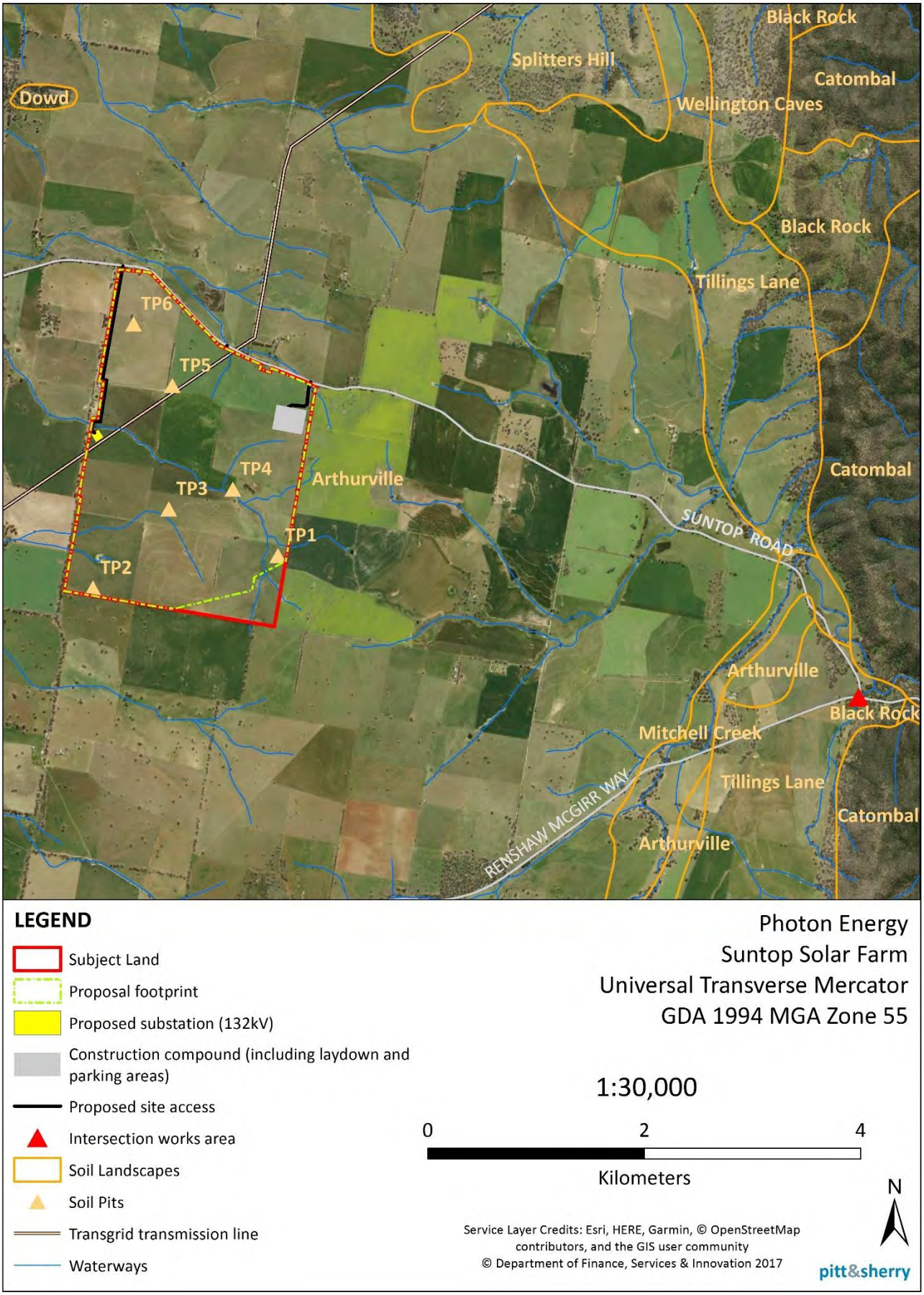



Figure 6-34 Soil test pit locations

### Soil Acidity

Acidity or soil pH is a measure of the concentration of hydrogen ions in the soil solution and the lower the pH of soil, the greater the acidity. It is recommended that pH (water) should be maintained at above 5.5 in the topsoil and 4.8 in the subsurface as well maintained soil pH will maintain the soil resource and increase crop and pasture choices, while also avoiding production losses associated with high and low pH's. Laboratory analysis of the soils sampled indicates a pH (water) range of 5.36 (slightly acid) to 6.8 (neutral).

Alternately pH in a Calcium Chloride solution can also be used as an indication of pH. As a rough guide the $CaCl_2$ reading will be 0.8 units lower than the water pH and values < 5.5 indicate that the soils are becoming acid. This is especially the case when the cation exchange capacity (CEC) levels are above 15. Acid soils restrict the availability of major nutrients such as phosphorus and nitrogen to the plants.

### Soil Salinity

Electrical conductivity (EC) is a measure used to determine the salinity levels in soils. The ECse range for non-saline soils to extremely saline soils are listed in Table 6-31.

Table 6-31 Salinity Rating

| Rating | Electrical Conductivity of a saturated soil Extract (ECe) |
|---|---|
| Non-saline (very low to Low) | <2 |
| Slightly saline (Medium) | 2 -4 |
| Moderately saline (High) | 4 – 8 |
| Highly saline (Very High) | 8-12 |
| Extremely saline (Extreme) | >12 |

There are no indicators of salinity present on the subject land including no:

- Visible signs of scalds (during the site inspection – some minor scalds have since been identified by the landholder)
- Poor crop growth in low-lying areas where water cannot drain freely due to poor layout and drainage
- Waterlogging-tolerant plant species becoming dominant
- Die back of native vegetation.

Table 6-32 Site Electrical Conductivities (1:5 solution)

| Sample | Electrical Conductivities dS/M | ECse |
|---|---|---|
| TP1/1 | 0.2 | 2.76 |
| TP1/2 | 0.026 | 0.359 |
| TP2/1 | 0.059 | 0.814 |
| TP2/2 | 0.042 | 0.58 |
| TP3/1 | 0.082 | 1.132 |
| TP3/2 | 0.021 | 0.199 |
| TP4/1 | 0.054 | 0.745 |
| TP4/2 | 0.028 | 0.386 |
| TP5/1 | 0.068 | 0.938 |
| TP5/2 | 0.064 | 0.371 |
| TP6/1 | 0.11 | 1.518 |
| TP6/2 | 0.041 | 0.353 |

The laboratory analysis shows a range of 0.026 to 0.2 dS/m in a 1:5 water solution (refer Table 6-32). When adjusted for the sandy loam textures for ECse, these soils are all non – saline soils.

Soil data and records indicate that salinity outbreaks are present further to the west of the Site and lower in the topography. It is also documented that salinity outbreaks are more prone to occur in gullies and low lying areas in this district. As has been documented in Section 6.7.3, contributions to the water table from infiltration of rainfall can have a detrimental effect by bringing salts contained within the soil to the surface and causing saline outbreaks.

To further assess this issue for the proposal, a salinity specialist from the NSW Local Land Services at Wellington was consulted in relation to this issue on the 8th May 2018. Advice received indicated that the establishment of perennial pastures and the managed grazing of livestock would assist in lowering groundwater levels due to the uptake of infiltration water by grazed pasture plants. The infiltration rates would also be lower than those that currently occur when the soil is exposed after cultivation.

Salinity should not be a high risk given the Sites location in the landscape and the infiltration rates will be the same as present or lower. The substantial replanting of deep rooted trees and shrubs as part of the landscape plan will also assist with the uptake of soil water on Site, as will the selection of suitable pasture species.

### *Sodicity*

Sodicity is related to the amount of sodium (Na) held in a soil within the cation exchange complex. Sodium is a cation (positive ion) that is held loosely on clay particles in soil and is one of many types of cations that are bound to clay particles. Other cations include calcium, magnesium, potassium and hydrogen. Problems occur in soils where there is an imbalance of sodium relative to other cations and this can occur with relatively low levels of sodium. If the exchangeable sodium percentage (ESP) is more than about 5% of all cations bound to clay particles, the soil is said to be sodic and above 10% is strongly sodic (Hazelton & Murphy, 2007).

The general problem with sodic soils is that high levels of sodium cause the soil to be dispersible and unstable when moisture is applied making them highly susceptible to erosion, particularly water erosion. Dispersion causes structural decline and surface crusting, leading to increased runoff susceptibility and reduced water infiltration.

Similarly, soils with high levels of magnesium levels in the cation exchange, referred to as magnesic soils, can exhibit signs similar to sodic soils. For soil to exhibit sodic symptoms due to high magnesium it is generally accepted that every 8 to 10 % of magnesium is equivalent to 1 % of sodium. Table 6-33 presents the measured sodium and magnesium concentrations for the soils tested.

**Table 6-33 Exchangeable Sodium and Magnesium in the Cation Exchange Complex (%)**

| Sample | Exchangeable Sodium (%) | Exchangeable Magnesium (%) |
|---|---|---|
| TP1/1 | N/A | 8.4 |
| TP1/2 | N/A | 10 |
| TP2/1 | N/A | 9.4 |
| TP4/1 | 0.54 | 6.7 |
| TP5/1 | 0.32 | 19 |
| TP5/2 | N/A | 7.6 |

The soil test results show ESP levels below 2 which indicates the soils are non- sodic, the majority of test pits also recorded relatively low exchangeable magnesium percentages. The majority of test pits recorded relatively low organic carbon levels of less than 1, this indicates these soils would potentially be subject to crusting and associated high runoff if the surface sealed.

The lower organic carbon values from the soil tests could be a result of repeated cropping over a number of years. Another indicator of potential instability is if the Ca/Mg ratio is less than 2. A value of one, or close to one indicates extreme susceptibility to surface crusting/sealing and values <2 indicate there may be issues from raindrop impact particularly if freshly cultivated and bare. The Ca/Mg ratio on site ranges between 4 and 12 which indicate this should not pose a problem if a vegetative cover is maintained.

**K Factor – Erosion Factor**

A number of factors can contribute to the erosion hazard at any particular site. The Revised Universal Soil Loss Equation (RUSLE) is one method commonly employed in NSW to estimate erosion hazard and allows risk assessment and comparison across various sites. It represents the product of various factors including rainfall erosivity, soil erodibility, landscape factors (e.g. slope gradient and length) and land management practices including surface cover and condition.

Soil erodibility (RUSLE K-factor) is a key factor in assessing erosion hazard. K-factor relates to both the susceptibility of a soil to erosion and the rate of erosion-causing water runoff. It is chiefly affected by soil texture but also structure, organic matter content and profile permeability.

Following is a general guide to K-factor based on soil texture:

- Soils high in clay typically have low K values, about 0.005 to 0.015, because they are resistant to detachment
- Similarly, coarse textured soils such as sands usually have low K values, about 0.005 to 0.02, due to the associated high profile permeability and low runoff, even though these soils are easily detached
- Medium textured soils, such as the silt loam soils, have moderate K values, about 0.025 to 0.04, because they are moderately susceptible to detachment and they produce moderate runoff
- Soils having a high silt content are most erodible of all soils. They are easily detached; tend to crust and produce high rates of runoff. Values of K for these soils tend to be greater than 0.04.

Six of the test pit samples were analysed for K factor and the test results show a range between 0.021 and 0.057 with the results shown in Table 6-34. The data indicates the soils tested have a low to moderate K-factor value.

Table 6-34 Particle size analysis and K factor

| P7C/2 Particle Size Analysis – mechanical (%) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample ID | OC (%) | Clay | Silt | F sand | C sand | Gravel | Soil Erodibility – K Factor |
| Suntop TP1/1 | 0.88 | 7 | 17 | 32 | 38 | 6 | 0.043 |
| Suntop TP1/2 | 0.28 | 4 | 15 | 31 | 37 | 13 | 0.049 |
| Suntop TP2/1 | 1.24 | 1 | 18 | 35 | 37 | 9 | 0.049 |
| Suntop TP4/1 | 0.85 | 1 | 23 | 33 | 35 | 8 | 0.055 |
| Suntop TP5/1 | 0.65 | 3 | 15 | 36 | 24 | 22 | 0.057 |
| Suntop TP5/2 | 0.44 | 33 | 17 | 6 | 21 | 23 | 0.021 |



Test Pit 1



Test Pit 2



Test Pit 3



Test Pit 4



Test Pit 5



Test Pit 6

Figure 6-35 Test Pit Photos

## *Nutrients*

**Phosphorus**

Phosphorus levels vary widely across the site. They range from 140 mg/kg, TP5/2, to 1.1 mg/kg, TP1/2. Without knowing the full history of the sampling sites, it may be assumed that some parts of the site have had applications of fertiliser containing phosphorous applied to improve the health and production of crops grown on the site. A proportion of the samples at depth indicate that there is the possibility there has been has some leaching of phosphorous down the profile, this can sometimes occur if fertiliser is not fully taken up by the plants.

**Nitrogen**

Soil nitrogen was determined as total nitrogen by combustion. This method is not very relevant to mineral availability for plants as 95 – 99% of the total nitrogen is tied up as organic matter. This means that only 1 –

5% of soil nitrogen is in the mineral forms ($NH_4^+$, $NO_3^-$, $NO_2^-$) and available to plants. Availability of this nitrogen is determined by the mineralisation of the organic nitrogen. There is a general rating for total soil nitrogen as a guide to what mineral nitrogen may be available to plants. Cross referencing this with the soil tests, <0.05 is very low and 0.05 to 0.15 is low. This means the soils generally have low to very low mineral nitrogen levels for plant growth with the results showing a range of 0.04% to 0.13%.

**Sulfur**

The level of sulfur generally recommended for crop growth needs to be greater than 8 to 10 mg/kg. The site soils display values between <2 mg/kg to11mg/kg. Given the relatively low range of some of the soils tested is indicative of marginal sulfur deficiency at some locations across the Site.

## *Erosion Hazard Analysis*

Soil disturbance is expected principally during the construction stage of solar farm development. A site-specific erosion hazard assessment has been undertaken to help assess the magnitude of risk associated with soil erosion and sedimentation of waterways.

Managing Urban Stormwater: Soils and Construction (Landcom, 2004; the "Blue Book" outlines a method for estimating erosion hazard using the Revised Universal Soil Loss Equation (RUSLE). Erosion hazard can be estimated by comparing the site specific RUSLE value with guideline values published in Figure 4.6 in the Blue Book.

Table 6-35 summarises the Revised Universal Soil Loss Equation (RUSLE) factors and assumed values for the site.

Table 6-35 Revised Universal Soil Loss Equation.

| Factor | Value | Description |
|---|---|---|
| **R-factor** | 1400 | Rainfall erosivity: related to average rainfall energy and intensity. Data taken from R-factor maps published in Annex B of the Blue Book |
| **K-factor** | 0.057 | Soil erodibility: conservative value calculated from soils data including texture, structure, organic matter content and permeability (refer Rosewell 1993) |
| **LS-factor** | 1.68 | Slope length/gradient factor: describes the combined effect of slope length and gradient on soil loss. Conservative slope length = 100m; slope gradient = 6% (Refer table A1 in the Blue Book) |
| **P-factor** | 1.3 | Practice-factor: related to site management practices and surface condition, and their relationship to runoff generation. A factor of 1.3 is standard on construction sites. |
| **C-factor** | 1.0 | Cover factor: describes the effect of surface cover in reducing exposure of soils to erosion. A nominal value of 1.0 is adopted for construction sites where soils are bare and compacted. |
| **Annual estimated soil loss** | 174 | Soil loss (in T/ha/yr) calculated by RUSLE equation, as $A = R \times K \times LS \times P \times C$ |
| **Soil Loss Class** | 2 | The Blue Book describes seven soil loss classes ranging from 1 (very low, 0-150 T/ha/yr) to 7 (extremely high,>1500 T/ha/yr). The Blue Book also prescribes management requirements dependent on soil loss class. |

The annual estimated soil loss for the Proposal footprint is 174 tonnes per hectare per year, which has a soil loss class of low. A conventional suite of erosion and sediment controls should be sufficient to manage the erosion and sedimentation risks associated with construction activities.

### 6.8.3 Assessment of Potential Impacts

#### *Construction*

The potential to impact upon soils on the site is greatest during construction. During this period the soils will be subject to disturbance associated with site preparation, access and construction activities. Works with potential to impact soils include:

- Site establishment and preparation for construction
- Installation of environmental controls
- Minor vegetation clearing (grasses, shrubs and isolated trees)
- Targeted clearance of low laying vegetation around trenching areas to steel post installation to minimise disturbance to existing ground cover
- Preliminary civil works including:
  - Drainage works
  - Setting up foundations for the substation
  - Earthing works (see below)
  - Installation of steel post and rail foundation system for the solar panels.
  - Installation of underground cabling (trenching) and installation of inverter stations.
- Upgrade works at the intersection of Suntop Road and Renshaw McGirr Way
- Construction of the 132kV substation
  - Site Establishment and clearing (if required)
  - Bulk earthworks via a range of plant that may include scrapers, bulldozers, excavators, rollers, trucks and loaders
  - Detailed civil works including drainage, earthing, foundations etc. generally using excavators, piling rigs, trucks and cranes.

If these activities are not adequately managed, impacts that could result include the following:

- Erosion of exposed soil and stockpiled materials
- Dust generation from excavation and vehicle movements over exposed soil
- Compaction and surface sealing of exposed soils, leading to increased erosion and runoff and poor vegetation condition
- Poor storm water quality due to erosion and increased sediment loads, causing turbid stormwater runoff and impacts on receiving waters
- Potential disturbance of historical land contamination
- Contamination of soil due to spillage of hazardous chemicals such as fuels, oils, and other hazardous substances.

Soils have the potential to be unstable which could lead to increased wind and water erosion across the site. By utilising the undulating topography, existing water management structures (roll over banks and culverts), maintaining well established vegetation cover, and standard erosion and sediment control measures, the

potential for erosion and the movement of sediments could be managed effectively. Erosion and sediment control plans would be implemented in accordance with *Managing Urban Stormwater: Soils and Construction Vol 1.* (Landcom 2004.).

Overall the soils do not present any major physical or chemical constraints that cannot be managed. In summary:

- The soils are susceptible to sheet erosion if left unvegetated for long periods
- pH's are generally within the acceptable range.
- Soils on site are non-saline
- K factors suggest soil erodibility is low to moderate.

Panels within the solar array area are designed to sit above the ground and ground cover would be maintained underneath and around the panels (excluding formal access roads) throughout the operational phase of development. The objective is to maintain a vegetative groundcover, preferably an improved pasture, throughout the construction phase which will minimise the erosion hazard. Apart from the permanent hardstands and formal access roads, areas disturbed by construction would be revegetated promptly and progressively including throughout the solar arrays.

The site is susceptible to westerly winds which can be problematic for wind erosion. The soils are susceptible to powdering with the use of heavy machinery and concentrated construction activities. This could expose them to wind erosion and a high risk of dust if left in a dry powdery condition. Conventional dust management activities such as watering of soils using a water cart and application of synthetic dust suppressants, can be employed effectively to manage wind erosion and reduce dust. These should form a key part of the erosion and sediment control plan.

Internal drainage of the site will remain as it is with buffer zones being implemented to ensure existing waterways and flowlines are not impacted by construction activities. Additionally, there will not be any major new stormwater diversions (e.g. contour banks) or watercourses. The existing earth roll over banks will continue to act as diversions to capture and divert stormwater on the site. This will assist in reducing potential impacts from sheet erosion and stormwater runoff.

In relation to engineering suitability, limited soil laboratory data has currently been collected to determine specific properties for design of structures such as drains, roads and building bases. Further geotechnical investigations and detailed design of structures would be undertaken post approval. Nothing in the data collected to date suggests there are significant risks for building structural work. Compacted structures such as roads and laydown areas should present no issues if constructed well. Disturbed areas will need to be revegetated as quickly as possible.

The soils at the intersection of Suntop Road and Renshaw McGirr Way have a moderate to high erosion hazard and as such works at this location have the potential to increase erosion and sedimentation in this area. Implementation of an Erosion and Sediment Control Plan for the duration of works will mitigate this risk.

### *Operation*

The potential for the Solar Farm to impact on site soils during operation, after all areas disturbed during construction have been rehabilitated and groundcover has been established, is minimal. The site will be accessed regularly for maintenance of the Solar Farm and management of grazing livestock, generally using 4WD vehicles. These activities will not involve significant levels of soil disturbance and potential impacts can be minimised by maintaining groundcover.

The maintenance of a protective groundcover and general soil management and monitoring measures will be included in a Land Management Plan. This Plan will address operation of the solar farm and general farm management activities to achieve several key goals relevant to environmental management and social responsibility:

- Maintain sustainable soil and plant systems to preserve the agricultural values of the land
- Promote and continue productive agriculture alongside electricity generating operations
- Minimise impacts to surrounding farmlands and the rural community.

The ground cover within the Site would be affected by shading to varying degrees depending on time of year and time of day, but is not expected to inhibit the maintenance of an effective groundcover.

It is anticipated that the soils will benefit from a break in cultivation activities and that on decommissioning of the solar farm will be in an equivalent or improved condition to support continued agricultural activities. During solar farm operation, the soils will not be affected by regular cultivation or the constant addition of mineral fertilisers. An improvement in accumulated organic matter can be anticipated under a permanent pasture scenario and this will assist in improving fertility as well as soil structure.

Livestock are proposed to be used to graze the area to reduce maintenance costs (i.e. to reduce the need for slashing, mowing and herbicides), and as such the area needs to be established to improved pasture consisting of a mix suitable grasses and legumes with suitable fertiliser prior to major construction works. Strategic electric fencing and watering points would also need to be established to assist with management of grazing livestock.

The issue of livestock management will be included in the Land Management Plan to address stock movement on site to assist with management of groundcover and weeds (**Appendix J**).

No impacts in addition to those mentioned for construction are anticipated for soils during the decommissioning phase.

### 6.8.4 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| S1 | A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP, in accordance with Managing Urban Stormwater: Soils and Construction (Landcom, 2004). This will include an erosion and sediment control plan for the Site and intersection for implementation during construction. |
| S2 | Minimise the footprint of disturbance during construction and employ progressive rehabilitation strategies to reduce the erosion hazard. |
| S3 | During trenching activities and backfilling, as far as practicable separate topsoil and subsoil and when backfilling return the soil layers in their original order where practicable to do so. |
| S4 | Employ dust management measures on unsealed roads, stockpiles and other areas of loose or disturbed soil prone to dust generation. Controls may include covering of stockpiles, watering roads and synthetic soil stabilisers. Dust management techniques shall be outlined in the SWMP. |
| S5 | Maintain erosion and sediment controls until construction works are complete. |
| S6 | Install stabilised site entrances that all construction vehicles will use to access the site. The stabilised entrance and traffic management protocols in the CEMP shall be designed to minimise tracking of sediment onto adjoining roads from departing vehicles. |

| Reference | Mitigation Measures |
|---|---|
| S7 | Undertake site inspections at least weekly and following significant rainfall events to observe the condition and operation of erosion and sediment controls and water management systems, and schedule any required maintenance. |
| S8 | Undertake soil amelioration and vegetation improvement works in line with the requirements of a Land Management Plan. This should include undertaking required land or vegetation improvement works at an appropriate stage during solar farm development. For example, soil amelioration and fertilising might be most practically undertaken prior to solar panel installation. For similar reasons the desired pasture should be sown before solar panel installation. |
| S9 | Design arrays to allow sufficient space between panels for essential maintenance activities and to facilitate maintenance of an effective ground cover beneath the panels to reduce erosion and help suppress weeds. |
| S10 | Develop and implement a protocol for management of an unexpected finds of soil contamination. |
| **Operational Mitigation Measures** | |
| S11 | Implement a Land Management Plan that addresses the ongoing land management and maintenance activities (Refer **Appendix J**). This would address:<br>• Ongoing agronomic management of the land including stock, water, vegetation and soils management<br>• Measures required to maintain healthy soil and plant systems and maintain the agricultural capability of the land<br>• Stock management programs and infrastructure (e.g. fencing, watering points)<br>• Soil amelioration, pasture management and weed control<br>• Monitoring programs for soil fertility and groundcover. |

## 6.9 Bushfire Risk

A Bushfire Impact Assessment (BIA) was undertaken by Eco Logical Australia Pty Ltd (Eco Logical) to investigate the potential construction and operational bushfire hazards of the Proposal and how these risks could be suitability reduced and managed (see **Appendix F**). A summary of the key findings of this assessment are outlined below.

### 6.9.1 Existing Environment

Vegetation within the site is largely cleared of native vegetation excluding several remnant patches (refer 6.1.2) and crops. The Subject Land is isolated from the forested Mount Arthur Reserve which is located approximately 5km to the north-east of the proposal with predominantly cleared agricultural land surrounding the property to the east, west and south and the sealed Suntop Road to the north. The topography of the Site is undulating with gentle slopes and several gullies running through the Site (refer Section 6.8.1).

#### *Fire History*

Mapped fire records from the Rural Fire Service (2001 to 2017) indicate that there were 14 grass or bush fires within 20 km of the Site during this period. The area impacted by these fires ranged from 0.3 to 56 ha, with no fires occurring within 3 km of the solar farm site.

The area is regarded as low risk for bushfires; fires are usually small and controlled by direct attack (Peter Fothergill RFS, pers. comm.).

The main sources of ignition in the district are:

- Lightning
- Crop harvesting equipment.

Water resources on the Subject Land include a series of small farm dams in various locations across the Site and one registered water bore. There are several natural watercourses or flowlines within the Site which are intermittent in flow, and these generally only carry water after rainfall events.

The intersection of Suntop Road and Renshaw McGirr Way is on the edge of bushfire prone land in the area however the works proposed in this location present a low fire risk during both construction and operation.

### *Fire Climate*

Data from the Bureau of Meteorology weather station at Wellington (site 065034 D&J Rural), which is 10 km from the solar farm site, indicate the frequency of occurrence of grassland fire weather Table 6-38. A Grassland Fire Danger Index (GFDI) of 25 to 49 (Very High fire danger) occur on average 1.0 days per year, while days of GFDI >50 are very rare with only three Severe/Extreme days recorded in 38 years. GFDI could not be calculated for 18.4% of the 3 pm records because of incomplete data and a random distribution of missing records should be assumed (i.e. 1.2, not 1.0, days per year of GFDI 25-49).

**Table 6-36 Average number of days per year of daily Grassland Fire Danger Rating and GFDI categories at 3 pm at Wellington (D&J Rural)**

| Fire Danger Rating & GFDI | Average Days per Year |
|---|---|
| Catastrophic (150+) | 0.0 |
| Extreme (100 – 149) | 0.03 |
| Severe (50 – 99) | 0.1 |
| Very High (25 – 49) | 1.0 |
| High (12 – 24) | 4.4 |
| Low – Moderate (0 – 11) | 285.2 |
| Incomplete | 65.4 |
| Total | 356.1 |

High fire danger conditions, or worse, occur in the months of December, January, February and March and rarely, if at all, in the other months (refer Table 6-37).

The wind directions associated with Very High or worse grassland fire danger are predominantly west but significant fire weather from all other wind directions can occur. Days of significant grassland fire danger with a southwest wind direction that would carry a fire towards the town of Wellington are very rare (approximately 1.3 per decade).

Table 6-37 Number of days in each month of daily Fire Danger Rating and GFDI categories at Wellington (D&J Rural)

| | Incomplete | Low – moderate (0-11) | High (12 – 24) | Very High (25 – 49) | Severe (50 – 99) | Extreme (100 – 149) | Catastrophic (150+) |
|---|---|---|---|---|---|---|---|
| January | 284 | 821 | 65 | 17 | 0 | 0 | 0 |
| February | 194 | 843 | 31 | 5 | 1 | 0 | 0 |
| March | 257 | 872 | 38 | 9 | 1 | 1 | 0 |
| April | 200 | 940 | 0 | 0 | 0 | 0 | 0 |
| May | 174 | 1004 | 0 | 0 | 0 | 0 | 0 |
| June | 144 | 996 | 0 | 0 | 0 | 0 | 0 |
| July | 121 | 1057 | 0 | 0 | 0 | 0 | 0 |
| August | 266 | 912 | 0 | 0 | 0 | 0 | 0 |
| September | 194 | 946 | 0 | 0 | 0 | 0 | 0 |
| October | 239 | 939 | 0 | 0 | 0 | 0 | 0 |
| November | 202 | 938 | 0 | 0 | 0 | 0 | 0 |
| December | 277 | 855 | 37 | 9 | 0 | 0 | 0 |
| **Totals** | **2552** | **11123** | **171** | **40** | **2** | **1** | **0** |
| Note: The table is based on daily records at 3pm from 1980 to 2017 | | | | | | | |

### 6.9.2 Potential Impacts

#### *Construction and decommissioning*

Bushfire impacts associated with the Proposal relate to the risk of the solar farm causing a bushfire or the risks of bushfire affecting the solar farm. Potential ignition sources associated with construction and decommissioning of the Proposal would include:

- Site preparation activities involving the use of other petrol-powered tools, and slashing machinery which could cause sparks
- Operating a petrol, LPG or diesel-powered motor vehicle (or other plant and equipment) over land containing combustible material
- Storage of fuels and dangerous goods
- Smoking from site personnel
- Electrical faults during testing
- Existing ignition sources such a lighting and cropping equipment.

With the exception of electrical faults, the activities listed above are undertaken regularly in this rural environment. The main sources of ignition in the existing environment (lightning and crop harvesting equipment) will remain however as the area will be only be used for grazing, the ignition risk from crop harvesting equipment on site will be reduced significantly and lightning protection including lightning arrestors will be installed at the solar farm.

The risks of bushfire within the site are limited by the following factors:

- The site is not located on bushfire prone land

- The majority of the site is cleared so there is a limited amount of fuel for the fire
- The vegetated clusters within the Subject Land are not connected to a larger vegetated area
- The solar array, which would occupy the majority of the site, would be largely constructed of glass, silicon, steel and aluminium which all have very low flammability
- All electrical components would be designed and managed to minimise potential for ignition
- Water storage dams are already located on site.

The ignition risks can be minimised further by installing electrical equipment in accordance with Australian standards and the implementation of the mitigation measures outlined in Section 6.9.3.

Works at the intersection of Renshaw McGirr Way and Suntop Road would be temporary in nature and the operation of this intersection does not present any further bushfire risks.

No bush fire impacts in addition to those mentioned for construction are anticipated during the decommissioning phase.

### *Operation*

During operation, crops and pasture surrounding the site are the main fuel for bushfires. Activities associated with operation of the Proposal and existing activities in the area that may cause or increase the risk of bush fire include:

- Storage of any dangerous goods (such as pesticides) will be within the maintenance storage container, however fuel will be stored in a bunded above ground tank outside the container
- Powerline failure or contact with vegetation within clearances
- Electrical infrastructure such as inverters, transformer and electrical cabling as they represent ignition risks
- Substation overheating
- Operating a petrol, LPG or diesel-powered motor vehicle (or other plant and equipment) over land containing combustible material
- Existing ignition sources such a lightning and cropping equipment.

The PV solar panels are non-reflective and present no risk of ignition from the concentration of solar energy.

Ignitions from other electrical equipment is theoretically possible from electrical faults such as arc faults, short circuits, ground faults, overheating and reverse currents. It is conceivable that arcs or melted components resulting from a fault could ignite grass fuels under or surrounding installations and start a bushfire. This risk can be managed by the mitigation measures specified in Section 6.9.3.

**Potential hazards to fire fighters**

The RFS is the primary response agency for fighting grass and structural fires within the Site. As such, the fire-fighters likely to respond to a bushfire in this area would be volunteers and/or individual property owners; the latter are mostly equipped with one or more of their own small fire units. Any fire-fighters from the RFS or neighbouring farms attending bushfires in this area may not be equipped with appropriate breathing apparatus and are unlikely to be trained in structural fire-fighting.

The risks to fire-fighter safety associated with a fire burning the solar panels and associated equipment include:

- Electrocution – solar panels would be energised under any natural or artificial light conditions

- Conduction of electrical current through water is also a risk when operational personnel spray the high-powered engine hose at the inverter or the components of the solar PV system
- Inhalation of potentially toxic fumes and smoke from any plastic components such as cables or other decomposed products of the panels, although the majority of the site, would be largely constructed of glass, silicon, steel and aluminium.

Each inverter station will be fitted with an isolation switch allowing for the isolation of individual inverter stations. The turning off of sections or all of the solar farm can be done on site at the control room or remotely from SSF's control centre. When the inverter station is turned off then the solar panels will be isolated and disconnected from the grid. This will mitigate risks to fire fighters by reducing their risk of electrocution.

**Firefighting water supplies**
Given the safety concerns for fire-fighters, fire-fighting equipment for fire-fighters will not be located on site because the equipment could not be utilised safely and effectively. One tank outside the APZ with a capacity of 50,000L will be located near the substation.

### 6.9.3 Mitigation/ Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Design** | |
| BF1 | All electrical components would be designed and managed to minimise potential for ignition |
| BF2 | The design would consider that the permanent access track must be trafficable by Category 1 fire appliances. |
| **Construction and Decommissioning Mitigation Measures** | |
| BF3 | Maximise use of construction components using materials such as glass, silicon, steel and aluminium rather than plastic |
| BF4 | Develop an Emergency Response Plan (ERP) in consultation with the NSW RFS District Fire Control Centre prior to construction. The FMP should include:<br>• Foreseeable on-site and off-site fire events<br>• Clearly states work health safety risks and procedures to be followed by fire-fighters, including:<br>– Personal protective clothing<br>– Minimum level of respiratory protection (e.g. rubber fire fighter's boots and gloves, a self-contained breathing apparatus)<br>– Minimum evacuation zone distances<br>– A safe method of shutting down and isolating the PV system<br>– Any other risk control measures required to be followed by fire-fighters<br>– Evacuation triggers and protocols<br>• Suppression response strategies and tactics, including aerial suppression options/management. |
| BF5 | Two copies of the ERP should be permanently stored in a prominent 'Emergency Information Cabinet' to be located at the main entrance point to the solar farm, external to any security fence or locked gate, and a copy provided to local emergency responders. |
| BF6 | An Asset Protection Zone (APZ) will be constructed around the solar farm with the following requirements: |

| Reference | Mitigation Measures |
|---|---|
| | • The APZ will be 15 m wide around the entire perimeter of the solar farm footprint, and 20 m wide for areas abutting the remnant treed areas and landscaping areas.<br>• The external edge of the APZ setback at least 25 m from the external edge of PV panels or other components.<br>• The APZ must be either a mineral earth fire break (i.e. dirt or gravel) or a heavily grazed area.<br>• Trees and tall shrubs associated with the landscape plan should not be planted close to the APZ.<br>• APZ preferably located external to any security fence.<br>• The substation should have a 20m APZ with no internal vegetation (gravel surface). |
| BF7 | The APZ or a fire break is to be constructed as part of the first stage of the development. |
| BF8 | Construction between 1 December and 31 March would be undertaken in accordance with the following:<br>• All plant, vehicles and earth moving machinery will be cleaned of any accumulated flammable material (e.g. soil and vegetation)<br>• A suitable fire appliance (e.g. fire extinguisher) is present on site with at least two personnel trained in bushfire fighting<br>• On days when Very High fire danger or worse is forecast for Wellington, the "fires near me" app is to be checked hourly for the occurrence of any fires likely to threaten the site<br>• All operations involving machinery will cease while the GFDI is or forecast to be 35 or greater. |
| BF9 | Installation of electrical equipment such as, junction boxes, inverters, transformer and electrical cabling, is to be in accordance with AS 3000:2007 Electrical installations and undertaken by qualified professionals. |
| BF10 | Install a water supply tank with a capacity of 50,000L outside the APZ near the substation. |
| **Operational Mitigation Measures** | |
| BF11 | Fit PV arrays with an earthing and lightning protection system connected to the main earth link. |
| BF12 | Vegetation fuel levels internal to the APZ and throughout the solar farm will be maintained by grazing, slashing or mowing. |
| BF13 | The solar farm will be monitored via off-site control centres to ensure systems are working correctly, investigate any alarms and monitor panel performance. |

## 6.10 Hazards

Hazards that could be associated with the Proposal and the Subject Land include risks associated with bushfire (refer 6.9), hazardous goods and electromagnetic interference.

### 6.10.1 Existing Environment

#### *Hazardous goods*

Current sources of hazardous goods on the Subject Land are:

- Petrol
- LPG

- Lubricating and hydraulic oils and greases
- Pesticides/ herbicides.

### *Electromagnetic interference*

Current sources of electromagnetic fields (EMF) on the Subject Land are:

- 132kV transmission line through the Site
- House-hold items such as televisions, microwave ovens, computers, Wi-Fi
- Existing electrical wiring in residences
- Cell phones and cell towers
- Radio and TV station broadcasts.

## 6.10.2 Assessment Methodology

### *Hazardous goods*

Hazardous goods expected to be used by the proposal will be compared against the Dangerous goods and SEPP 33 thresholds to determine whether they are exceeded or not. If the screening thresholds are exceeded the proposal would be considered potentially hazardous, and a Preliminary Hazard Assessment (PHA) would be prepared. However, for quantities below the given thresholds, the SEPP indicates that there is unlikely to be a significant off-site risk, in the absence of other risk factors and no further assessment is warranted.

### *Electromagnetic interference*

Electric and magnetic fields (EMFs) are a physical field produced by electricity or electrically charged objects. EMFs occur both in the natural environment (e.g. discharges during thunderstorms or the earth's magnetic field) and by man-made objects (*WHO, 2018*).

EMFs can be hazardous to human health, the World Health Organisation (WHO) has concluded that short-term exposure to very high levels of EMFs can be harmful to health however exposure to low EMFs is inconclusive (*WHO, 2018*). In Australia, electrical devices and infrastructure such as transmission lines and substations, operate at a frequency of 50 Hz. This frequency falls within the Extremely Low Frequency (ELF) range of 0-300 Hz.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) published *Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz*) in 1998 and an updated version in 2010.

The guideline provides a reference document for limiting exposure to EMF that will provide protection against established adverse health effects including direct interactions of fields with the body and indirect effects from interactions with a conducting object where the electric potential of the object is different from that of the body. Reference levels for occupational and general public exposure are shown in Table 6-38.

The strengths of the fields decrease rapidly with increasing distance from operating electrical equipment and can also be reduced by shielding. Trees, tall fences, buildings and most other large structures provide shielding from electric fields. As such electromagnetic fields, would vary in different locations at the Site.

Table 6-38 ICNIRP reference levels for 50Hz for occupational and general public exposure to time varying electric and magnetic fields (ICNIRP 2010)

| Exposure characteristics | Electric Field | Magnetic Field |
|---|---|---|
| Occupational exposure | 10kV/m | 10,000mG |
| Public exposure | 5kV/m | 2,000mG |

An impact assessment of potential hazards and risks associated with Electric and Magnetic Fields (EMFs) was completed. This included a comparison of magnetic and electrical field levels with the ICNIRP Guidelines.

Typical EMF levels and the ICNIRP exposure criteria for these types of infrastructure are shown in Table 6-39.

Table 6-39 Example magnetic and electrical field levels (TransGrid N.D, and EMF info)

| Object | Electric Field Levels (kV/m) | Magnetic Field Levels (mG) |
|---|---|---|
| ICNIRP Public exposure criteria | 5kv/m | 2,000mG |
| Distribution Line | | |
| Directly beneath the line | 0.3 – 2.6 | 2 – 20 |
| 40m from the line | 0.01 – 0.1 | 1 - 10 |
| High Voltage Transmission Line (132 kV) | | |
| Directly beneath the line | 0.3 – 3.6 | 10 – 200 |
| Edge of the line easement | 0.01 – 0.1 | 2 – 50 |
| Substations | | |
| Substations at the fence-line (excluding where overhead supply lines enter or leave the station) | ≤ 0.1 | 1 – 8 |
| Underground cables | | |
| Directly above underground cables (1m depth) | Underground cabling would not produce external electric fields due to shielding from soil | 5 – 200 |
| Example: House hold appliance (Kettle) | | |
| 300mm away from the appliance | 0.01 – 0.05 | 2 – 10 |

## 6.10.3 Impact Assessment

### *Hazardous goods*

**Construction and operation**

Potential hazards and risks during construction and operation would be associated with the on-site storage, use and transport of dangerous goods and hazardous substances. Dangerous goods that would require transportation and storage during construction or operation of the Proposal are identified in Table 6-40. These substances do not exceed SEPP 33 thresholds therefore further assessment, in the form of a PHA, is not required.

Some components of solar infrastructure can contain hazardous substances such as cadmium however the components to be used for the Proposal do not contain hazardous substances.

Table 6-40 Dangerous goods criteria and SEPP 33 thresholds relevant to the construction and operation of the proposal

| Hazardous Material | Storage threshold | Transport Thresholds | | Storage Method | Anticipated quantities | Exceedance of SEPP 33 thresholds |
|---|---|---|---|---|---|---|
| | | Movements | Quantities | | | |
| | Class 2 – Gases | | | | | |
| Fire Extinguisher | Not subject to regulations | Not subject to regulations | Not subject to regulations | Compressed in a steel bottle and housed in the construction compound | 2 | No |
| LPG | 10 tonnes or 16m3 (above ground) | >500 cumulative >30/week | 2-5 tonnes | Cylinders stored in a secure area within the Proposal boundary | <1 tonne | No |
| | Class 3 – Flammable liquids | | | | | |
| Fuel (Petrol) | 5 tonnes (stored with other class 3 flammable liquids) | >750 cumulative >45/week | 3-10 tonnes | Stored in drums in a bunded area. Class 3 goods will only be stored with other class 3 goods. | < 3 tonnes | No |
| Lubricating and hydraulic oils and greases | Not subject to regulations | Not subject to regulations | Not subject to regulations | Stored in drums or original containers in a bunded area. Class 3 goods will only be stored with other class 3 goods. | < 1 tonne | No |
| | Class 6 – Toxic and infectious substances | | | | | |
| Pesticides (herbicides) | 2.5 tonnes | All | 1 to 3 tonnes | Stored in a secure area within the Proposal boundary | <1 tonne | No |

### *Electromagnetic interference*

EMF may be generated during construction and operation of the solar farm including from the following components when operational:

- Transmission Lines
- Substation
- Cabling (underground)/ collection circuits

- Central inverters
- Solar PV panels.

*Transmission Lines*
High voltage transmission lines are already present in the area. The expected transmission line EMF levels, as specified in Table 6-39, are below the ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)'.

*Substation*
The substation boundary fence will create a suitable buffer to reduce EMF to negligible levels.

*Cabling (underground)*
The solar farm would require installation of cabling between panels and the inverters. This cabling would be under ground. The levels specified in Table 6-39 are below the public and occupational exposure levels recommended by the ICNIRP Guidelines.

*Central Inverters*
Up to 60 inverters are expected to be installed across the site. The AC power frequency range of the inverters will fall into the Extremely Low Frequency (ELF) range of 0-300Hz, with the inverters expected to have a frequency of between 47 and 63Hz.

*PV Panels*
The layout of the Proposal has been designed to provide a buffer between the facility, sensitive receivers, road users and the general public. The site is surrounded by agricultural land and rural residences with the closest receiver being adjacent to the solar farm boundary. The majority of the infrastructure that would generate EMF would be located within the secured solar farm Site with no public access, aside from new electricity transmission lines similar to those already present in the area.

Given the levels associated with the infrastructure components, and the distance to publicly accessible land and the nearest receiver, EMFs from the proposed development are likely to be indistinguishable from background levels at the boundary fence.

**Construction**
Up to 250 staff may access the site during the 12-month construction period. No other access to the Site is anticipated and the Proposal will be fenced with a 1.8 to 2.5m chain link security fence with three barbed wires on top to restrict any public access**.** There are six residents within 1km of the proposed Site, and five residences located within 1 to 2km of the Site.

As a result of the low EMF, short term construction period and distance between components producing EMF and receivers there will be low to negligible potential for EMF impacts upon human health.

**Operation**
During operation of the solar farm limited staff (six to ten) will attend the site for regular inspections, maintenance work and stock management activities. In consideration of the security fencing and distance from sensitive receivers with the potential to be impacted by EMF during operation the risk of impacts from EMF generated during operation of the Proposal will be limited.

No dangerous goods or hazard impacts in addition to those mentioned for construction are anticipated during the decommissioning phase.

### 6.10.4 Mitigation / Management Measures

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| *Hazardous Goods* | |
| Haz 1 | Dangerous or hazardous materials would be transported, stored and handled in accordance with AS1940-2004: The storage and handling of flammable and combustible liquids and the ADG Code where relevant. |
| *Electromagnetic Interference* | |
| Haz 2 | All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia. |
| Haz 3 | The layout of the Proposal has been designed considering buffer distances between the solar farm and sensitive receivers, road users and the general public. |

## 6.11 Air Quality

Air quality can be affected by dust caused by soil disturbance and emissions from vehicles, plant and equipment. This can impact the amenity of the local area and become a nuisance to nearby sensitive receivers (such as residences and staff on the adjoining farm properties).

### 6.11.1 Existing Environment

**Local Climate**

The closest Bureau of Meteorology weather station is in Wellington at D&J Rural (Site No.065034) which is located approximately 10 km to the east of the Proposal. Long-term climatic data from this site has been reviewed to characterise the local climate in the proximity of the Proposal.

Review of the data indicates that January is the hottest month with a mean maximum temperature of 32.1 degrees Celsius (°C) and July is the coldest month with a mean minimum temperature of 2.2°C. Humidity levels exhibit some variability and seasonal flux across the year. Mean 9am humidity levels range from 83 % in June and July to 54 % in December. Mean 3pm humidity levels vary from 57 % in June to 34 % in December.

The annual average rainfall for Wellington is approximately 617 mm with rainfall peaking during the summer months and declining during autumn and winter. The data indicates that January is the wettest month with an average rainfall of 59.2 mm and September is the driest month with 44.8 mm. Mean 9am wind speeds range from 8.0 km per hour (km/h) in October to 3.9 km/h in June. Mean 3pm wind speeds range from 11.7km/h in October to 7.0km/h in May. The most common winds are from the east and south-west sectors.

**Local Air Quality**

The main sources of particulate matter emissions in the area surrounding the site emissions from anthropogenic activities such as motor vehicle exhaust, locomotive emissions, wood heater emissions and various commercial, agricultural and industrial activities. Motor vehicle emissions include those from nearby roads including the Mitchell Highway and Suntop Road. Some of the smaller local roads and farm access roads in the vicinity of the site are unsealed and traffic on these would contribute to air quality impacts from dust.

Regional air emission sources include agricultural activities and light industrial activities. The National Pollution Inventory details that there are no recorded sources of substance emissions in the Wellington area and accordingly there are no Sites that report data to the NPI.

## 6.11.2 Impact Assessment

**Construction**

During construction of the proposal the primary emissions will be dust generated from material handling, vehicle movements, land preparation and windblown dust generated from exposed areas. These sources of dust are temporary in nature for the duration of the construction period. Particulate emissions would also be generated from the exhaust of construction vehicles and plant.

Furthermore, the total amount of dust generated from the construction process is unlikely to be significant given the limited dust generating activities for a limited period. Additionally, as construction would be staged areas would be stabilized before moving on to a new area thereby limiting the extent of any exposed ground. As such, air quality impacts during construction are anticipated to be minor.

Works associated with the upgrade of the intersection of Suntop Road and Renshaw McGirr Way may generate dust for a short period associated with excavation for the widening of the shoulder.

No air quality impacts in addition to those mentioned for construction are anticipated during the decommissioning phase.

**Operation**

The generation of renewable energy during operation of the Proposal would not generate any emissions or affect air quality, excluding minor emissions from vehicles associated with maintenance activities.

During operation, the Proposal is expected to have a positive impact on regional and national air quality as the plant would not generate any emissions and would reduce Australia's reliance on fossil fuels for electricity generation.

## 6.11.3 Mitigation / Management Measures

The following mitigation and management measures are recommended to minimise potential air quality impacts.

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| A1 | Activities shall be assessed during adverse weather conditions and modified as required to reduce dust generation (e.g. cease activity where reasonable levels of dust cannot be maintained). |
| A2 | Engines to be switched off when not in use for any prolonged period. |
| A3 | Water suppression of dust on exposed areas, roads and stockpiles when required. |
| A4 | Temporarily excavated soil and other materials that exhibit significant dust lift off would be wet down, stabilised or covered to manage dust. |
| A5 | Development of a complaint procedure to promptly identify and respond to complaints. |
| A6 | Vehicles and plant would be fitted with suitable pollution reduction devices wherever possible and maintained according to manufacturer's specifications. |
| **Operational Mitigation Measures** | |
| A7 | Establish and maintain ground cover in accordance with the Land Management Plan for the site. |

## 6.12 Socio-Economic and Property

### 6.12.1 Existing Environment

At the 2016 census, the former Wellington LGA had a population of approximately 9000 and an area of 4113km$^2$. The population of the former Wellington LGA is projected to grow to 9550 people by 2036 (Dubbo Regional Council Area Population Projections, 2016).

The median age of people in 2016 in Wellington was 44 years, children aged 0 – 14 years made up 19.7 % of the population and people aged 65 years and over made up 24.9 % of the population (*ABS, 2017b).* In Wellington, 82.4% of people were born in Australia. The other most common countries of birth were England 12 %, New Zealand 1.1 %, Philippines 0.4 %, India 0.3 % and Netherlands 0.2%. Aboriginal and/or Torres Strait Islander people made up 27.8 % of the population. The most common ancestries in Wellington were Australian 39 %, English 28.2 %, Irish 8.2 %, Scottish 4.9 % and Australian Aboriginal 2.3 % (*ABS, 2017b*).

In 2016, 1362 people in Wellington reported being in the labour force in the week before Census night. The most common occupations in the Wellington area are provided in Table 6-41.

Table 6-41 Comparison of employment data averages from Wellington, NSW and Australia

| | Wellington | % | NSW | % | Australia | % |
|---|---|---|---|---|---|---|
| **Occupation** (Employed people aged 15 years and over) | | | | | | |
| Community and Personal Service Workers | 256 | 21.6 | 350,261 | 10.4 | 1,157,003 | 10.8 |
| Labourers | 175 | 14.8 | 297,887 | 8.8 | 1,011,520 | 9.5 |
| Technicians and Trades Workers | 166 | 14.0 | 429,239 | 12.7 | 1,447,414 | 13.5 |
| Professionals | 153 | 12.9 | 798,126 | 23.6 | 2,370,966 | 22.2 |
| Sales Workers | 126 | 10.6 | 311,414 | 9.2 | 1,000,955 | 9.4 |
| Clerical and Administrative Workers | 118 | 10.0 | 467,977 | 13.8 | 1,449,681 | 13.6 |
| Machinery Operators and Drivers | 91 | 7.7 | 206,839 | 13.5 | 670,106 | 6.3 |
| Managers | 83 | 7.0 | 456,084 | 13.5 | 1,390,047 | 13.0 |
| **Industry of employment** (Top responses) | | | | | | |
| Aged care residential services | 68 | 6.1 | 67,209 | 2.0 | 211,621 | 2.0 |
| Correctional and Detention Services | 62 | 5.5 | 7,878 | 0.2 | 27,656 | 0.3 |
| Takeaway Food Services | 59 | 5.3 | 56,957 | 1.7 | 189,447 | 1.8 |
| Supermarket and Grocery Stores | 53 | 4.7 | 74,487 | 2.2 | 254,275 | 2.4 |
| Local Government Administration | 50 | 4.5 | 43,378 | 1.3 | 142,724 | 1.3 |

At the 2011 Agricultural Census, Wellington had a gross value of agricultural production being $60.7 million which equated to 0.52 % of the gross value of production in NSW (NSW Trade and Investment).

### *Social infrastructure and facilities*

Community services and facilities are present within Wellington which cater for the needs of the local community (refer Table 6-42).

**Table 6-42 Community services, facilities and Attractions available in Wellington LGA (Dubbo Regional *Council*)**

| Type | Facilities and Services in Wellington |
|---|---|
| Sport and recreational facilities | • Pool – 50m outdoor / Two children's pools<br>• Playing Fields<br>• Netball Courts<br>• Tennis Courts<br>• Showground<br>• Golf Course<br>• Skate Park<br>• Lake Burrendong State Park – land and water-based activities<br>• Parks and Reserves including picnic facilities, playgrounds and walking trails<br>• Lawn Bowls Wellington bowling club. |
| Cultural and Entertainment Facilities | • Wellington Civic Centre<br>• Licensed Clubs & Hotels<br>• Art Galleries<br>• Wellington Library. |
| Religious facilities | • Wellington Anglican Church<br>• Wellington Catholic Church<br>• Wellington Baptist Church<br>• Wellington Uniting Church<br>• Salvation Army. |
| Children's Services | • Wellington Youth Services<br>• Wellington Community Children's Centre Inc<br>• Pre-schools and long day care<br>• Family day care<br>• Playgroups. |
| Community Services | • Counselling<br>• Community housing<br>• Community transport<br>• Information and Neighbourhood Services. |

| Type | Facilities and Services in Wellington |
|---|---|
| Education facilities | • One Secondary School (Public)<br>• Two Primary Schools – (Public)<br>• Two Primary Schools (Catholic and Christian)<br>• Pre-schools<br>• Interest / Activity based tuition – music, dance. |
| Health and medical facilities | • Wellington Hospital - < 50 beds including Emergency<br>• Wellington Aboriginal Health Services<br>• General Practitioners<br>• Dental<br>• Allied and Alternative Health Services including – Psychology / Counselling, Optometrist, Homeopathy<br>• Ambulance station. |
| Aged Care Facilities | • Bellhaven Aged Care Facility (47) Beds<br>• Maranatha House (73 Beds)<br>• Home and Community Care Services and Transport<br>• Meals on Wheels<br>• Wellington Senior Citizens Centre. |
| Emergency Services | • SES: Wellington Local Headquarters<br>• Wellington Police station<br>• Wellington Fire Station<br>• Ambulance station<br>• NSW Rural Fire Service |
| Events | • Wellington Antique Vintage Fair<br>• Wellington Boot Racing Carnival weekend<br>• Annual Wellington Show<br>• Cob Loaf Festival |
| Tourism and Attractions | • Wellington Caves<br>• Lake Burrendong State Park<br>• Burrendong Arboretum<br>• Mt Arthur Reserve (walking trails)<br>• Oxley Historical Museum<br>• Osawano Japanese Gardens<br>• Galleries<br>• Parks and Reserves<br>• Macquarie River<br>• Cobb & Co Heritage Trail |

| Type | Facilities and Services in Wellington |
|---|---|
| Retail and Services | • Wellington is a sub-regional centre providing a range of retail, commercial, professional and personal services.<br>• Wellington shopping centre is anchored by Coles and Woolworths supermarkets with a range of smaller speciality retailers. |

### *Key economic activities within Wellington (Dubbo LGA)*

Key economic and employment sectors in the Wellington district include agriculture, retail trade, healthcare and social assistance, education and training, accommodation and food services, and construction.

**Agriculture**
Agriculture is the dominant land use and economic activity in the Wellington district. Most of the land employed for agricultural use is used for dryland cropping and livestock production. There are a diverse range of services available in Wellington to support the agricultural sector, such as: spraying, contract harvesting, consultants, veterinary, silos and storage. The majority of farming enterprises in the Wellington district are mixed farms, which helps to spread financial risk and improve land management. The crops produced are determined by the climate / weather, expected availability of water, market demand and commodity prices. Common crops include: cereals, oilseeds, and legumes. Livestock production in Wellington includes mainly cattle and sheep with other enterprises producing other meats and poultry.

**Retail**
Retailing is concentrated in the centre of the township of Wellington, while outlying villages such as Mumbil and Stuart Town also rely on the retail facilities in Wellington. The performance of the retail sector is very closely tied with the performance of the agricultural sector. Uncertainty and/or contractions in this sector translates almost immediately to a contraction in retail expenditure. The retail sector in Wellington is comprised primarily of small businesses or businesses employing between one and four people. Types of retail businesses in Wellington include fast food outlets, automotive sales and repairs, clothing and footwear, speciality retail and fresh food.

**Healthcare and social assistance**
Within Wellington the main service areas are health care, aged care and child care. Health care services are concentrated in Wellington and like most inland rural areas, the town has struggled to attract and retain doctors, dentists, nurses and health care professionals.

**Education and Training**
Educational facilities are listed in Table 6-42 above.

**Accommodation and Food Services**
Dubbo Regional Council lists 33 accommodation and food service businesses within Wellington.

**Construction**
Types of construction businesses in Wellington include design and assessment, site preparation, building and construction and trade installation (e.g. plumber or electrician).

### *Accommodation within Wellington Township*

There are many accommodation options within Wellington including, motels, hotels, B&B's and caravan parks. There is also the possibility to rent a house through an accommodation website such as stayz.

### *Renewable Energy Projects in the Region*

The Wellington and Dubbo area is becoming a sought-after area for the establishment of renewable energy projects including solar farms. Two other solar farms have been proposed on the northern side of Wellington with one already approved and one in the planning stages. These are detailed in Section 7.
Photon / Canadian Solar/ Polpo also have another two proposals in the preliminary planning stages with one at Maryvale approximately 15km to the north of Wellington and one located near Mumbil approximately 20km south west of Wellington.
A smaller facility has been constructed on the eastern approached to Dubbo and is nearing completion.

## 6.12.2 Stakeholder and Community Engagement

As part of the EIS, a Community and Stakeholder Engagement Plan (CESP) has been developed to inform the level of engagement required, identity key stakeholders and included an implementation plan. The intent is to speak to the Community and other stakeholders to understand the potential constraints and opportunities for the proposed development and consider this feedback through the environmental and engineering design components of the development.

The following key stakeholders have been identified

- Local residents surrounding the proposal area
- Dubbo Regional Council
- Various government agencies including DP&E, Roads and Maritime Services, SES, OEH, DPI, DRG, and RFS
- Local aboriginal community and local aboriginal land council
- TransGrid.

A summary of consultation undertaken, consultation findings as well as responses to issues raised and any ongoing consultation requirements is summarised in Section 5 of this EIS.

## 6.12.3 Community Views

### *Attitudes to renewable energy proposals in NSW*

In November 2015, NSW OEH published a paper entitled '*Community Attitudes to Renewable Energy in NSW*' (*NSW OEH, 2015*). They surveyed 2,000 individuals over the age of 18 across seven regions of NSW with strong results around recognition and knowledge or renewable energy in particular solar and wind.

The OEH survey results showed that nine-in-ten people supported the use of renewable technology to generate electricity in NSW and approximately five-in-ten people strongly supported it. There was also a widely-held view that NSW should be producing more of its electricity from renewables rather than maintaining current levels or producing less. Most people surveyed supported the use of both wind farms (81 %) and solar farms (89 %).

The principal advantages respondents saw in renewables were:

- Benefits to the environment
  - Cleaner/creating less 'pollution' or fewer greenhouse gases
  - More sustainable, reducing reliance on non-renewable resources such as coal
  - Benefits in the preservation of the landscape and agricultural land, e.g. by not digging up the landscape
- Lower cost, or at least the potential for reduced cost in the long run.

The principal disadvantages people saw in renewables were:

- Higher cost, particularly in the set-up phase
- Concerns about efficiency and reliability
- Effects on wildlife, e.g. bird mortality associated with wind farms.

It was clear that along with the environment, cost was a pivotal element in community thinking about renewables. The most prevalent community view was that renewable energy was a good idea provided it did not generate additional costs to electricity.

### *Attitudes towards local wind and solar farms*

The survey also sought people's attitudes to having renewable energies in their local region and even closer, within 1–2km of where they lived. The majority of respondents still supported or strongly supported wind and solar farms within their local region or within 1-2km of where they lived. However, as the renewable energy got closer to the respondent there was a corresponding increase in opposition and decrease in support (refer Figure 6-36). At closer proximity, more respondents would strongly support a solar farm than a wind farm.

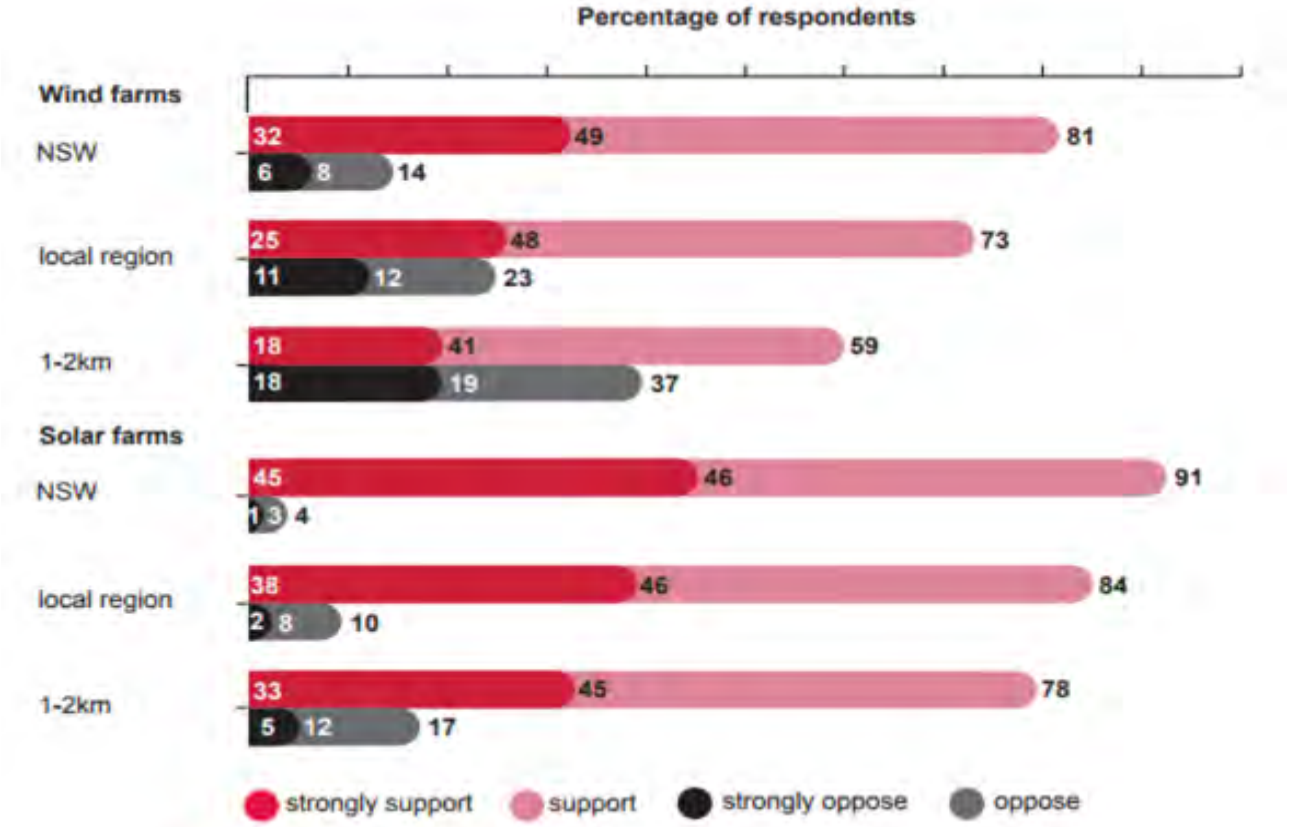



Figure 6-36 Support for and opposition to building wind/solar farm in three proximities – in NSW, within the respondent's local region, and within 1-2km of where the respondent lived.

### *Community feedback on this proposal*

The feedback from the community in relation to this Proposal has identified a number of concerns around the potential impacts on local residents as well as support for renewable energy. Further detail on the feedback including concerns raised and consultation undertaken is outlined in Section 5.

### 6.12.4 Cost Benefit Analysis

#### *Renewable Energy Sector*

Employment in the renewable energy sector is considered a positive driver for the economy; the Australian Bureau of Statistics estimated that renewable energy projects that were progressed in 2016 for construction in 2017 represent more than $6.9 billion of investment, 3,725 direct jobs and 3,150 MW in new power generation capacity (*Clean Energy Council, 2016*).

#### *Case Studies*

Data from the recently constructed Nyngan and Broken Hill Solar Farms provide an example of the cost benefit analysis. These projects have a combined capacity of 150 MW (AC) slightly less than this Proposal.

Nyngan and Broken Hill solar farms will generate 360,000 megawatt hours of electricity each year and represent a total investment of $440 million. During construction, they will provide 450 direct jobs (*First Solar, N.D.*) and contribute to regional development in the following ways:

- On-site jobs involved in the delivery of the projects
- Off-site jobs involved in the supply of materials for the projects
- Off-site jobs involved in the design, management and support of the projects.

Other local benefits were identified from the Nyngan and Broken Hill Solar Projects with data indicating that approximately 56 % of the procurement budget was spent on local good and services (local defined as Australia) including $66 million spent on cables, mounting structure and power conversion equipment from local companies. The total value of local subcontractor procurement for services provided on the Nyngan and Broken Hill projects is over $76 million (*First Solar, N.D.*).

#### *Suntop Solar Farm*

The Proposal will generate 379 gigawatt hours (GWh) of electricity each year. The Proposal represents a total investment of $262 million and is estimated to provide 250 direct construction jobs at peak period. Section 6.12.5 below details how the Proposal will contribute to regional development. The solar farm will provide a source of clean, renewable electricity.

The key benefit of the Proposal is the production of renewable electricity reducing our greenhouse gas emissions and reliance on fossil fuels. The production of renewable electricity will help contribute to NSW Governments Renewable Energy Action Plan and other schemes and agreements made.

The proposal will have a positive effect on the National Energy Grid. On an annual basis, the Proposal will produce enough electricity to meet the needs of approximately 65,000 average Australian Homes (based on *AER data (AER 2013-14*)). Additionally, the Proposal will reduce greenhouse gas (GHG) emissions by over 357,000 tonnes of CO2 equivalent per annum, assuming a rate of 0.948 tonnes per MWh of electricity. This is roughly equivalent to removing approximately 25,000 cars from the road. Particulate and heavy metal emissions will also be reduced.

The upgrade to the intersection of Suntop Road and Renshaw McGirr Way will provide a long term benefit to local residents and the community by improving safety at the intersection for all road users.

### 6.12.5 Impacts

The Proposal will change the character of the Subject Land to electricity generation coupled with grazing agriculture. The change in land use is mitigated by several factors:

- The site will be producing energy while maintaining use for grazing

- The solar farm will cover 91 % of the site and the remaining area will continue to be used for agriculture
- The solar farm will help rest the land from cultivation and allow the physical and chemical fertility of the soil to improve
- The reversible nature of the development also means they can easily be decommissioned and the land returned to its former agricultural use at the end of the operational period.

The change in land use can be seen as positive or negative depending on the individual. Solar farms have been met with opposition as they can be considered to conflict with existing environment and scenic values. They have also been supported as they provide opportunity for jobs and economic stimulus within the region, provide long term energy stability and assist in the protection of the environment by creating renewable sources of energy.

Other adverse social impacts include:

- Increased traffic on local roads and hazards associated with construction traffic. These potential impacts are assessed in detail in Section 6.5
- Additional traffic may be noticeable and could present an adverse effect on local tourism, if coinciding with local festivals
- Influx of workers putting pressure on local accommodation and health services (see below)
- Amenity impacts including, visual, noise and air quality during operation. These potential impacts are assessed in detail in Sections 6.3, 6.4 and 6.11 including relevant mitigation measures to reduce and manage these impacts.

The proposal will also create benefits for the region by:

- Increased employment – there is the potential for local employment to be generated during the construction phase where suitable local contractors and labour hire are available
- Stimulation and diversification of the local economy creating greater resilience
- Developing regional skills in renewable energy technology.

### *Socio-economic benefits*

The influx of employees to the Wellington township is likely to result in the following expenditure for the local economy per employee:

- Accommodation – Approximately $110 per night per room, (based on figures from '*trip advisor.com'* from the 5 motels in Wellington at four points during the year)
- Food – Approximately $80 to $280 per week (based on figures from the Australian Government: Study Australia)
- Entertainment – Approximately $80 to $150 per week (based on figures from the Australian Government: Study Australia)
- Petrol – Approximately $36 per week, Transport is likely to be provided by the Proposal or via private means but petrol would need to be purchased locally (based on figures from a 2017, Canstar Blue survey of over 2,000 motorists).

Dubbo Regional Council has identified the retail, construction and service sectors as businesses whose performance is dependent on performance in the agricultural sector and investment in the region. Due to the influx of people to the area for construction the solar facility is expected to have a positive economic influence on retail, construction and service sectors in Wellington.

**Employment opportunities**

The proposed development will have a positive employment impact during construction, and is likely to create in the order of up to 250 onsite jobs during the peak construction period. Of these workers, it is expected that the majority will be sourced from the local area using facilities and programs operating in the area including any the Council have in place. The Proposal will also supply off-site jobs involved in the supply of materials and off-site jobs involved in the design, management and support of the Proposal. The Proposal will also offer scope to develop regional skills and create more sustainable employment.

**Employment multiplier effect**

The construction industry has important linkages with other sectors, so the impacts on the economy go well beyond the direct contribution of construction activities. It is estimated that every $1 spent on construction generates $2.60 in the economy as a whole. Money spent on construction creates more jobs in the construction industry and this leads to increased spending from businesses that manufacture materials such as steel frames and concrete. The increase in the use of products such as this, then creates an increase in demand for all types of raw materials used in manufacturing building products. Additionally, spending of wages and salaries from employees in this industry induces a further round of consumption effects in other areas of the economy. Where required, the Proposal would engage with local accommodation providers and Dubbo Regional Council to assist in providing additional short term and temporary accommodation.

### *Workforce*

The Proposal will provide six to ten positions during operation and there will be no displaced jobs from the current site as agricultural activities will continue. The number of people employed during different stages of construction is detailed in Table 6-43

Local opportunities provided during construction may include:

- Civil engineering and site preparation
- Post, racking, and module installation
- High voltage power system work
- Construction and supervision roles
- Administration and construction support roles.

Table 6-43 Expected labour force during different stages of construction

| Stage of the Proposal | Estimated Number of Employees | Job type | Estimated employment time<br>Timeframe |
|---|---|---|---|
| Construction | | | |
| Site establishment and preparation for construction including vegetation clearing | 100 | Trade Assistant, Subcontractor | 1 month |
| Preliminary civil works (such as drainage works, and foundations for the substation) | 200 (Peak) | Civil, Trade Assistant, Sub-contract, Electrician | 1 month |
| Installation of:<br>Steel post and rail foundation system for the solar panels.<br>PV panels and DC wiring beneath the panels. | 250 (peak) | Civil, Trade Assistant, Sub-contract, Electrician, Electrician QA | 6 Months |

| Stage of the Proposal | Estimated Number of Employees | Job type | Estimated employment time Timeframe |
|---|---|---|---|
| Underground cabling (trenching) and installation of inverter stations. | | | |
| Construction of 132kV substation and new transmission line from substation to existing 132 kV transmission line. | 200 (Peak) | Civil, Trade Assistant, Sub-contract, Electrician, Electrician QA, Commissioning | 2 Months |
| Offsite electrical works on existing transmission line and existing Wellington Substation | 60 (Peak) | Civil, Trade Assistant, Sub-contract, Electrician, Electrician QA, Commissioning | 1 Months |
| Removal of temporary construction facilities and rehabilitation of disturbed areas | 100 | Trade Assistant, Sub contract Electrician | 1 Month |
| Operation | | | |
| Operation and maintenance | 6-10 | | 30 years |

The labour force may be constrained by:

- Access to accommodation within a reasonable distance from the proposed development and during tourism events
- Availability of local labour with the required skill set.

The Proposal expects to use both local labour and non-local labour. Local labour is preferred due to the socio-economic benefits however due to the estimated number of skilled labour and the labour requirements of other local projects (refer Table 6-43) it is anticipated that non-local labour will also be required. It is anticipated that approximately 50% of these jobs will be sourced within 100km of the site, subject to the labour force being available. Due to the size of the Wellington township and proximity of Dubbo and Orange (within 100km) to the Site it is considered there are suitably sized populations proximate to the site to enable this level of local labour supply to be met based on discussions with local council and review of ABS data (ABS 2017a and ABS 2017b).

Currently, the seasonal agricultural production industry is well serviced by labour supply companies who are also supplying labour to solar developments in the region and across the State meaning they have developed a good understanding of the skill based required for their delivery, the timing of the labour requirements and the commitments to meeting local content.

An Australian Industry Participation Plan will be prepared and identify the minimum requirement of 50% of the labour within 100km of the site.

A skills and employment strategy for the Proposal will be developed in consideration of the NSW Infrastructure Legacy Program. Whilst this Program is aimed at multi-billion-dollar projects being delivered in metropolitan Sydney with greater scope to achieve the specified targets, it is considered an excellent guide to determining priorities and approach for the Proposal.

Both the plan and strategy will form part of the engineering, procurement and construction (EPC) contract.

Any non-local specialised contractors are likely to come from across other areas of NSW and would utilise accommodation in Wellington and Dubbo if necessary. Accommodation within Wellington consists of a variety of establishments with a range of facilities and services, these include 5 motels, 5 hotels and three caravan parks which provide cabins, onsite caravans and camping facilities.

Dubbo also has over 40 accommodation options that would be able to accommodate the overflow of people travelling to Wellington during tourism events or competing events and developments. As such it is anticipated that most workers would be accommodated at existing accommodation within the local area.

It is anticipated the workforce needed for the Proposal will travel to site through a combination of shuttle buses from Wellington and potentially from Dubbo. In addition, labour will travel to site via private vehicles. The EPC Contractor will be required to minimise traffic to the site using buses and carpooling wherever possible.

### *Impact on available accommodation and services*

The proposal would provide a positive impact on the accommodation sector of Wellington by increasing occupancy rates, however, during events and other peak periods the Proposal may create a strain on local accommodation. Additionally, should other major infrastructure Proposals commence within proximity to Wellington there may be a significant strain on accommodation.

The influx of workers has the potential to place increased pressure on local health services. It is considered that the demand for health care could be dispersed throughout surrounding towns based on where they are staying to minimise the impact.

### *Amenity*

The potential adverse social impacts associated with the Proposal relate to amenity aspects including, visual, noise, traffic and air quality during construction and visual amenity during operation. These potential impacts are assessed in detail in Sections 6.3, 6.4, 6.5 and 6.11, but a short summary is provided below.

Amenity impacts from noise would involve construction noise from plant and equipment during the 12-month period of construction during standard construction hours.

Key traffic and transport impacts for the Proposal relate to haulage of plant equipment and materials as well as employee transport during construction and disruption to existing services including school buses. Increased vehicle numbers have the potential to impact road condition and create indirect impacts such as noise and dust. Dust generation and reduced air quality may occur as a result of earthworks and vehicle movements.

Two types of visual impacts will be generated by the proposal which are:

- Impact to landscape character of the site and the surrounding area
- Visual impact to the surrounding viewpoints, both public and private.

The assessment results of Impact to landscape character finds there is a moderate impact. The assessment of visual impact to public viewpoints finds that there would be a moderate impact to views from Suntop Road. Additionally, there were 29 potentially affected private viewpoints. Of these 29, the visual impact assessment found that there was one viewpoint with a high impact, three viewpoints with a moderate-high impact, three with a moderate impact and twenty-two with a low-moderate impact.

Large scale solar farms can create polarised reactions in communities; some see solar farms as eye sores and a large change to existing land use, lifestyles and land character, others see the benefits of less polluting, renewable sources of energy and the economic benefits of such Proposals.

### 6.12.6 Mitigation / Management Measures

The following management and mitigation measures will be implemented to address potential impacts

| Reference | Mitigation Measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| Socio 1 | The Community Stakeholder Engagement Program (CSEP) will continue to be implemented, including:<br>• Providing regular updates to the community<br>• Inform relevant stakeholders of potential impacts (for example noise impacts)<br>• Establishment of a complaints handling procedure and a response protocol<br>• Responding to any complaints received. |
| Socio 2 | Liaise with local industry representatives to maximise the use of local contractors, manufacturing facilities and materials. Create a resourcing plan to ensure jobs will be local. |
| Socio 3 | Local accommodation options for staff will be maximised. |
| Socio 4 | Continued engagement with Dubbo Regional Council to discuss community and business concerns. |

## 6.13 Waste

### 6.13.1 Impact Assessment

Activities proposed during the construction and operation of the solar farm have the potential to generate waste. Potential waste streams generated during the construction, operation and decommissioning stage include:

- Green waste (from vegetation removal and some from ongoing maintenance activities)
- Wood/plastic pallets and cable drums
- Plastic wrapping and straps
- Liquid waste
- Paper and cardboard
- Soil from trenching and backfill works for cable laying and road upgrades that cannot be reused on site
- Electrical components (from repair, replacement or removal of PV infrastructure)
- Metals
- General construction waste (offcuts)
- Sewage
- General domestic waste.

The classification and description of each of the general waste types to be potentially generated by the proposal is summarized in Table 6-44.

Table 6-44 Potential waste generated on-site during construction and operation

| Waste material and description | Waste classification | Management Details |
|---|---|---|
| **Green Waste**<br>Shrubs, clearing of groundcover | General Solid Waste (non-putrescible) | Management options for green waste include beneficial offsite reuse or disposal to a green waste facility or landfill. If suitably weed free the green waste could also we used as mulch for other vegetated areas. |
| **Wood**<br>Pallets and cable drums | General Solid Waste (non-putrescible) | Pallets and cable drums will be separated for reuse or recycling.<br>Pallets can be recycled by processing the wood into products like particleboard, wood chips, mulch, animal bedding, biofilters (for storm water) or used as biomass - a source of renewable energy.<br>Photon will investigate whether a "take-back" arrangement for the pallets can be organized so the pallets can be re-used. |
| **Plastic**<br>Plastic wrapping and straps associated with packaging of solar infrastructure. | General Solid Waste (non-putrescible) | Plastic wrapping and straps will be disposed to landfill. |
| **Liquid waste**<br>Oil, fuels, etc. Contaminated water from equipment washing | Liquid waste | Onsite testing may be carried out on the waste water generated onsite to see if it is within discharge limits.<br>If the waste water is not within discharge limits the wastewater collected in the tanks would be pumped out and taken to an offsite licensed facility on a regular basis. |
| **Paper and cardboard**<br>From packaging of solar infrastructure | General Solid Waste (non-putrescible) | Recyclables will be collected by a suitably qualified waste management contractor and sent to a recycling facility. |
| **Soil**<br>From trenching and backfill works for cable laying/ road upgrade | General Solid Waste (non-putrescible) | The soil would be reused to backfill trenched areas. If there is excess soil after back filling then this soil will be reused elsewhere on site.<br>Soil from excavation associated with the road upgrades would be reused at the intersection to facilitate the proposed works.<br>Potential Acid Sulphate Soils (PASS) have not been identified on site however in the event of an unexpected find Acid Sulphate Soils (ASS) would be treated using lime and then reused. If following treatment (or for other reasons) these soils are still not considered suitable then soil should be transported to the nearest licensed waste disposal facility. |
| **Electrical components**<br>Repair, replacement or removal of infrastructure components | General Solid Waste (non-putrescible) | During decommissioning or in the event of repair works all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities. |
| **Metals** | General Solid Waste (non-putrescible) | Metals will be separated for recycling. |

| Waste material and description | Waste classification | Management Details |
|---|---|---|
| Repair, replacement or removal of infrastructure components | | |
| **Construction waste** Metal, steel, timber, fittings, | General Solid Waste (non-putrescible) | The construction of infrastructure will involve prefabricated components which are manufactured off site and transported to the site for installation/ assembly. As such, the construction of the Proposal is not expected to generate a significant amount of construction waste. All attempts would be made to separate and reuse or recycle building materials. |
| **Sewage** | Liquid Waste and General Solid Waste (putrescible) | Biological waste will be collected as part of a service agreement with the temporary amenity hire contractor and disposed of appropriately. |
| **General domestic waste** Paper, cardboard, aluminum cans, steel, plastics, glass, food waste, plastic wrap, etc. generated by onsite staff | General Solid Waste (non-putrescible and putrescible) | General waste will be collected by a waste management contractor and disposed of to a suitably licensed facility (putrescible landfill). |

Potential impacts from the generation, handling, storage and disposal of waste from the Proposal includes:

- Pollution of land and waterways
- Air pollution
- Overuse of scarce resources
- Human and animal health impacts
- Decreased amenity.

It is proposed that all waste generated during the construction of the proposal will be segregated in accordance with the construction waste management plan (WMP). The waste management plan will include management options for stockpiles.

Table 6-45 below provides details for potential recycling facilities and disposal points that will be used to remove waste and recyclables. Discussions with Dubbo Regional Council has identified that a notice period must be given to the Wellington Waste Management Depot for any large quantities of waste.

Table 6-45 Material reuse, recycling and disposal facilities which can be used to dispose of waste and recyclables

| Name of the facility | Address | Opening Hours | Materials and Services | Distance from the Site |
|---|---|---|---|---|
| Wellington Waste Transfer Station<br><br>02 6845 2244 | 83 Nanima Village Road, Wellington 2820 | 8:00am to 5:00pm Monday, Thursday, Friday<br>Saturday 10am - 3pm<br>Sunday 11am – 5pm<br>Tuesday – Wednesday 8am – 12 noon – Green waste only | • General domestic waste<br>• Metals<br>• Lighting<br>• Paints<br>• Green waste<br>• Wood<br>• Batteries<br>• Pallets<br>• E-waste | 23km |
| Wellington Waste Transfer Station is licensed to accept: general solid waste (putrescible); general solid waste (non-putrescible); asbestos waste; waste tyres; any waste received on site that is below licensing thresholds in Schedule 1 of the POEO Act. | | | | |

General contingency procedures and remedial actions for the management of potentially contaminated material discovered will be illustrated in an Unexpected Finds Protocol (Waste). The protocol will be developed by the contractor within a site-specific Waste Management Plan (WMP) prior to the commencement of construction works and implemented in the case of unanticipated discovery of contaminated material during construction of the proposal

During decommissioning, all infrastructure (excluding the substation) and materials would be removed from the site and recycled or otherwise disposed of at approved facilities.

### 6.13.2 Mitigation / Management Measures

The following mitigation and management measures are recommended to minimise potential air quality impacts.

| Reference | Mitigation measures |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| W1 | A WMP will be prepared and implemented as part of the CEMP to manage any construction waste. The WMP will include but not be limited to:<br>• Measures to avoid and minimise waste associated with the Proposal<br>• The procedure for assessing, classifying and storing waste in accordance with the EPA's Waste Classification Guidelines (EPA, 2014) and management options<br>• Procedures for storage, transport and disposal of waste<br>• Procedures for notification to Wellington Waste Management Depot prior to any large disposals |

| Reference | Mitigation measures |
|---|---|
| | • Monitoring, record keeping and reporting, e.g. waste tracking data demonstrating the lawful disposal of contaminated products, waste or residues generated at the facility. |
| W2 | An Unexpected Finds (Waste) Protocol would be established and implemented in case potentially contaminated, hazardous or unsuitable material are encountered during the site works. |
| W3 | Waste management strategies and mitigation measures will be communicated to all employees and contractors during site induction, prior to commencing works at the site. |
| W4 | A schedule will be created with the temporary amenity hire contractor to remove sewage. |
| W5 | The proposed facility will comply with the relevant Protection of Environment Operations Act waste-tracking requirements for any wastes assessed or classified as hazardous waste, industrial waste or 'Group A' waste (such as solvents, paints or oils). |
| W6 | Waste generated from the Proposal will be managed in accordance with the principles of the waste hierarchy.<br>A decommissioning environmental management plan will be prepared for the proposed facility with a Waste Management Plan. |
| W7 | Wellington Waste Management Depot given appropriate notification before any large quantities of waste are deposited at the Wellington Waste Management Depot.<br>Consultation will be undertaken with Dubbo Regional Council to determine what these notification periods will be and what waste can be taken by the facility. |
| **Operational Mitigation Measures** | |
| W8 | A WMP will be prepared and implemented as part of the OEMP to manage any waste operational waste. |

# 7. Cumulative Impacts

The cumulative impact assessment has considered the local government area of Wellington which is now part of the larger Dubbo Regional Council.

## *Background*

A search of the Major Projects Register on the DP&E website and the former Wellington LGA (now Dubbo Regional Council LGA) website was undertaken on the 9th March 2018 to identify any other major projects within the vicinity of the development site which would likely contribute to cumulative impacts. This search identified the following projects in the council area that may add to cumulative impacts.

- Wellington Solar
- Wellington North Solar Plant
- Mumbil Solar Farm
- Maryvale Solar Farm.

## *Potential Impacts*

Developments that have been approved, or are proposed to be carried out in the vicinity of the Proposal are outlined in Table 7-1.

Table 7-1 Developments that are proposed to be carried out within the Dubbo LGA

| Project | Cumulative construction Impacts | Cumulative operational Impacts |
|---|---|---|
| **Wellington Solar**<br>This includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 174 MW of electricity.<br><br>The project site is approximately 2km to the north of Wellington on the Goolma Road and is approximately 15 km by road and 12 km in a straight line from the Suntop Site. | The current timing of this proposal for construction is unknown. Currently the EIS is being prepared. If the development proceeds the timing may overlap with this Proposal. Cumulative construction impacts may include:<br>• Additional construction traffic causing congestion along haulage routes, increased collision risk, damage to road infrastructure and associated noise from additional traffic.<br>• Local labour may not be available to accommodate both projects increasing the demand for local accommodation and health services.<br>• Generation of additional waste. Local waste disposal centres may not be able to accommodate waste disposal from both projects during construction.<br><br>These impacts would be temporary and are manageable with the implementation of safeguards (refer to mitigation measures below). | There are not expected to be any cumulative impacts resulting from the operation of the Wellington Solar proposal. |
| **Wellington North Solar Plant**<br>This includes the construction, operation and decommissioning of a | The current timing of this proposal for construction is unknown. Currently the EIS is being prepared. If the development proceeds the timing may overlap with this Proposal. Cumulative construction impacts may include: | There are not expected to be any cumulative impacts resulting from the operation of the |

| Project | Cumulative construction Impacts | Cumulative operational Impacts |
|---|---|---|
| photovoltaic (PV) solar farm that would produce up to 300 MW of electricity. The proposal footprint is approximately 650 ha with the site approximately 5 km to the north of Wellington on the Goolma Road and approximately 17km by road and 14 km in a straight line from the Suntop Site. | • Additional construction traffic causing congestion along haulage routes, increased collision risk, damage to road infrastructure and associated noise from additional traffic.<br>• Local labour may not be available to accommodate both projects increasing the demand for local accommodation and health services.<br>• Generation of additional waste. Local waste disposal centres may not be able to accommodate waste disposal from both projects during construction.<br><br>These impacts would be temporary and are manageable with the implementation of safeguards (refer to mitigation measures below). | Wellington North Solar Plant. |
| **Mumbil Solar Farm**<br>This includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 138 MW of electricity. The proposal footprint is approximately 201 ha with the site approximately 20 km to the south east of Wellington on the Burrendong Way and 2km north of the Village of Mumbil. This is approximately 33 km by road and 19 km in a straight line from the Suntop site. | Due to the timeframe of this application there are not expected to be cumulative construction impacts. | There are not expected to be any cumulative impacts resulting from the operation of the Mumbil Solar Farm |
| **Maryvale Solar Farm**<br>This includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 115 MW of electricity. The proposal footprint is approximately 150 ha with the site approximately 15 km to the north west of Maryvale and Seatonville | Due to the timeframe of this application there are not expected to be cumulative construction impacts. | There are not expected to be any cumulative impacts resulting from the operation of the Mumbil Solar Farm |

| Project | Cumulative construction Impacts | Cumulative operational Impacts |
|---|---|---|
| Roads. The site is approximately 25 km by road and 15km in a straight line from the Suntop site. | | |

The cumulative impacts from projects in the Wellington district of the Dubbo LGA can be grouped into four broad categories:

- Traffic generation and associated risks (increased risk of collision, damage to infrastructure)
- Pressure on local accommodation and services
- Waste disposal
- Access to local labour.

**Traffic generation**
The major road networks affected by the additional projects include the Mitchell Highway and the Golden Highway. The Wellington Solar Farm and the Wellington North Solar Plant are both located on the northern side of Wellington, whereas Suntop is located to the west side of the township and will utilise a different series of local Roads to provide access to the Site.

Both the Mitchell Highway and Golden Highway have suitable capacity to cater for construction and operational traffic as both are key freight routes in NSW and designated as '*oversize, over mass load carrying vehicles network approved roads*' by Roads and Maritime Services. Both highways are State roads, which carry high traffic volumes and any additional construction or operational vehicle traffic on these major roads would be within the range of daily variation in traffic on these routes.

As discussed, the Site is located to the west of Wellington, and Renshaw - McGirr Way and Suntop Road are two roads that will provide direct access to the site. The Traffic Impact Assessment prepared as part of this EIS details that these roads will be able to accommodate the increase in traffic during the construction period (**Appendix H**).

The proposals could lead to an increase in congestion along haulage routes and additional construction traffic may also increase collision risk, have the potential to cause damage to road infrastructure and increase noise levels along haulage routes. Traffic impacts would largely be temporary and are considered manageable with the implementation of safeguards (refer to Section 6.5).

**Pressure on local accommodation and services**
Should several projects occur at the same time local labour may not be available to all projects and non-local labour will be required for construction increasing the demand for local accommodation and local health services. Strain on local accommodation and health services is expected to be spread over the region with employees staying primarily in Wellington or accommodated by Dubbo or Orange if necessary.

However, there is also potential for positive cumulative economic effects from the construction of multiple developments in the area (refer Section 6.12.5). The increased creation of jobs and economic input into local businesses would provide a benefit to local communities.

**Waste Disposal**
Construction of the projects listed above is expected to generate additional construction related waste. Local waste disposal centres may not be able to accommodate waste disposal from multiple projects during construction. Should projects occur concurrently the WMP within the CEMP would need to be updated to

incorporate and address potential cumulative impacts from surrounding development activities as they become known.

**Access to Local Labour**
The construction of the projects listed in Table 7-1 are expected to use local labour, however, there is a limited amount of labour available in Wellington and the surrounding areas. This will most likely result in the use of non-local labour to assist with labour requirements.

### *Mitigation*

Cumulative impacts are best addressed through careful management of individual components, as set out in Section 8. However, the following mitigation and management measures are recommended to minimise potential cumulative impacts.

### 7.1.1 Mitigation / Management Measures

| Ref | Mitigation Measure |
|---|---|
| **Construction and Decommissioning Mitigation Measures** | |
| CU1 | The CEMP would be updated as required to incorporate potential cumulative impacts from surrounding development activities as they become known. This would include a process to review and update mitigation measures as new work begins or if complaints are received.<br>Key areas within the CEMP include the Waste Management Plan and the Traffic Management Plan. |

# 8. Environmental Management

## 8.1 Summary of Environmental Mitigation Measures

Throughout this EIS, a number of management and mitigation measures have been identified in order to minimise adverse environmental, social and economic impacts that could potentially arise from the Proposal. These management and mitigation measures would be implemented during the construction, decommissioning and operation of the Proposal. The identified management and mitigation measures will be incorporated into contractual arrangements with any future contractors for construction and operation of the Proposal.

These management and mitigation measures would minimise any potential adverse impacts arising from the Proposal on the surrounding environment. The general management and mitigation measures for construction and decommissioning of the proposal are summarised in Table 8-1. The specific management and mitigation measures for construction and operation of the proposal are summarised in Table 8-2 and Table 8-3 respectively.

**Table 8-1 Summary of General Management and Mitigation Measures for Construction and Decommissioning**

| Mitigation Measure Reference | Description |
|---|---|
| G1 | A project specific Construction Environmental Management Plan (CEMP) and all relevant sub-plans will be prepared by the Contractor prior to commencing Stage 1 construction. The sub-plans will include:<br>• Land Management Plan (LMP) including a weed management plan<br>• Soil and Water Management Plan (SWMP) including erosion and sediment (ERSED) control<br>• Unexpected Finds protocol<br>• Waste Management Plan (WMP)<br>• Traffic Management Plan (TMP)<br>• Emergency Contingency Plan. |
| G2 | All employees, contractors and subcontractors are to receive a project induction.<br>The environmental component may be covered in toolbox talks and should include:<br>• Environmental mitigation measures<br>• Vegetation clearing operations and controls to prevent unauthorised clearing<br>• The Unexpected Finds Protocols (historic heritage, Aboriginal heritage and waste)<br>• Aboriginal heritage (Types of aboriginal heritage objects, details of the NMH heritage object, legislative requirements and penalties associated with the harm or desecration of Aboriginal heritage objects)<br>• Waste management strategies and mitigation measures. |
| G3 | Implement community consultation measures to inform the community of construction activity and potential impacts. |
| G4 | A complaint handling procedure and register will be implemented to assist in recording and managing potential conflict with the local community during construction. |
| G5 | Mud and other debris shall be removed from the wheels and bodies of construction vehicles and equipment prior to leaving the project site and before entering the sealed public road network. |

| Mitigation Measure Reference | Description |
|---|---|
| | Soil, earth, mud and other similar materials must be removed from the roadway preferably by dry methods (sweeping, shovelling). |

Table 8-2 Summary of Management and Mitigation Measures for Construction and Decommissioning

| Reference | Mitigation Measure |
|---|---|
| **Biodiversity** | |
| B1 | A 10-m buffer shall be established between the perimeter of the remnant vegetation stands and the works footprint. |
| B2 | Erect barriers to protect remnant perimeter trees, planting in Paddock 12 and Fuzzy Box clump in Paddock 1 |
| B3 | The works (e.g. plant, material stockpiling) should not encroach into remnant vegetation and buffer areas. |
| B4 | A clearing protocol will be developed to ensure any potential impacts to native fauna are minimised during vegetation removal, this will include supervised removal of trees with hollows by a trained wildlife carer. |
| B5 | A Land Management Plan which will be developed (**refer Appendix J**) and will be incorporated into an overall construction environmental management plan (CEMP). This will include weed management, animal pest management and monitoring as well as an induction for all employees and contractors detailing the trees that are protected on Site. |
| B6 | Trenches should be backfilled as soon as possible to minimise the chance of fauna becoming trapped. Any trench sections left open for greater than a day would be inspected daily, early in the morning and any trapped fauna removed. The use of ramps or ladders to facilitate trapped fauna escape is recommended. |
| B7 | Speed limits should be set to 20km per hour on internal roads and tracks. |
| B8 | A Vegetation Management Plan will be developed and incorporate tree protection measures to conserve the trees around the perimeter of the Site. |
| B9 | Enhancement of buffer zones around the perimeter of the site to include additional planting of replacement trees for those lost due to the clearing of the paddocks |
| B10 | Any works surrounding the dam located on the western boundary of the site will include implementation of appropriate erosion and sediment controls to prevent silt build up in the dam. |
| **Heritage** | |
| *Aboriginal Heritage* | |
| AB1 | An Unexpected Finds Protocol which addresses unexpected aboriginal heritage finds will be included in the Construction Environmental Management Plan to be completed by the construction contractor. |
| AB2 | The Unexpected Finds Protocol will form part of the site induction and must be viewed by all relevant employees and contractors before working on site. |
| AB3 | Aboriginal archaeological sites, Suntop IF 1 and Suntop IF 2, (two isolated artefacts identified along a creek bank) and a Culturally significant tree (all outside the footprint), should be addressed in the CEMP to ensure protection. |
| AB4 | If suspected Aboriginal objects, such as stone artefacts are identified during works, works must cease within 10m of the affected area and an archaeologist called in to assess the finds. If the finds are found to be Aboriginal objects, the OEH must be notified under section 89A of the NPW Act. Appropriate management or avoidance should be sought if Aboriginal objects are to be moved or harmed. |

| Reference | Mitigation Measure |
|---|---|
| AB5 | In the extremely unlikely event that human remains are found, works should immediately cease and the NSW Police are to be contacted. If the remains are suspected to be Aboriginal, the OEH may also be contacted at this time to assist in determining appropriate management. |
| *Heritage* | |
| H1 | An Unexpected Finds Protocol which addresses unexpected non-indigenous heritage finds will be included in the Construction Environmental Management Plant to be completed by the construction contractor. |
| H2 | The Unexpected Finds Protocol will form part of the site induction and must be viewed by all relevant employees and contractors before working on site. |
| H3 | If an item (or suspected item) of heritage is discovered during construction, all work in the area of the find will cease immediately and the Unexpected Finds Protocol implemented including notifying an officer from the Heritage branch of OEH immediately (in accordance with section 146 of the *Heritage Act 1977*) and seeking advice for management of the object. |
| **Visual** | |
| V1 | Minimise impact through use of siting and design features<br>Group ancillary facility structures where possible to minimise sprawl<br>• Stabilise new access roads formed within the Site required for operations, but do not seal with bitumen or other dark coating |
| V2 | Minimise and repair ground disturbance<br>Minimise grading across the Site and undertake the minimum levelling necessary to install panel supports<br>• Rehabilitate exposed ground surfaces as soon as possible |
| V3 | Implement Concept Landscape Plan, which includes visual screening. (refer **Appendix C**). |
| V4 | Minimise vegetation removal and retain existing trees and other native vegetation by including:<br>• Temporary fencing around vegetation<br>• Demarcating area as a no-go zone. |
| V5 | Retain as much existing grass cover beneath solar panels as possible. |
| V6 | Progressively stabilise disturbed area with pasture grasses. |
| **Noise** | |
| N1 | Prepare a construction noise management protocol for site to manage noise emissions. |
| N2 | Implement a formal complaint handling procedure to manage any potential concerns from the community. This will include:<br>• Details of a readily accessible contact person.<br>• A well-documented process that includes an escalation procedure so that (if required) there is a path to follow should the complainant not be satisfied.<br>• Details regarding setting up a complaint register.<br>Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits |
| N3 | Works are to be carried out during standard work hours (i.e., 7am to 6pm Monday to Friday; 8am to 1pm Saturdays).<br>Any construction outside of these normal working hours would only be undertaken in the event of an emergency or with prior approval from relevant authorities. For non-emergency works outside standard hours, residents and other sensitive land use |

| Reference | Mitigation Measure |
|---|---|
| | occupants should be informed of the works between 5 and 14 days before commencement. |
| N4 | Toolbox and induction of personnel prior to start of shift to discuss noise control measures that may be implemented to reduce noise emissions to the community, construction hours and nearest sensitive receivers. |
| N5 | All plant should be shut down when not in use. Plant to be parked/started at farthest point from relevant assessment locations |
| N6 | Avoid the operation of noisy equipment near noise sensitive areas and where possible, loading and unloading would be conducted away from sensitive areas. |
| N7 | Noise levels will be considered when procuring equipment. |
| N8 | All plant is to utilise a broadband reverse alarm in lieu of the traditional hi frequency type reverse alarm. |
| N9 | Ongoing community consultation for residences within close proximity of the works. The information would include details of:<br>• The proposed works and when these will occur<br>• The duration and nature of the works<br>• Details of what to do should they have a noise complaint<br>• Updates on the progress of works |
| N10 | Where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (e.g. unloading and laydown areas) |
| N11 | Limiting and scheduling the number of work areas along the northern boundary for piling, trenching and assembly activities to minimise noise levels at receptors along Suntop Road. |
| **Traffic, Transport and road Safety** | |
| T1 | The proposed road improvements, as stated above, and any ancillary road works should be completed prior to the construction of the proposal. |
| T2 | A Traffic Management Plan (TMP) for construction shall be developed in accordance with Roads and Maritime Guidelines and the Australian Standard AS1742.3. The plan would include:<br>• The designated routes of construction traffic to the site<br>• A map of the primary access routes highlighting critical locations<br>• Drivers Code of Conduct<br>• Carpooling/shuttle bus arrangements to minimise vehicle numbers during construction<br>• Scheduling of deliveries<br>• Community consultation requirements<br>• Any restrictions on traffic movements (such as residential areas, school pick-up and drop-off times)<br>• Traffic controls (speed limits, signage, etc.)<br>• A complaint handling procedure / register<br>• An induction process for vehicle operators. |
| T3 | All Proposal personnel will be provided training on the requirements of the TMP through site inductions, toolbox talks or specific training |

| Reference | Mitigation Measure |
|---|---|
| T4 | The heavy vehicle route will be included within the Driver's Code of Conduct and will form part of the project inception meeting for the project for all staff and drivers. This will include informing all drivers of school bus pick up, and drop off times along the route. |
| T5 | Traffic control will be provided in accordance with the approved construction TMP to manage traffic movements (vehicular, cycle and pedestrian) during construction and maintain the flow of traffic within the site and on surrounding public roads |
| T6 | Traffic management controls will be communicated to appropriate stakeholders which will include the local community in the site vicinity via a letter box drop |
| T7 | Directional signage will be installed to direct construction traffic, and warn other motorists of construction traffic. This signage is positioned in accordance with the approved Traffic Control Plans. |
| T8 | All employees, subcontractors and suppliers will comply with the speed limits within the worksite, which are as follows:<br>• 40 km/h on formed roads<br>• 20 km/h during foggy/dusty conditions with headlights on<br>• • 10 km/h when passing pedestrians. |
| T9 | Develop a protocol which will be provided for undertaking dilapidation surveys and making any necessary repairs following construction.<br>The dilapidation surveys will assess the existing condition of Suntop Road prior to construction and identify any damage once construction is complete.<br>Should any damage be identified the road will be repaired in line with Council standards. |
| T10 | A dilapidation survey will be completed along Suntop Road prior to upgrades on this road and after the works are complete. A dilapidation survey protocol is provided in **Appendix H**. |
| T11 | A Traffic management plan (TMP) for decommissioning will be developed as part of the decommissioning management plan. This will include a decommissioning haulage route. The indicative decommissioning route provided in this EIS will be reviewed prior to the start of decommissioning. |
| **Land Use** | |
| L1 | Managed grazing will be used to maintain the height of ground cover during operation of the solar farm. |
| L2 | If operations cease and the Site is to be decommissioned, a remediation plan will be compiled and implemented. |
| L3 | Implement the Landscape Plan (refer **Appendix C**) |
| L4 | All pesticides will be used in accordance with the *Pesticides Act 1999*, such that only registered pesticides are used based on label instructions that are designed to minimise impacts on surrounding land |
| L5 | All the infrastructure will be removed upon decommissioning with the possible exception of the substation, transmission lines to the substation and access road to the substation. |
| **Surface Water, Hydrology and Groundwater** | |
| SW1 | A Soil and Water Management Plan (SWMP) will be prepared and implemented by the Contractor as part of the CEMP, this will include use of onsite water for dust mitigation measures. |
| SW2 | Minimise the footprint of disturbance at any one time by implementing progressive construction and remediation works. |
| SW3 | Design solar panel arrays to allow sufficient space between panels to establish and maintain ground cover beneath the panels and assist in reducing potential sediment impacts on water quality. |
| SW4 | Ensure all refuelling activities are undertaken in a bunded area at least 40m from any |

| Reference | Mitigation Measure |
|---|---|
| | waterways. |
| **Soils, Geology and Contamination** | |
| S1 | A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP, in accordance with Managing Urban Stormwater: Soils and Construction (Landcom, 2004). This will include an erosion and sediment control plan for the Site and intersection for implementation during construction. |
| S2 | Minimise the footprint of disturbance during construction and employ progressive rehabilitation strategies to reduce the erosion hazard. |
| S3 | During trenching activities and backfilling, as far as practicable separate topsoil and subsoil and when backfilling return the soil layers in their original order where practicable to do so. |
| S4 | Employ dust management measures on unsealed roads, stockpiles and other areas of loose or disturbed soil prone to dust generation. Controls may include covering of stockpiles, watering roads and synthetic soil stabilisers. Dust management techniques shall be outlined in the SWMP. |
| S5 | Maintain erosion and sediment controls until construction works are complete. |
| S6 | Install a stabilised site entrance that all construction vehicles will use to access the site. The stabilised entrance and traffic management protocols in the CEMP shall be designed to minimise tracking of sediment onto adjoining roads from departing vehicles. |
| S7 | Undertake site inspections at least weekly and following significant rainfall events to observe the condition and operation of erosion and sediment controls and water management systems, and schedule any required maintenance. |
| S8 | Undertake soil amelioration and vegetation improvement works in line with the requirements of a Land Management Plan. This should include undertaking required land or vegetation improvement works at an appropriate stage during solar farm development. For example, soil amelioration and fertilising might be most practically undertaken prior to solar panel installation. For similar reasons the desired pasture should be sown before solar panel installation. |
| S9 | Design arrays to allow sufficient space between panels for essential maintenance activities and to facilitate maintenance of an effective ground cover beneath the panels to reduce erosion and help suppress weeds. |
| S10 | Develop and implement a protocol for management of an unexpected finds of soil contamination. |
| **Bushfire** | |
| BF1 | All electrical components would be designed and managed to minimise potential for ignition |
| BF2 | The design would consider that the access track must be trafficable by Category 1 fire appliances. |
| BF3 | Maximise use of construction components using materials such as glass, silicon, steel and aluminium rather than plastic |
| BF4 | Develop an Emergency Response Plan (ERP) in consultation with the NSW RFS District Fire Control Centre prior to construction. The FMP should include:<br>• Foreseeable on-site and off-site fire events<br>• Clearly states work health safety risks and procedures to be followed by fire-fighters, including:<br>– Personal protective clothing<br>– Minimum level of respiratory protection (e.g. rubber fire fighter's boots and gloves, a self-contained breathing apparatus) |

| Reference | Mitigation Measure |
|---|---|
| | – Minimum evacuation zone distances<br>– A safe method of shutting down and isolating the PV system<br>– Any other risk control measures required to be followed by fire-fighters<br>– Evacuation triggers and protocols<br>Suppression response strategies and tactics, including aerial suppression options/management. |
| BF5 | Two copies of the ERP should be permanently stored in a prominent 'Emergency Information Cabinet' to be located at the main entrance point to the solar farm, external to any security fence or locked gate, and a copy provided to local emergency responders. |
| BF6 | An Asset Protection Zone (APZ) will be constructed around the solar farm with the following requirements:<br>• The APZ will be 15 m wide around the entire perimeter of the solar farm footprint, and 20 m wide for areas abutting the remnant treed areas and landscaping areas.<br>• The external edge of the APZ setback at least 25 m from the external edge of PV panels or other components.<br>• The APZ must be either a mineral earth fire break (i.e. dirt or gravel) or a heavily grazed area.<br>• Trees and tall shrubs associated with the landscape plan should not be planted close to the APZ.<br>• APZ preferably located external to any security fence.<br>• The substation should have a 20m APZ with no internal vegetation (gravel surface). |
| BF7 | The APZ or a fire break is to be constructed as part of the first stage of the development. |
| BF8 | Construction between 1 December and 31 March would be undertaken in accordance with the following:<br>• All plant, vehicles and earth moving machinery will be cleaned of any accumulated flammable material (e.g. soil and vegetation)<br>• A suitable fire appliance (e.g. fire extinguisher) is present on site with at least two personnel trained in bushfire fighting<br>• On days when Very High fire danger or worse is forecast for Wellington, the "fires near me" app is to be checked hourly for the occurrence of any fires likely to threaten the site<br>All operations involving machinery will cease while the GFDI is or forecast to be 35 or greater. |
| BF9 | Installation of electrical equipment such as, junction boxes, inverters, transformer and electrical cabling, is to be in accordance with AS 3000:2007 Electrical installations and undertaken by qualified professionals. |
| BF10 | Install a water supply tank with a capacity of 50,000L outside the APZ near the substation. |
| **Hazardous Goods** | |
| Haz 1 | Dangerous or hazardous materials would be transported, stored and handled in accordance with AS1940-2004: The storage and handling of flammable and combustible liquids and the ADG Code where relevant. |
| **Electromagnetic Interference** | |
| Haz 2 | All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia. |

| Reference | Mitigation Measure |
|---|---|
| Haz 3 | The layout of the Proposal has been designed considering buffer distances between the solar farm and sensitive receivers, road users and the general public. |
| **Air Quality** | |
| A1 | Activities shall be assessed during adverse weather conditions and modified as required to reduce dust generation (e.g. cease activity where reasonable levels of dust cannot be maintained). |
| A2 | Engines to be switched off when not in use for any prolonged period. |
| A3 | Water suppression of dust on exposed areas, roads and stockpiles when required. |
| A4 | Temporarily excavated soil and other materials that exhibit significant dust lift off would be wet down, stabilised or covered to manage dust. |
| A5 | Development of a complaint procedure to promptly identify and respond to complaints. |
| A6 | Vehicles and plant would be fitted with suitable pollution reduction devices wherever possible and maintained according to manufacturer's specifications. |
| **Socio-economic** | |
| Socio 1 | The Community Stakeholder Engagement Program (CSEP) will continue to be implemented, including:<br>• Providing regular updates to the community<br>• Inform relevant stakeholders of potential impacts (for example noise impacts)<br>• Establishment of a complaints handling procedure and a response protocol<br>Responding to any complaints received. |
| Socio 2 | Liaise with local industry representatives to maximise the use of local contractors, manufacturing facilities and materials. Create a resourcing plan to ensure jobs will be local. |
| Socio 3 | Local accommodation options for staff will be maximised. |
| Socio 4 | Continued engagement with Dubbo Regional Council to discuss community and business concerns. |
| **Waste** | |
| W1 | A WMP will be prepared and implemented as part of the CEMP to manage any construction waste. The WMP will include but not be limited to:<br>• Measures to avoid and minimise waste associated with the Proposal<br>• The procedure for assessing, classifying and storing waste in accordance with the EPA's Waste Classification Guidelines (EPA, 2014) and management options<br>• Procedures for storage, transport and disposal of waste<br>• Procedures for notification to Wellington Waste Management Depot prior to any large disposals<br>• Monitoring, record keeping and reporting, e.g. waste tracking data demonstrating the lawful disposal of contaminated products, waste or residues generated at the facility. |
| W2 | An Unexpected Finds (Waste) Protocol would be established and implemented in case potentially contaminated, hazardous or unsuitable material are encountered during the site works. |
| W3 | Waste management strategies and mitigation measures will be communicated to all employees and contractors during site induction, prior to commencing works at the site. |
| W4 | A schedule will be created with the temporary amenity hire contractor to remove sewage. |
| W5 | The proposed facility will comply with the relevant Protection of Environment Operations Act waste-tracking requirements for any wastes assessed or classified as hazardous waste, industrial waste or 'Group A' waste (such as solvents, paints or oils). |
| W6 | Waste generated from the Proposal will be managed in accordance with the principles of the waste hierarchy. |

| Reference | Mitigation Measure |
|---|---|
| | A decommissioning environmental management plan will be prepared for the proposed facility with a Waste Management Plan. |
| W7 | Wellington Waste Management Depot given appropriate notification before any large quantities of waste are deposited at the Wellington Waste Management Depot.<br>Consultation will be undertaken with Dubbo Regional Council to determine what these notification periods will be and what waste can be taken by the facility. |
| **Cumulative Impacts** | |
| CU1 | The CEMP would be updated as required to incorporate potential cumulative impacts from surrounding development activities as they become known. This would include a process to review and update mitigation measures as new work begins or if complaints are received.<br>Key areas within the CEMP include the Waste Management Plan and the Traffic Management Plan. |

Table 8-3 Summary of Management and Mitigation Measures for Operation

| Reference | Mitigation Measure |
|---|---|
| **Biodiversity** | |
| B11 | The OEMP will include:<br>• The land management plan – which will have a procedure or plan for monitoring vegetation cover and composition and allow for adaptive management<br>• The weed management plan – which will include weed monitoring and control<br>• Vehicle speed limits, to reduce risk of collision with fauna<br>• Prohibition of domestic pets on site. |
| **Visual** | |
| V7 | Minimise impact through use of siting and design features.<br>Signage required at the Site should be of sufficient size to be readable at driver height within short range (0-20m) and contain only information sufficient for basic facility and company identification, for safety, navigation, and delivery purposes. Large scale signage will not be installed. |
| V8 | Avoid Night Sky Impacts.<br>Permanent evening lighting will be limited to compulsory lighting required for the substation. Substation lighting will be turned on if an intrusion is detected or if staff are on site undertaking works outside of daylight hours.<br>Amber colour lights will be used rather than bluish-white lighting. |
| V9 | An OEMP will be prepared for the Proposal and will incorporate a complaints management process. |
| V10 | Monitor performance of screen planting areas six-monthly for first three years then annually. Replant as necessary if plants die, and supplement planting with alternative species if plants are not adapting to the Site. |
| **Noise** | |
| N12 | Complete a one-off noise validation monitoring assessment to quantify emissions from site and to confirm emissions meet relevant criteria. |
| N13 | Prepare an operational noise protocol that can be implemented to address any community concerns regarding noise emissions for future operations of the Proposal. |
| **Land Use** | |
| L6 | An OEMP will be prepared for the Proposal and will incorporate: |

| Reference | Mitigation Measure |
|---|---|
| | • The land management plan including a weed management<br>• Ongoing landscaping commitments |
| **Surface water, Hydrology and Groundwater** | |
| SW5 | Implement the Land Management Plan to ensure at least 80% groundcover is restored and maintained (Refer **Appendix J**) |
| **Soils, Geology and Contamination** | |
| S11 | Implement a Land Management Plan that addresses the ongoing land management and maintenance activities (Refer **Appendix J**). This would address:<br>• Ongoing agronomic management of the land including stock, water, vegetation and soils management<br>• Measures required to maintain healthy soil and plant systems and maintain the agricultural capability of the land<br>• Stock management programs and infrastructure (e.g. fencing, watering points)<br>• Soil amelioration, pasture management and weed control<br>• Monitoring programs for soil fertility and groundcover. |
| **Bushfire** | |
| BF11 | Fit PV arrays with an earthing and lightning protection system connected to the main earth link. |
| BF12 | Vegetation fuel levels internal to the APZ and throughout the solar farm will be maintained by grazing, slashing or mowing. |
| BF13 | The solar farm will be monitored via off-site control centres to ensure systems are working correctly, investigate any alarms and monitor panel performance. |
| **Air Quality** | |
| A7 | Establish and maintain ground cover in accordance with the Land Management Plan for the site. |
| **Waste** | |
| W8 | A WMP will be prepared and implemented as part of the OEMP to manage any waste operational waste. |

# 9. Conclusion

This chapter provides the justification for the Proposal taking into account its biophysical, social and economic impacts, the suitability of the Site and whether or not the Proposal is in the public interest. The Proposal is also considered in the context of the objectives of the EP&A Act 1979, including the principals of ecologically sustainable development (ESD) as defined in Schedule 2 of the *EP&A Regulation 2000*.

## 9.1 Justification for the Development

The project, identified as a State Significant Development (SSD) has been subject to an environmental impact assessment under Part 4, Section 4.1 of the EP&A Act. As noted in Section 4.1, the Project is classified as SSD in accordance with the State and Regional Development (SRD) SEPP.

This EIS has examined and taken into account all matters affecting or likely to affect the environment by reason of the proposed activity.

The environmental impact assessment that was undertaken concludes that whilst the project would have some impacts on:

- Biodiversity
- Aboriginal Heritage
- Visual amenity
- Traffic and Transport
- Erosion and sediment control
- Bush Fire

A summary of the impacts for these is provided below. Appropriate mitigation and management measures outlined in Section 8 will be carried out during the construction, operational, and decommissioning phases.

**Biodiversity**
A biodiversity assessment was undertaken by flora and fauna specialists to assess the impacts of the development on biodiversity. The project will require minor land clearing to facilitate the installation of the solar PV panels. The Site has historically been predominantly cleared for agricultural use and clusters of native vegetation will be retained along the southern and western boundaries as part of the proposal. No threatened species or EECs will be impacted as part of the proposal.

**Aboriginal Heritage**
An Aboriginal Cultural Heritage Assessment was undertaken to assess the impacts on aboriginal heritage and to determine the archaeological potential of the Site. Consultation with Aboriginal stakeholders was undertaken in accordance with the Proposal SEARs.

Three sites of Aboriginal archaeological potential were identified within the study area but outside the proposed footprint of the development. These consisted of two scatters on the edge of a flowline in the south east of the Site, and a tree of cultural significance located to the north of an existing row of trees. These trees will be retained as part of the vegetation management for the Site.

The Wellington Local Aboriginal Land Council (WLALC) were present and participated in the Site assessment. They have supplied a letter stating that they have no objection to the proposal proceeding, but stipulated that the three areas need to be protected from impacts during construction. Accordingly, they have requested that these sites be addressed in the Construction Environmental Management Plan (CEMP). No further Aboriginal cultural heritage assessment is warranted for the Proposal and an unexpected Aboriginal heritage finds procedure will be developed prior to construction.

**Visual Amenity**

The Proposal would be visible to 29 potentially affected private viewpoints as well as one public viewpoint being Suntop Road. A Visual Impact Assessment (VIA) was prepared and concluded that one viewpoint had a high impact and three viewpoints had a moderate to high impact. The VIA also concluded that these impacts could be reduced through the implementation of mitigation strategies, such as landscape screening.

**Traffic**

A traffic impact assessment (TIA) was completed to assess traffic impacts and this recognised that during the construction phase of the project, there will be an increase in the number of heavy vehicle movements which have the potential to impact on the local road network. Heavy vehicles will use a designated route which currently caters for a large number of heavy vehicles. It is considered that this route can safely accommodate the additional traffic movements associated with the project.

The major road safety impact is associated with the heavy vehicles accessing the site and their impact upon the operation of the intersections along the haulage route. In particular, the intersection of Renshaw McGirr Way and Suntop Road will need upgrading to accommodate the movement of heavy vehicles at this corner in a safe manner. Proposed works will include, widening the turning area at the corner, installation of a sheltered right turn lane from Renshaw McGirr Way into Suntop Road and the provision of safety barriers over a culvert on the north east side of the corner. Suntop Road and Renshaw McGirr way are part of a local school bus route. Traffic associated with the proposal will made aware of this and deliveries by heavy vehicles will be scheduled to avoid school bus pick up and drop off times.

**Erosion and Sediment Control**

The construction phase has the potential to increase dust levels from the Site. The use of appropriate land management techniques during construction and the implementation of the mitigation measures specified in Section 8 will reduce potential dust impacts. A Soil and Water Management Plan (SWMP) will be developed as part of the CEMP.

**Bushfire**

A Bushfire risk assessment was completed and concluded that potential ignition sources from construction and decommissioning of the proposal were generally consistent with the existing environment apart from any electrical faults. Similarly, ignitions from electrical equipment is theoretically possible during operation. Solar farms also present unusual risks to fire fighters such as electrocution and inhalation of fumes. The land is not mapped as fire prone land and it has been concluded that these risks can be managed by the mitigation measures specified in Section 8.

Lower risk issues including noise, air quality, waste generation, hazards, and cumulative impacts have been addressed in Section 6.

## 9.2 Objects of the EP&A Act

Table 9-1 Objectives of the EP&A Act

| Object | Comment |
|---|---|
| 1.3 (a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources. | The Proposal does result in the loss of cropping agricultural land for a period of approximately 30 years however in the meantime it can be used for grazing agriculture (sheep) and could be returned to cropping agricultural use upon decommissioning. |

| | |
|---|---|
| | The Proposal will not result in the sterilisation of natural resources including mineral resources |
| 1.3 (b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment | Ecologically sustainable development is considered in Section 9.3. |
| 1.3 (c) To promote the orderly economic use and development of land. | The Proposal would diversify sources of income for the agricultural sector, allowing financial resilience whilst retaining its agricultural use within the Site. |
| 1.3 (d) To promote the delivery and maintenance of affordable housing. | Not relevant to the project. |
| 1.3 (e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats. | The Proposal will not impact on any threatened species or communities. Vegetation removal will be limited and all remnant areas of vegetation will be retained with suitable buffers from the Site boundary. |
| 1.3 (f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage). | The proposal will not impact upon any areas of built and cultural heritage. Several items of Aboriginal heritage were identified and will be managed in accordance with an approved CEMP and OEMP. Additionally, an Unexpected (heritage) Finds protocol will be developed prior to construction. |
| 1.3 (g) To promote good design and amenity of the built environment. | Not relevant to the project. |
| 1.3 (h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants. | Not relevant to the project. |
| 1.3 (i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State. | Not relevant to the project. |
| 1.3 (j) To provide increased opportunity for community participation in environmental planning and assessment. | Consultation activities are outlined in Section 5. Suntop Solar Farm will continue to consult the community and stakeholders during the Proposal's development. |

## 9.3 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all State and Territory governments endorsed the *National Strategy for Ecologically Sustainable Development*.

Clause 7(1)(f) of the *Environmental Planning and Assessment Regulation 2000* requires an EIS to provide justification for a development with specific reference to the principles of ecologically sustainable development (ESD) as set out in the Regulation. This is provided below.

### *The Precautionary Principle*

The precautionary principle states that where '*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*'. Implementing the precautionary principle includes:

- Careful evaluation to avoid serious or irreversible damage to the environment wherever practicable

- An assessment of the risk-weighted consequences of various options.

This EIS assesses environmental aspects and impacts associated with the Proposal with the purpose of eliminating (where practicable) and reducing the risk of serious and permanent impacts on the environment. Specialist studies were undertaken to provide accurate information to assist with the evaluation and development of the Proposal. Mitigation measures are provided in Section 8.

### *Intergenerational Equity*

The intergenerational equity principle recognises 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 Proposal would result in amenity impacts, however would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations. The Proposal would benefit future generations by reducing the reliance on energy sources derived from non-renewable resources, which produce GHG emissions.

Should the Proposal not proceed, the principle of intergenerational equity may be compromised, as the impacts of climate change continue to be realised, due to a continued dependence on GHG emitting energy resources.

The solar farm would be decommissioned at the end of its operational life, removing all above ground infrastructure. Decommissioning would therefore result in returning the site to its existing land capability for future generations. The Proposal is therefore consistent with the principles of intergenerational equity.

### *Conservation of Biological Diversity and Ecological Integrity*

Ecologically Sustainable Development mandates that the conservation of biological diversity and ecological integrity should be a fundamental consideration in environmental planning and decision-making processes. Biodiversity refers to the variety of all life.

An assessment of the existing local flora and fauna has been undertaken in order to recognise and manage any potential impacts of the Proposal on local biodiversity. This assessment is provided in **Appendix D** and summarised in Section 6.1. The assessment included avoidance of areas of higher conservation value and management prescriptions to minimise and manage residual impacts. The Proposal is expected to have negligible adverse impacts on biodiversity.

### *Improved valuation, pricing and incentive mechanisms*

This principle requires that environmental factors should be included in the valuation of assets and services in terms of the overall costs to the Proposal.

The environmental consequences of the Proposal have been assessed in this EIS and mitigation measures identified for factors with potential for adverse impact. Implementing the mitigation measures would impose an economic cost on the proponent, increasing both the capital and operating costs of the Proposal. This signifies that environmental resources have been given appropriate valuation.

The Proposal has been designed with an objective of minimising potential impacts on the surrounding environment. This indicates that the concept design for the Proposal has been developed with an environmental objective in mind.

The aims, structure and content of this EIS have incorporated these ESD principles. The mitigation measures in Section 8 provide an auditable environmental management commitment to these parameters. This proposed development would be considered ecologically sustainable, due to the social, economic and

environmental benefits provided in Section 2.3, and the mitigation measures put in place to protect from adverse impacts on the environment.

# 10. References


AER, N.D., Understand and compare your home electricity usage, viewed online 02/01/2018, <www.energymadeeasy.gov.au/benchmark>

AGL, N.D., How we source Energy: Nyngan Solar Plant, webpage, viewed 03/01/2018 <https://www.agl.com.au/about-agl/how-we-source-energy/renewable-energy/nyngan-solar-plant>

Aussie Towns, 2018, Wellington, NSW: History, webpage, viewed online 14/03/2018, <www.aussietowns.com.au/town/wellington-nsw>

Australian Heritage, 2018, Historical Towns Directory: Wellington, webpage, viewed online 14/03/2018, <www.heritageaustralia.com.au/preview.php?state=NSW&region=101&view=555>

Australian Bureau of Statistics, ABS, 2017a, 2016 Census QuickStats: Wellington State Suburb, webpage, viewed 18/04/2018, <www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC11812?opendocument>

Australian Bureau of Statistics, ABS, 2017b, 2016 Census QuickStats: Wellington LGA, webpage, viewed 18/04/2018, <www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA13550?opendocument>

Bureau of Meteorology (BOM), 2017, Climate Statistics for Australian Locations: Monthly Climate Statistics - Summary Statistics Wellington Research Station, webpage, accessed 11/04/2018, <www.bom.gov.au/climate/averages/tables/cw_055023.shtml>

Clean Energy Council, 2016, CLEAN ENERGY AUSTRALIA REPORT 2016, Report, viewed online on 3/01/2018, <https://www.cleanenergycouncil.org.au/policy-advocacy/reports/clean-energy-australia-report.html>

Department of Environment and Climate Change (DECC), 2007, Guidelines for Threatened Species Assessment, August 2007, published by DECC, accessed online January 16, <www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf>

Department of Environment and Energy (DoEE), 2016, The Renewable Energy Target (RET) Scheme, viewed 4/10/2016, <www.environment.gov.au/climate-change/renewable-energy-target-scheme>

Department of Environment and Energy (DoEE), 2017, Australian Energy Update 2017, viewed 09/02/2018, <www.environment.gov.au/system/files/resources/f02a388d-74eb-4200-96fb-fe2a9d0caf5b/files/energy-update-report-2017.pdf>

Department of Planning and Environment: Resources and Planning (DP&E Resources and Planning), 2016, Electricity generation, viewed 09/02/2017, <www.resourcesandenergy.nsw.gov.au/investors/electricity-generation>

Department of Planning and Environment (DP&E), 2016, Population Projections: 2016 NSW Population and household projections, webpage, Viewed 14 /12/2017, <www.planning.nsw.gov.au/Research-and-Demography/Demography/Population-projections>

Department of Trade and Investment, 2011, Land Use Conflict Risk Assessment Guide, Factsheet, Published by the Department of Primary Industries, a part of the Department of Trade and Investment, Regional Infrastructure and Services.

EMFs.info, 2018, Electric and magnetic fields and health, webpage, viewed 24/01/2018, <www.emfs.info/sources/overhead/specific/132-kv/>

First Solar, N.D., Industry Development and Job Creation in Australia, brochure, viewed online 03/01/2018, <http://www.pac.nsw.gov.au/resources/pac/media/files/pac/projects/2017/10/beryl-solar-farm/other-information-provided-by-the-applicant/3-first-solarindustry-development-australia-brochure.pdf>

Hoen, B., Wiser R., Cappers P., Thayer M., and Sethi G., 2010. The impact of wind power projects on residential property values in the United States: A multi-site hedonic analysis. Lawrence Berkeley National Laboratory.

Hoen, B., Brown, J.P., Jackson, T., Wiser, R., Thayer, M. and Cappers, P., 2013. A spatial hedonic analysis of the effects of wind energy facilities on surrounding property values in the United States.

OEH, 2014a, Biobanking assessment methodology (BBAM), published by OEH September 2014, accessed, <www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf>

OEH, 2014b, Framework for Biodiversity Assessment (FBA), published by OEH September 2014, accessed, <www.environment.nsw.gov.au/resources/biodiversity/140675fba.pdf >

OEH, 2015, Community Attitudes to Renewable Energy in NSW, published by OEH 59 Goulburn St, Sydney, NSW 2000, viewed online 03/01/2018, <http://www.environment.nsw.gov.au/resources/actionmatters/community-attitudes-renewable-energy-150419.pdf>

OEH, 2017, Land and Soil Capability Mapping for NSW, NSW Office of Environment and Heritage, Sydney.

OEH, 2018, Search air quality data, viewed online 22/12/2017, <www.environment.nsw.gov.au/AQMS/search.htm >

OEH and Office of Agricultural Sustainability & Food Security (OASFS), 2013, Interim Protocol for site verification and mapping of biophysical strategic agricultural land, report, accessed 10/01/2018.

TransGrid, N.D., Electric and Magnetic Fields, Brochure, accesses online, viewed 24/01/2018, <www.transgrid.com.au/being-responsible/public-safety/Documents/Electric%20and%20Magnetic%20Fields.pdf>

Vyn, R.J. and McCullough, R.M., 2014. The effects of wind turbines on property values in Ontario: does public perception match empirical evidence?, Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie, 62(3), pp.365-392.

World Health Organisation (WHO), 2018, Electromagnetic Fields (EMF): Summary of Health effects, viewed online 5/03/2018, <www.who.int/peh-emf/about/WhatisEMF/en/index1.html>

**Contact**
Jessica Berry
0438 598 793
jberry@pittsh.com.au

transport | community | mining | industrial | food & beverage | energy






**Brisbane**
Level 10
241 Adelaide Street
PO Box 5243
Brisbane City QLD 4000
T: (07) 3058 7499

**Devonport**
Level 1
35 Oldaker Street
PO Box 836
Devonport TAS 7310
T: (03) 6451 5599

**Hobart**
Level 1, Surrey House
199 Macquarie Street
GPO Box 94
Hobart TAS 7001
T: (03) 6210 1400
F: (03) 6223 1299

**Launceston**
Level 4
113 Cimitiere Street
PO Box 1409
Launceston TAS 7250
T: (03) 6323 1900
F: (03) 6334 4651

**Melbourne**
Level 1, HWT Tower
40 City Road
Southbank VIC 3006
PO Box 259
South Melbourne VIC 3205
T: (03) 9682 5290
F: (03) 9682 5292

**Newcastle**
Level 1
81 Hunter Street
Newcastle NSW 2300
T: (02) 4910 3600

**Sydney**
Suite 902, Level 9,
1-5 Railway Street
Chatswood NSW 2067
PO Box 5487
West Chatswood NSW 1515
T: (02) 9468 9300

**E:** info@pittsh.com.au
**W:** www.pittsh.com.au

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Pitt & Sherry (Operations) Pty Ltd
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**Planning Services**
**Resource Assessments**
Contact: Rose-Anne Hawkeswood
Phone: (02) 9274 6324
Email: rose-anne.hawkeswood@planning.nsw.gov.au

Mr Robert Ibrahim
Photon Energy Engineering Australia Pty Ltd
204/55 Grafton Street
Bondi Junction NSW 2022

Dear Mr Ibrahim

**Suntop Solar (SSD 8696)**
**Environmental Assessment Requirements**

I have attached the Environmental Assessment Requirements for the preparation of an Environmental Impact Statement (EIS) for the Suntop Solar Farm.

The requirements are based on the information you have provided to date, and have been prepared in consultation with the relevant government agencies. The agencies comments are attached for your information (see Attachment 2).

Please note that the Department may alter these requirements at any time, and that you must consult further with the Department if you do not lodge a development application and EIS for the project within the next two years.

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will also require approval under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

This approval is in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Department of the Environment in Canberra (6274 1111 or www.environment.gov.au).

Please contact the Department at least two weeks before you plan to submit the development application and EIS for the project. This will enable the Department to:

- confirm the applicable fee (see Division 1AA, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- determine the required number of copies of the EIS.

It is important for you to recognise that the Department will review the EIS for the project before putting it on public exhibition. If it fails to adequately address these requirements, you will be required to submit an amended EIS.

Yours sincerely

21/9/17

Clay Preshaw
**Director**
**Resource & Energy Assessments**
as nominee of the Secretary

# Environmental Assessment Requirements

## State Significant Development

**Section 78A(8A) of the *Environmental Planning and Assessment Act 1979***

| | |
|---|---|
| **Application Number** | SSD 8696 |
| **Proposal** | Suntop Solar Project which includes:<br>• the construction and operation of a photovoltaic (PV) generation facility with an estimated capacity of 220 MW; and<br>• associated infrastructure, including a grid connection |
| **Location** | 909 Suntop Road, Suntop |
| **Applicant** | Photon Energy Pty Ltd |
| **Date of Issue** | 21 September 2017 |
| **General Requirements** | The Environmental Impact Statement (EIS) for the development must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.*<br><br>In particular, the EIS must include:<br>• a stand-alone executive summary;<br>• a full description of the development, including:<br>– details of construction, operation and decommissioning;<br>– 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);<br>– a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development;<br>• a strategic justification of the development focusing on site selection and the suitability of the proposed site;<br>• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including:<br>– a description of the existing environment likely to be affected by the development;<br>– an assessment of the likely impacts of all stages of the development (which is commensurate with the level of impact), including any cumulative impacts, taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice;<br>– 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<br>– a description of the measures that would be implemented to monitor and report on the environmental performance of the development;<br>• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and<br>• the reasons why the development should be approved having regard to:<br>– 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;<br>– the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and<br>– feasible alternatives to the development (and its key components), including the consequences of not carrying out the development. |

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| | While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development.<br><br>In addition to the matters set out in Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*, the development application must be accompanied by:<br>• 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 2000*), including details of all the assumptions and components from which the capital investment value calculation is derived; and<br>• 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)*. |
| **Specific Issues** | The EIS must address the following specific issues:<br><br>**Biodiversity –** including an assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with the *Biodiversity Conservation Act 2016* (NSW), a detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the project over time, and a strategy to offset any residual impacts of the project in accordance with the *Biodiversity Conservation Act 2016* (NSW);<br><br>• **Heritage** – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including adequate consultation with the local Aboriginal community;<br><br>• **Land** – including an assessment of the impact of the development on agricultural land (including an investigation of the potential for dryland salinity), flood prone land and the karst landscape, 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;<br><br>• **Visual** – including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners;<br><br>• **Noise** – including 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;<br><br>• **Transport** – including an assessment of the site access route (Suntop Road, Renshaw McGirr Way and Mitchell Highway), site access points, and likely transport impacts (including peak and average traffic generation) of the development on the capacity and condition of roads (including on any Crown land), a description of the measures that would be implemented to mitigate any impacts during construction, and a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required);<br><br>• **Water** – including:<br>– an assessment of the likely impacts of the development (including flooding) on surface water (including the unnamed stream crossing the |

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| | site) and groundwater resources, wetlands, riparian land, groundwater dependent ecosystems, aquatic ecology, and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts;<br>– details of water requirements and supply arrangements; and<br>– 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); and<br><br>• **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.* |
| **Consultation** | During the preparation of the EIS, you should consult 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.<br><br>In particular, you must undertake detailed consultation with affected landowners surrounding the development and Dubbo Regional Council.<br><br>The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS. |
| **Further consultation after 2 years** | If you do not lodge a development application and EIS for the development within 2 years of the issue date of these EARs, you must consult further with the Secretary in relation to the preparation of the EIS. |

**ATTACHMENT 1**

# Environmental Planning Instruments, Policies, Guidelines & Plans

| | |
|---|---|
| **Biodiversity** | |
| | Biodiversity Assessment Method (OEH) |
| | Threatened Species Assessment Guidelines - Assessment of Significance (OEH) |
| | Biosecurity Act 2015 |
| | Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI) |
| | Policy and Guidelines for Fish Habitat Conservation and Management (DPI) |
| **Heritage** | |
| | Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH) |
| | Code of Practice for Archaeological Investigations of Objects in NSW (OEH) |
| | Guide to investigating, assessing and reporting on aboriginal cultural heritage in NSW (OEH). |
| | NSW Heritage Manual (OEH) |
| **Land** | |
| | Primefact 1063: Infrastructure proposals on rural land (DPI) |
| | Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry (ARENA) |
| | Local Land Services Act 2013 |
| | Australian Soil and Land Survey Handbook (CSIRO) |
| | Guidelines for Surveying Soil and Land Resources (CSIRO) |
| | The land and soil capability assessment scheme: second approximation (OEH) |
| **Noise** | |
| | NSW Industrial Noise Policy (EPA) |
| | Interim Construction Noise Guideline (EPA) |
| | NSW Road Noise Policy (EPA) |
| **Lighting** | |
| | Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring (DPE) |
| **Transport** | |
| | Guide to Traffic Generating Developments (RTA) |
| | Road Design Guide (RMS) & relevant Austroads Standards |
| | Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development |
| **Water** | |
| | Managing Urban Stormwater: Soils & Construction (Landcom) |
| | Floodplain Development Manual (OEH) |
| | Guidelines for Controlled Activities on Waterfront Land (DPI Water) |
| | Water Sharing Plans (DPI Water) |
| | Floodplain Management Plan (DPI Water) |
| | Guidelines for Watercourse Crossings on Waterfront Land (DPI Water) |
| **Waste** | |
| | Waste Classification Guidelines (EPA) |
| **Electromagnetic Interference** | |
| | ICNIRP Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields |
| **Environmental Planning Instruments** | |
| | State Environmental Planning Policy (State and Regional Development) 2011 |

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| State Environmental Planning Policy (Infrastructure) 2007 |
| State Environmental Planning Policy (Rural Lands) 2008 |
| State Environmental Planning Policy No. 44 – Koala Habitat Protection |
| State Environmental Planning Policy No. 55 – Remediation of Land |
| Wellington Local Environmental Plan 2012 |

Parcel 44877
dtq:D

Your ref: SSD 8696

20 September 2017

DUBBO REGIONAL COUNCIL

Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Dear Ms Hawkeswood

**RE: State Significant Development 8696**
**Lots 1, 2 & 3 DP 506925, Lot 122 DP 753238 & Lot 90 DP 657805,**
**No.909 Suntop Road, Suntop**

I refer to the Department's email dated 30 August 2017, inviting comments on the Preliminary Environmental Assessment (PEA) prepared by Pitt & Sherry for the proposed solar farm located at the abovementioned property.

The following comments are provided to assist in the preparation of the SEARs:

- The Department's email and the Environmental Assessment Requirements (EAR) state that the proposal has an estimated capacity of 220MW, when the PEA states 260MW.

- The EAR has the address of the property as 909 Suntop Toad, obviously a typing error. A legal description perhaps should refer to the various lots and deposited plans.

- The EAR refers to consultation with Upper Lachlan Shire Council. This shall be corrected to read - Dubbo Regional Council.

- Attachment 1 – Environmental Planning Instruments, doesn't reference the Environmental Planning and Assessment (EP&A) Act, 1979, the Environmental Planning and Assessment (EP&A) Regulation, 2000 or Wellington Local Environmental Plan (WLEP) 2012.

- The PEA and the Department's email continually refers to the site being 20 km from Wellington. This is true via road, but really about 10km straight line.

- The PEA refers to Wellington LGA (2.1). This shall be corrected to read - Dubbo Regional Council LGA.

All communications to: **THE GENERAL MANAGER**
**ABN 53 539 070 928**
PO Box 81 Dubbo NSW 2830
**T** (02) 6801 4000 **F** (02) 6801 4259 **E** council@dubbo.nsw.gov.au
Civic Administration Building Church St Dubbo NSW 2830
**W** dubbo.nsw.gov.au

evocities
REGIONAL CITY LIVING

- The PEA (Figure 2-2) shows a watercourse through the site and section 2.2 identifies that development *"… will avoid the existing surface water bodies on the site where possible including a buffer of 40m between infrastructure and any waterway."* As such, the proposal may be designated as per S91 Integrated Development, EP&A Act, 1979. The NSW Office of Water should be contacted to provide advice accordingly.

- The PEA makes constant reference to a layout plan (Appendix A), but no layout plan of the proposed/likely/indicative footprint of the proposed panels has been provided. Consequently, it is not known what proportion of the site will be taken-up with the proposed 787,892 PV panels, their set-backs from creek lines and existing overhead powerlines and easements.

  The absence of a layout/site plan also means that the provisions of access perimeter roads are not identified to permit servicing of the on-site infrastructure and security fencing.

  The Department may need to consider the legality of seeking stakeholder input into the preparation of the SEARs, without providing this crucial information, which may bring any approval into question and expose the Department and the applicant to subsequent appeals.

- The PEA in section 2.4.1 makes reference to the solar farm's construction in *"… 1ha stages – with up to 10 stages …".* Given recent issues regarding 'staged development' and S83 of the EP&A Act, this terminology needs to be clarified.

- The PEA in Table 2-2 Key Components of Proposal, refers to 2 x 40' shipping containers for storage and maintenance equipment. Council is not generally supportive of shipping containers, but further details regarding location, screening, footings, etc., may resolve such concerns.

- The PEA in section 2.4.7 relates to decommissioning of the site. While Council endorses the intention to decommission the site, the question arises as to how is this achieved, how is this enforced? Council may be unaware that a site is closing down and the site could be left in poor condition, especially for agricultural pursuits.

- The PEA in section 3.2 relates to alternative locations, but no details are provided.

- The PEA in section 5.1.4 WLEP 2012, states that the proposal *"… can be considered a sustainable primary industry that extracts renewal energy (a natural resource)".* A solar farm is not a 'primary industry'.

- The PEA in section 5.1.4 states that *"electricity generation is not listed among developments which are permitted with consent for the zone …".* It should be noted that WLEP 2012 doesn't list *electricity generating works* in the land use zones, as directed by a Department of Planning circular to all local councils, some years ago.

- The PEA fails to note that the site is deemed to be high-moderately high with regard to groundwater, as per WLEP 2012 clause 6.4 Groundwater vulnerability.

- The PEA in section 5.1.5 refers to the Threatened Species Conservation Act 1995 and the Native Vegetation Act 2003, both of which were recently repealed. Council is also unsure why SEPP 33 Hazardous and Offensive Development is listed.

- Whilst the subject property may not be mapped as being Bush Fire Prone Land, the land will still be at risk of bushfires by virtue of its existing grassland vegetation. As is evident in the NSW version of the Building Code of Australia and commentary in Planning for Bush Fire Protection 2006, bushfire hazard exposure is not reliant upon the mapping by the NSWRFS Commissioner.

  Consequently, bushfire exposure needs to be addressed. In this regard it is expected that a minimum 10m fire break would be provided around the perimeter of the development and appropriate water storage provided on-site for use by the NSW Rural Fire Service.

  It is expected that the setback requirements specified under clause 45 of the Infrastructure SEPP will be addressed and that the fire radiant heat exposure and explosion setbacks imposed by the NSW electrical utility operators will be addressed for the facility's substations.

- The Dark Skies Guidelines have not been addressed or mentioned in the submission despite the site being located within the Siding Spring Observatory's Dark Sky Region (ie. within 200 km of the observatory). This Dark Sky Region applies to State Significant Development and invokes clause 92 of the Environmental Planning and Assessment Regulation, 2000.

- The PEA makes no mention of State Environmental Planning Policy (Rural Lands) 2008. Whilst this proposal does not involve the subdivision of land or the erection of a dwelling on the subject RU1 land, it will remove prime agricultural land from production. Consequently, it would seem appropriate that any assessment should consider the proposed development in terms of the Aims and Planning Principles outlined under such SEPP, at least for the purposes of Section 79C of the Act.

- With regard to road infrastructure, Council would expect the Environmental Impact Statement (EIS) to address:
  - a breakdown of vehicles by type, specifying gross vehicle mass, vehicle length and expected daily volumes travelling to the site; and
  - the capacity of the construction phase to accommodate curfew periods of travel on Suntop Road by 'restricted access vehicles' to ensure traffic safety of school buses and the like.

- Given the proposal foreshadows up to 40 x B-Double movements per day during construction, a Dilapidation Report on Suntop Road shall be provided.

- The intersection of Suntop Road and Renshaw McGirr Way is very marginal for B-Double access. Given the numbers of movements proposed, this could trigger upgrading of the intersection.

- Travelling of these vehicles through the Curra Creek gorge on Renshaw McGirr Way will require some traffic safety related Safe Work Method Statement by Restricted Access Vehicle operators.

- A cursory inspection of the site revealed a ridge line about 500 metres south of Suntop Road. Ideally, the solar farm could be located on the southern side of the ridge line, which would effectively screen the entire enterprise from any passing traffic along Suntop Road. However, given no layout plan was provided, this remains unknown.

If you have any enquiries in this matter, please do not hesitate to contact Council's Statutory Planning Services Team Leader, Darryll Quigley, during normal office hours, on 6801 4000.

Yours faithfully

*Stephen Wallace*
Manager Building and Development Services

Department of Primary Industries

OUT17/35970

Ms Rose-Anne Hawkeswood
Senior Planning Officer | Resource Assessments
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Rose-Anne.Hawkeswood@planning.nsw.gov.au

Dear Ms Hawkeswood

**Suntop Solar Farm (7955)**
**Request for Secretary's Environmental Assessment Requirements**

I refer to your email of 29 August 2017 to the Department of Primary Industries (DPI) in respect to the above matter. Comment has been sought from relevant branches of DPI. Views were also sought from NSW Department of Industry - Lands that are now a division of the broader Department and no longer within NSW DPI.
Any further referrals to DPI can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

DPI has reviewed the Preliminary Environmental Assessment and draft SEARS and provides the following recommendations for matters to be addressed in the Environmental Impact Statement (EIS) for the proposal, with further detail at **Attachment A**.

**Land**

The SEARs should include a specific request for greater detail and exploration of:

- The potential at this site for dryland salinity outbreaks.
- Any potential impacts from the project to the nearby karst environment.
- The potential for the site to continue to be used for agricultural purposes during the operation of the solar farm.

Yours sincerely

Mitchell Isaacs
**Director, Planning Policy & Assessment Advice**
13 September 2017

*DPI appreciates your help to improve our advice to you. Please complete this three minute survey about the advice we have provided to you, here:*
https://goo.gl/o8TXWz

**Attachment A**

***Suntop Solar Farm (7955)***
**Request for Secretary's Environment Assessment Requirements**
**Detailed comments – DPI Agriculture**

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The SEARs supplied indicate that the impacts on the land, especially in relation to initial soil investigations and impacts regarding construction and use are included for assessment**.** However further considerations include:

1. The site is an area that has been subject to dryland salinity outbreaks, and a karst occurrence is also close by. It is an area that supports cropping and grazing so the agricultural value of the land should be confirmed through a soil survey which will also provide a basis for this and to be continued to be used for:

- an agricultural purpose during the operation of the solar farm, and
- its ability to be returned back to agricultural production at final rehabilitation on closure of this operation.
- Its management if impacting on the karst environment.

2. Attention to the need to develop Rehabilitation and Decommissioning/Closure Management Plans that outlines the rehabilitation objectives and strategies. This includes, but is not limited to:

- describing the design criteria of the final land use and landform
- indicators to guide the return of the land back to agricultural production.
- monitoring and mitigation measures to be adopted for rehabilitation remedial actions, and
- commitment to burying cables and pipes to a depth >500mm on any land with a cropping history or land with a capability for cropping to allow greater opportunity for agricultural activities to continue above the cables. This is a particular issue for the cables/pipes which will be left in situ once restoration is complete.

3. The current agricultural value of the site is quantified, and the anticipated use of the site during the operation of the solar farm is also assessed

**End Attachment A**

Planning & Environment
Resources & Geoscience

OUT17/37528

Rose-Anne Hawkeswood
Senior Planning Officer
Resource Assessments - Planning Services Division
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Rose-Anne.Hawkeswood@planning.nsw.gov.au

Dear Rose-Anne

**Suntop Solar Farm Project (SSD8696)**
**Request for Secretary's Environmental Assessment Requirements (SEARs)**

I refer to your email dated 30 August 2017 inviting the Division of Resources & Geoscience (the Division) to provide comments on the Suntop Solar Project (the Project) SEARs submitted by Photon Energy SPV 8 Pty Ltd (the Proponent).

The Division has reviewed the adequacy of information supplied relation to the abovementioned Project and provides the following advice:

With regard to the **Specific Issues;** Land requirements of the Draft SEARs, the proponent is required to:

- Identify on a locality or constraints map, the current Exploration Licence 8463 (Act 1992) (EL 8463) held by Lachlan Resources Pty Ltd (Lachlan Resources). The title must be shown in relation to the proposed solar farm project boundary, electricity transmission infrastructure and any biodiversity offset areas (refer Figure 1).

  Titles searches should be undertaken prior to finalisation of the Environmental Impact Statement (EIS), with the search date noted. Current mineral authorities and applications can be viewed at:

  http://www.resourcesandenergy.nsw.gov.au/miners-and-explorers/geoscience-information/services/online-services/minview

  http://www.resourcesandenergy.nsw.gov.au/landholders-and-community/common-ground

With regard to the **Consultation** requirements of the Draft SEARs, the proponent is required to:

- Consult with Lachlan Resources to establish if the proposal is likely to have a significant impact on current or future mineral exploration, including by limiting access to, or impeding assessment of, those resources, and any way the proposed development may be incompatible with any obligations of the titleholder under the *Mining Act 1992* and associated regulations.

This should include a letter of notification of the proposal to the title holder, and a letter of response from the title holder to the proponent, addressing the above considerations, and documented in full in the EIS. To assist the proponent, the Division provides the following contact details:

Lachlan Resources Pty Ltd
PO Box 1573
WEST PERTH WA 6872

Should biodiversity offsets be considered for the project, the Division requires consultation with the Geological Survey of NSW to ensure there are no potential sterilisation impacts to resources.

Should you have any enquires regarding this matter please contact:
Adam Banister, Acting Senior Advisory Officer, Royalties & Advisory Services at (02) 4931 6439 or adam.banister@industry.nsw.gov.au.

Yours sincerely



Zane West
**Manager Royalties & Advisory Services**
13 September 2017

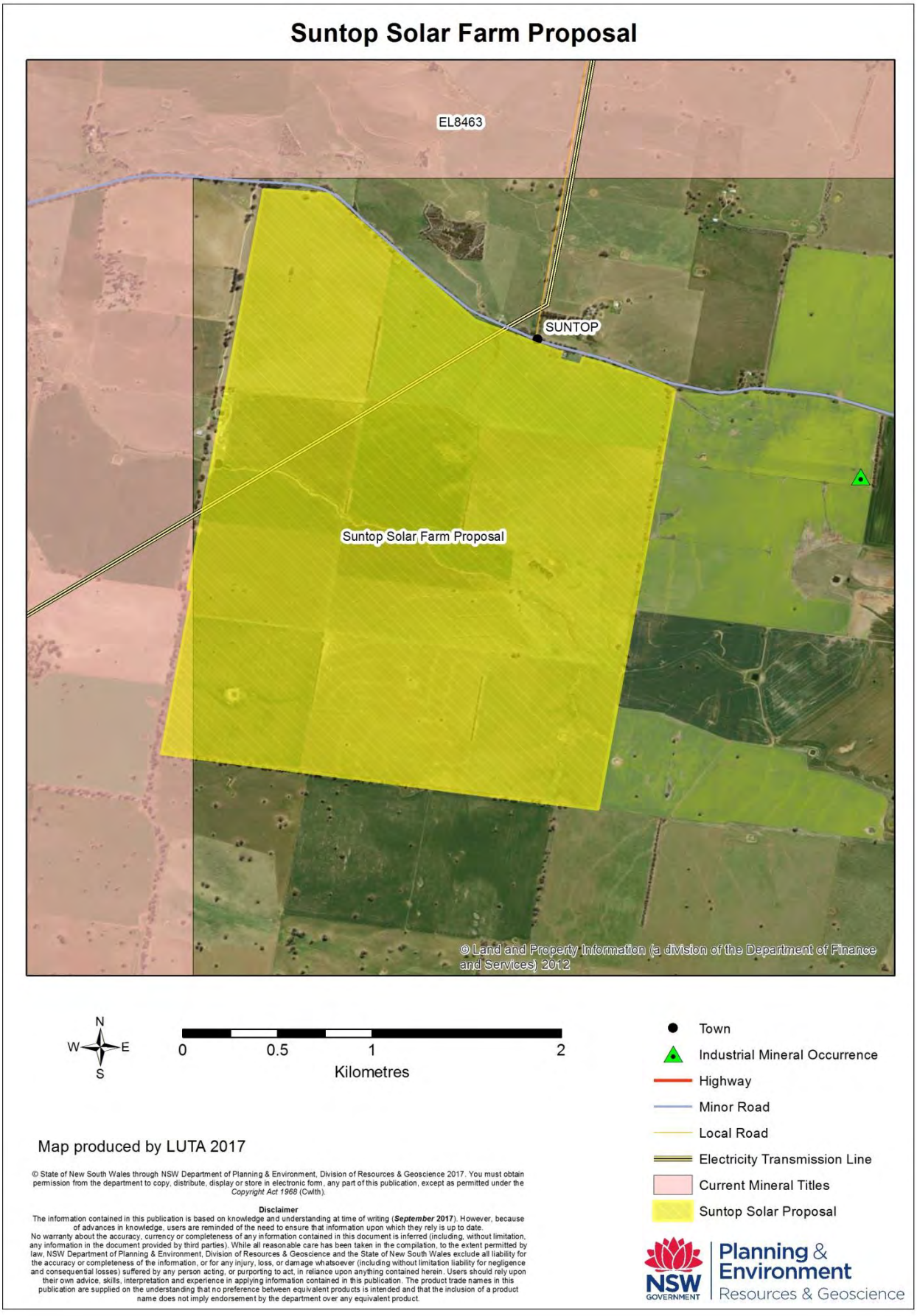



**Figure 1: Suntop Solar Farm Proposal**

DOC17/466435
SSD 8696

Ms Rose-Anne Hawkeswood
Senior Planning Officer
Resource Assessments
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Dear Ms Hawkeswood

**Suntop Solar Farm – SSD 8696**

I refer to your email dated 30 August 2017 seeking input into the Department of Planning and Environment Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an Environmental Impact Assessment (EIS) for the Suntop Solar Farm (SSD 8696).

OEH has considered your request and provides SEARs for the proposed development in **Attachments A** and **B**.

OEH recommends the EIS needs to appropriately address the following:

1. Biodiversity and offsetting
2. Aboriginal cultural heritage
3. Historic heritage
4. Water and soils
5. Flooding

Please note that for projects **not** defined as pending or interim planning applications under Part 7 of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* the Biodiversity Assessment Method (BAM) **must** be used to assess impacts to biodiversity in accordance with the *Biodiversity Conservation Act 2016* (BC Act). For this project the BAM **must** be used.

If you have any questions regarding this matter further please contact Michelle Howarth on 02 6883 5339 or email michelle.howarth@environment.nsw.gov.au .

Yours sincerely

**PETER CHRISTIE**
**Director North West**
**Regional Operations Division**

PO Box 2111 Dubbo NSW 2830
Level 1, 48-52 Wingewarra Street Dubbo NSW 2830
Tel: (02) 6883 5330 Fax: (02) 6884 8675
ABN 30 841 387 271
www.environment.nsw.gov.au

18 September 2017

Contact officer: MICHELLE HOWARTH
6883 5339

Attachment A - Environmental Assessment Requirements

Attachment B - Guidance Material

**ATTACHMENT A**

# Standard Environmental Assessment Requirements
# Suntop Solar Farm (SSD 8696)

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| **Biodiversity** |
| 1. Biodiversity impacts related to the proposed Suntop Solar Farm are to be assessed in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s 6.12), Biodiversity Conservation Regulation 2017 (s 6.8) and Biodiversity Assessment Method including details of the measures proposed to address the offset obligation as follows;<br>• The total number and classes of biodiversity credits required to be retired for the development/project;<br>• The number and classes of like-for-like biodiversity credits proposed to be retired;<br>• The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules;<br>• Any proposal to fund a biodiversity conservation action;<br>• Any proposal to conduct ecological rehabilitation (if a mining project);<br>• Any proposal to make a payment to the Biodiversity Conservation Fund (Fund).<br>If requesting the application of the variation rules, the BDAR must contain details of what reasonable steps have been taken to attempt to obtain the required like-for-like biodiversity credits.<br>The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under S6.10 of the Biodiversity Conservation Act 2016 |
| **Aboriginal cultural heritage** |
| 2. The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the Suntop Solar Farm project and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW, 2011) and consultation with OEH regional officers. |
| 3. Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS. |
| 4. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH. |
| **Historic heritage** |
| 5. The EIS must provide a heritage assessment including but not limited to an assessment of impacts to *State and local heritage* including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be |

assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall:

a. outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996),
b. be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria),
c. include a statement of heritage impact for all heritage items (including significance assessment),
d. consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and
e. where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.

**Water and soils**

6. The EIS must map the following features relevant to water and soils including:
   a. Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).
   b. Rivers, streams, wetlands, estuaries (as described in s4.1 of the Biodiversity Assessment Method).
   c. Wetlands as described in s4.1 of the Biodiversity Assessment Method
   d. Groundwater.
   e. Groundwater dependent ecosystems.
   f. Proposed intake and discharge locations.

7. The EIS must describe background conditions for any water resource likely to be affected by the Suntop Solar Farm project, including:
   a. Existing surface and groundwater.
   b. Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations.
   c. Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters.
   d. Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government.

8. The EIS must assess the impacts of the project on water quality, including:
   a. The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the project protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the

mitigating effects of proposed stormwater and wastewater management during and after construction.

b. Identification of proposed monitoring of water quality.

9. The EIS must assess the impact of the project on hydrology, including:

a. Water balance including quantity, quality and source.

b. Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas.

c. Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems.

d. Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (eg river benches).

e. Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water.

f. Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options.

g. Identification of proposed monitoring of hydrological attributes.

**Flooding and coastal erosion**

10. The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:

a. Flood prone land

b. Flood planning area, the area below the flood planning level.

c. Hydraulic categorisation (floodways and flood storage areas).

11. The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 1 in 10 year, 1 in 100 year flood levels and the probable maximum flood, or an equivalent extreme event.

12. The EIS must model the effect of the proposed project (including fill) on the flood behaviour under the following scenarios:

a. Current flood behaviour for a range of design events as identified in 11 above. This includes the 1 in 200 and 1 in 500 year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.

13. Modelling in the EIS must consider and document:

a. The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood.

b. Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories.

c. Relevant provisions of the NSW Floodplain Development Manual 2005.

14. The EIS must assess the impacts on the proposed project on flood behaviour, including:

a. Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.

b. Consistency with Council floodplain risk management plans.

c. Compatibility with the flood hazard of the land.

d. Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.
e. Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
f. Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
g. Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.
h. Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.
i. Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES.
j. Any impacts the development may have on the social and economic costs to the community as consequence of flooding.

**ATTACHMENT B**

# Guidance Material

| Title | Web address |
|---|---|
| **Relevant Legislation** | |
| *Biodiversity Conservation Act 2016* | https://www.legislation.nsw.gov.au/#/view/act/2016/63/full |
| *Coastal Management Act 2016* | https://www.legislation.nsw.gov.au/#/view/act/2016/20/full |
| *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* | http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/ |
| *Environmental Planning and Assessment Act 1979* | http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N |
| *Fisheries Management Act 1994* | http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N |
| *Marine Parks Act 1997* | http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N |
| *National Parks and Wildlife Act 1974* | http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N |
| *Protection of the Environment Operations Act 1997* | http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N |
| | |
| *Water Management Act 2000* | http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N |
| *Wilderness Act 1987* | http://www.legislation.nsw.gov.au/viewtop/inforce/act+196+1987+FIRST+0+N |
| **Biodiversity** | |
| Biodiversity Assessment Method (OEH, 2017) | https://biodiversity-ss.s3.amazonaws.com/Uploads/1494298079/Biodiversity-Assessment-Method-May-2017.pdf |
| Guidance and Criteria to assist a decision maker to determine a serious and irreversible impact (OEH, 2017) | https://biodiversity-ss.s3.amazonaws.com/Uploads/1494298198/Serious-and-Irreversible-Impact-Guidance.PDF |
| Fisheries NSW policies and guidelines | http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals/fish-habitat-conservation |
| List of national parks | http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx |
| Revocation, recategorisation and road adjustment policy (OEH, 2012) | http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm |
| Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECCW, 2010) | http://www.environment.nsw.gov.au/protectedareas/developmntadjoiningdecc.htm |
| **Heritage** | |
| The Burra Charter (The Australia ICOMOS charter for places of cultural significance) | http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf |
| Statements of Heritage Impact 2002 (HO & DUAP) | http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf |

| Title | Web address |
|---|---|
| NSW Heritage Manual (DUAP) (scroll through alphabetical list to 'N') | http://www.environment.nsw.gov.au/Heritage/publications/ |
| **Aboriginal Cultural Heritage** | |
| Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010) | http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf |
| Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010) | http://www.environment.nsw.gov.au/resources/cultureheritage/10783FinalArchCoP.pdf |
| Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) | http://www.environment.nsw.gov.au/resources/cultureheritage/20110263ACHguide.pdf |
| Aboriginal Site Recording Form | http://www.environment.nsw.gov.au/resources/parks/SiteCardMainV1_1.pdf |
| Aboriginal Site Impact Recording Form | http://www.environment.nsw.gov.au/resources/cultureheritage/120558asirf.pdf |
| Aboriginal Heritage Information Management System (AHIMS) Registrar | http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm |
| Care Agreement Application form | http://www.environment.nsw.gov.au/resources/cultureheritage/20110914TransferObject.pdf |
| **Water and Soils** | |
| **Acid sulphate soils** | |
| Acid Sulfate Soils Planning Maps via Data.NSW | http://data.nsw.gov.au/data/ |
| Acid Sulfate Soils Manual (Stone et al. 1998) | http://www.environment.nsw.gov.au/resources/epa/Acid-Sulfate-Manual-1998.pdf |
| Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004) | http://www.environment.nsw.gov.au/resources/soils/acid-sulfate-soils-laboratory-methods-guidelines.pdf<br>This replaces Chapter 4 of the Acid Sulfate Soils Manual above. |
| **Flooding and Coastal Erosion** | |
| Reforms to coastal erosion management | http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm |
| Floodplain development manual | http://www.environment.nsw.gov.au/floodplains/manual.htm |
| Guidelines for Preparing Coastal Zone Management Plans | Guidelines for Preparing Coastal Zone Management Plans<br>http://www.environment.nsw.gov.au/resources/coasts/130224CZMPGuide.pdf |
| NSW Climate Impact Profile | http://climatechange.environment.nsw.gov.au/ |
| Climate Change Impacts and Risk Management | Climate Change Impacts and Risk Management: A Guide for Business and Government, AGIC Guidelines for Climate Change Adaptation |
| **Water** | |
| Water Quality Objectives | http://www.environment.nsw.gov.au/ieo/index.htm |
| ANZECC (2000) Guidelines for Fresh and Marine Water Quality | www.environment.gov.au/water/publications/quality/australian-and-new-zealand-guidelines-fresh-marine-water-quality-volume-1 |

| Title | Web address |
|---|---|
| Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones | http://deccnet/water/resources/AWQGuidance7.pdf |
| Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004) | http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf |

# NSW RURAL FIRE SERVICE

Secretary
Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Your reference: SSD 8696
Our reference: D17/2992

05/09/2017

**Attention:** Rose-Anne Hawkeswood

Dear Sir/Madam,

**Suntop Solar Farm – 909 Suntop Road Suntop**

Reference is made to correspondence dated 30 August 2017 seeking input regarding the preparation of Secretary's environmental assessment requirements for the above State Significant Development in accordance with the *Environmental Planning and Assessment Act 1979.*

The New South Wales Rural Fire Service (NSW RFS) has reviewed the information provides the following conditions;

- A 10 metre trafficable defendable space shall surround the solar farm infrastructure.

If you have any queries regarding this advice, please contact Matthew Apps, Development Assessment and Planning Officer, on 1300 NSW RFS.

Yours sincerely,

Nika Fomin
Manager, Planning and Environment Services (East)

**Postal address**
NSW Rural Fire Service
Records Management
Locked Bag 17
GRANVILLE NSW 2141

**Street address**
NSW Rural Fire Service
Planning and Environment Services (East)
42 Lamb Street
GLENDENNING NSW 2761

T 1300 NSW RFS
F (02) 8741 5433
E pes@rfs.nsw.gov.au
www.rfs.nsw.gov.au

Transport
Roads & Maritime
Services

5 September 2017

SF2017/201122; WST17/00132

Manager
Resource Assessments
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

**Attention: Ms Rose-Anne Hawkeswood**

Dear Ms Hawkeswood,

**SSD 8696: Lots 1, 2 and 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805**
**Suntop Road, Suntop; Suntop Solar Farm**
**Request for Secretary's Environmental Assessment Requirements (SEARs)**

Thank you for your email on 30 August 2017 seeking SEARs from Roads and Maritime Services for the Suntop Solar Farm proposal. Roads and Maritime notes the proposal is for construction and operation of a 220 megawatt solar farm on land south-west of Wellington with frontage to Suntop Road.

The preliminary information submitted in support of the proposed development has been reviewed. Roads and Maritime requests that the following issues be addressed in the Environmental Assessment:

- A traffic impact study prepared in accordance with the methodology set out in Section 2 of the RTA's *Guide to Traffic Generating Developments 2002* and including:
  - Hours and days of construction.
  - Schedule for phasing/staging of the project.
  - Traffic volumes:
    - Existing background traffic.
    - Project-related for each stage of the project including construction, operation and decommissioning.
    - Projected cumulative traffic volumes.

- Traffic volumes are to also include a description of:
  - Ratio of light vehicles to heavy vehicles.
  - Peak times for existing traffic.
  - Peak times for project-related traffic.
  - Transportation hours.
  - Project related traffic interaction with existing and projected background traffic.
- The origin, destination and routes for:
  - Employee and contractor light traffic.
  - Heavy traffic.
  - Over size and over mass traffic.

- A description of all oversize and over mass vehicles and the materials to be transported.
- The impact of traffic generation on the public road network and measures employed to ensure traffic efficiency and road safety during construction, operation and decommissioning of the project.
- The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and to mitigate the impact of project-related traffic.
- Local climate conditions that may affect road safety for vehicles used during construction, operation and decommissioning of the project (eg fog, wet and dry weather).
- Proposed road facilities, access and intersection treatments are to be identified and be in accordance with *Austroads Guide to Road Design 2010* including Safe Intersection Sight Distance (SISD). In particular SISD needs to be provided at the intersection of Suntop Road and Renshaw McGirr Way (MR233).
- The layout of the internal road network, parking facilities and infrastructure within the project boundary.
- A Traffic Management Plan (TMP) developed in consultation with Dubbo Regional Council and Roads and Maritime. The TMP is to identify and provide management strategies to manage the impacts of projected related traffic including:
  - Haulage of materials to site.
  - Transportation of construction workers from accommodation facilities to site and return.

Roads and Maritime appreciates the opportunity to contribute to the SEARs and requests that a copy of the SEARs be forwarded to Roads and Maritime at the same time they are sent to the applicant.

Should you require further information please contact me on 02 6861 1453.

Yours faithfully



Andrew McIntyre
Manager Land Use Assessment
Western

| Assessment Requirements | Reference in EIS |
|---|---|
| Department of Planning and Environment: Environmental Assessment Requirements<br>*Section 78A (8) of the Environmental Planning and Assessment Act 1979* | |
| Must comply with the requirements in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* | EIS Chapter 4 Section 4.3.2 |
| DEPARTMENT OF PLANNING AND ENVIRONMENT | |
| A stand-alone executive summary | EIS Section v |
| A full description of the development, including:<br>• Details of construction, operation and decommissioning<br>• 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)<br>• A detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development | EIS Chapter 3<br>Section 3.3.2 – 3.3.4<br><br>Figure 3-9<br><br>Figure 1-4 |
| Strategic justification of the development focusing on site selection and the suitability of the proposed site | EIS Chapter 2 Section 2.4<br>EIS Chapter 9 Section 9.1 |
| Environment Impact Assessment – General Requirements | |
| A description of the existing environment likely to be affected by the development | EIS Chapter 3 Section 3.1 – 3.2 |
| 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 | EIS Chapter 6 Section 6.1 – 6.13 |
| 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 | EIS Chapter 6 Section 6.1 – 6.13<br>EIS Chapter 8 Section 8.1<br>Appendices C - J |
| A description of the measures that would be implemented to monitor and report on the environmental performance of the development | EIS Chapter 6 Section 6.1 – 6.13<br>Appendices C - J |
| A consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS | EIS Chapter 8 Section 8.1 |
| Proposal Justification | |
| Why the development should be approved having regard to:<br>• 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. | EIS Chapter 2<br>EIS Chapter 9<br>Section 9.1 – 9.3 |

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| The suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses | EIS Chapter 2 Section 2.4<br>EIS Chapter 6 Section 6.6 |
| Feasible alternatives to the development (and its key components), including the consequences of not carrying out the development. | EIS Chapter 2 Section 2.4 |
| In addition to *Schedule 1 of the Environmental Planning and Assessment Regulation 2000* | |
| 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 2000), including details of all the assumptions and components from which the capital investment value calculation is derived | Provided Separately |
| 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 |
| Specific Issues - Biodiversity | |
| An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with the *Biodiversity Conservation Act 2016* (NSW) | EIS Chapter 6 Section 6.1<br><br>Appendix D |
| A detailed description of the proposed regime for minimising, managing and reporting on the biodiversity impacts of the project over time | EIS Chapter 6 Section 6.1.3 - 6.1.4<br><br>Appendix D |
| A strategy to offset any residual impacts of the project in accordance with the *Biodiversity Conservation Act 2016* (NSW) | EIS Chapter 6 Section 6.1.4<br><br>Appendix D |
| Specific Issues – Heritage | |
| Assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development | EIS Chapter 6 Section 6.2.1 |
| Including adequate consultation with the local Aboriginal community | Appendix E<br>EIS Chapter 5 Section 5.5 |
| Specific Issues – Land | |
| An assessment of the impact of the development on:<br>• Agricultural land (including an investigation of the potential for dryland salinity)<br>• Flood prone land<br>• Karst landscape | EIS Chapter 6 Section 6.6<br>Appendix J<br><br>Not applicable<br><br>EIS Chapter 6 Section 6.8 |
| A soil survey to consider the potential for erosion to occur | EIS Chapter 6 Section 6.8.2<br>Appendix K |
| Pay particular attention to the compatibility of the development with the existing land uses on the site and adjacent land including:<br>• Operating mines<br>• Extractive industries<br>• Mineral or petroleum resources<br>• Exploration activities | EIS Chapter 6 Section 6.6<br>EIS Chapter 7 |

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| • Aerial spraying<br>• Dust generation<br>• Risk of weed and pest infestation<br>during operation and after decommissioning, with reference to the zoning provisions applying to the land. | |
| Specific Issues - 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 | EIS Chapter 6 Section 6.3<br>Appendix C |
| Include a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners | Appendix C<br>EIS Chapter 5 Section 5.7 |
| Specific Issues - 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) | EIS Chapter 6 Section 6.4<br>Appendix I |
| Include a draft noise management plan **if** the assessment shows construction noise is likely to exceed applicable criteria. | EIS Chapter 6 Section 6.4<br>Appendix I |
| Specific Issues - Transport | |
| An assessment of the site access route (Suntop Road, Renshaw McGirr Way and Mitchell Highway), site access points, and likely transport impacts (including peak and average traffic generation) of the development on the capacity and condition of roads (including on any Crown land). | EIS Chapter 6 Section 6.5<br>Appendix H |
| Description of the measures that would be implemented to mitigate any impacts during construction, and a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required) | EIS Chapter 6 Section 6.5<br>EIS Chapter 5 Section 5.3<br>Appendix H |
| Specific Issues - Water | |
| An assessment of the likely impacts of the development (including flooding) on surface water (including the unnamed stream crossing the site) and groundwater resources, wetlands, riparian land, groundwater dependent ecosystems, aquatic ecology, and acid sulfate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts. | EIS Chapter 6 Section 6.7 |
| Details of water requirements and supply arrangements | EIS Chapter 6 Section 6.7<br>Table 6-27 |
| 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) | EIS Chapter 6 Section 6.8.4 |
| Specific Issues – 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. | EIS Chapter 6 Section 6.10<br>EIS Chapter 6 Section 6.9<br><br>Appendix F |
| Consultation Requirements | |

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| Consult 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 | EIS Chapter 5 Section 5.1 – 5.7<br><br>Appendix G |
| Must undertake detailed consultation with affected landowners surrounding the development and Dubbo Regional Council. | EIS Chapter 5 Section 5.4<br>EIS Chapter 5 Section 5.7<br>Appendix G |
| Describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS. | EIS Chapter 5 Section 5.1 – 5.11<br>Appendix G |
| OFFICE OF ENVIRONMENT AND HERITAGE | |
| The Biodiversity Assessment Method (BAM) must be used by proponent to assess all biodiversity values on the development site, in accordance with the Biodiversity Conservation Act 2016 (BC Act) | EIS Chapter 6 Section 6.1.1 |
| Biodiversity | |
| The Proponent must assess biodiversity impacts in accordance with the current guidelines including the Biodiversity Assessment Method (BAM), and documented in a Biodiversity Development Assessment Report (BDAR). | EIS Chapter 6 Section 6.1<br>Appendix D |
| The BDAR must include the following:<br>• The total number and classes of biodiversity credits required to be retired for the development/project<br>• The number and classes of like-for-like biodiversity credits proposed to be retired<br>• The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules<br>• Any proposal to fund a biodiversity conservation action<br>• Any proposal to conduct ecological rehabilitation (if a mining project)<br>• Any proposal to make a payment to the Biodiversity Conservation Fund (Fund) | Appendix D |
| If requesting the application of the variation rules, the BDAR must contain details of what reasonable steps have been taken to attempt to obtain the required like-for-like biodiversity credits | Not Applicable |
| The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for Application of the Biodiversity Assessment Method Order 2017 under S6.10 of the Biodiversity Conservation Act 2016 | Appendix D |
| Aboriginal and Cultural Heritage | |
| The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in the EIS. This may include the need for surface survey and test excavation. | EIS Chapter 6 Section 6.2.1<br>Appendix E |
| Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW)* | EIS Chapter 5 Section 5.5<br>Appendix E |
| The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS | EIS Chapter 6 Section 6.2.1<br>Appendix E |
| Any impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. | EIS Chapter 6 Section 6.2.1<br>Appendix E |

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| The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures propose to mitigate impacts. | EIS Chapter 6 Section 6.2.1.4<br>Appendix E |
| Any objects recorded as part of the assessment must be documented and notified to OEH | EIS Chapter 6 Section 6.2.1<br>Appendix E |
| Historic Heritage | |
| Provide a heritage assessment including but not limited to an assessment of impacts to State and local heritage including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. | EIS Chapter 6 Section 6.2.1<br>EIS Chapter 6 Section 6.2.2<br>Appendix E |
| Where impacts to State or locally significant heritage items are identified, the assessment shall:<br>• Outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures).<br>• Be undertaken by a suitably qualified heritage consultant | EIS Chapter 6 Section 6.2.1<br>EIS Chapter 6 Section 6.2.2 |
| Include a statement of heritage impact for all heritage items. | EIS Chapter 6 Section 6.2.2.3 |
| Consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant) | EIS Chapter 6 Section 6.2.2<br>Appendix E |
| Where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations. | EIS Chapter 6 Section 6.2.2 |
| Water and Soils | |
| The EIS must describe and map the existing hydrological regime for any surface and groundwater resources including:<br>a. Rivers, streams, wetlands, estuaries<br>b. Acid sulfate soils<br>c. Groundwater and groundwater dependent ecosystems<br>d. Proposed intake and discharge locations | EIS Chapter 1 Section 1.3<br>EIS Chapter 6 Section 6.7<br>EIS Chapter 6 Section 6.8<br><br>Figure 6-30 |
| The EIS must describe background conditions for any water resource likely to be affected by the development, including:<br>• Existing surface and groundwater<br>• Hydrology including volume, frequency and quality of discharges at proposed intake & discharge locations<br>• Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters<br>• Water quality indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the *ANZECC (2000) Guidelines for Fresh and Marine Water Quality* | EIS Chapter 6 Section 6.7 |

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| The EIS must assess the impacts of the development on water quality, including:<br>• The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction | EIS Chapter 6 Section 6.7 |
| Identification of proposed monitoring of water quality | EIS Chapter 6 Section 6.7 |
| The EIS must assess the impact of the development on hydrology, including:<br>• Water balance (quantity, quality and source)<br>• Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas<br>• Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems<br>• Impacts to natural process and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow aquatic connectivity and access to habitat for spawning and refuge.<br>• Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water. | EIS Chapter 6 Section 6.7 |
| • Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options.<br>• Identification of proposed monitoring of hydrological attributes. | EIS Chapter 6 Section 6.7 |
| Flooding and Coastal Erosion | |
| The EIS must **map** the following features:<br>• Flood prone land.<br>• Flood planning area, the area below the flood planning level.<br>• Hydraulic categorisation (floodways and flood storage areas). | **Not Applicable** – Correspondence with OEH provided in:<br>EIS Chapter 5 Section 5.3<br>Appendix G |
| The EIS must describe flood assessment and modelling undertaken flood levels for events, including a minimum of the 1 in 10 year, probable maximum flood, or an equivalent extreme event. | **Not Applicable** – Correspondence with OEH provided in:<br>EIS Chapter 5 Section 5.3<br>Appendix G |
| The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:<br>• Current flood behaviour for a range of design events including the 1 in 200 and 1 in 500 year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to **climate change**. | **Not Applicable** – Correspondence with OEH provided in:<br>EIS Chapter 5 Section 5.3<br>Appendix G |
| Modelling in the EIS must consider and document: | **Not Applicable** – Correspondence with OEH provided in: |

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|---|---|
| • The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood.<br>• Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories<br>• Relevant provisions of the NSW Floodplain Development Manual 2005 | EIS Chapter 5 Section 5.3<br>Appendix G |
| The EIS must assess the impacts on the proposed development on flood behaviour, including:<br>• Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.<br>• Consistency with Council floodplain risk management plans.<br>• Compatibility with the flood hazard of the land.<br>• Compatibility with the hydraulic functions of flow conveyance in flood-ways and storage in flood storage areas of the land.<br>• Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.<br>• Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses. | **Not Applicable** – Correspondence with OEH provided in:<br>EIS Chapter 5 Section 5.3<br>Appendix G |
| Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council. | **Not Applicable** – Correspondence with OEH provided in:<br>EIS Chapter 5 Section 5.3<br>Appendix G |
| Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council. | **Not Applicable** – Correspondence with OEH provided in:<br>EIS Chapter 5 Section 5.3<br>Appendix G |
| Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES. | **Not Applicable** – Correspondence with OEH provided in:<br>EIS Chapter 5 Section 5.3<br>Appendix G |
| Any impacts the development may have on the social and economic costs to the community as consequence of flooding. | **Not Applicable** – Correspondence with OEH provided in:<br>EIS Chapter 5 Section 5.3<br>Appendix G |
| NSW RURAL FIRE SERVICE | |
| A 10-metre trafficable defendable space shall surround the solar farm infrastructure | EIS Chapter 6 Section 6.9<br>Appendix F |
| NSW ROADS & MARITIME SERVICES | |
| A Traffic impact study prepared in accordance with the methodology set out in Section 2 of the RTA's *Guide to Traffic Generating Developments 2002* and including: | EIS Chapter 3 Section 3.3<br>EIS Chapter 6 Section 6.5<br>Appendix H |

| | |
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| • Hours and days of construction.<br>• Schedule for phasing/staging of the project.<br>• Traffic volumes<br>• Existing background traffic.<br>• Project-related for each stage of the project including construction, operation and decommissioning.<br>• Projected cumulative traffic volumes. | |
| Traffic volumes are to also include a description of:<br>• Ratio of light vehicles to heavy vehicles.<br>• Peak times for existing traffic.<br>• Peak times for project-related traffic.<br>• Transportation hours.<br>Project related traffic interaction with existing and projected background traffic | EIS Chapter 3 Section 3.3<br>EIS Chapter 6 Section 6.5<br>Appendix H |
| The origin, destination and routes for:<br>• Employee and contractor light traffic.<br>• Heavy traffic.<br>Over size and over mass traffic. | EIS Chapter 6 Section 6.5<br>Appendix H |
| A description of all oversize and over mass vehicles and the materials to be transported. | EIS Chapter 3 Section 3.3<br>EIS Chapter 6 Section 6.5<br>Appendix H |
| The impact of traffic generation on the public road network and measures employed to ensure traffic efficiency and road safety during construction, operation and decommissioning of the project. | EIS Chapter 6 Section 6.5<br>Appendix H |
| The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and to mitigate the impact of project-related traffic. | EIS Chapter 6 Section 6.5<br>Appendix H |
| Local climate conditions that may affect road safety for vehicles used during construction, operation and decommissioning of the project (e.g. fog, wet and dry weather) | EIS Chapter 1 Section 1.3 |
| Proposed road facilities, access and intersection treatments are to be identified and be in accordance with *Austroads Guide to Road Design 2010* including Safe Intersection Sight Distance (SISD). In particular, SISD needs to be provided at the intersection of Suntop Road and Renshaw McGirr Way (MR233). | EIS Chapter 6 Section 6.5<br>Appendix H |
| The layout of the internal road network, parking facilities and infrastructure within the project boundary. | EIS Chapter 6 Section 6.5<br>Appendix H |
| A Traffic Management Plan (TMP) developed in consultation with Dubbo Regional Council and Roads and Maritime Services. The TMP is to identify and provide management strategies to manage the impacts of projected related traffic including:<br>• Haulage of materials to site.<br>Transportation of construction workers from accommodation facilities to site and return. | EIS Chapter 6 Section 6.5<br>Appendix H |
| DIVISION OF RESOURCES & GEOSCIENCE | |
| Identify on a locality or constraints map, the current Exploration Licence 8463 (Act 1992) (EL 8463) held by Lachlan Resources Pty Ltd (Lachlan | EIS Chapter 6 Section 6.9<br>Figure 5-1 |

| | |
|---|---|
| Resources). The title must be shown in relation to the proposed solar farm project boundary, electricity transmission infrastructure and any biodiversity offset areas. | |
| Consult with Lachlan Resources to establish if the proposal is likely to have a significant impact on current or future mineral exploration, including by limiting access to, or impeding assessment of, those resources, and any way the proposed development may be incompatible with any obligations of the titleholder under the *Mining Act 1992* and associated regulations. | EIS Chapter 5 Section 5.6 |
| Should biodiversity offsets be considered for the project, the Division requires consultation with the Geological Survey of NSW to ensure there are no potential sterilisation impacts to resources | Not applicable |
| NSW DEPARTMENT OF PRIMARY INDUSTRIES | |
| Land | |
| The agricultural value of the land should be confirmed through a soil survey which will also provide a basis for this and to be continued to be used for:<br>• An agricultural purpose during the operation of the solar farm<br>• The ability to be returned back to agricultural production at final rehabilitation on closure of this operation<br>• Management if impacting on the karst environment. | EIS Chapter 6 Section 6.6<br>Appendix K<br>Appendix J |
| Develop a Rehabilitation and Decommissioning/Closure Management Plans that outlines the rehabilitation objectives and strategies. This includes, but is not limited to:<br>• Describing the design criteria of the final land use and landform<br>• Indicators to guide the return of the land back to agricultural production<br>• Monitoring and mitigation measures to be adopted for rehabilitation remedial actions<br>• Commitment to burying cables and pipes to a depth >500mm on any land with a cropping history or land with a capability for cropping to allow greater opportunity for agricultural activities to continue above the cables. This is a particular issue for the cables/pipes which will be left in situ once restoration is complete. | EIS Chapter 6 Section 6.6<br>Appendix J |
| The current agricultural value of the site is quantified, and the anticipated use of the site during the operation of the solar farm is also assessed. | EIS Chapter 6 Section 6.6 |
| DUBBO REGIONAL COUNCIL | |
| The Department's email and the Environmental Assessment Requirements (EAR) state that the proposal has an estimated capacity of 220MW, when the PEA states 260MW. | Not Applicable |
| The EAR has the address of the property as 909 Suntop Toad, obviously a typing error. A legal description perhaps should refer to the various lots and deposited plans. | Not Applicable |
| The EAR refers to consultation with Upper Lachlan Shire Council. This shall be corrected to read - Dubbo Regional Council. | Corrected |
| Attachment 1 – Environmental Planning Instruments, doesn't reference the Environmental Planning and Assessment (EP&A) Act, 1979, the | Not Applicable |

| | |
|---|---|
| Environmental Planning and Assessment (EP&A) Regulation, 2000 or Wellington Local Environmental Plan (WLEP) 2012. | |
| The PEA and the Department's email continually refers to the site being 20 km from Wellington. This is true via road, but really about 10km straight line. | Corrected<br>EIS Chapter 1 Section 1.3 |
| The PEA refers to Wellington LGA (2.1). This shall be corrected to read - Dubbo Regional Council LGA. | Corrected<br>EIS Chapter 1 Section 1.3 |
| The PEA (Figure 2-2) shows a watercourse through the site and section 2.2 identifies that development *"… will avoid the existing surface water bodies on the site where possible including a buffer of 40m between infrastructure and any waterway."* As such, the proposal may be designated as per S91 Integrated Development, EP&A Act, 1979. The NSW Office of Water should be contacted to provide advice accordingly. | Not Applicable |
| The PEA makes constant reference to a layout plan (Appendix A), but no layout plan of the proposed/likely/indicative footprint of the proposed panels has been provided. Consequently, it is not known what proportion of the site will be taken-up with the proposed 787,892 PV panels, their set-backs from creek lines and existing overhead powerlines and easements.<br><br>The absence of a layout/site plan also means that the provisions of access perimeter roads are not identified to permit servicing of the on-site infrastructure and security fencing.<br><br>The Department may need to consider the legality of seeking stakeholder input into the preparation of the SEARs, without providing this crucial information, which may bring any approval into question and expose the Department and the applicant to subsequent appeals. | Not Applicable |
| The PEA in section 2.4.1 makes reference to the solar farm's construction in *"… 1ha stages – with up to 10 stages …".* Given recent issues regarding 'staged development' and S83 of the EP&A Act, this terminology needs to be clarified. | Removed |
| The PEA in Table 2-2 Key Components of Proposal, refers to 2 x 40' shipping containers for storage and maintenance equipment. Council is not generally supportive of shipping containers, but further details regarding location, screening, footings, etc., may resolve such concerns. | Figure 3 – 9<br>2 maintenance containers will be located at the construction compound |
| The PEA in section 2.4.7 relates to decommissioning of the site. While Council endorses the intention to decommission the site, the question arises as to how is this achieved, how is this enforced? Council may be unaware that a site is closing down and the site could be left in poor condition, especially for agricultural pursuits. | EIS Chapter 3 Section 3.3.4<br>EIS Chapter 6 Section 6.6<br><br>Appendix J |
| The PEA in section 3.2 relates to alternative locations, but no details are provided. | EIS Chapter 2 Section 2.4 |

| | |
|---|---|
| The PEA in section 5.1.4 WLEP 2012, states that the proposal *"… can be considered a sustainable primary industry that extracts renewal energy (a natural resource)".* A solar farm is not a 'primary industry'. | Corrected |
| The PEA in section 5.1.4 states that *"electricity generation is not listed among developments which are permitted with consent for the zone …".* It should be noted that WLEP 2012 doesn't list *electricity generating works* in the land use zones, as directed by a Department of Planning circular to all local councils, some years ago.<br><br>The PEA fails to note that the site is deemed to be high-moderately high with regard to groundwater, as per WLEP 2012 clause 6.4 Groundwater vulnerability. | Noted<br><br>EIS Chapter 6 Section 6.7 |
| The PEA in section 5.1.5 refers to the Threatened Species Conservation Act 1995 and the Native Vegetation Act 2003, both of which were recently repealed. Council is also unsure why SEPP 33 Hazardous and Offensive Development is listed. | EIS Chapter 4 Section 4.3 |
| Whilst the subject property may not be mapped as being Bush Fire Prone Land, the land will still be at risk of bushfires by virtue of its existing grassland vegetation. As is evident in the NSW version of the Building Code of Australia and commentary in Planning for Bush Fire Protection 2006, bushfire hazard exposure is not reliant upon the mapping by the NSWRFS Commissioner.<br><br>Consequently, bushfire exposure needs to be addressed. In this regard it is expected that a minimum 10m fire break would be provided around the perimeter of the development and appropriate water storage provided on-site for use by the NSW Rural Fire Service.<br><br>It is expected that the setback requirements specified under clause 45 of the Infrastructure SEPP will be addressed and that the fire radiant heat exposure and explosion setbacks imposed by the NSW electrical utility operators will be addressed for the facility's substations | EIS Chapter 6 Section 6.9<br>Appendix F |
| The Dark Skies Guidelines have not been addressed or mentioned in the submission despite the site being located within the Siding Spring Observatory's Dark Sky Region (ie. within 200 km of the observatory). This Dark Sky Region applies to State Significant Development and invokes clause 92 of the Environmental Planning and Assessment Regulation, 2000. | Table 4-1 |
| The PEA makes no mention of State Environmental Planning Policy (Rural Lands) 2008. Whilst this proposal does not involve the subdivision of land or the erection of a dwelling on the subject RU1 land, it will remove prime agricultural land from production. Consequently, it would seem appropriate that any assessment should consider the proposed development in terms of the Aims and Planning Principles outlined under such SEPP, at least for the purposes of Section 79C of the Act. | EIS Chapter 4 Section 4.5.3 |
| With regard to road infrastructure, Council would expect the Environmental Impact Statement (EIS) to address:<br>A breakdown of vehicles by type, specifying gross vehicle mass, vehicle length and expected daily volumes travelling to the site; and | EIS Chapter 6 Section 6.5<br>Appendix H |

| | |
|---|---|
| the capacity of the construction phase to accommodate curfew periods of travel on Suntop Road by 'restricted access vehicles' to ensure traffic safety of school buses and the like. | |
| Given the proposal foreshadows up to 40 x B-Double movements per day during construction, a Dilapidation Report on Suntop Road shall be provided. | B-Doubles no longer proposed<br>EIS Chapter 6 Section 6.5<br>Appendix H |
| The intersection of Suntop Road and Renshaw McGirr Way is very marginal for B-Double access. Given the numbers of movements proposed, this could trigger upgrading of the intersection. | EIS Chapter 6 Section 6.5<br>Appendix H |
| Travelling of these vehicles through the Curra Creek Gorge on Renshaw McGirr Way will require some traffic safety related Safe Work Method Statement by Restricted Access Vehicle operators. | EIS Chapter 6 Section 6.5<br>Appendix H |
| A cursory inspection of the site revealed a ridge line about 500 metres south of Suntop Road. Ideally, the solar farm could be located on the southern side of the ridge line, which would effectively screen the entire enterprise from any passing traffic along Suntop Road. However, given no layout plan was provided, this remains unknown. | EIS Chapter 5 Section 5.4<br>Figure 3-6 |

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# SUNTOP SOLAR FARM

## VISUAL IMPACT ASSESSMENT

Prepared for Pitt & Sherry - May 2018



CAMBIUM GROUP

# PROPOSED SUNTOP SOLAR PHOTOVOLTAIC (PV) FARM
# VISUAL IMPACT ASSESSMENT

DATE: 7 May 2018
PREPARED FOR: PITT & SHERRY ON BEHALF OF PHOTON ENERGY
PREPARED BY: Alison Dodds, *PGCert Public Policy, BPlan, BLArch*
*Registered Planner and*
Stacey Brodbeck, *MEnvPlan, BLArch, CPP, MPIA*
*Registered Landscape Architect*

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ENVISAGE CONSULTING PTY LTD
ABN 89 139 313 296
envisageconsulting.com.au

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Visual communication science
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| 02 | 13 March 2018 | Updated Draft for review: revised footprint, use of tracking panels, revised substation location | A. Dodds | S. Brodbeck |
| 03 | 2 May 2018 | Updated Draft for review: revised spacing of tracking panels | A. Dodds | S. Brodbeck |
| 04 | 7 May 2018 | Panel numbers | A. Dodds | S. Brodbeck |

# Contents


1 Introduction ..... 1

1.1 Purpose of this report ..... 1

1.2 Brief project description ..... 2

1.3 Report format ..... 2

2 Assessment methodology ..... 4

2.1 Methodology Framework ..... 4

2.2 Applied Methodology ..... 5

2.3 Potential visibility ..... 6

2.4 Site assessment ..... 6

2.5 Assessment criteria ..... 6

2.5.1 Sensitivity criteria ..... 7

2.5.2 Magnitude of change criteria ..... 8

2.5.3 Level of Impact ..... 10

3 Site context and description ..... 11

3.1 Site context ..... 11

3.2 The Site ..... 12

3.2.1 Heritage ..... 14

3.2.2 Vegetation ..... 14

3.2.3 Landform ..... 14

3.3 Planning and regulatory requirements ..... 14

3.3.1 Land zoning ..... 14

3.3.2 Scenic provisions ..... 14

3.3.3 Future development ..... 15

4 Description of the Proposal ..... 17

4.1 The Proposal ..... 17

4.2 Main components relevant to visual impact assessment ..... 19

4.3 Construction ..... 24

4.4 Operation ..... 26

4.5 Decommissioning and rehabilitation ..... 27

5 Potential visual concerns ..... 28

5.1 Scale ..... 28

5.2 Glint and glare ..... 28

5.3 Light refraction ..... 31

5.4 Geometric pattern and viewer position ..... 33

5.5 Aviation ..... 35
5.6 Movement ..... 35
5.7 Skylining ..... 35
5.8 Ancillary structures ..... 36
6 Impact to landscape character ..... 38
6.1 Sensitivity ..... 38
6.2 Magnitude of change ..... 38
6.3 Level of impact to landscape character ..... 40
7 Impact to viewpoints ..... 41
7.1 Identification of viewpoints ..... 41
7.1.1 Private viewpoints ..... 41
7.1.2 Public viewpoints ..... 41
7.1.3 Aerial viewpoint ..... 42
7.2 Assessment of viewpoints ..... 42
7.3 Summary of results to viewpoints ..... 54
8 Photomontages ..... 56
8.1 Viewpoint 1 (VP1) ..... 56
8.2 Viewpoint 6 (VP6) ..... 57
8.3 Viewpoint 7 (VP7) ..... 57
8.4 VP Suntop Road ..... 58
9 Mitigation ..... 79
9.1 Best practice ..... 79
9.2 Existing measures and proposed mitigation ..... 79
9.3 Landscape Plan ..... 85
10 Cumulative impact ..... 87
11 Conclusion ..... 88
12 References ..... 91

## Tables

TABLE 1-1: SEARS VISUAL REQUIREMENTS ..... 1
TABLE 2-1: SENSITIVITY RANKING CRITERIA ..... 8
TABLE 2-2: MAGNITUDE OF CHANGE RANKING CRITERIA ..... 9
TABLE 2-3: LEVEL OF IMPACT ..... 10
TABLE 7-1: ASSESSED VIEWPOINTS AND PREDICTED VISUAL IMPACT LEVELS ..... 43
TABLE 9-1: MITIGATION MEASURES ..... 80
TABLE 11-1: APPLICATION OF DRAFT LARGE SCALE SOLAR ENERGY GUIDELINE ..... 88

## Figures

FIGURE 1-1: SITE LOCATION ..... 3
FIGURE 3-1: TYPICAL LANDSCAPE CHARACTER OF SUNTOP ..... 11
FIGURE 3-2: EXISTING SITE FEATURES ..... 13
FIGURE 3-3: PROPOSED SOLAR FARMS IN THE WELLINGTON AREA ..... 16
FIGURE 4-1: PROPOSED SITE LAYOUT ..... 18
FIGURE 4-2: EXAMPLE OF TRACKER SOLAR (PV) PANELS (provided by Pitt & Sherry) ..... 19
FIGURE 4-3: EXAMPLE OF GROUND-MOUNTING ARRANGEMENT (provided by Pitt & Sherry) ..... 20
FIGURE 4-4: EXAMPLE OF PV SOLAR INVERTER & INVERTER STATION (provided by Pitt & Sherry) ..... 20
FIGURE 4-5: GENERAL ARRANGEMENT OF SUBSTATION (plan supplied by TransGrid) ..... 22
FIGURE 4-6: EXAMPLE OF A SIMILAR SUBSTATION TO THAT PROPOSED (supplied by Pitt & Sherry) ..... 22
FIGURE 5-1: PHOTOVOLTAIC SOLAR PANEL HEIGHT COMPARISON (TRACKING) ..... 29
FIGURE 5-2: 'MIRAGE EFFECT' ON ROAD ON A HOT DAY ..... 31
FIGURE 5-3: PHOTOGRAPH OF ROYALLA SOLAR FARM NEAR CANBERRA (2.75km from solar farm) ..... 32
FIGURE 5-4: VIEWER POSITION IN RELATION TO PV PANELS (Argonne National Laboratory) ..... 33
FIGURE 5-5: ROYALLA SOLAR FARM SHOWING COLOUR CHANGE WITH SIDE VIEW ..... 34
FIGURE 5-6: ROYALLA SOLAR FARM SHOWING WHITE ANCILLARY STRUCTURES ..... 36
FIGURE 5-7: WILLIAMSDALE SOLAR FARM SHOWING COLOUR-TREATED INVERTERS ..... 37
FIGURE 7-1: PREDICTED VISUAL IMPACT LEVELS FOR IDENTIFIED VIEWPOINTS ..... 53
FIGURE 8-1: PHOTOMONTAGE LOCATIONS ..... 59
FIGURE 8-2: VP1 - EXISTING VIEW ..... 60
FIGURE 8-3: VP1 - ANALYTICAL VIEW OF LIKELY VISIBILITY OF PROPOSAL ..... 61
FIGURE 8-4: VP1 - PHOTOMONTAGE OF LIKELY VIEW OF PROPOSAL POST CONSTRUCTION ..... 62
FIGURE 8-5: VP1 - PHOTOMONTAGE OF LIKLEY VIEW OF PROPOSAL WITH LANDSCAPE SCREENING 5 YEARS AFTER CONSTRUCTION ..... 63
FIGURE 8-6: VP6, VIEW A - EXISTING VIEW ..... 64
FIGURE 8-7: VP6, VIEW A - ANALYTICAL VIEW OF LIKELY VISIBILITY OF PROPOSAL ..... 65
FIGURE 8-8: VP6, VIEW A - PHOTOMONTAGE OF LIKELY VIEW OF PROPOSAL POST CONSTRUCTION ..... 66
FIGURE 8-9: VP6, VIEW A - PHOTOMONTAGE OF LIKELY VIEW OF PROPOSAL WITH LANDSCAPE SCREENING 5 YEARS AFTER CONSTRUCTION ..... 67
FIGURE 8-10: VP6, VIEW B - EXISTING VIEW ..... 68
FIGURE 8-11: VP6, VIEW B - ANALYTICAL VIEW OF LIKELY VISIBILITY OF PROPOSAL ..... 69
FIGURE 8-12: VP6, VIEW B - PHOTOMONTAGE OF LIKELY VIEW OF PROPOSAL POST CONSTRUCTION ..... 70
FIGURE 8-13: VP6, VIEW B - PHOTOMONTAGE OF LIKELY VIEW OF PROPOSAL WITH LANDSCAPE SCREENING 5 YEARS AFTER CONSTRUCTION ..... 71
FIGURE 8-14: VP7 - EXISTING VIEW ..... 72
FIGURE 8-15: VP7 - ANALYTICAL VIEW OF LIKELY VISIBILITY OF PROPOSAL ..... 73
FIGURE 8-16: VP7 - PHOTOMONTAGE OF LIKELY VIEW OF PROPOSAL POST CONSTRUCTION ..... 74
FIGURE 8-17: VP SUNTOP ROAD - EXISTING VIEW ..... 75
FIGURE 8-18: VP SUNTOP ROAD - ANALYTICAL VIEW OF LIKELY VISIBILITY OF PROPOSAL ..... 76
FIGURE 8-19: VP SUNTOP ROAD - PHOTOMONTAGE OF LIKELY VIEW OF PROPOSAL POST CONSTRUCTION. 77
FIGURE 8-20: VP SUNTOP ROAD - PHOTOMONTAGE OF LIKELY VIEW OF PROPOSAL WITH LANDSCAPE SCREENING 5 YEARS AFTER CONSTRUCTION ..... 78
FIGURE 9-1: CONCEPT LANDSCAPE PLAN ..... 86

# 1 Introduction

## 1.1 Purpose of this report

This report has been prepared to assess visual impacts associated with a proposed photovoltaic (PV) solar farm at Suntop, NSW (the 'Proposal'). The report has been prepared for the Proponent, Photon Energy, and addresses the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning and Environment (DPE) regarding 'visual' issues potentially associated with the Proposal.

The relevant SEARs state:

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

The requirements of the SEARs, and the relevant sections of this report where these requirements are met are identified in TABLE 1-1.

TABLE 1-1: SEARS VISUAL REQUIREMENTS

| Visual Requirement | Where addressed in this report |
|---|---|
| ...an assessment of the likely visual impacts of the development... | Whole of report. |
| ...(including any glare, reflectivity and night lighting)... | Key visual concerns of solar farms such as glare and reflectivity are considered in SECTION 5.0.<br>Night lighting is discussed at SECTION 4.4. |
| ...surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain... | SECTION 6.0 - likely effects to landscape character.<br>SECTION 7.0 - likely affects to surrounding key viewpoints, including public viewpoints from Suntop Road and from surrounding rural residences. |
| ...a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners. | SECTION 9.3 – A Concept Landscape Plan has been prepared for on-site perimeter planting. |

## 1.2 Brief project description

Photon Energy propose to construct and operate a PV solar farm generating up to 200 megawatt (MW) with the use of tracking panels, on a property at 909 Suntop Road, Suntop. Suntop is a rural area, approximately 10 kilometres (km) south-west of Wellington in the Dubbo Regional Council Local Government Area (LGA). The solar farm (the 'Site') would occupy 472 hectares (ha) of the 517ha rural property, approximately 91%.

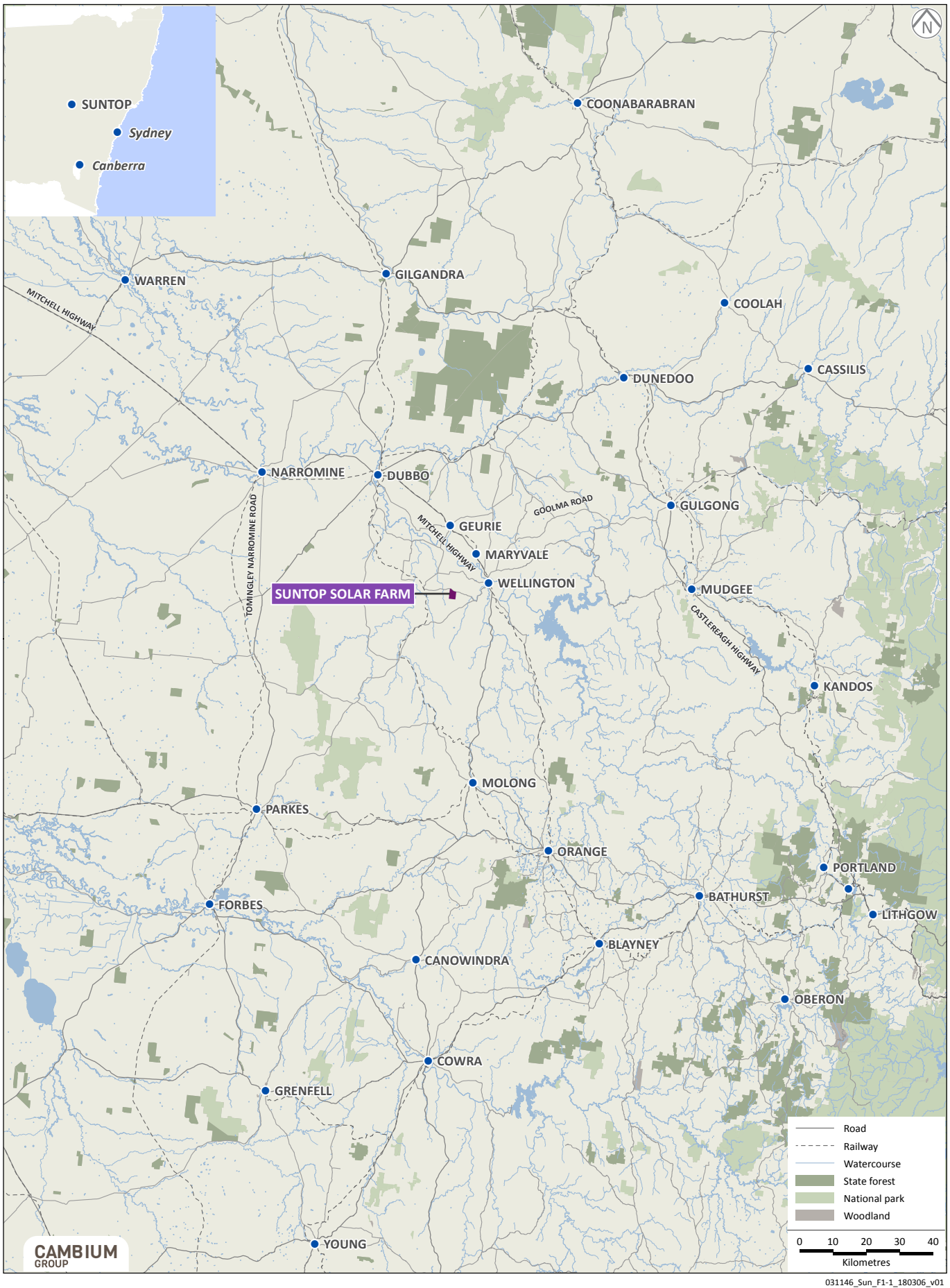
The location of the proposed Site is shown in FIGURE 1-1. A description of the Site is provided in SECTION 3.0 and a detailed description of the Proposal and its components is provided in SECTION 4.0.

## 1.3 Report format

The key tasks of the assessment process are set-out in the report's format:

- Outline the methodology for the assessment (SECTION 2.0)
- Establish baseline conditions and describe the site context (SECTION 3.0)
- Describe the main visual changes associated with the Proposal (SECTION 4.0)
- Discuss key visual concerns of solar farms (SECTION 5.0)
- Assess the likely effects to landscape character (SECTION 6.0)
- Assess the likely affects to surrounding key viewpoints (SECTION 7.0)
- Present photomontages from key viewpoints (SECTION 8.0)
- Present mitigation measures including a concept landscape plan (SECTION 9.0)
- Discuss cumulative impacts (SECTION 10.0)
- Conclusion (SECTION 11.0).

**FIGURE 1-1**
Site location
SUNTOP SOLAR FARM - VISUAL IMPACT ASSESSMENT




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# 2 Assessment methodology

This section of the report defines the methodology for the assessment. The assessment methodology has been based on the relevant state government guideline (i.e. the Draft Large Scale Solar Energy Guideline), professional experience with other large-scale infrastructure projects, and visual assessment guidelines used by government authorities in Australia and internationally.

## 2.1 Methodology Framework

The *Draft Large Scale Solar Energy Guideline* (New South Wales (NSW) Department of Planning (DPE), 2017) provides the community, industry, applicants and regulators with guidance on the planning framework for the assessment and approval of large scale solar energy development proposals under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), which are classified as 'State significant development' (SSD).

The Guideline identifies the key planning and strategic considerations relevant to solar energy SSD in NSW. It aims to assist in the site selection and design of proposals and it will be used by the DPE to assist in the assessment of relevant development applications. It is intended as a general guideline only.

Under the Guideline, visual impact considerations are most relevant in the section on 'site selection', where it states that:

> *'sites with characteristics that may assist in minimising localised impacts such as:*
>
> - *land that does not contain native vegetation or has previously been cleared and utilised for industrial - type purposes (brown - field sites) in rural settings,*
> - *unobtrusive sites with flat, low - lying topography, and*
> - *sites with potential to be screened, such as those that can be readily vegetated along boundaries, to reduce visual impacts'.*

Additionally, under the heading of 'Site Constraints' (where this heading is further defined as meaning that 'while the following types of land or sites are not precluded from large-scale solar energy development, they do indicate areas of constraint that should be identified as part of the constraints mapping'), the following relevant component is identified:

> *'sites with high visibility, such as those on prominent or high ground positions, or sites which are located in a valley with residences with elevated views looking toward the site' (NB: a footnote further defines this to mean: 'high visibility or prominence is of particular concern if the solar infrastructure at the site would be juxtaposed against significant scenic, historic or cultural landscape'.)*

Under 'Key Assessment Issues' the Guideline refers to the consideration of visual impacts as follows:

*Visual impacts: the acceptability of impacts on landscape character and values, the amenity of landholders and communities, and the adequacy of the measures which are proposed to avoid, reduce or otherwise manage these impacts.*

*The visual impact of solar energy development will depend on the scale and type infrastructure, the prominence and topography of the site relative to the surrounding environment, and any proposed measures to screen or otherwise reduce visibility of the site. Solar thermal projects may have greater offsite visibility due to the presence of tower infrastructure. Greater off - site visibility of the site will increase the chances of impacts such as glint, glare, reductions in visual amenity, and detraction from the surrounding landscape character including natural, scenic, historic or cultural landscapes. There may also be road safety impacts from glint and glare.*

The most relevant parts of the Guidelines relating to visual impacts have been addressed as part of this report. The findings are presented in the conclusion at TABLE 11-1.

## 2.2 Applied Methodology

The applied methodology used in this report has been based on professional experience with other large-scale infrastructure projects, and visual assessment guidelines used by government authorities in Australia and internationally, including:

- '*Environmental Impact Assessment Guidance Note – Guidelines for Landscape Character and Visual Impact Assessment'*, 2013, NSW Roads and Maritime Services
- *'Visual Landscape Planning in Western Australia',* 2007, Western Australian Planning Commission
- the United Kingdom's widely used '*Guidelines for Landscape and Visual Impact Assessment,*' 2013, the Landscape Institute and Institute of Environmental Management and Assessment.
- '*Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands'*, 2013, United States Department of the Interior.

The below guideline on reviewing visual assessments has also informed the methodology:

- '*Guide to Evaluating Visual Impact Assessments for Renewable Energy Projects'*, 2014, Sullivan and Meyer, for United States Department of the Interior.

The methodology has been tailored to address the particular visual impacts of establishing this type and scale of infrastructure in this location.

## 2.3 Potential visibility

An initial step in the assessment was to identify potentially-sensitive viewing locations such as residences, and publicly accessible areas such as towns and local roads. These locations were initially determined by establishing the potential geographic extent of the viewing area using desktop analysis of aerial photography and elevation.

## 2.4 Site assessment

A site inspection was held 22 November 2017. The Proposal was considered in the context of the Site setting. Landscape character within the locality is described at SECTION 3.0.

The potentially sensitive viewing locations previously identified by desktop analysis were verified[1] during the site inspection. Viewpoints were modified or confirmed based on site findings (such as the screening effects of vegetation).

Access to four of the close private properties was possible during the site inspection. For the remainder of properties, visibility was assessed from the closest public access to each viewpoint and desktop analysis. The assessment viewpoints are identified in SECTION 7.0.

The initial site investigation findings are shown at APPENDIX A.

Due to the large number of potential viewers, and the relatively similar visual experience from some locations, some viewpoints were grouped. Groups (or clusters of viewpoints) were determined based on:

- 1. distance from the Proposal;
- 2. elevation comparative to the Proposal; and
- 3. proportion of the Site potentially seen.

Viewpoints were then selected for photomontage images. Where possible, the locations selected have the 'worst case' (most prominent) view of the Proposal. However, viewpoints have also been selected that are representative of the variety of locations with views of the Proposal.

## 2.5 Assessment criteria

Two main types of visual impacts are assessed in this report:

1. Effect on the landscape character – the overall impact of a project on an area's character and sense of place.
2. Effect on key viewpoints – the day to day visual effects of a project on people's views.

The level of impact to landscape character and viewpoints is based on the combination of two criteria – 'sensitivity' and 'magnitude of change', defined by Roads and Maritime (2013) as:

[1] Desktop analysis does not take into account site features such as vegetation and built elements which may obstruct views.

- Sensitivity - The sensitivity of a landscape character zone or view and its capacity to absorb change. In the case of visual impact this also relates to the type of viewer and number of viewers.
- Magnitude - The measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer.

For the purposes of this assessment, the specific criteria used to determine sensitivity and magnitude of change (both for landscape character and visual impact to viewpoints) are listed in TABLE 2-1 and TABLE 2-2. These criteria have been defined for this Proposal and take into account the particular characteristics of the solar farm Proposal, such as its low height.

### 2.5.1 Sensitivity criteria

Understanding the characteristics of those who would likely view the Proposal is important because it is the human response to visible changes in a landscape that determines whether the changes represent an improvement in scenic attractiveness (a positive visual impact) or a decrease in scenic attractiveness (a negative visual impact)[2].

The following sensitivity criteria have been considered in this assessment[3]:

- The type of viewer that sees from a particular viewpoint (private or public, stationary or moving and their engagement in the view) (Refer also side bar "public vs private viewpoints")
- Viewer distance from the Proposal (clarity is reduced as distance increases)[4]
- Numbers of people viewing from the viewpoint
- Expected duration of views
- Particular sensitivities of the viewers

These criteria have been used as a guide to determine high, moderate, low or negligible sensitivity ranking, as shown in TABLE 2-1.

Public vs Private viewpoints

Visual perceptions of renewable energy equipment dominate public acceptability but differ between visitors and residents*.

When assessing private viewpoints, such as residences, the closer the proximity and clearer the potential view, generally the greater sensitivity to change, and therefore the higher potential for visual impact. However, although a high impact may be experienced by an individual residence, or group of residences, the overall level of impact needs to take into account the number of residents affected, plus how significant that impact may be in terms of the wider community.

* Apostol, D. 2017. *The Renewable Energy Landscape.* Routledge, 20160819. (Apostol 108)

[2] Sullivan, R. and M Meyer. 2014. p22

[3] Adapted from:

- Apostol, D. 2017. *The Renewable Energy Landscape*; Sullivan, R. and M Meyer. 2014. p43; and
- United States Department of the Interior. 2013. Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands.

[4] Regions with sunnier skies and dryer air will, on average, experience higher levels of visual contrast and longer visibility distances for renewable energy facilities than will regions with less sunny skies and higher humidity levels. United States Department of the Interior. 2013

TABLE 2-1: SENSITIVITY RANKING CRITERIA

| Sensitivity | Criteria (general guide only, some or all may apply) |
|---|---|
| High | ▪ Landscape or cultural heritage of high to very high conservation value<br>▪ Landscape with characteristics that are highly sensitive and highly affected by large-scale development<br>▪ Public views with a high to very high number of users and/or in close proximity<br>▪ Private views in close proximity (generally less than 1km) with mostly unimpeded views |
| Moderate | ▪ Landscape or cultural heritage of moderate conservation value<br>▪ Landscape with characteristics moderately affected by large-scale development<br>▪ Public views with a moderate to high number of viewers and/or viewers are in close or moderate proximity (generally less than 2.5km away)<br>▪ Private views in moderate proximity (generally 1-2.5km) with some views, or a further distance (2.5-5km) with mostly unimpeded views |
| Low | ▪ Some landscape or cultural heritage conservation value but of lower visual value<br>▪ Landscape characteristics not greatly affected by large-scale development<br>▪ Public views for a small number of users and/or viewers more distant (generally over 2.5km away)<br>▪ Private views in more distant proximity (generally 5km+) with some unimpeded views |
| Negligible | ▪ Landscape has no or very little cultural heritage, conservation or visual value<br>▪ Characteristics relatively unaffected by large-scale development<br>▪ Very few people can view<br>▪ Viewers are a long distance from site (generally over 5km with no obvious views)<br>▪ Private views generally not affected. |

### 2.5.2 Magnitude of change criteria

The following magnitude criteria have been considered when determining magnitude of change:

- The characteristics of the proposal (its size, scale relative to other objects in view)

- Visual prominence (how dominant, or the focal point of the view is the proposal)
- Viewer position in relation to the proposal (elevation and angle of viewpoint, relationship to sun angle)
- Extent (proportion of the proposal that would be seen)
- Compatibility with surrounding landscape (the contrasts of the proposal in scale and character (either existing or planned) and effect on scenic quality
- Whether the change would be temporary or permanent

These criteria have been used as a guide to determine high, moderate, low or negligible magnitude taking into account the general visual features (scale, bulk and height) of the proposal, as shown in TABLE 2-2.

TABLE 2-2: MAGNITUDE OF CHANGE RANKING CRITERIA

| Magnitude | Criteria (general guide only, some or all may apply) |
|---|---|
| High | ▪ Significant scale (bulk and height) and extent of area affected<br>▪ Permanent and irreversible change<br>▪ The site has a high visual prominence (is a key feature of the view)<br>▪ The viewer position in relation to the proposal is substantially elevated and from a northern, eastern or western location<br>▪ The viewer sees a large proportion of the facility (typically more than half (50%))<br>▪ The proposal forms a significant and immediately apparent part of the scene, and one that significantly contrasts in scale and character (either existing or planned) and is severely detrimental to the quality of the scene. |
| Moderate | ▪ Moderate scale (bulk and height) and extent of area affected<br>▪ The site is visually prominent (a recognisable feature of the view)<br>▪ The viewer position in relation to the proposal is elevated<br>▪ The viewer sees a moderate proportion of the facility (typically a quarter to a half (25-50%))<br>▪ Temporary, or if permanent, effects which may reduce over time<br>▪ The proposal becomes a noticeably dominant feature of the scene, and one that contrasts in scale and character (either existing or planned), possibly reducing the quality of the scene. |
| Low | ▪ Small in scale (bulk and height) and extent of area affected |

| Magnitude | Criteria (general guide only, some or all may apply) |
|---|---|
| | ▪ Temporary, or if permanent, visual effects able to be reduced substantially over time<br>▪ The site is less visually prominent<br>▪ The viewer position is usually to the south of the facility<br>▪ The viewer sees a small portion of the facility (typically less than a quarter (25%) and/or from a further distance)<br>▪ The proposal forms a visible and recognisable new element within the overall scene, yet one that is relatively compatible with the surrounding character (either existing or planned) and would not generally reduce the quality of the scene. |
| Negligible | ▪ The proposal constitutes only a minor component of the wider view, which might be missed by the casual observer or receptor. Awareness of the proposal would not have a marked effect on the overall quality of the scene. |

### 2.5.3 Level of Impact

By combining sensitivity and magnitude of change, an approximate level of impact to either landscape character or visual impact to viewpoints is ascertained, as shown in TABLE 2-3 (as adapted from Roads and Maritime, 2013). The range of overall impact level (to both the landscape character and visual impact to surrounding viewpoints) can be either beneficial or adverse, with six possible rankings: high, moderate-high, moderate, moderate-low, low, and negligible.

TABLE 2-3: LEVEL OF IMPACT

| Matrix of relationship between sensitivity and magnitude | | | | | |
|---|---|---|---|---|---|
| | | Magnitude | | | |
| | | HIGH | MODERATE | LOW | NEGLIGIBLE |
| Sensitivity | HIGH | High | Moderate - high | Moderate | Negligible |
| | MODERATE | Moderate - High | Moderate | Moderate - Low | Negligible |
| | LOW | Moderate | Moderate - Low | Low | Negligible |
| | NEGLIGIBLE | Negligible | Negligible | Negligible | Negligible |

# 3 Site context and description

This section of the report describes the Site and its surroundings. It identifies any important visual resource areas (including sensitive scenic, historic, or cultural resources) and other sensitive viewpoints (residential areas, roads, etc.) that could have views of the Proposal.

## 3.1 Site context

Suntop is a rural area approximately 10km south-west of Wellington, the nearest town. The area is part of the NSW Central West wheat-sheep belt[5], and is typical of the undulating, agricultural, broadacre farming areas within the mid-western region. An image of the Suntop area is shown on FIGURE 3-1 to illustrate landscape character.



FIGURE 3-1: TYPICAL LANDSCAPE CHARACTER OF SUNTOP

[5] Australian broadacre zones and regions. http://apps.daff.gov.au/agsurf/regions.html#122. Accessed 30 November 2017

Geographically separating Suntop and Wellington, and providing the backdrop for Suntop, is the Mount Arthur Reserve, a 2,123ha Crown Reserve set aside for Public Recreation and Environmental Protection. FIGURE 3-3 shows the general locality of Mount Arthur Reserve. The Reserve lies within the northern most section of the Catombal Range and takes in three main peaks - Mounts Arthur, Wellesley and Duke - rising to 563m above sea-level. The Reserve is recognised on the Register of the National Estate for its natural values. A large portion of the Reserve has been protected in various forms since 1913.

West of the Reserve, land in the Suntop area has been developed for agricultural purposes and is primarily used for crops (wheat and canola) and grazing (sheep and cattle). Large paddocks of improved pastures, crops, rural residences, large farm sheds, stores of grain and stock feed, trucks and harvesters are common throughout the area.

Land in the vicinity is undulating. There are numerous small creeks and the nearest river is the Macquarie River at Wellington. The area can experience extremes in temperature. In 2017, the hottest temperature recorded was 45 degrees and the coldest was -4.5 degrees[6]. During harvesting, dust plumes are common.

Suntop is home to approximately 70 residents. Two local roads - Suntop Road and Renshaw McGirr Way - provide connection to the main NSW road and rail network (refer to FIGURE 3-3).

The dominant background colours common to the area are the colours of the crops (seasonally changing from bright greens to pale, muted yellows), grazing pastures (light, bright greens to light browns and yellows), scattered tall vegetation (dark grey-green), soil (red-brown), surrounding vegetated ridges (soft deep blue) and occasional patches of exposed rocks (greys).

There are no local sources of large-scale artificial lights such as would be associated with an industrial premises or commercial facility operating at night. Farm sheds and associated farming infrastructure are made of sheet metal, concrete or timber. Some surfaces, particular roofs, are highly reflective. Power lines and tall transmission lines cross the paddocks and run along the local road. They generally appear as dark vertical lines via their steel or timber pole construction.

## 3.2 The Site

The Site (at 909 Suntop Road, Suntop) borders Suntop Road along its northern boundary. Existing 132KV transmission lines traverse the property. There is an existing homestead along the western property boundary, agricultural sheds, fences, water tanks, silos and farm equipment located at the property.

The nearest neighbour is located near the intersection of Suntop Road and the electricity transmission lines. Land use within and immediately around the Site is agricultural. The existing features of the Site are shown on FIGURE 3-2.

[6] Meat and Livestock Australia. Weather.mia.com.au.climate-history.nsw/suntop. Accessed 29 November 2017

**FIGURE 3-2**

Existing site features

SUNTOP SOLAR FARM - VISUAL IMPACT ASSESSMENT




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### 3.2.1 Heritage

There were no heritage places or items identified at the Site or within 1km of the Site.

### 3.2.2 Vegetation

The Site is mostly cleared of trees, however, there are mature native trees along the western boundary and a few remnant trees are scattered within the paddocks over exotic ground cover (pasture grasses). Several rows of trees have been planted along paddock boundaries within the Site. Some shrubs and trees also occur within the lower lying areas of the property.

A detailed Biodiversity Assessment has been prepared as part of the EIS which provides further details on existing vegetation and biodiversity.

### 3.2.3 Landform

The Site is undulating. There are two ridges within the property, both 420m above sea level (ASL), shown on FIGURE 3-2. The lowest point on the property is approximately 370m ASL. A tributary of Barney's Creek passes east to west through the middle of the Site and there are several small dams.

The site has been classified as groundwater vulnerable under Wellington Local Environmental Plan (LEP) 2012.

## 3.3 Planning and regulatory requirements

### 3.3.1 Land zoning

The Proposal occurs within the Dubbo Regional Council LGA. The LGA has two LEPs, including the Wellington LEP 2012 which commenced operation on 23 November 2012. Under Wellington LEP, the Site is zoned Primary Production (RU1 zone).

Electricity generating works are not permitted within the RU1 zone under the LEP. However, clause 34(7) of the Infrastructure State Environmental Planning Policy (ISEPP) provides that developments for the purpose of 'solar energy systems' may be carried out with consent on any land, except as prescribed by subclause 34(8). As such, electricity generating works such as the proposed Suntop Solar Farm are permissible with consent.

### 3.3.2 Scenic provisions

There are no specific documents relating to scenic protection within the western plains region, however, one of the aims of the Wellington LEP 2012 is:

> *to facilitate and encourage sustainable growth and development that…protects and enhances environmentally sensitive areas, ecological systems, areas of a high scenic, recreational or conservation value, and areas that have potential to contribute to improved environmental and scenic outcomes*[7]

[7] Clause 1.2(2)(c)(iii), Wellington LEP 2012

### 3.3.3 Future development

Plans for further PV solar installations in the Wellington area are being considered by the Proponent of the Suntop solar farm (Photon Energy). Similar facilities involving PV solar panels and a substation are proposed at Mumbil and Maryvale. The proposed locations of all three PV solar farms are shown on FIGURE 3-3.

The proposed Mumbil solar farm is located on the eastern side of the Mount Arthur Reserve, south of Wellington, and south-east of Suntop. It is approximately 21.5km from the proposed Suntop solar farm in a straight line, or 33km on road.

The proposed Maryvale solar farm is located on the eastern side of the Mount Arthur Reserve, north of Wellington, and north-east of Suntop. It is approximately 14.5km from the proposed Suntop solar farm in a straight line, or 21km on road.

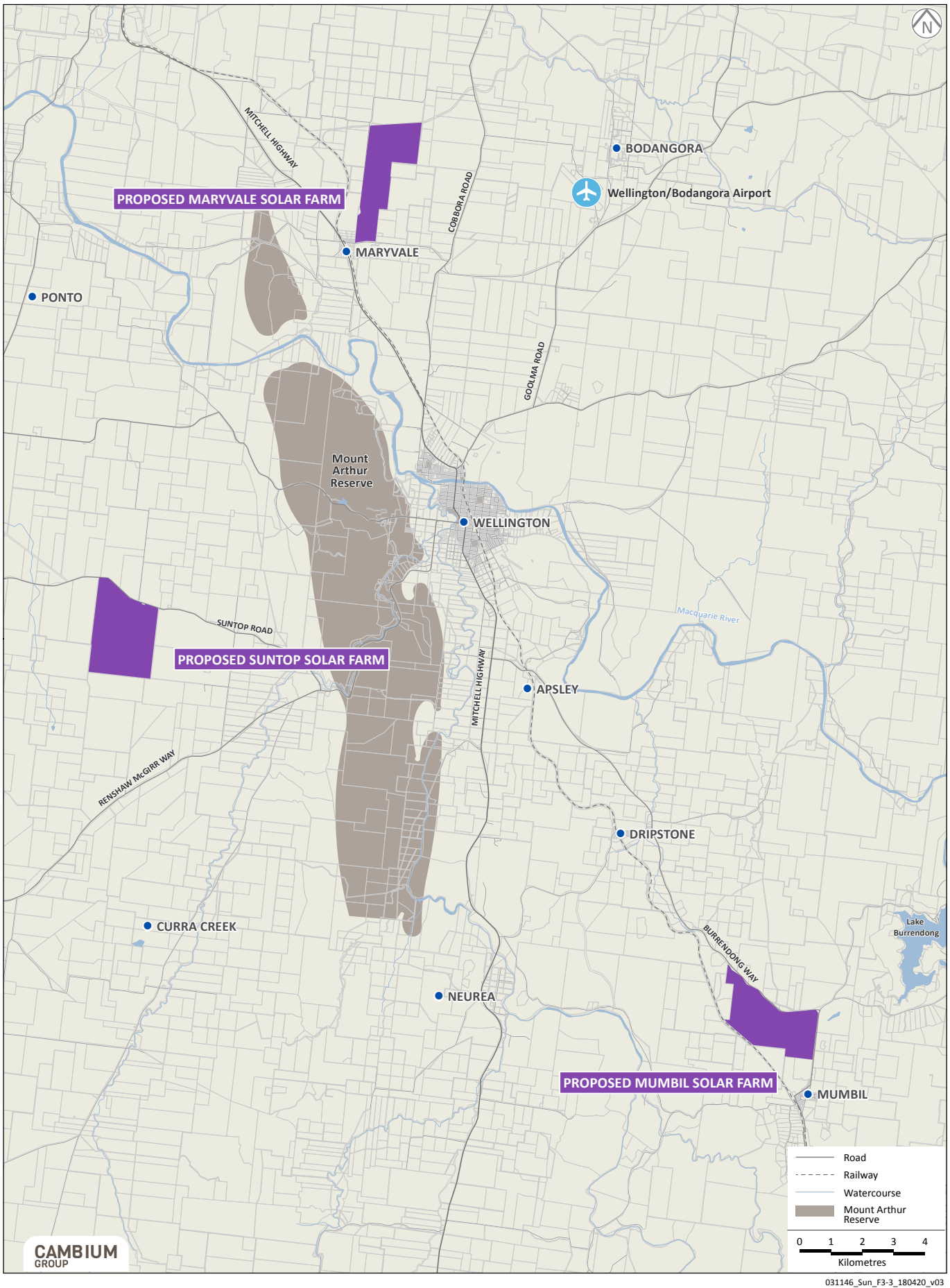
It is not possible to see all three sites from a single viewpoint (except possibly from the air). Neither the Mumbil nor the Maryvale site are visible from the proposed Suntop solar farm Site.

The cumulative impact of the potential development is further considered at SECTION 10.0.

**FIGURE 3-3**

Proposed solar farms in the Wellington area

SUNTOP SOLAR FARM - VISUAL IMPACT ASSESSMENT




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# 4 Description of the Proposal

This section of the report presents information about the Proposal, describes the visual characteristics of the solar farm and sources of potential visual change associated with the Proposal.

## 4.1 The Proposal

The Proposal would occupy 472 ha of the rural property at 909 Suntop Road. This is equivalent to approximately 91% of the property, with the remaining land continuing to be used for agricultural purposes. The Site is proposed to be leased by the Proponent for 30 years.

The Proposal would consist of PV solar panels installed on a single axis tracker system across the Site. The single axis tracker system would allow the PV panels to tilt from +60° angle east in the morning, to -60° angle west in the afternoon, to follow the sun throughout the day.

A substation would be installed in the vicinity of the existing TransGrid electricity transmission lines to connect to the existing transmission lines and transmit power generated by the solar farm to the local energy grid. Ancillary infrastructure, such as roads and buildings, would also be required to support the operation of the solar farm.

The development footprint would avoid existing surface water bodies on the site where possible. A buffer of 40m would be provided between infrastructure and any waterway and a 10m buffer would be provided from the Site boundaries. The footprint would also avoid the majority of vegetation present.

In summary, the Proposal comprises the following elements:

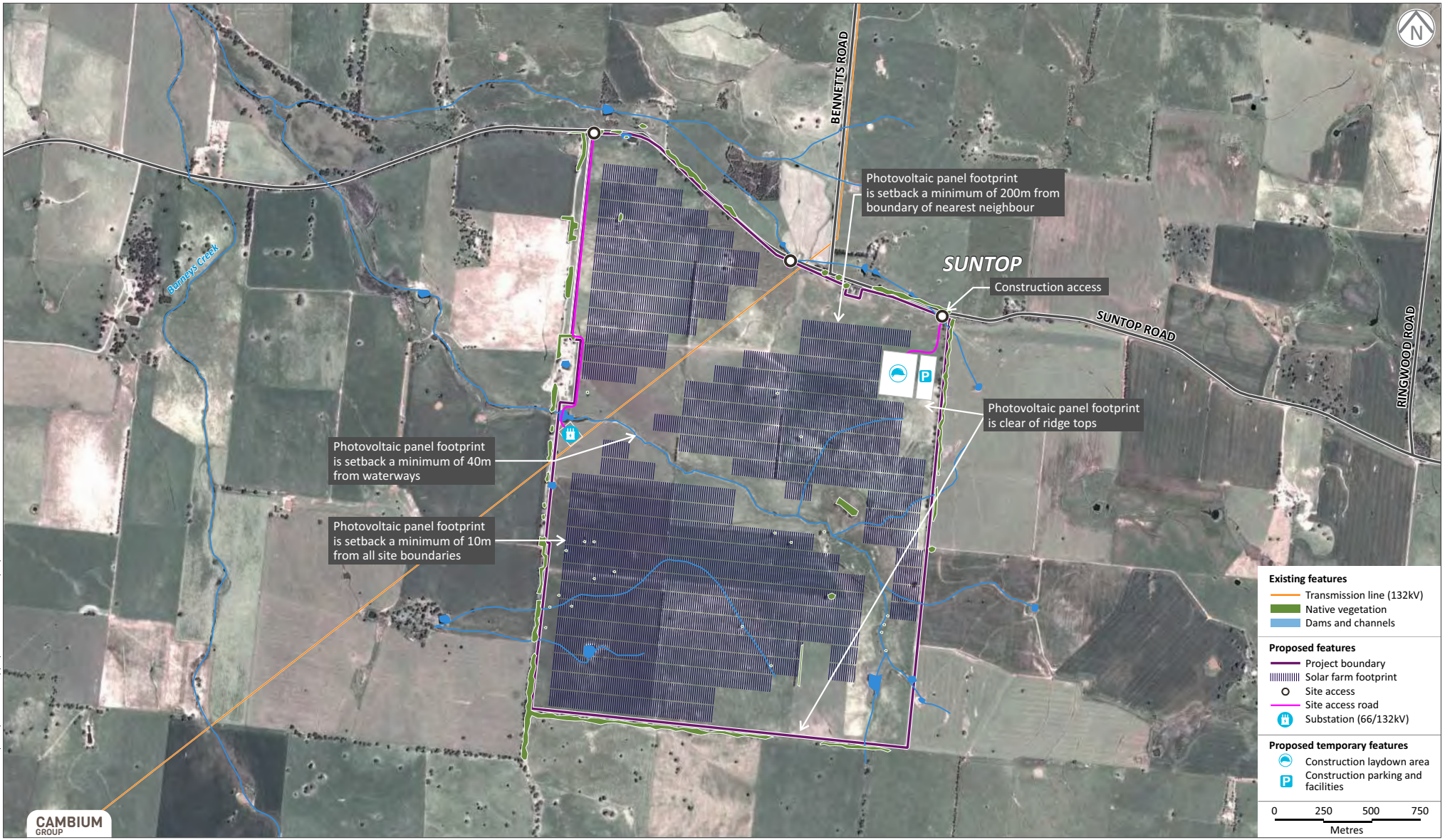
- 472ha of PV solar panels (2m x 1m) mounted on steel posts to achieve a maximum panel height of approximately 4m
- A 132kv substation (30m x 80m) on a concrete slab, including two transformers and associated 132kv switchgear
- Inverters and inverter stations (containers comprising wiring/cabling which collect and convey the energy produced by the PV panels)
- Underground cabling and other electrical infrastructure (eg security systems)
- A maintenance compound and buildings
- A 1.8m high wire link security fence with 24/7 surveillance cameras, installed around the perimeter of the Site
- Landscaping and environmental works
- A main access road off Suntop Road for all access and egress for the Site, including the substation.

The key elements of the Proposal, including the approximate footprint of the PV solar panels, are shown on FIGURE 4-1.

**FIGURE 4-1**

Proposed site layout

SUNTOP SOLAR FARM - VISUAL IMPACT ASSESSMENT




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## 4.2 Main components relevant to visual impact assessment

The main components of the Proposal are discussed below. Potential visual issues that may be associated with solar farms are discussed at SECTION 5.0.

### PV panels

An estimated 550,000 PV panels would be installed. Each PV panel would be approximately 2 metres (m) x 1m in area, constructed of dark-coloured material covered with an anti-reflective coating. Each panel is comprised of 72 high efficiency monocrystalline cells with glass and aluminium frames.

The PV panels would be arranged in groups (arrays) which would run north/south, mounted on steel posts in rows approximately 11m apart. An example of the type of panels to be installed at Suntop is shown at FIGURE 4-2.



FIGURE 4-2: EXAMPLE OF TRACKER SOLAR (PV) PANELS (provided by Pitt & Sherry)

The mounting structure would provide a maximum panel height of approximately 4m at full tilt which occurs twice during the day - in the morning when facing east (9am), and in the afternoon when facing west (3pm). During the day, the panels would slowly tilt and in the middle of the day lie flat facing up, resulting in a panel height of approximately 2.3m at midday.

The steel posts of the mounting structure would extend between 1.6 to 4m below ground depending on geological conditions. The ground surface under the panels would essentially remain unchanged and covered with pasture grasses. An example of the type of mounting structure to be installed at Suntop is shown at FIGURE 4-3.



FIGURE 4-3: EXAMPLE OF GROUND-MOUNTING ARRANGEMENT (provided by Pitt & Sherry)

### Inverters

Energy generated by the PV panels would be transferred from the arrays via cables to inverters. Approximately 10,000 PV panels would connect to each inverter. Two to three inverters would be housed within a single container ("inverter station") located at the end of rows of PV panels. There would be approximately 60 inverter stations across the Site.

The inverter stations would convert the energy from direct current (DC) to alternating current (AC). An image of the type of PV solar inverter station to be installed at Suntop is provided at FIGURE 4-4.



FIGURE 4-4: EXAMPLE OF PV SOLAR INVERTER & INVERTER STATION (provided by Pitt & Sherry)

The inverter stations to be installed across the site would follow one of the following options:

- 40 x 4.92 MW Ingeteam CON40 inverters (Dimensions: 12.2m long x 2.4m wide x 2.9m high) – housed in a 40' container.
- 59 x 3.20 MW Ingeteam CON20 inverters (Dimensions: 6.1m long x 2.4m wide x 2.6m high) – housed in a 20' container.

The inverter stations would be delivered fully containerised and be installed on concrete foundations, slightly elevated above the ground.

Colour treating the inverters, inverter stations, and ancillary structures proposed at the Site is one of the numerous mitigation measures proposed. A dark grey is proposed for the structures (although final colour choice would be determined during detailed design). A dark colour would have a receding effect, decreasing the visibility and contrast of the structures. Mitigation measures are discussed in detail at SECTION 9.0.

### Substation

Energy would be conveyed from the inverter stations to the substation via underground electrical cabling. The substation is proposed to be located within the Site along the western boundary, over 1.5km from Suntop Road. An access road would be formed from Suntop Road close to the western boundary to provide access to the substation.

The substation would be operated by TransGrid. TransGrid's general arrangement for the substation is illustrated in FIGURE 4-5. The key features of the substation include:

- entry gate
- 3m high security fencing around the substation,
- 33kV switchgear building and auxiliary services building, and
- two transformers which would increase the voltage of the energy received from the inverter stations to a level that could be transmitted from the Site via the TransGrid powerlines.

An example of a similar substation is shown at FIGURE 4-6.

The substation would be constructed on a concrete pad, approximately 60m x 80m, with gravel placed around the equipment and fence to restrict vegetation growth and provide a safe working environment in accordance with Australian Standards.

A 10m asset protection zone (APZ) would be maintained around the substation in accordance with TransGrid design and safety standards.

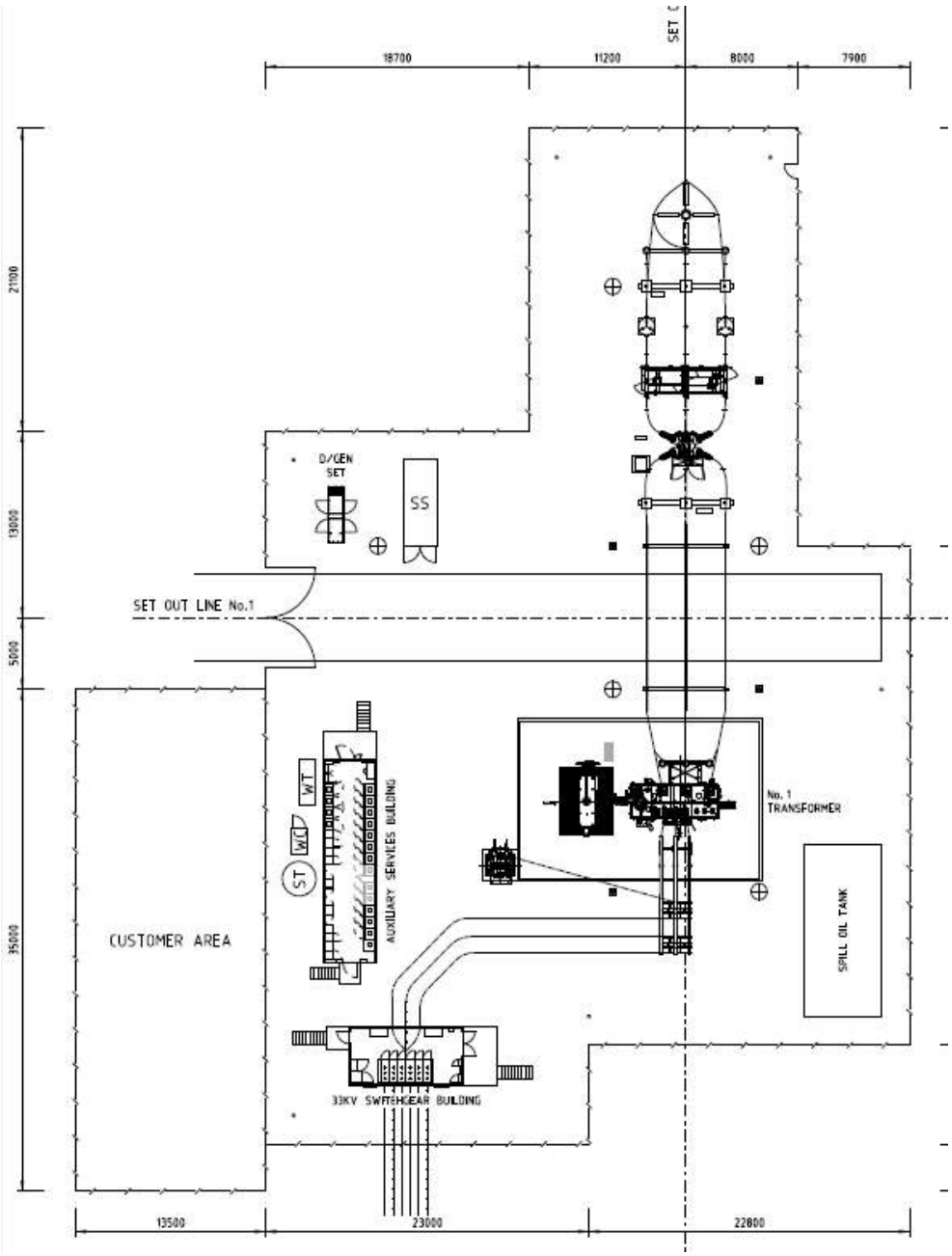



FIGURE 4-5: GENERAL ARRANGEMENT OF SUBSTATION (plan supplied by TransGrid)

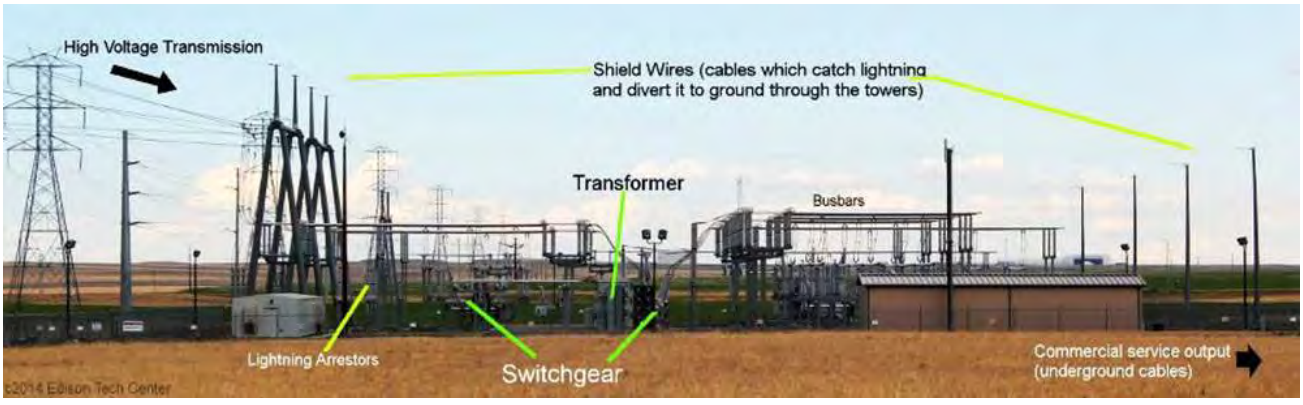



FIGURE 4-6: EXAMPLE OF A SIMILAR SUBSTATION TO THAT PROPOSED (supplied by Pitt & Sherry)

### TransGrid infrastructure works

A short section of new overhead transmission lines (20m height, 132kV single-circuit, wood poles) would be installed to enter and exit the substation to connect to the existing 132 kV transmission line. This connection is subject to TransGrid detailed design however it is assumed that timber poles (similar to surrounding infrastructure) would be installed to carry powerlines from the substation to the 132kV transmission line.

Further works to connect to the existing TransGrid Wellington Substation would be undertaken by TransGrid and would occur wholly within the existing transmission line easement. TransGrid have advised their works would not result in any change to existing land use and has limited potential for environmental impacts due to the existing disturbed nature of the easement and temporary nature of the works.

### Site access

Access to the Site would be from Suntop Road, a local, sealed road managed by Dubbo Regional Council. The main entrance to the solar farm would be located at the existing Site entrance, along the western boundary of the property. The main entrance road would also provide access to the proposed TransGrid substation.

Additional access roads are required across the Site for operations and would be formed between panel installations, wide enough for maintenance vehicles to move through. These internal roads would not be constructed or delineated due to the low frequency of proposed access.

A creek crossing would be constructed to gain access to the southern part of the Site.

A temporary site access would be formed off Suntop Road at the north-east corner of the Site for use during construction.

### Parking and storage

A small parking area may be provided for worker's utility vehicles to park during periodic Site maintenance.

Two 40' shipping containers for storage of maintenance equipment would be located near the eastern boundary (within the compound area used during construction).

Emergency firefighting water would be stored in a tank (approximately 50,000 litres (L) in size - likely to be 4-5m in diameter and approximately 2-3m high), which may be located near the Site entrance (although the final location is yet to be determined).

Colour treating the storage containers and water storage tank (same as the inverters and other ancillary structures) is proposed in this report to reduce their visibility.

### Site fencing

The perimeter of the Site would be bounded by security fencing (at least 1.8m high) with lockable access gates from the main access off Suntop Road and with 24/7 surveillance cameras. An example of the Site security fencing is shown at FIGURE 4-7.

The substation would have its own, additional security fencing – 3m high palisade security fencing installed around the perimeter of the substation – and additional security gate.



FIGURE 4-7: EXAMPLE OF A SIMILAR SECURITY FENCING TO THAT PROPOSED (supplied by Pitt & Sherry)

### Planting

The Proposal for the solar farm includes tree planting around the boundary of the Site to screen and filter direct views into the Site. A Concept Landscape Plan is provided at FIGURE 9-1. Planting is one of numerous mitigation measures proposed for the solar farm. Mitigation measures are discussed in detail at SECTION 9.

### Residence

The existing residence and built structures on the western side of the property are subject to a subdivision and would not form part of the Site.

## 4.3 Construction

The construction phase of the Proposal is expected to take twelve months. Up to 250 people would be required on Site during the peak construction period. It is anticipated that the solar farm would be constructed in 1ha stages – with up to 10 stages in construction at any one time.

No construction works are proposed to occur at night. Standard construction hours would be adopted.

### Site establishment

A temporary construction compound would be installed along the eastern boundary of the Site. The location of the construction compound is shown on FIGURE 4-1. Access to the construction compound would be via a temporary access road off Suntop Road.

During construction, the traffic volume is expected to be up to 40 heavy vehicles (mostly B-double trucks), and 50 light commercial vehicles per day.

Initial site establishment works would include:

- Formation of a stabilised, tmporary construction access
- Materials laydown area
- construction offices (one 12m x 3m site office, four 12 x 3m break rooms)
- parking area (for approximately 80 vehicles)
- staff amenities
- CCTV (Security purposes)
- Fencing.

Preparation of the construction laydown area would include limited site grading, lining the ground surface and placing a gravel cap over the lining. Gravel and lining would be removed when the construction phase is complete.

### Vegetation clearance

Vegetation to be retained would be protected. A buffer of 40m is proposed between infrastructure and any waterway and the majority of existing vegetation on Site would be avoided.

Minor vegetation clearing is proposed. Vegetation clearance would be targeted to grasses, shrubs and isolated trees located at proposed trenching areas, and where steel post installation is proposed.

### Earthworks

Minor earthworks would be required to prepare the ground for footings and concrete slabs to install the inverters, transmission kiosk and substation. The earthworks would temporarily expose the red soils of the Site. A range of plant may be used including scrapers, bulldozers, excavators, rollers, trucks, backhoe and loaders.

Trenching (up to 1.2m deep) would be required over the Site to lay the interconnecting cabling. The trenches would be backfilled.

Pile driving (approximately 1.6m to 4m deep) would be required to install the supporting structures for the solar panels.

Minor, localised earthworks may be required beneath the PV panels to achieve more consistent gradients. However, broadscale, levelling/benching across the Site is not required to install the PV panel mounting structures.

### Delivery

Most of the infrastructure for the solar farm would be pre- fabricated off-site, delivered and then assembled on-site. Trucks would transport the modular equipment to Site via Suntop Road. Suntop Road, Renshaw McGirr Way, and the Mitchell Highway (21km west of the Site) would be the major transport routes for haulage and Site vehicles during construction.

A truck parking area would be provided at a suitable location either within Wellington or on the outskirts of the town. In the event a suitable location cannot be found, a suitable site at Dubbo would be investigated.

### Installation

Plant required to install the components of the solar farm would likely include excavators, cable trenching equipment, elevated work platform, backhoes, bulldozers, scrapers, rollers, pile drivers, trucks, fork-lifts and cranes.

The PV mounting structures would be driven or screwed into ground using a pile driver or similar. Additional support structures would be attached to the steel mounting structures and the PV panels would then be crane-mounted onto the support structures.

New powerlines would be installed (if required) and the substation would be connected to the existing transmission line to convey the energy.

The main Site access road along the western boundary of the Site would be upgraded.

The inverters, inverter stations and other ancillary buildings would be installed (including the two shipping containers to be used for storage of maintenance equipment).

Proposed planting would be undertaken.

## 4.4 Operation

The Proposal would operate 24 hours a day, 7 days a week, however, this would not involve the presence of staff on-site or active operations. Night operations are not required for the solar farm or for the substation, and ordinarily, there would be no night lighting at the site. Any lights installed would only be illuminated in an extraordinary event (such as an emergency).

The Site would have remote 24/7 on-line monitoring and 24hr site security response would be available should a security event occur.

Irregular maintenance activities will be undertaken during standard working hours (except in an emergency) and are expected to include:

- Panel cleaning
- Repairs, cleaning or replacement of infrastructure, as required
- Mowing or stock management activities to control vegetation.

## 4.5 Decommissioning and rehabilitation

The Proposal is intended to be operational for approximately 30 years. At the end of this period, the solar farm would either be decommissioned or updated for continued use. If the Site is decommissioned, all structures (with the exception of the substation) would be removed and the Site would be rehabilitated and returned to agricultural use.

# 5 Potential visual concerns

A review (by others) of studies of social-cultural attitudes and renewable energy acceptance, based on surveys from 13 countries, concluded that "the singularly most important concern about renewable energy is visual intrusion"[8].

This section of the report briefly discusses, and seeks to address, some of the potential visual concerns the community may have related to PV solar farms. The impact assessment presented in SECTIONS 6.0 and 7.0 takes account of concerns where relevant.

## 5.1 Scale

Large scale solar facilities can occupy very large land areas, have regular, strong geometry, and can be visible for long distances. One study found that large PV solar facilities are not uncommonly visible at a distance of 16km[9], yet it is notable that, when viewed from long distances, the facilities may not be recognisable as solar facilities.

FIGURE 5-1 provides a visual comparison of the height of PV panels compared to other familiar elements, illustrating the overall low profile of the Proposal.

Although large, such solar facilities have visual advantages in that they are generally low to the ground, have low visual contrast, and can appear as shadows from a distance[10]. Depending on the project layout and contrast, in some cases they may appear to be natural features, while in other cases, they may lack sufficient visual detail to be identified positively as solar facilities[11].

## 5.2 Glint and glare

Glint is generally defined as a momentary flash of light. Glare is a longer and for some time continuous source of light reflection.

In desert areas, glare has been observed from parabolic trough facilities and solar array facilities[12]. The Proposal does not use these technologies. These types of solar facilities concentrate thermal solar power by using mirrors to reflect the sun to one point, concentrating the sunlight. The PV solar modules proposed to be installed at Suntop are non-reflective and do not use concentrating mirrors.

The *NSW Department of Industry Resources & Energy: Solar Farms in NSW Fact Sheet* (June 2016) states:

[8] Apostol, Dean (2017) *The Renewable Energy Landscape*. Routledge. (Apostle 121)

[9] Sullivan, R. et.al. (2012). *Visual impacts of utility-scale solar energy facilities on southwestern desert landscapes.*

[10] Sullivan et al. (2012). *p14*

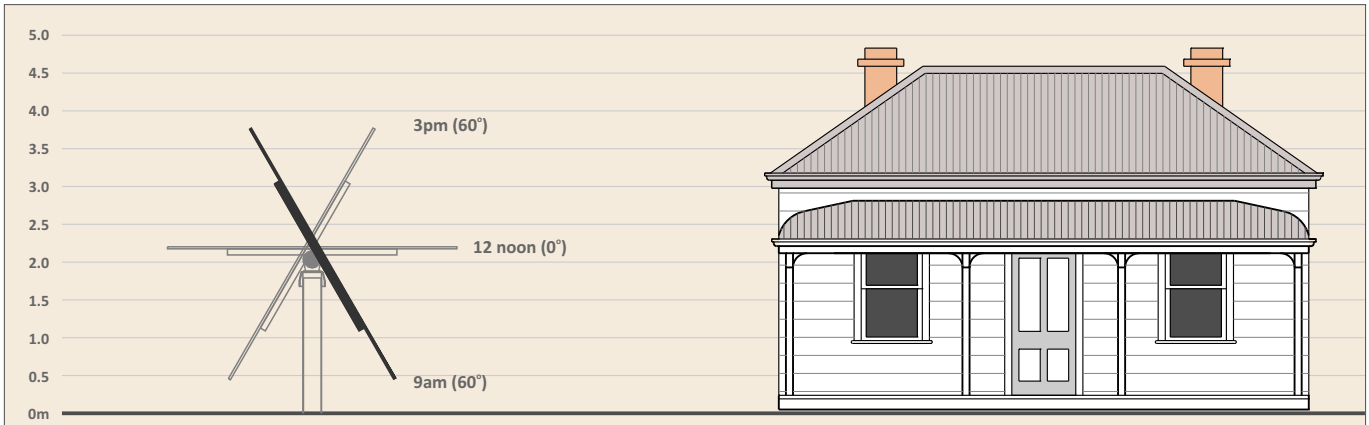
[11] Apostol, Dean. (2017) (Apostle 21)

[12] Sullivan et al. (2012). *p16*

**FIGURE 5-1**

Photovoltaic solar panel height comparison (Tracking)

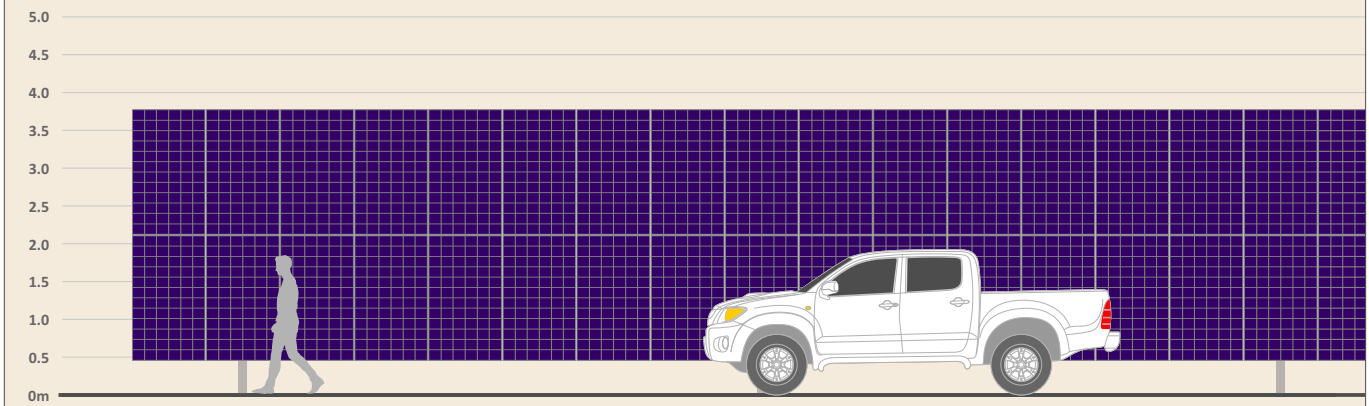
SUNTOP - VISUAL IMPACT ASSESSMENT



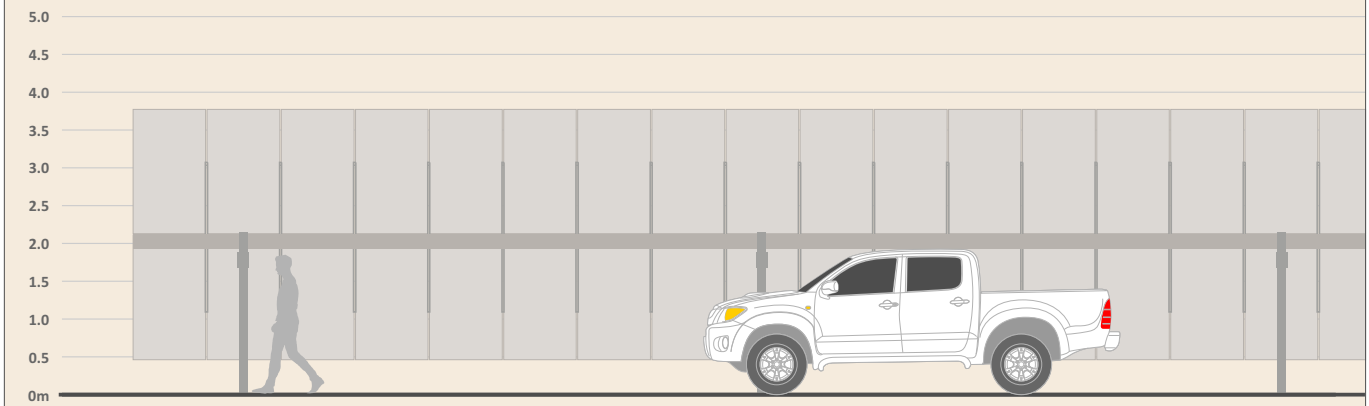

NORTH/SOUTH ELEVATION



FARM HOUSE




EAST ELEVATION (9am - 60°)




WEST ELEVATION (9am - 60°)



INDICATIVE ARRANGEMENT

CAMBIUM GROUP

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*Solar farms are not considered to be reflective. Photovoltaic panels are designed to reflect as little light as possible (generally around 2% of the light received) to maximise their efficiency, absorb sunlight and convert it to electricity. Minimising the light reflected from solar panels is a goal of panel design, manufacture and installation. The glare from panels is significantly less than that from bodies of water.*

A comprehensive study of potential for glint and glare was undertaken for the proposed Sapphire Solar Farm near Glen Innes, NSW (Pager Power, November 2017). The proposed solar farm would comprise PV solar 'tracking panels'.

The study reviewed a substantial amount of available literature and found that:

- *Glint and glare effects can only ever occur when the weather is clear and sunny*
- *The reflections produced are of intensity similar to or less than those produced from still water and significantly less than reflections from glass and steel*
- *In the scenario where a solar reflection is possible towards a road user or resident in a surrounding dwelling, the individual will also be looking in the general direction of the Sun. This means the Sun and solar reflection will be visible simultaneously. The Sun is a significantly brighter source of light.*
- *Lastly, at any one location, only a particular area of solar panels will produce a solar reflection towards it.*

The study concluded:

- *'the overall expected impact upon road users with respect to safety is classified as Low (at worst) where the reflecting solar panels are visible*[13]
- And that for residents, *'The solar reflections would last for up to 20 minutes per day for up to 6 months from windows with a clear view of the reflecting solar panels... In all cases, a clear view of the reflecting solar panels at the particular time of day when a solar reflection was geometrically possible would be required. In addition, the weather would also have to be clear and sunny...the resulting impact significance is Low to Moderate. If screening removes the solar panels from view, No Impact will be possible.*
- *If mitigation were to be requested, the most appropriate form would be the installation of screening in the form of vegetation.*

Therefore, based on available information, and in-line with the *NSW Department of Industry Solar Farm Fact Sheet*, glint and glare are unlikely to be an issue for surrounding residents or road users.

[13] Pager Power, 2017, p3

## 5.3 Light refraction

A 'mirage' effect — glittering or shimmering — may be observed at PV facilities. The effect is similar to the shimmering seen over a bitumen road on a hot day which can make the road surface appear as though it is wet, rippling or reflective (refer to FIGURE 5-2).




FIGURE 5-2: 'MIRAGE EFFECT' ON ROAD ON A HOT DAY

The effect occurs because the surface of the road is hotter than the air around it. In the case of PV panels, heat from the panel surface warms the air above it, distorting (refracting) light waves. The air wobbles and makes the colour above the surface appear brighter and bluer[14].

The 'mirage' effect is not bright enough to cause discomfort. It is likely to be only observed during certain times of day and from certain viewing positions. FIGURE 5-3 shows the effect (although difficult to see) from an elevated position (45m higher), north-east of, and 2.75km from, Royalla Solar Farm, the Australian Capital Territory (ACT). Another image of the Royalla Solar Farm is provided at FIGURE 5-5.

It is to be noted that the Royalla Solar Farm is not a directly comparable visual example as it is comprised of fixed-angle panels.

[14] Adapted from:
- The Naked Scientists, 01/06/2008, https://www.thenakedscientists.com/forum/index.php?topic=14849.0
- Physics, 26 May 2011, https://physics.stackexchange.com/questions/10464/why-does-the-road-look-like-its-wet-on-hot-days




FIGURE 5-3: PHOTOGRAPH OF ROYALLA SOLAR FARM NEAR CANBERRA (2.75km from solar farm)

## 5.4 Geometric pattern and viewer position

Viewer position in relation to the layout of PV modules also affects the appearance of the solar farm. An image showing viewer position in relation to the rows (arrays) of PV modules is shown at FIGURE 5-4. Viewer position determines which side of the PV modules is in view, and therefore which angle of surface is seen with respect to the viewer.

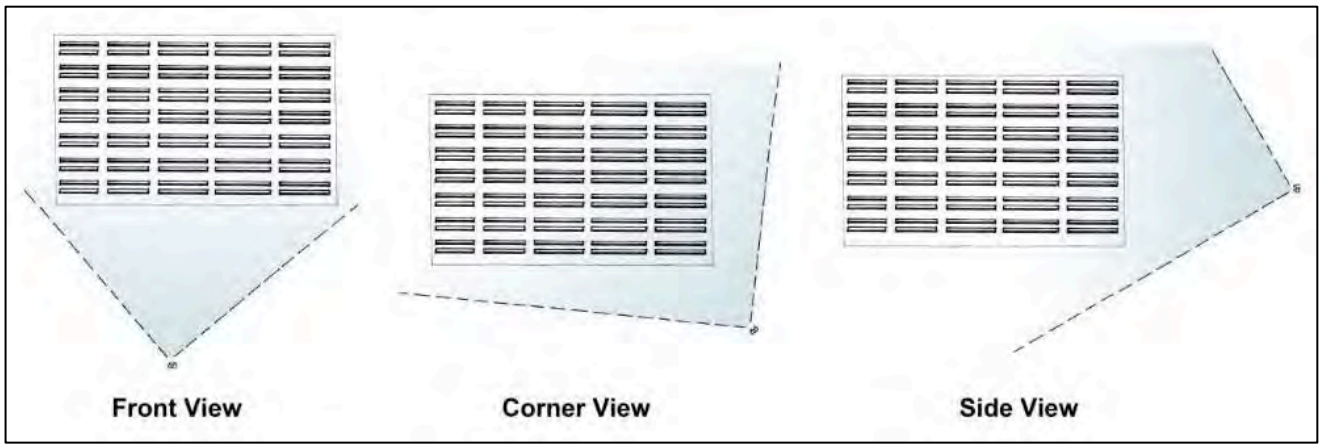



FIGURE 5-4: VIEWER POSITION IN RELATION TO PV PANELS (Argonne National Laboratory[15])

From some viewer positions it may be possible to see down the long rows (arrays) of the PV solar modules. If travelling past rows perpendicular to a road, the rapid change in viewer position would result in abrupt changes in angle and pattern of the panels. The colour of the panels would appear to change rapidly from black (when viewing the rear of the panels) to various shades from blue to white (when viewing the face of the panels). The visual change – the lightening or darkening appearance of the panels as the vehicle passes the facility[16] - would only be seen if looking directly down the rows when travelling past at speed and would be momentary[17].

Colour change in relation to viewer position is shown in the image at FIGURE 5-5 (taken 200m from the nearest panels at Royalla Solar Farm, ACT). When viewing the face of the panels, the panels appear lighter in colour – with shades of blue to white. Looking at the rear of the panels, the panels appear black as they cast shadow.

However, as previously noted, the Royalla Solar Farm is not a directly comparable visual example as it is comprised of fixed-angle panels permanently facing the same direction. The proposed solar farm at Suntop would comprise tracking panels which slowly move throughout the day, changing their angle and direction.

[15] In Sullivan, R. and Meyer, M. 2014.

[16] Sullivan, R (2012) p22

[17] Sullivan, R et.al. (2012) p22



FIGURE 5-5: ROYALLA SOLAR FARM SHOWING COLOUR CHANGE WITH SIDE VIEW

## 5.5 Aviation

Aviation warning lights are required for towers and other tall structures which may be a hazard to aircraft. Normally these would be red flashing lights. As the proposed solar panels are low-profile, aviation warning lights are not required.

The solar panels also do not need to be painted white (such as would be required for wind turbines) as an aide to aerial navigation safety. There would be no colour contrast from the solar panels as a result of aviation safety requirements.

There is no movement (visible to the naked eye) that would be associated with the solar farm infrastructure. Therefore, motion would not be an obstruction to aviation.

The Proposal would not include solar towers or other structures that would contrast with dark night skies. The Proposal would not include mirrors or lenses or other reflective surfaces.

It is understood that the Civil Aviation Safety Authority (CASA) has generally advised that large scale solar farms, such as that proposed, are very unlikely to be a hazard to aircraft operations unless they are very close to and aligned to an airports approach or take off paths. The Proposal does not fall into that category.

## 5.6 Movement

Fixed solar panels are permanently oriented toward one aspect (north). Tracking PV solar panels, however, slowly follow the daily transverse of the sun in a 180 degree turn from the north-east in the morning, to the north-west by the afternoon. There is a wider range of potential viewpoints which may face moving panels during the day, however, their exposure to the face of the panels would be shorter in duration.

Although solar panels may change their orientation during the day, the movement is usually very slow and not apparent in short-duration views[18].

## 5.7 Skylining

Skylining occurs when structures are placed on ridgelines, summits, or other locations where they would be silhouetted against the sky. The eye is naturally drawn to prominent landscape features and high points[19]. Examples of skylining can be seen with power poles, telecommunications towers and wind turbines that are installed on ridges in rural landscapes.

PV solar panels are low-profile. Therefore, skylining is unlikely to be an issue unless the panels are located on prominent, exposed, high points, which drawn the attention of the viewer.

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[18] Sullivan, R. and M Meyer. 2014. p50

[19] United States Department of the Interior. 2013. *Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands*. BMP 6.2.12

## 5.8 Ancillary structures

PV solar farms require a high number of inverters and ancillary structures to be installed across the Site. Multiple inverter stations (at 2.9m high x 2.4m wide x 12.2m long) are installed at the end of PV solar panel rows to convert the energy produced by the panels. The colour of such ancillary PV solar farm structures may contrast against the background landscape of the solar fam and could have the effect of drawing attention to the multiple structures laid out in a grid pattern across the farm.

The colour of ancillary structures is therefore important. Inverters and other facility components that are colour-treated two to three shades darker than the background landscape colour, better match the surroundings and decrease their visibility and contrast. White is generally the most conspicuous colour. Lighter colours should be avoided.

An example of white coloured inverters and other solar farm buildings is shown at FIGURE 5-6, Royalla Solar Farm, near Canberra, ACT. An example of a colour-treated inverter is shown FIGURE 5-7, at Williamsdale Solar Farm, near Canberra. These images show that the use of darker, more-recessive colours can lower visual contrast and potential visual impact.

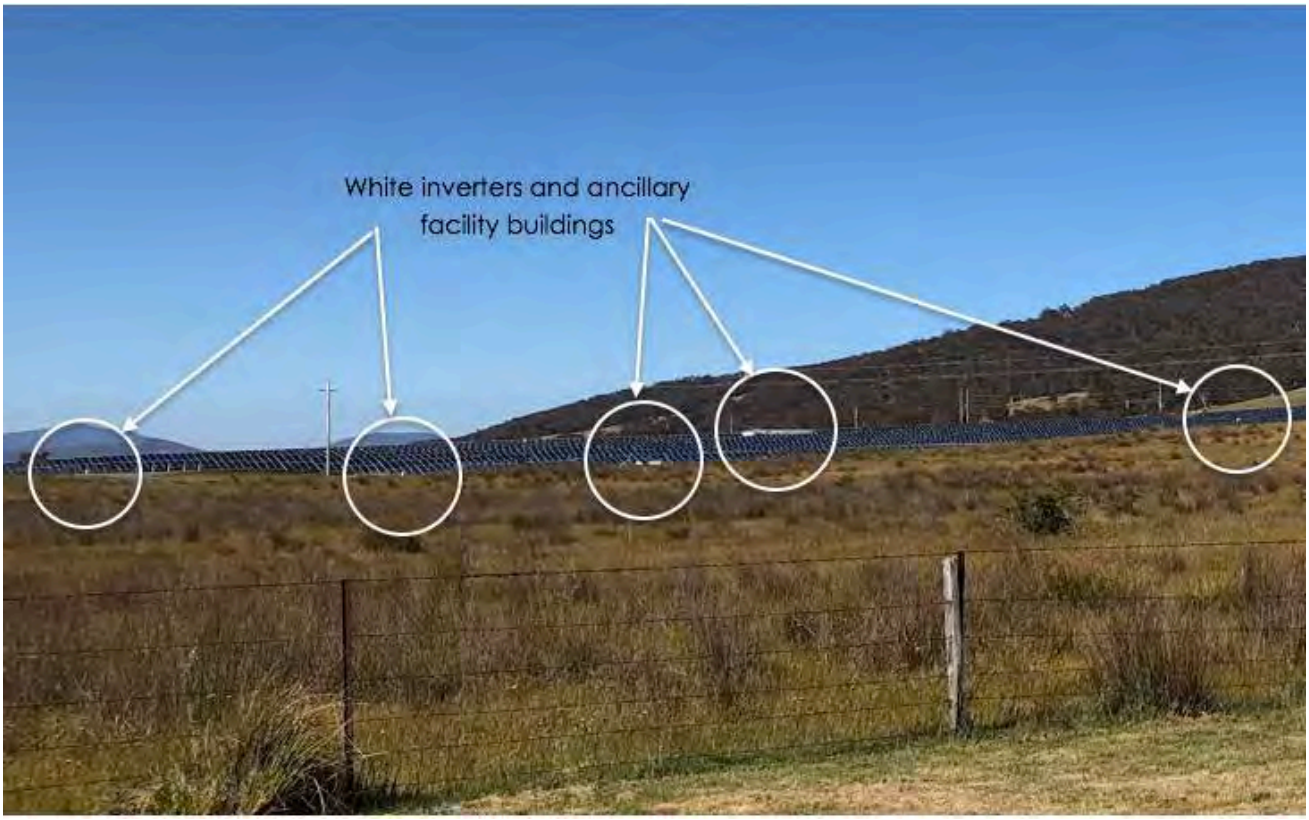



FIGURE 5-6: ROYALLA SOLAR FARM SHOWING WHITE ANCILLARY STRUCTURES



FIGURE 5-7: WILLIAMSDALE SOLAR FARM SHOWING COLOUR-TREATED INVERTERS

# 6 Impact to landscape character

The landscape character of the vicinity has been described at SECTION 3.0. This section of the report describes the changes in visual quality and character of the landscape caused by the Proposal. As noted in SECTION 2.0, the assessment of impact is based on the combination of two criteria: sensitivity and magnitude of change.

## 6.1 Sensitivity

The existing rural setting of Suntop is typical of the mid-western region. The landscape occasionally includes industrial-type elements, such as silos and sheds, and the land surface is often divided into grids and rows via fences, trees, and cropping patterns. However, the installation of a large-scale PV solar farm within the rural setting of Suntop would introduce a new, significantly large (although low-profile), human-made element into the agricultural landscape.

The colour contrast of the solar panels may be more evident in warmer months during wheat growing and harvesting. The dark colour of, and shadows cast by, the solar panels would contrast against the light, bright colour of the crops. The local landscape of broadacre paddocks, however, also creates a variety of patterns and background colours depending upon the crop or use of the land. Linear shadows are also cast by existing rows of trees within and around the Site.

Existing Site infrastructure (such as the sheds and silos) is taller than the proposed infrastructure, although, the Proposal would cover a larger land area.

Using the criteria listed in TABLE 2-2, the overall landscape character is rated as having moderate sensitivity:

- The landscape does not have particular high scenic significance; however, it is an attractive working, rural landscape, typical of the mid-western NSW agricultural area
- The patterning of the area is broadscale, with large agricultural farming lots
- There is a small local population, with the only access road to the Site, Suntop Road, not a main, through road.

## 6.2 Magnitude of change

### Construction

The construction footprint would affect a large area – over 470ha. During construction, residents and visitors driving along Suntop Road would likely see machinery and equipment on the slopes of the Site installing the PV panels and inverters. However, construction of the substation would not be seen.

A key construction impact would be the number of trucks accessing the site to deliver equipment, and daily arrival and departure of construction worker's vehicles. Suntop Road would be affected by the number and frequency of transport movements. The construction compound and construction carpark (proposed to be located along the eastern boundary) would be seen from Suntop Road.

Using the criteria listed in TABLE 2.2, the magnitude of change to landscape character during construction is rated as moderate. There would be:

- Large extent of area affected
- Construction would be the dominant feature of the scene, but principally, only visible from the immediate area of Suntop Road
- The local road would be disrupted by frequent truck movements.

### Operation

Once construction is completed, PV solar panels and inverters would be visible from Suntop Road and from several private properties. The substation, located over 1.5km from Suntop Road and at a lower elevation, would not be seen by Suntop Road users. There is one private property likely to have views of the substation (the impact to individual residents is assessed in SECTION 7.0).

The extent of land covered by the panels would be large – occupying the area of approximately 10 paddocks of common size in the vicinity. However, the undulating nature of the Site would restrict the extent of panels and inverters seen. In addition, due to the low profile of the panels and shadows created by the panel rows, the solar farm is unlikely to be particularly prominent, especially when viewed at a distance.

Colour-treating the inverters, as well as other structures on the Site as proposed in the mitigation measures (refer SECTION 9.0), would reduce their visibility. Proposed planting at perimeter locations of the PV solar farm (as proposed in the mitigation measures (refer SECTION 9.0), would restrict close views of the panels and inverters (in approximately 5 years from construction, allowing time for plants to grow sufficiently). From a distance, the PV solar farm would appear as dark shadow.

Using the criteria listed in TABLE 2.2, the magnitude of change to landscape character during operation is rated as moderate:

- The Site is not visually prominent
- The scale and colour of the PV solar farm would contrast the surrounding rural landscape, however, given the low-profile of the proposed Site structures and proposed dark colours, the PV solar farm would not be visually prominent
- The Proposal would be recognisable at close proximity until the proposed planting has time to grow sufficiently, however, given its low profile and proposed dark colouring, even in the interim period, the PV solar farm would not become the dominant feature of the scene

- The substation, located 1.5km from Suntop Road and at a lower elevation, would not be seen by travellers of Suntop Road

## 6.3 Level of impact to landscape character

### Construction

The moderate sensitivity ranking, combined with the moderate magnitude of change during construction, leads to an overall moderate level of impact.

### Operation

The moderate sensitivity ranking, combined with the moderate magnitude of change post-construction, leads to an overall moderate level of impact.

# 7 Impact to viewpoints

This section of the report assesses the potential effects of the changes on the viewer experience.

## 7.1 Identification of viewpoints

Fifty-seven potential viewing points were initially investigated during the site inspection (22 November 2017)[20]. Identification (ID) numbers were allocated to identify each viewpoint. Site verification determined that 27 viewpoints of the 57 viewpoints initially investigated could potentially see some sections of the proposed solar farm.

### 7.1.1 Private viewpoints

The majority of the identified viewpoints were from private residences. Access to four of the closest private properties[21] was possible during the site inspection. For the remainder of properties, visibility was determined from the closest public access to each viewpoint and desktop analysis of aerial and topographic mapping.

Generally, residences with potential viewpoints located within 2km of the Proposal site were assessed as individual viewpoints. However, due to the large number of potential private viewers, and the relatively similar visual experience from some locations, viewpoints beyond 2km were grouped based on their common experience of:

- distance from the Proposal;
- extent of the Proposal likely to be seen; and
- viewer position in relation to the proposed panels.

### 7.1.2 Public viewpoints

The closest recreational and scenic resource in the area – Mount Arthur Reserve – does not provide public viewing points. ID20, however, is located in an elevated position within the Reserve.

The only ground-level public locations with views of the Proposal site are from Suntop Road and Bennetts Road (refer FIGURE 3-2). Bennetts Road is an unsealed road providing local access to several properties. Suntop Road is the main public vehicular thoroughfare through Suntop. Suntop Road has been assessed as single viewpoint (VP Suntop Road), as the visual experience from the road is linear.

[20] A map of the viewpoints investigated is provided at APPENDIX A, FIGURE A-1.

[21] ID numbers 1, 7, 10 and 27, Appendix A, Figure A-2.

### 7.1.3 Aerial viewpoint

There could also be views of the Proposal from aircraft accessing the local Wellington Airport, which is situated approximately 20km to the north-east of the Site. Wellington Airport does not support commercial flights and is primarily used for private light aircraft. Some airborne viewers may find a solar (PV) farm interesting to look at - others may feel it reduces the quality of the landscape character.

There are other large-scale industrial-type facilities in the area that would be seen from the air (such as Wellington Correctional Centre and intensive poultry farm sheds – both located north east of Wellington), however, none are of the scale of the proposed solar farm. Regardless, from an airplane, the proposed solar farm is most likely to appear dark in colour, similar to shadowing and vegetation, and would likely have a similar dark appearance as that of the Mount Arthur Range.

## 7.2 Assessment of viewpoints

Each viewpoint, or viewpoint group, identified for assessment is shown in TABLE 7-1[22]. The table presents:

- the key factors affecting each viewpoint's visibility, and
- identifies the projected impact rating of each viewpoint at the time of construction.

The potential to further reduce impact through the implementation of mitigation measures has also been assessed for each viewpoint (or group). The proposed mitigation measures include planting around the boundary of the Site to screen and filter direct views (as per the Concept Landscape Plan provided at FIGURE 9-1). In most cases, trees and shrubs take several years to grow to a height that could successfully screen through views. Therefore, the assessment findings at TABLE 7-1 identifies the projected rating five years following construction – whereby visual impact is reduced to an extent through screen planting.

A map showing the location of each viewpoint and its initial rating is provided at FIGURE 7-1.

[22] The original ID numbers used in the site investigation (22 November 2017) have been retained for consistency, therefore, the VP numbers are not consecutive.

TABLE 7-1: ASSESSED VIEWPOINTS AND PREDICTED VISUAL IMPACT LEVELS

| Viewpoint (VP) | Analysis | Distance to nearest view of panels (approx.) | Approx. extent of Site potentially seen | Viewer position in relation to panels | Sensitivity (criteria in TABLE 2-1) | Magnitude of change (criteria in TABLE 2-2) | Impact level (criteria in TABLE 2-3) | Could impact be reduced with mitigation? | Impact level with mitigation measures implemented (5yrs following construction) |
|---|---|---|---|---|---|---|---|---|---|
| VP1 - Lot 53 DP 753238, approximately 490m from the Site boundary | The residence at VP1 is on an elevated ridge<br>However, direct views from the house are not possible<br>The Site is seen from the paddock east of the residence<br>From the viewpoint east of the residence, a moderately large proportion of the PV solar farm could be seen<br>Could potentially see the substation<br>During the late afternoon, the front of the tracking panels would be seen as the panels tilt to face the west<br>Throughout the morning, a rear view of the panels would be seen<br>The closest row of the panels would be half a kilometre away | 550m | Less than half (40%) | West | High | Moderate | Moderate-high | Extent of panels and inverters likely to be seen could reduce via screen planting near the boundary between the Site and VP1 property. Planting along the boundary could also reduce views of the substation | Moderate.<br>Due to proximity and elevation of VP1, views of the PV panels (particularly the rows closest to VP1) and substation would reduce through planting, however, panels over some parts of the Site would remain visible above the height of screen planting |
| VP2 – 898 Suntop Road, Suntop (Lot 97 DP 753238), | The viewpoint is a private home; however, existing vegetation within the property and along Suntop | 850m | Less than a quarter of site (20%) | North-west | High | Low | Moderate | Planting near the Site's northern and western | Moderate-low |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| approximately 780m from the Site boundary | Road obstructs much of the view<br>A moderate proportion of the solar farm would be seen, although obstructed by existing vegetation, reducing the view substantially<br>During the late afternoon, a view of the face of the tracking panels may be possible, although the view is at an angle, not directly front-on to the panels<br>Is unlikely to see the substation | | | | | | | boundary would reduce views into the Site | |
| VP3 - 796 Suntop Road, Suntop (Lot 2 DP 983890), approximately 160m from the Site boundary | Is in close proximity to proposed panels and inverters (350m to nearest panels)<br>Is opposite the Site entry (which would also be a second entry during construction)<br>A relatively small proportion of the Site would be seen<br>Is generally at same elevation as Suntop Road<br>Existing trees along Suntop Road may substantially reduce views to the Site from the residence. However, access to the house was not possible during the Site inspection to confirm this, therefore, a worst case has been assumed | 350m | Less than a quarter of Site (15%) | North | High | Moderate | Moderate-high | Views into the Site would reduce via screen planting along the northern 'Suntop Road' boundary | Moderate-low |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | The viewpoint would potentially look down the long rows of PV panels. The viewer would not face the panels directly. Rather the viewer would see a side view of the panels (refer FIGURE 5-4 and FIGURE 5-5), and see the angle of the panels change throughout the day as they tilt on their axis from east to west. Colour changes from viewing the long rows of panels at different angles would be likely<br>Is unlikely to see the substation | | | | | | | | |
| VP4 – 14 Bennetts Road, Suntop (Lot 92 DP 753238), approximately 270m from the Site boundary | The viewpoint is in close proximity to the Site boundary (270m); however, the nearest panels would be approximately 400m away<br>A relatively small proportion of the Site would be seen<br>Existing trees within VP4 property and along Suntop Road potentially reduce views to the Site from the residence<br>The viewpoint would potentially look down the long rows of PV panels. The viewer would have a side view and see the panels on an angle as they tilt on their axis from east to west during the day. Colour | 400m | Less than a quarter of Site (15%) | North | High | Moderate | Moderate - high | Views would reduce via proposed screen planting along the northern 'Suntop Road' boundary, and planting within VP6 property | Moderate-low |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | changes from viewing the rows of panels at different angles would be likely<br>The substation is unlikely to be seen | | | | | | | | |
| VP5 – Lot 51 DP 1082497, approximately 380m east of the Site boundary | The closest panels to the viewpoint would be half a kilometre away<br>A relatively small proportion of the Site would be seen<br>Trees between the property and the solar farm would likely limit views<br>The private home would potentially view the face of the panels in the morning, although the view is at an angle, not directly facing the panels<br>Later in the day a rear view of the panels would be seen<br>The substation is unlikely to be seen | 500m | Less than a quarter of Site (4%) | North-east | High | Low | Moderate | Views into the Site would potentially reduce via screen planting along the northern 'Suntop Road' boundary | Moderate-low |
| VP6 – Lot 90 DP 657805, immediately north of the Site | Located immediately north of (adjoining) the Site, on the southern side of Suntop Road<br>This is the closest residence to the proposed panels and inverters<br>The property is lower in elevation than the surrounding solar farm Site<br>The property faces north, and views are directed | 200m | Less than a quarter of Site (15%) | North | High | High | High | Planting is proposed within the VP6 property. Planting includes shrubs and trees to create a dense screen along the three sides of the property | Moderate.<br>Ultimately, if dense enough, the planting could completely screen views of the solar farm from this property. However, the visual change is still assessed |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | northward, away from the proposed solar farm<br>A relatively small proportion of the solar farm would be seen, however, views of the panels would be possible from three sides of the property<br>From the yard of the property, in the morning, when looking west, the viewer would face the front of the panels. In the afternoon, when looking east, the viewer would again face the front of the panels<br>At all times of the day when looking south, the viewer could potentially look upon the long rows of PV panels. The viewer would see the panels at a side angle (refer FIGURE 5-4 and FIGURE 5-5), as they tilt on their axis from east to west during the day. Colour changes from viewing the long rows of panels at different angles is likely<br>The substation would not be seen<br>VP6 would also be in close proximity to the proposed construction compound and would be the closest residence to the construction area. | | | | | | | bordering the Site. Screen planting is expected to substantially reduce views into the Site | as moderate due to the permanent magnitude of change. The setting of VP6 would have changed from a residence adjacent an open paddock, to a residence surrounded by dense native vegetation |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Although the interruption and visual disturbance resulting from construction and construction traffic accessing the compound would be temporary, the works would be a visually obvious and unavoidable change to the scenery and directly observable from VP6 | | | | | | | | |
| VP7 – 582 Suntop Road, (Lot 50 DP 753238), approximately 950m north of the Site | This viewpoint is over a kilometre from the nearest panels and inverters<br>It is a private residence in an elevated positon, however direct views to the Site from the house are not possible<br>A moderate proportion of the Site potentially seen<br>The solar farm site would be seen from the paddock west of the residence<br>The viewer would have a side view of the tracking panels. However, at this distance, colour changes from looking down the rows of panels may not be noticeable<br>The substation would not be seen | 1050m | Approximately a quarter of the Site (25%) | North | Moderate | Moderate | Moderate | Planting along Suntop Road would not be seen from this viewpoint due the its elevation above the Site | Moderate |
| VP Group A – ID13, ID15 and ID16 | This group of viewpoints is within 2.5km of the Site boundary(approximately)<br>Small to moderate | 2.35km | Up to half of Site (up to 50%) | North to west | Low | Low | Low | Proposed planting unlikely to reduce views from these | Low |

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| | proportion of the Site potentially visible<br>ID13 and ID15 would have a distant view of the face of the panels during the late afternoon. For the remainder of the day, the rear of the panels would be seen.<br>For ID16, a side view of panels may be possible. However, from all three viewer positions, the extent of panels seen would be minimal and unlikely to be prominent in the view<br>Substation unlikely to be seen | | | | | | | viewpoints | |
| VP Group B – ID28, ID32 and ID38 | More distant from Site boundary (2.5 to 5km)<br>Located west of the Site<br>Large extent of Site potentially visible although Site unlikely to be prominent in the view<br>During the late afternoon, the face of panels would orient toward the viewer. For the remainder of the day, a rear view of the panels would be most likely<br>Existing vegetation likely to reduce potential viewing area<br>Potential views of the panels would have minimal visibility | 4km to nearest view of panels | Over half of Site (up to 75%) | West | Low | Low | Low | Proposed planting along the vicinity of the western boundary of the Site may reduce views into the Site | Negligible |

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| | Views of the substation unlikely | | | | | | | | |
| VP Group C – ID20, ID30, ID31, ID34, ID35, ID55, ID56 | More distant from the Site boundary (5km or more), located north-east to north-west of the Site, with only small proportion of the Site potentially seen<br>During the early afternoon (early morning for ID20), a view of the face of the tracking panels may be possible, although the view is at an angle, not directly facing the panels<br>Substation would not be seen<br>Due to distance from Site and the siting of PV panels to avoid higher ridges on the site, potential views of the panels would have minimal visibility.<br>Solar farm unlikely to be prominent in the view | 6km to nearest view of panels | Over half of the Site (up to 75%) | North-east to north west | Low | Negligible | Negligible | | Negligible |
| VP Group D – ID40 and ID41 | Over 5km from the Site<br>Located west of the Site<br>During the late afternoon, the viewer would face the front of the panels<br>Substation unlikely to be seen<br>A moderate proportion of the Site possibly seen<br>Views likely to be obscured by trees<br>Solar farm unlikely to be | 7.25km to nearest view of panels | Up to a half of the Site (50%) | West | Low | Low | Low | Screen planting along the western Site boundary may reduce view | Negligible |

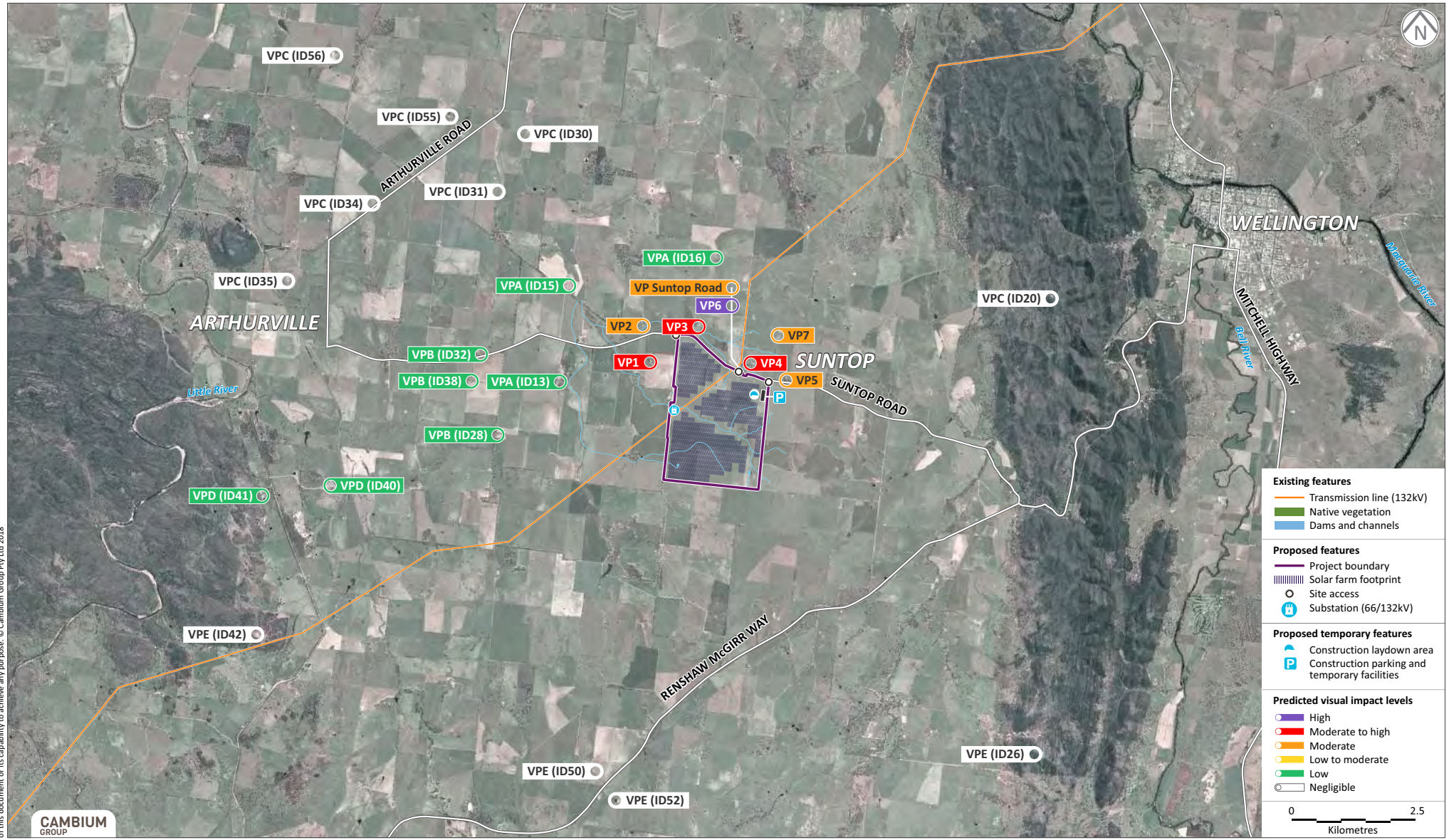
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | prominent in the view<br>Due to distance from Site and the siting of PV panels to avoid higher ridges on the Site, potential views of the panels would be limited | | | | | | | | |
| VP Group E - ID26, ID42, ID50, ID52 | Distant from the Site (over 5km)<br>Located south of the Site<br>Would see side angle of panels although tilt of panels is unlikely to be discernible<br>Moderate proportion of the Site seen with side or rear view of the panels seen<br>Substation would not be seen<br>Solar farm unlikely to be prominent in the view<br>Due to distance from Site and the proposed PV panels avoiding higher ridges on the Site, potential views of the panels would be very limited | 6km to nearest view of panels | Up to a half of the Site (up to 50%) | South-east to south-west | Low | Negligible | Negligible | | Negligible |
| VP Suntop Road (linear viewpoint) | Travellers using Suntop Road pass immediately to the north of the Site<br>The road is in close proximity to the Site, however, the distance to the proposed panels and inverters ranges from 75m to 200m or more as the viewer travels along the road | 75m to the nearest view of panels | 15% | North | Moderate | Moderate | Moderate | Views into the Site likely to reduce via screen planting along the northern 'Suntop Road' boundary | Moderate-low |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | The PV modules would be in rows perpendicular to the road. Therefore, when travelling past the solar farm, the viewer is likely to see the colour of the panels change rapidly from black to various shades from blue to white, lightening in appearance as the viewer position changes. This visual change would only be seen if looking directly down the rows when travelling past at speed, and would be momentary<br>Views are temporary<br>Substation would not be seen<br>A relatively small proportion of the Site seen | | | | | | | | |

**FIGURE 7-1**

Predicted visual impact levels for identified viewpoints

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## 7.3 Summary of results to viewpoints

In summary, the assessment of impact to viewpoints finds there are 26 private viewpoints with potential views of the proposed PV solar farm, one with potential views of the substation, and one public, linear viewpoint. Several potential viewpoints would view the face of the PV panels, however, their exposure to the face of the panels would be shorter in duration in comparison to fixed angle panels that did not move during the day.

Ratings are summarised below:

- One private viewpoint with a high impact (VP6):
  - Is in close proximity to the proposed panels and inverters (approximately 200m away), and in close proximity to the proposed construction compound (approximately 300m)
  - The proposed solar farm would surround, and would be visible from, three sides of the private property (eastern, western and southern sides)
  - Views of the panels and inverters may be likely from the residence, as well as the yard
  - Colour changes due having a side view of the panels would be possible (when looking south)
  - The face of panels would be possible in the morning (when looking west) and the afternoon (when looking east)
  - The substation would not be seen.
- Three viewpoints with a moderate-high impact (VP1, VP3 and VP4):
  - In close proximity to panels and inverters
  - VP1 is on an elevated ridge and likely to see the substation. However, views toward the Site are only possible from the yard on the eastern side of the residence, not from the residence
  - VP3 and VP4 are viewpoints directly opposite the Site, however, existing vegetation within each private property, and along Suntop Road, would likely significantly obstruct views
- Three private viewpoints with a moderate impact (VP2, VP5 and VP7):
  - Less than, or near to, 1km from the proposed panels and inverters
  - All unlikely to see substation
  - Existing vegetation within VP2 and VP5, and along Suntop Road, would be likely to significantly obstruct views. These residences do not directly face the Site, and the Site is not the focus of views

- VP7 is on an elevated ridge. Views toward the Site are only possible from the yard on the south-western side of the residence, not from the residence

- Remaining private viewpoints have a low or negligible impact rating.
- Visual impact from the public viewpoint (Suntop Road) has been assessed as moderate:
  - Users of Suntop Road would be in close proximity to the panels and inverters
  - Views of the solar farm would be temporary (only possible while travelling the approximately 2km distance past the northern boundary of the Site)
  - The substation would not be seen
- Visual impact from the air has been assessed as low.

Following the anticipated growth and screening effects of proposed mitigation planting, for most viewpoints, the impact rating would reduce so that there would be:

- Three private residences rated moderate (VP1, VP6 and VP7), and
- Four private residences and one public viewpoint rated moderate-low (VP2, VP3, VP4, VP5 and VP Suntop Road)

# 8 Photomontages

Photomontages included in this report have been independently prepared by, and verified by, Cambium Group.

Photomontages have been prepared for VP1, VP6, VP7 and VP Suntop Road. It is acknowledged that it is not feasible to illustrate all views. Some of these viewpoints were explicitly selected due to the potential visual impact level (such as VP1 and VP6), others (such as VP Suntop Road) were selected as they represent public views.

The photomontages illustrate the predicted view at a momentary point in time, approximately 9am in the morning, mid-summer, when the tracking panels would be oriented east (+60 degrees).

A plan showing the location of photomontage viewpoints is shown at FIGURE 8-1 (at the end of this Section). For each viewpoint, four images are provided:

- The existing view toward the Proposal
- Analytical - using the same image as the existing view, the analytical image shows the location of the proposed solar farm in pink
- Photomontage - this image shows the likely view following construction of the proposed solar farm
- Photomontage with mitigation - this image shows the likely view five years following construction when proposed screen planting has grown. Note it has been assumed that a height of 5-7m of dense vegetation would be achievable in that timeframe. More detail is provided in SECTION 9-1.

A brief description of each viewpoint is provided below. The photomontages illustrating the view from each viewpoint are consolidated at the end of this section (refer FIGURES 8-2 to 8-20).

## 8.1 Viewpoint 1 (VP1)

VP1 is a private residence on an elevated ridge approximately 490m west of the western Site boundary. Direct views from the VP1 residence are not possible, however the Site can be seen from the paddock immediately east of the residence, This is the only viewpoint that could potentially see the substation.

The assessment findings are presented at TABLE 7-1. The assessed visual impact level, without landscape screening, was assessed at moderate-high. The viewpoint has mostly unimpeded views and can view a moderately large proportion of the Site. During the late afternoon, a front view of the tracking panels would be seen as the panels tilt to face the west.

Five years following construction, the assessed visual impact is assessed to reduce to moderate. Proposed screen planting near the boundary between the Site and VP1 property would reduce views of the closest rows of panels, and thereby the front face of the panels. Planting along the boundary could also reduce views of the substation.

A typical existing view from VP1 toward the Site is shown at FIGURE 8-2. The analytical image of the proposed solar farm (coloured pink) is shown at FIGURE 8-3. FIGURE 8-4 illustrates the view following construction and FIGURE 8-5 the view five years following construction.

## 8.2 Viewpoint 6 (VP6)

VP6 is located immediately north of the proposed solar farm, on the southern side of Suntop Road. It is the closest private residence to the Site. The property is lower in elevation than the surrounding slopes of the Site and the outlook is toward Suntop Road.

The assessment findings are presented at TABLE 7-1. The assessed visual impact level, without landscape screening, was assessed as high. Although a relatively small proportion of the Site would be seen, the Proposal would occur on three sides of the property. In the morning when looking west, and again in the afternoon when looking east, the viewer would face a front view of the panels. At all times of the day when looking south, the viewer could potentially see colour changes from viewing the long rows of panels at different angles.

Five years following construction, the visual impact is assessed to reduce to moderate. Proposed screen planting along all three sides of the boundary between the Site and VP1 property would reduce views into the Site.

Two views have been selected for photomontages of VP6 (view A and view B), both from Suntop Road showing the western corner of the VP6 property with the proposed solar farm property seen behind.

Existing view A is shown at FIGURE 8-6. Photomontages of the proposed view from View A are shown at FIGURE 8-7, FIGURE 8-8 and FIGURE 8-9.

Existing view B is shown at FIGURE 8-10. Photomontages of the proposed view from View B are shown at FIGURE 8-11, FIGURE 8-12 and FIGURE 8-13.

## 8.3 Viewpoint 7 (VP7)

VP7 is a private residence approximately 950m north of the Site. Direct views from the house to the Site are not possible, however, the Site can be seen from the paddock immediately south-west of the residence.

The assessment findings are presented at TABLE 7-1. The assessed visual impact level, without landscape screening, was assessed as moderate. Although a relatively small proportion of the Site would be seen, the view is unobstructed and from an elevated vantage point.

Five years following construction, the visual impact is still assessed as moderate. Proposed screen planting would not be seen from VP7, therefore, the extent of the Site seen would not reduce.

A typical existing view from VP7 toward the Site is shown at FIGURE 8-14. Photomontages of the proposed view are shown at FIGURE 8-15 and FIGURE 8-16. An image five years post construction is not included as there is no change in the view.

## 8.4 VP Suntop Road

VP Suntop Road is a linear viewpoint. The Road passes immediately to the north of the Site. Views from Suntop Road are in close proximity of the proposed solar farm, however, are temporary and for short-periods.

The assessment findings are presented at TABLE 7-1. The assessed visual impact level, without landscape screening, was assessed at moderate. The viewer is likely to see the colour of the panels change rapidly from black to various shades from blue to white if looking directly down the rows of panels when travelling past.

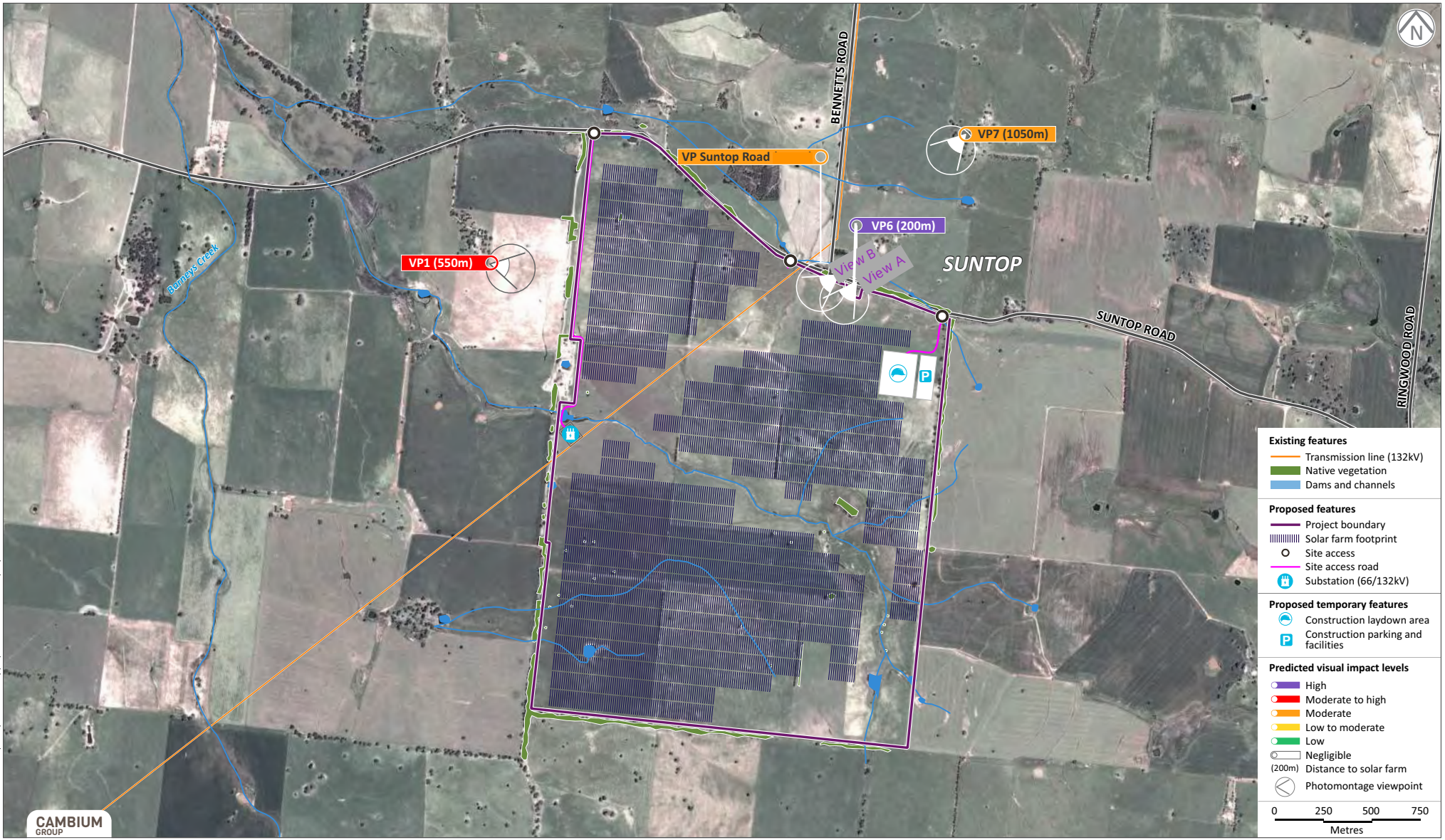
Five years following construction, the assessed visual impact is still assessed as moderate-low. Proposed screen planting along the Suntop Road boundary would reduce views into the Site.

A typical existing view from Suntop Road toward the Site is shown at FIGURE 8-17. Photomontages of the proposed view are shown at FIGURE 8-18, FIGURE 8-19 and FIGURE 8-20.

**FIGURE 8-1**

Photomontage locations

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**FIGURE 8-2**

VP1 - Existing view

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**FIGURE 8-3**

VP1 - Analytical view of likely visibility of Proposal

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**FIGURE 8-4**

VP1 – Photomontage of likely view of proposal post construction

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**FIGURE 8-5**

VP1 – Photomontage of likely view of Proposal with landscape screening 5 years after construction

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**FIGURE 8-6**

VP6, View A – Existing view

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**FIGURE 8-7**

VP6, View A - Analytical view of likely visibility of Proposal

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**FIGURE 8-8**

VP6, View A – Photomontage of likely view of Proposal post construction

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**FIGURE 8-9**

VP6, View A – Photomontage of likely view of Proposal with landscape screening 5 years after construction

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**FIGURE 8-10**

VP6, View B – Existing view

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**FIGURE 8-11**

VP6, View B - Analytical view of likely visibility of Proposal

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**FIGURE 8-12**

VP6, View B – Photomontage of likely view of Proposal post construction

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**FIGURE 8-13**

VP6, View B – Photomontage of likely view of Proposal with landscape screening 5 years after construction

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**FIGURE 8-14**

VP7 – Existing view

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**FIGURE 8-15**

VP7 - Analytical view of likely visibility of Proposal

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**FIGURE 8-16**

VP7 – Photomontage of likely view of Proposal post construction

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**FIGURE** 8-17

VP Suntop Road – Existing view

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**FIGURE** 8-18

VP Suntop Road - Analytical view of likely visibility of Proposal

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**FIGURE** 8-19

VP Suntop Road – Photomontage of likely view of Proposal post construction

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**FIGURE** 8-20

VP Suntop Road – Photomontage of likely view of Proposal with landscape screening 5 years after construction

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# 9 Mitigation

This section of the report specifies mitigation measures to avoid, reduce, or compensate for the visual impacts of the Proposal.

## 9.1 Best practice

Visual impact mitigation for the PV solar farm includes a range of measures that could be undertaken to avoid, reduce or compensate for potential impacts. The following is a list of best practices applicable to PV solar facilities when considering potential mitigation options[23]:

1. Minimise impact through use of design features (refer also to 'vegetation screening' in sidebar at SECTION 9.3)
2. Minimise and repair ground disturbance
3. Site facilities away from most prominent land features (locate in less prominent locations and away from focal points)
4. Avoid night sky impacts
5. Site facilities in already disturbed landscapes or clearings
6. Increase distance to reduce visual dominance
7. Use site-specific location and topographic features to reduce visibility
8. Use colour to reduce contrast
9. Monitor visual impacts.

## 9.2 Existing measures and proposed mitigation

The Proposal already features a number of elements that serve to mitigate potential landscape character and visual impacts to key viewpoints. TABLE 9-1 lists the best practices, the positive features of the Proposal, and additional mitigation measures which are recommended to achieve the reduced landscape character and visual impact ratings determined in this report.

[23] Adapted from Apostol, D. 2017 (180)

TABLE 9-1: MITIGATION MEASURES

| Best-practice | Existing positive measures within the Proposal | Additional measures recommended |
|---|---|---|
| 1. Minimise impact through use of siting and design features | - The proposed solar farm has been located in a rural area with a small local population, and limited visual exposure due to the surrounding hills<br>- There are only a few elevated viewpoints to the Site, and none that are visually prominent<br>- The Site is located along a local road generally only accessed by residents and visitors to local Suntop properties<br>- The solar farm has a low profile with panels a maximum height of 4m above the ground<br>- The surface of the panels would be non-reflective<br>- The substation is proposed to be located away from the public viewpoint (Suntop Road) and would only be seen from one private viewpoint | Prior to construction:<br>- A Concept Landscape Plan has been prepared (refer to FIGURE 9-1) to provide screening where likely to reduce visibility. The plan has been adapted to the local topography and viewpoints. Prior to construction, consult with the community and develop a Detailed Landscape Plan.<br>- Select vegetative screening plant species. Provide community feedback to refine and detail proposed planting in a Detailed Landscape Plan.<br>- Check vegetative screening plans with bushfire study currently being prepared for the Proposal and local authorities (if relevant) to reduce potential for fire risk by introducing an additional fuel source.<br>Construction:<br>- Group ancillary facility structures where possible to minimise sprawl.<br>- Stabilise new access road within the Site required for operations<br>- Locate the construction compound and storage areas away from nearest residents.<br>Operation:<br>- Do not install commercial messages, or large-scale signage. Signage required at the Site should be of sufficient size to be readable at driver height within short range (0-20m) and contain only information sufficient for basic facility and company identification, for safety, navigation, and delivery purposes.<br>- Keep Site tidy and neat, remove weeds, and undertake necessary repairs |

| Best-practice | Existing positive measures within the Proposal | Additional measures recommended |
|---|---|---|
| 2. Minimise and repair ground disturbance | - The Proposal is located within an area already cleared of trees<br>- The Proposal would require minimum cut and fill<br>- Trenches for cabling would be backfilled as soon as possible<br>- Installation of the panels are on pile driven mounts, foundations are not required. | Construction:<br>- Minimise grading across the Site and undertake the minimum levelling necessary to install panel supports. Do not bench the Site<br>- Rehabilitate exposed ground surfaces as soon as possible<br>- Implement dust and wind erosion controls to avoid visual issues associated with dust. E.g.: water cart on site; avoid ground disturbance on high wind days; water exposed surfaces; cover stockpiles<br>- Implement erosion and sediment controls to avoid visual issues associated with erosion and water pollution. |
| 3. Site facilities away from most prominent land features (locate in less prominent locations and away from focal points) | - The PV panels would be sited to avoid the two higher ridges within the site, thereby reducing the number of potential viewers<br>- The Proposal would avoid waterways and existing vegetation<br>- The development footprint would avoid the existing surface water bodies on the site where possible.<br>- A buffer of 40m would be provided between infrastructure and any waterway.<br>- A 10m minimum buffer would be provided from the Site boundaries.<br>- The footprint would also avoid the majority of tall woody vegetation present on the site.<br>- The substation is proposed to be located in a low-lying area of the Site, away from the public viewpoint (Suntop Road) | |

| Best-practice | Existing positive measures within the Proposal | Additional measures recommended |
|---|---|---|
| 4. Avoid night sky impacts | - The Proposal would not be operated at night. Lighting of the site at night is not required, and is not anticipated unless in emergency situations | Operations:<br>- Undertake maintenance activities (such as cleaning the panels and other routine tasks) during daylight hours<br>- Use amber lighting if lights are required, rather than bluish-white lighting |
| 5. Site facilities in already disturbed landscapes or clearings | - The panels and ancillary infrastructure would be generally located in already cleared areas.<br>- Minimal tree clearing is required. | Construction:<br>- Retain existing grass cover beneath solar panels and supports if possible to do so safely, and not interfering with facility management<br>Decommissioning:<br>- Develop a remediation plan to include the following actions:<br>o recontour, cultivate, seed, and stabilise the majority of disturbed surfaces with pasture grass species following the removal of infrastructure<br>o re-establish any previously removed native vegetation with appropriate, similar species. |
| 6. Increase distance to reduce visual dominance | - There is a significant buffer between the linear, public viewpoint (Suntop Road) to the panels<br>- The panels are well set back from the closest residence to the Site | |
| 7. Use site-specific location and topographic features to reduce visibility | - The PV panels would be sited to avoid the two higher ridges within the site, thereby reducing the number of potential viewers<br>- The substation is proposed to be located in a low-lying area of the Site, away from the | Construction:<br>- Protect existing vegetation by installing temporary fencing around vegetation areas to be retained and demarcating as a no-go zone. No storage or equipment, stockpiling or disturbance is to occur within the zone. |

| Best-practice | Existing positive measures within the Proposal | Additional measures recommended |
|---|---|---|
| | public viewpoint (Suntop Road) and not visible to the residence closest to the Site<br>- Existing vegetation on site would be retained | |
| 8. Use colour to reduce contrast | | Construction:<br>- Treat the support structures of PV panels and ancillary structures such as inverters, with a non-reflective finish.<br>- Paint or colour-treat facility components to better match the surroundings and decrease their visibility and contrast. Choose a colour two to three shades darker than the background colour. Dark grey is generally considered a good colour for ancillary infrastructure. Do not paint components white unless there is a safety or functional requirement to do so. White is generally the most conspicuous colour. Lighter colours should be avoided.<br>- Test colour selection prior to implementing across the site for visually compatibility and minimal contrast. Assess colours as they would be seen from the most affected viewpoints to determine which colour is more effective blending with the background.<br>- Colour treat grouped structures using the same colour. Use semi-gloss finish rather than flat or gloss finish<br>- Specify substation to have a low-reflectivity, neutral colour finish. Insulators at substations should be non-reflective and non-refractive. Choose a colour for the substation surfaces two to three shades darker than the background colour. As the substation is located near a line of trees, a deep green or dark grey may be suitable. |

| Best-practice | Existing positive measures within the Proposal | Additional measures recommended |
|---|---|---|
| | | - Chain-link fences surrounding the substations should have a dulled, darkened finish to reduce contrast. Black or dark grey is generally a suitable colour for substation fencing.<br><br>Operation:<br>- Keep non-reflective finishes and colour-treated coatings in good repair. Reapply if surface is subject to fading or flaking. |
| 9. Monitor visual impact | | Operation:<br>- Periodically contact the nearest residents to the facility to determine if visual issues are being experienced<br>- Monitor performance of screen planting areas via a three-year planting maintenance period. Replant as necessary if plants die, and supplement planting with alternative species if plants do not adapt to the Site. Ensure density and growth is satisfactory to achieve screening effect.<br>- Record complaints of visual issues<br>- Discuss possible remedies for visual issues with the resident or complainant<br>- Take meaningful action to remedy visual issues. For example:<br>o introduce planting to screen views,<br>o colour treat ancillary site infrastructure, or<br>o install fabric-covered screening fences to reduce views from particular viewpoints |

## 9.3 Landscape Plan

One of the mitigation measures is screen planting. A Concept Landscape Plan has been provided at FIGURE 9-1 which identifies strategic locations for screen planting within the Site to reduce visual impacts. General issues regarding planting at solar farms are discussed in the side bar "*Vegetation Screening*" and "*Shading cast by vegetation*".

Vegetation Screening

Vegetation, typically trees, may screen views fully or partially, especially close to the viewpoint*. But in many cases, vegetation is not tall enough to screen views of large-scale infrastructure. Such infrastructure extends over a wide area of land, and, particularly if viewpoints are elevated, vegetation is not sufficient to block or even reduce views. However, in some instances, where elevation is favourable, it would be possible to plant trees of adequate height and density, within a wide planting area, to minimise or even eliminate some views.

* United States Department of the Interior. 2013. *Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands.* Bureau of Land Management.

Shading cast by vegetation

Solar farms require maximum exposure to sunlight to generate energy. Screen planting close to the northern, eastern and western sides of a solar farm could shade the panels closest to the planting area during part of the day. The shadow cast in summer would be minimal, however, longer during winter months.

Proposed landscape screening also needs to consider the implications of any bushfire restrictions which could affect the suitability of different types of plant species, screening locations and planting densities.

The Concept Landscape Plan has been developed in consultation with affected property owners. Following further discussions with landowners and Dubbo Council, a Detailed Landscape Plan would be prepared.

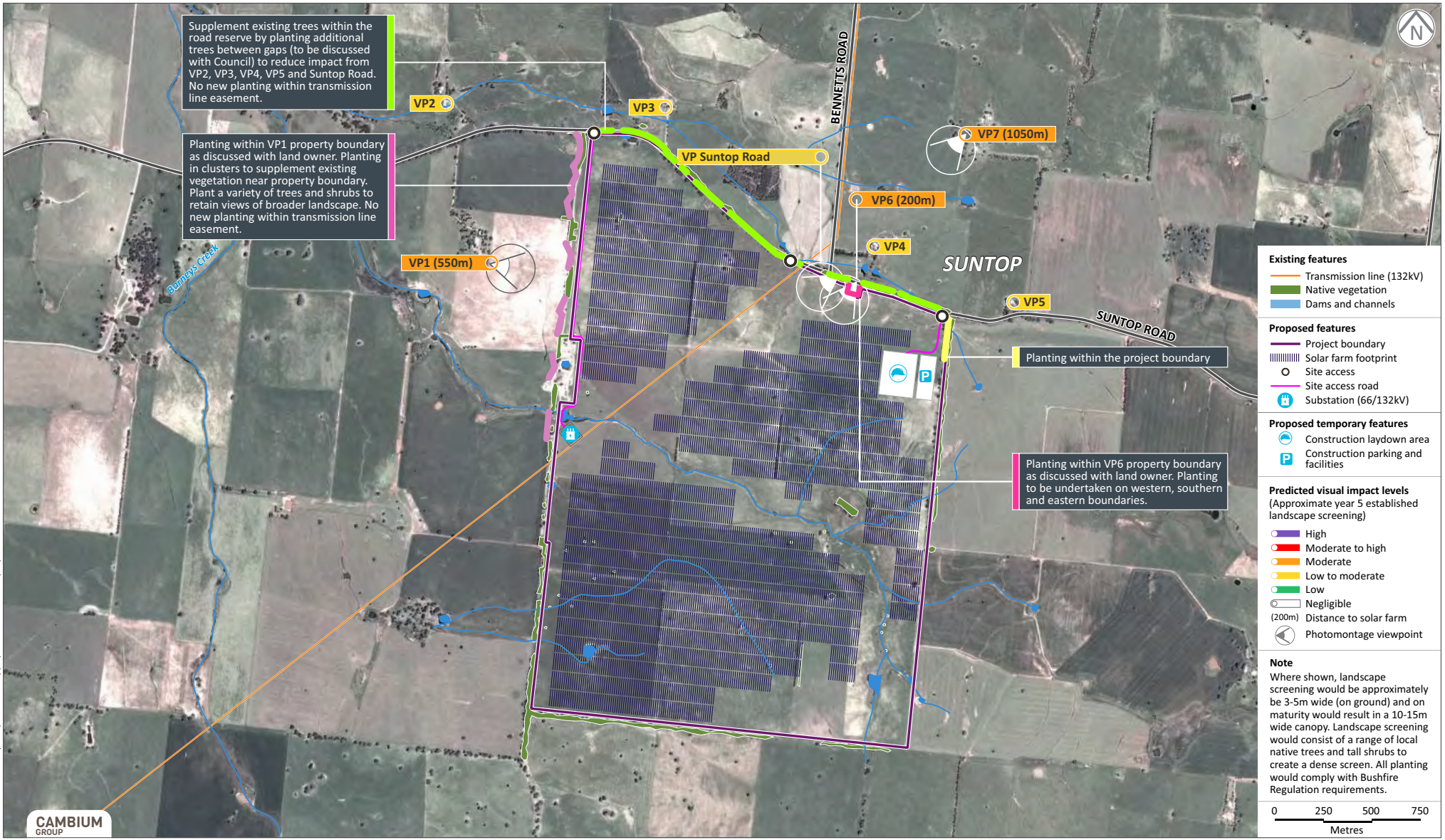
The key features of the Concept Landscape Plan are:

- Planting within the VP6 property along all three boundaries with the Site. Planting to include trees and shrubs to create a dense screen
- Planting within the VP1 property within the vicinity of the western boundary of the Site. Planting would comprise a variety of trees so as to not create a tree line that removes views of the wider landscape and to mitigate the key impact which is the leading row of panels
- Planting to continue along the western boundary to screen the location of the substation
- Planting along the northern boundary of the Site (Suntop Road) to screen views from the public viewpoint (VP Suntop Road) as well as private viewpoints along Suntop Road. Planting is proposed to occur within the road reserve (to be discussed with Dubbo Council)
- Planting within the Site along the eastern boundary for approximately 200m
- All planting would comply with Bushfire Regulation requirements
- In general, planting areas would be approximately 3-5m wide (on ground) and consist of a range of local native trees and tall shrubs to create a dense screen
- Where space and regulation requirements permit, a wider planting area (10m) is recommended within the Site along the northern boundary to allow for increased planting rates and greater potential for denser screen planting.

**FIGURE 9-1**

Concept landscape plan

SUNTOP SOLAR FARM - VISUAL IMPACT ASSESSMENT




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# 10 Cumulative impact

Cumulative visual effects occur as we move through the landscape. The combined effects from the Proposal with other past, present, and likely future projects or activities, are discussed below.

At note in SECTION 3.3.3, Photon Energy, is also proposing PV solar farms at Mumbil and Maryvale. Each proposed farm would comprise the same low-profile, non-reflective solar panels, and include a substation.

Should all of the proposed PV solar farms be realised it would not be possible to see more than one of the solar farms within the same view. When driving through the landscape, however, it would be possible to see more than one, or all three, within the same day, although such a journey would be probably unusual (refer to FIGURE 3-3). Regardless, the locations of each of the farms are in different directions from Wellington, along routes to different destinations:

Mumbil solar farm is proposed to be located south-east of Wellington on Burrendong Way. It would be visible to travellers heading to Lake Burrendong, and visible to travellers using Burrendong Way as an alternative route from Orange to Wellington.

Maryvale solar farm is proposed to be located north of Wellington. It would be visible to travellers using the Mitchell Highway, the major northern access road to Wellington.

Suntop solar farm, on the western side of the Mount Arthur Reserve, would only be visible to residents and their visitors of local Suntop properties. Suntop Road is not a major through route.

It is possible that travellers from Sydney heading to Lake Burrendong could see two solar farms during the same day of their journey. However, it would be unlikely, in the normal routine of residents or visitors, that views of all three solar farms would occur in the same day.

The proposed solar farms are separated by driving distances of over 20km, the urban centre of Wellington, and by the major landform of the Mount Arthur Reserve. When driving past each solar farm, the panels would only be in view momentarily.

Considering the physical separation and visual characteristics of the PV solar farm and surrounding environs, the combined effects from the three proposed solar farms is unlikely to change the dominant agricultural setting of the physical landscape.

# 11 Conclusion

The assessment results of Impact to landscape character finds there is a moderate impact.

The assessment results of impact to viewpoints finds that there are seven private viewpoints and one public viewpoint with moderate to high impact:

- 1 private viewpoint with a high impact (VP6)
- 3 private viewpoints with a moderate-high impact (VP1, VP3, VP4)
- 3 private viewpoints with a moderate impact (VP2, VP5, VP7)
- the public viewpoint (Suntop Road) has been assessed as moderate

Remaining viewpoints have a low or negligible impact rating. Visual impact from the air has been assessed as low.

When assessing the Proposal against visual impact components of the NSW State Government's draft *Large Scale Solar Energy Guideline*, the result is that the Site is suitable. TABLE 11-1 lists the key visual factors from the Guideline to be taken into account when considering the likely impact of solar energy developments, together with the findings from this assessment.

TABLE 11-1: APPLICATION OF DRAFT LARGE SCALE SOLAR ENERGY GUIDELINE

| Relevant component of Guideline | Visual consideration from Guideline that may assist in minimising localised impacts: | Finding from this assessment |
|---|---|---|
| Site selection | ▪ land that does not contain native vegetation or has previously been cleared and utilised for industrial – type purposes (brown field sites) in rural settings | ▪ The proposed Site at Suntop is mostly cleared and within a rural setting. The Site has been used for agricultural purposes. The majority of existing native vegetation would remain on site as part of the Proposal |
| | ▪ Unobtrusive sites with flat, low-lying topography | ▪ The proposed Site at Suntop is generally well concealed. There are two ridges within the Site, however, the PV panels would not be located over the two ridges<br>▪ There are few external locations where elevated views into the proposed Site are possible |
| | ▪ Sites with potential to be screened, such as those that can be readily vegetated along boundaries, to reduce visual impacts | ▪ The proposed site at Suntop has good screening potential for the majority of viewers which would see the Site as they travel along Suntop Road. Planting along the boundary with Suntop Road has been proposed and would reduce the number of viewers and impact of views |

| Relevant component of Guideline | Visual consideration from Guideline that may assist in minimising localised impacts: | Finding from this assessment |
|---|---|---|
| Site constraints | ▪ sites with high visibility, such as those on prominent or high ground positions ('high visibility or prominence is of particular concern if the solar infrastructure at the site would be juxtaposed against significant scenic, historic or cultural landscape'), or sites which are located in a valley with residences with elevated views looking toward the site | ▪ The proposed Site at Suntop does not have high visibility, is not on a prominent or high ground position. It does have two ridges within the Site, however, the proposed footprint of the solar farm would not run over the ridges<br>▪ The Site does not comprise and is not near significant scenic, historic or cultural landscape. The Mount Arthur Reserve is the most prominent scenic landscape feature of the area. However, the Reserve is approximately 5km from the Site and the Proposal would not be seen from publicly accessible areas within the Reserve<br>▪ The proposed Site at Suntop is not located in a valley with residents with elevated views looking toward the site |
| Key assessment issues | The visual impact of solar energy development will depend on:<br>▪ the scale and type of infrastructure, | ▪ The proposed infrastructure is low-profile, with a maximum height above ground level of approximately 4m |
| | ▪ the prominence and topography of the site relative to the surrounding environment, | ▪ The proposed Site is not prominent relative to the surrounding environment.<br>▪ The two ridges within the Site would not be included in the PV panel footprint |
| | ▪ and any proposed measures to screen or otherwise reduce visibility of the site. | ▪ A Concept Landscape Plan has been prepared which proposes screening along Suntop Road, and along the western boundary of the Site<br>▪ Further mitigation measures have been proposed, such as colour treating ancillary facilities, as set out in TABLE 9-1. |

This assessment concludes that the proposed Suntop Site is appropriate for the proposed solar development. The Site is within a rural setting, is generally cleared of native vegetation, is not visually prominent, and has relatively few sensitive receptors viewing the Site. Importantly, the Proposal incorporates a number of key measures that limit potential visual impacts. In particular: the proposed PV solar panels are low-profile and non-reflective; two existing ridges within the Site would not be included within the PV solar footprint; and the Site is suitable for screen planting which would reduce exposure of the PV solar panels over time.

Following the anticipated growth and screening effects of proposed mitigation planting, the impact rating would reduce so that there would be:

- Three private residences rated moderate (VP1, VP6 and VP7), and
- Four private residences and one public viewpoint rated moderate-low (VP2, VP3, VP4, VP5 and VP Suntop Road)

Overall the Proposal would represent a moderate and acceptable level of change to the landscape character of the Site and its surrounds. Initial high impacts to close viewpoints are predicted to reduce over time as proposed planting increases in height and is able to adequately screen the Site.

# 12 References


Apostol, D (Editor). 2017. *The renewable energy landscape: preserving scenic values in our sustainable future.* Edited by Dean Apostal, James Palmer, Martin Pasqualetti, Richard Smardon and Robert Sullivan.

Landscape Institute and Institute of Environmental Management and Assessment, 2013 (3RD edition). *Guidelines for Landscape and Visual Impact Assessment*. Spoon press, United Kingdom.

New South Wales Department of Industry Resources & Energy, 2016. *Solar Farms in NSW Fact Sheet* (June 2016)

New South Wales Department of Planning, 2010. *Discussion Paper on Planning for Renewable Energy Generation – Solar Energy*. Consultation paper outlining a proposed approach to streamline planning processes for solar energy systems in NSW.

New South Wales Department of Planning, November 2017. *Draft Large Scale Solar Energy Guideline.*

New South Wales Roads and Traffic Authority, 2009. *Environmental Impact Assessment Guidance Note – Guidelines for Landscape Character and Visual Impact Assessment.*

Pager Power, November 2017. *Solar Photovoltaic Glint and Glare Study*, Sapphire Solar Farm Environmental Impact Statement, Volume 3 - Appendices

Sullivan, R. and M Meyer. 2014. *Guide to evaluating visual impact assessments for renewable energy projects.* Natural Resource Report NPS/ARD/NRR—2014/836. National Park Service, Fort Collins, Colorado.

Sullivan, R. G., L. B. Kirchler, C. McCoy, J. McCarty, K. Beckman, and P. Richmond. 2012. *Visual impacts of utility-scale solar energy facilities on southwestern desert landscapes.* Paper presented at the National Association of Environmental Professionals, 37th Annual Conference, Portland, Oregon, May 21–24 2012.

United States Department of the Interior. 2013. *Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands.* Bureau of Land Management. Cheyenne, Wyoming.

Western Australian Planning Commission, 2007. *Visual Landscape Planning in Western Australia.*

# Appendix A

Preliminary findings

A map of the viewpoints initially investigated is provided at FIGURE A-1. Identification (ID) numbers were allocated to identify each viewpoint.

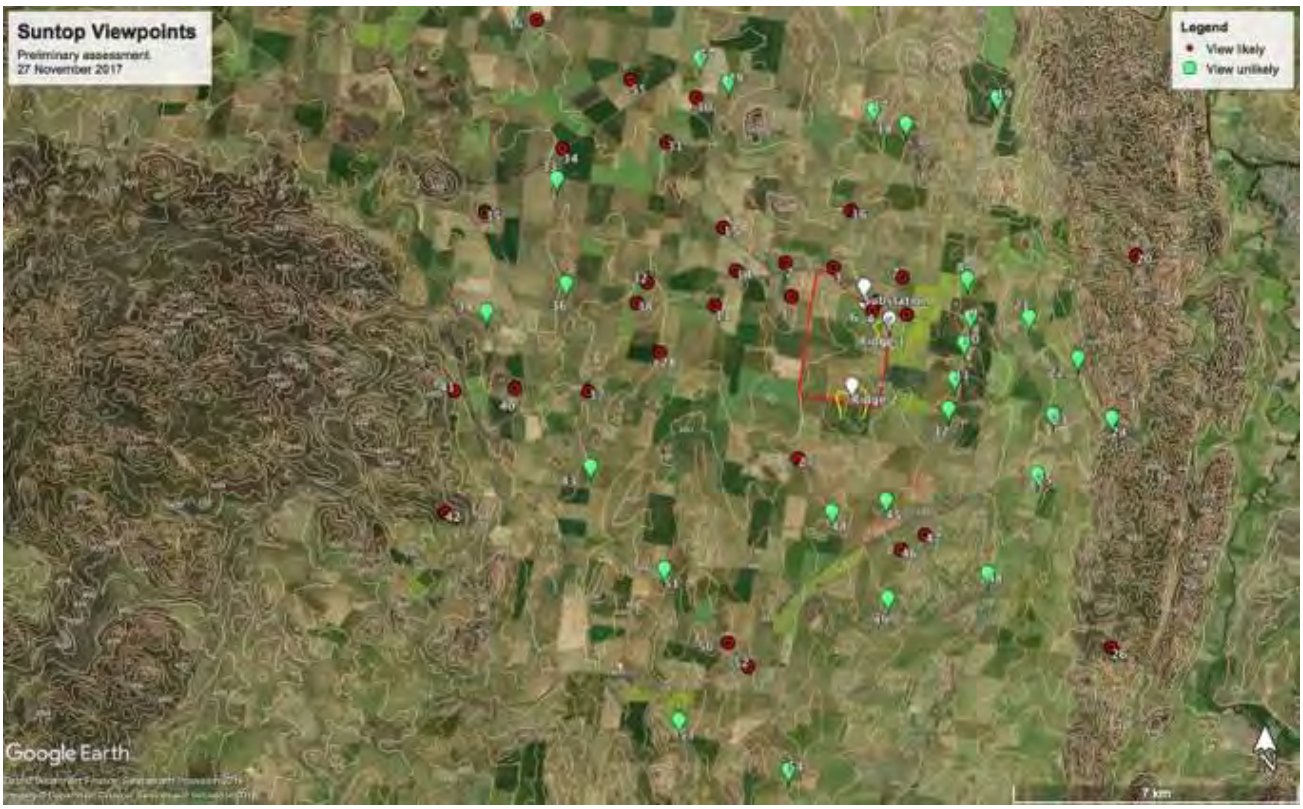



FIGURE A-1: INITIAL VIEWPOINTS INVESTIGATED

The initial identification and assessment of viewpoints was based on a preliminary PV solar panel footprint shown at FIGURE A-2. Based on the preliminary footprint, the following high-level findings were determined:

- The proposed location of the substation would potentially be seen from three residential properties, however, would be seen by all users of Suntop Road
- Of the 29 residences that could potentially see some sections of the solar farm, the proportion of the solar farm seen ranged from less than 5% to 90%
- The distance of the viewer from the solar farm ranged from approximately 150m to 12km

The initial site investigation findings are shown at TABLE A-1.




FIGURE A-2: PRELIMINARY FOOTPRINT

TABLE A-1: PRELIMINARY SITE INVESTIGATION

| House ID number | Likely to see solar farm? | Approximate % of solar farm seen | Approximate distance / range of visual access to solar farm | Could see ridge 1? | Could see Ridge 2? | Could see Substation? | Could impact be reduced if no panels on high points? | Could impact be reduced through planting? |
|---|---|---|---|---|---|---|---|---|
| 1 | yes | 40% | 0.5 - 3.25km | unlikely | yes | no | minor | yes. Planting along western boundary could reduce views |
| 2 | possibly although trees between property and solar farm may limit views | possibly 30% | 0.75 - 4km | possibly | possibly | unlikely | minor | no |

| House ID number | Likely to see solar farm? | Approximate % of solar farm seen | Approximate distance / range of visual access to solar farm | Could see ridge 1? | Could see Ridge 2? | Could see Substation? | Could impact be reduced if no panels on high points? | Could impact be reduced through planting? |
|---|---|---|---|---|---|---|---|---|
| 3 | yes | 20% | 150m - 2km | possibly | no | yes | Ridge 1. Reduce viewing area by 10% | planting along northern 'Suntop Road' boundary could reduce views |
| 4 | yes. although trees between property and solar farm may limit views | 15% | 200m - 1.5km | no | no | yes | n/a | planting along northern 'Suntop Road' boundary could reduce views |
| 5 | yes. although trees between property and solar farm may limit views | 5% | 400m - 1.5km | yes | no | no | Ridge 1. Reduce viewing area by 10% | minor |
| 6 | yes | 15% | adjacent - 1.5km | no | no | yes | n/a | planting around the property could reduce views |
| 7 | yes | 30% | 1 - 3.25km | yes | yes | yes | Ridge 1 & 2. Reduce viewing area by 20% | minor |
| 8 | no | | | | | | | |
| 9 | no | | | | | | | |
| 10 | no | | | | | | | |
| 11 | no | | | | | | | |
| 12 | no | | | | | | | |
| 13 | yes | 40% | 2.25 - 4.25km | yes | yes | no | Ridge 1 & 2. Reduce viewing area by 20% | unlikely |

| House ID number | Likely to see solar farm? | Approximate % of solar farm seen | Approximate distance / range of visual access to solar farm | Could see ridge 1? | Could see Ridge 2? | Could see Substation? | Could impact be reduced if no panels on high points? | Could impact be reduced through planting? |
|---|---|---|---|---|---|---|---|---|
| 14 | yes | | | | | | | |
| 15 | Possibly, although existing vegetation likely to reduce potential viewing area | 20% | 3 - 5.75 | no | yes | no | Ridge 2. Reduce viewing area by 20% | unlikely |
| 16 | Possibly, although existing vegetation likely to reduce potential viewing area | 5% | 2.5 - 3km | yes | no | no | Ridge 1. Reduce viewing area by 25% | no |
| 17 | no | | | | | | | |
| 18 | unlikely | | | | | | | |
| 19 | no | | | | | | | |
| 20 | yes. Unsure if this is a private home | 10% | 7 - 8.25km | no | yes | no | Ridge 2. Reduce viewing area by 20% | no |
| 21 | no | | | | | | | |
| 22 | no | | | | | | | |
| 23 | no | | | | | | | |
| 24 | no | | | | | | | |
| 25 | no | | | | | | | |
| 26 | yes | 10% | 8 - 9.75km | yes | yes | no | Ridge 1 & 2. Reduce viewing area by 50% | no |
| 27 | Visit to the property confirmed no home at this location | | | | | | | |

| House ID number | Likely to see solar farm? | Approximate % of solar farm seen | Approximate distance / range of visual access to solar farm | Could see ridge 1? | Could see Ridge 2? | Could see Substation? | Could impact be reduced if no panels on high points? | Could impact be reduced through planting? |
|---|---|---|---|---|---|---|---|---|
| 28 | Possibly | >10% | 4.5 - 5.5km | yes | unlikely | no | Ridge 1. Reduce viewing area by 50% | no |
| 29 | no | | | | | | | |
| 30 | Possibly | >10% | 7.25 - 8.5km | no | yes | NO | Ridge 2. Reduce viewing area by 25% | no |
| 31 | possibly although trees between property and solar farm may limit views | 20% | 6.25 - 8.25km | no | yes | no | . Ridge 2. Reduce viewing area by 25% | no |
| 32 | Possibly. Although obscured by trees | 90% | 4 - 6.5km | yes | yes | no | minor | no |
| 33 | no | | | | | | | |
| 34 | Possibly. Although obscured by trees | 90% | 6.75 - 10km | yes | yes | no | minor | no |
| 35 | Possibly. Although obscured by trees | 90% | 8.25 - 10km | yes | yes | unlikely | minor | no |
| 36 | no | | | | | | | |
| 37 | Possibly. Although obscured by trees | 5% | 7.25 - 7.5km | yes | no | no | Ridge 1. Reduce viewing area by 80% | no |
| 38 | Possibly. Although obscured by trees | 90% | 4.25 - 6.25km | yes | YES | no | minor | minor |
| 39 | no | | | | | | | |
| 40 | Possibly. Although obscured by trees | 30% | 7.5 - 9.25km | yes | possibly | no | minor | no |

| House ID number | Likely to see solar farm? | Approximate % of solar farm seen | Approximate distance / range of visual access to solar farm | Could see ridge 1? | Could see Ridge 2? | Could see Substation? | Could impact be reduced if no panels on high points? | Could impact be reduced through planting? |
|---|---|---|---|---|---|---|---|---|
| 41 | Possibly. Although obscured by trees | 90% | 8.5 - 10.75km | yes | yes | no | minor | minor |
| 42 | Possibly. Although obscured by trees | 90% | 9.25 - 11.5km | yes | yes | no | minor | minor |
| 43 | no | | | | | | | |
| 44 | no | | | | | | | |
| 45 | unlikely | | | | | | | |
| 46 | Possibly. Although obscured by trees | >5% | 5 - 5.5km | possibly | no | no | Ridge 1. Reduce viewing area by 100% | no |
| 47 | Possibly. Although obscured by trees | >5% | 5 - 5.5km | possibly | possibly | no | Ridge 1 & 2. Reduce viewing area by 100% | no |
| 48 | no | | | | | | | |
| 49 | no | | | | | | | |
| 50 | Possibly. Although obscured by trees | 15% | 6.5 - 9.25km | no | possibly | no | no | no |
| 51 | no | | | | | | | |
| 52 | Possibly. Although obscured by trees | 20% | 6.75 - 9.75 | no | possibly | no | no | no |
| 53 | no | | | | | | | |
| 54 | no | | | | | | | |
| 55 | Possibly. Although obscured by trees | 80% | 7-10km | yes | yes | unlikely | minor | no |
| 56 | Possibly. Although obscured by trees | 90% | 9.25 - 12km | yes | yes | unlikely | minor | no |
| 57 | No | | | | | | | |

Revised footprint

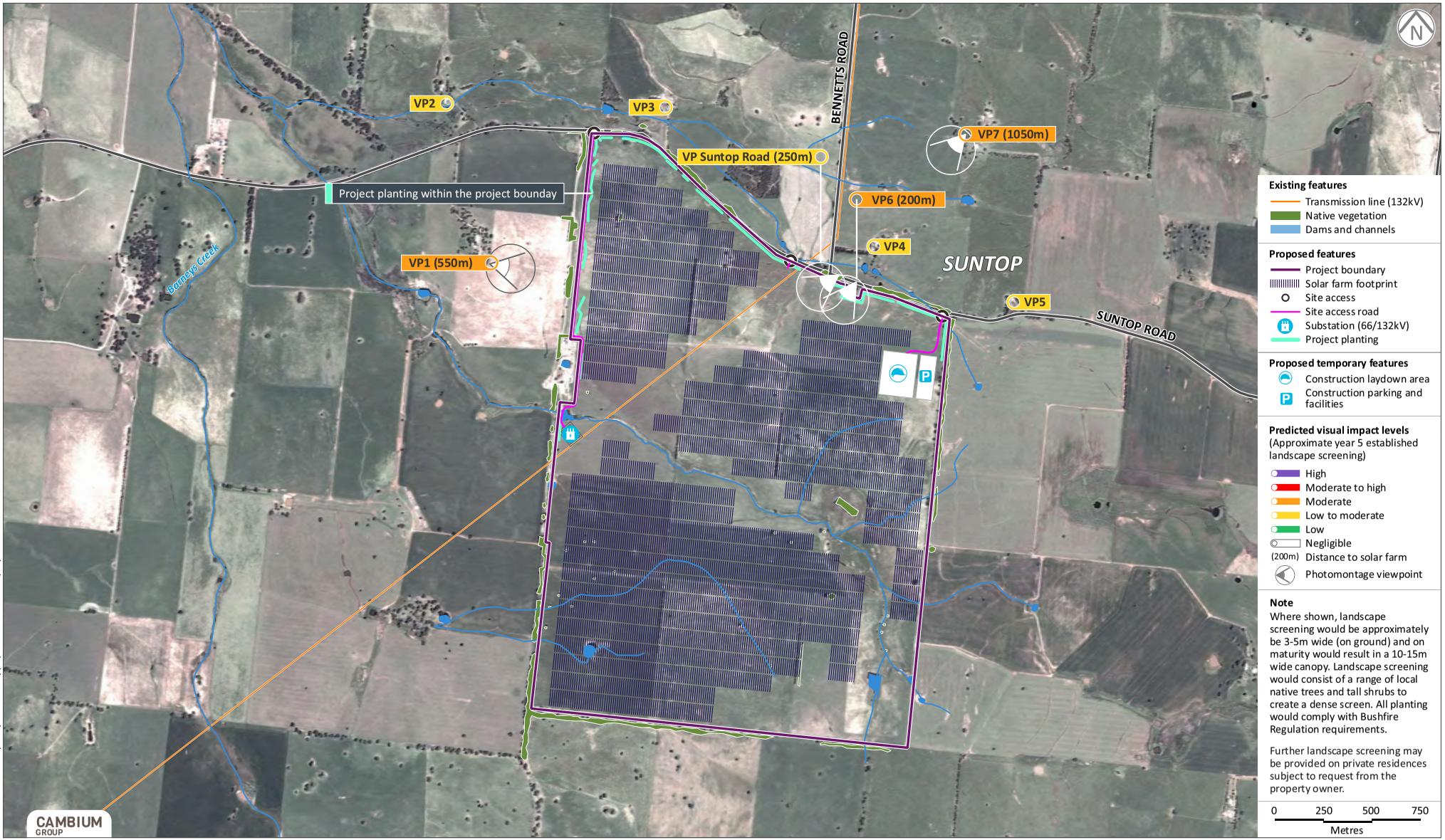
Since the initial site investigation findings were determined, the footprint of the PV solar panels and location of the substation has been updated. The revised footprint proposed by the Proponent is shown in the body of this report at FIGURE 4-1. Based on the revised footprint, in comparison to the initial footprint, the following high-level findings were determined:

- The revised location of the substation would potentially be seen from only one residential property (VP1), and would be unlikely to be seen by users of Suntop Road
- Potential views of the solar farm would be eliminated for three properties (VP37, VP46 and VP47), reducing the overall number of residences that would potentially see some sections of the solar farm from 29 to 26
- It is highly likely that views would be eliminated for a further 12 properties, reducing the overall number of residences that would potentially see some sections of the solar farm to 14
- Of the remaining 14 residences that are more likely to potentially see some sections of the solar farm, the extent of the solar farm likely to be seen would reduce for 11 of the residences, by 10-20%.

**FIGURE 9-1**

Concept landscape plan

SUNTOP SOLAR FARM - VISUAL IMPACT ASSESSMENT




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FLORASEARCH

# SUNTOP SOLAR FARM

# BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

**Prepared for Pitt & Sherry Pty. Ltd.**

**by C.C. Bower**
**Principal Consultant Ecologist**

**MAY 2018**

*FloraSearch*

37 Kent Avenue, Orange, NSW 2800
PO Box 300, Orange, NSW 2800

Tel: 0263690252
Mob: 0428263274
E-mail: colbower@bigpond.net.au
ABN: 43060913622

# TABLE OF CONTENTS


| | | | Page |
|---|---|---|---|
| EXECUTIVE SUMMARY | | | 1 |
| 1 | INTRODUCTION | | 1 |
| | 1.1 | PROJECT OVERVIEW | 1 |
| | 1.2 | BIODIVERSITY ASSESSMENT METHOD | 5 |
| | 1.3 | GENERAL DESCRIPTION OF THE DEVELOPMENT SITE | 5 |
| 2 | STAGE 1 – BIODIVERSITY ASSESSMENT | | 13 |
| | 2.1 | LANDSCAPE FEATURES | 13 |
| | | 2.1.1 Regional Setting | 13 |
| | | 2.1.2 Mitchell Landscapes | 13 |
| | | 2.1.3 Native Vegetation Extent | 13 |
| | | 2.1.4 Connectivity | 13 |
| | 2.2 | NATIVE VEGETATION | 16 |
| | | 2.2.1 Plant Community Types | 16 |
| | | 2.2.2 Streamlined Assessment Module | 16 |
| | | 2.2.3 Plantings | 17 |
| | | 2.2.4 Roadside Woodland on Renshaw – McGirr Way | 18 |
| | | 2.2.5 Paddock and Roadside Trees | 19 |
| | | 2.2.6 High Threat, Priority and Nationally Significant Weeds | 20 |
| | 2.3 | THREATENED SPECIES | 20 |
| | | 2.3.1 Data Sources | 20 |
| | | 2.3.2 Likelihood of Threatened Species Occurrence on the Site | 31 |
| | | 2.3.3 Habitat Features of the Site | 31 |
| | | 2.3.4 Ecosystem Credit Species | 32 |
| | | 2.3.5 Habitat Features for Species Credit Species | 32 |
| | | 2.3.6 Species Credit Species | 33 |
| | | 2.3.7 Targeted Surveys for Threatened Species | 33 |
| | | 2.3.8 Threatened Species Listed under the EPBC Act | 33 |
| | | 2.3.9 SEPP 44 | 33 |
| 3 | STAGE 2 – IMPACT ASSESSMENT | | 34 |
| | 3.1 | MEASURES TO AVOID AND MINIMISE IMPACTS | 34 |
| | | 3.1.1 Impact Avoidance | 34 |
| | | 3.1.2 Vegetation Management Plan (VMP) | 34 |
| | | 3.1.3 Weed Management Strategy | 34 |
| | | 3.1.4 Animal Pest Management and Monitoring | 34 |
| | | 3.1.5 Rehabilitation | 35 |
| | | 3.1.6 Summary of Avoidance and Mitigation Actions | 35 |
| | 3.2 | SUMMARY OF PROJECT IMPACTS ON BIODIVERSITY | 36 |
| | | 3.2.1 Serious and Irreversible Impacts | 36 |
| | | 3.2.2 Vegetation Clearance Requiring Offsetting | 36 |
| | | 3.2.3 Vegetation Clearance Not Requiring Assessment or Offsetting | 36 |
| | | 3.2.4 Species Credit Species | 36 |
| | | 3.2.5 Cumulative Impacts | 36 |
| | 3.3 | BIODIVERSITY CREDIT REPORT | 36 |
| | | 3.3.1 BAM Assessment Number | 36 |
| | | 3.3.2 Credits for Removal of Plantings | 36 |
| | | 3.3.3 Credits for Paddock Tree Removal | 37 |
| | | 3.3.4 Credit summary | 37 |
| 4 | REFERENCES | | 38 |

## LIST OF TABLES

Table 1. Mitchell Landscapes in the BDAR Footprint ..... 13
Table 2. Likely Pre-European Plant Community Types on the Development Site (BioNet, 2018a). ..... 16
Table 3. Size Distribution of Planted Native Trees. ..... 17
Table 4. Estimates of Inputs to BAMC for Farm Plantings. ..... 17
Table 5. Vegetation Integrity Statistics for Plantings (PCT267). ..... 18
Table 6. Inputs to BAMC for Roadside Woodland. ..... 18
Table 7. Tree Size Distribution in Roadside Woodland. ..... 18
Table 8. Vegetation Integrity Statistics for the Roadside Box-Gum Woodland. ..... 18
Table 9. Paddock and Roadside Tree Sizes and Presence of Hollows. ..... 19
Table 10. Threatened Flora Species Returned by Database Searches of the Surrounding Region. ..... 22
Table 11. Threatened Fauna Species Returned by Database Searches of the Surrounding Region. ..... 25
Table 12. Ecosystem Credit Fauna Potentially Able to Utilise the Site. ..... 32
Table 13. Avoidance and Minimisation Measures, Responsibility and Timing. ..... 35
Table 14. Cumulative Losses of Native Vegetation in Affected Mitchell Landscapes ..... 36
Table 15. Paddock Trees Assigned to Classes ..... 37
Table 16. Combined Biodiversity Credits Summary. ..... 37

## LIST OF FIGURES

Figure 1. Regional Location of the Project Site. ..... 2
Figure 2. Site Layout. ..... 3
Figure 3. Proposed Widening of Renshaw - McGirr Way at the Suntop Road Intersection. ..... 4
Figure 4. Paddock Arrangement on the Development Site. ..... 6
Figure 5. BAM Site Map of Subject Land. ..... 14
Figure 6. BAM Location Map of Subject Land. ..... 15
Figure 7. Native Vegetation on the Subject Land. ..... 17
Figure 8. Flora Quadrat Site, Box-Gum Woodland EEC and Locations of Trees for Removal. ..... 18
Figure 9. Locations of Threatened Species within 10 km of the Subject Land. ..... 21

## LIST OF PLATES

Plate 1. Lucerne crop in Paddock 1. ..... 7
Plate 2. Paddock 2 recently cultivated. ..... 7
Plate 3. Lucerne crop in Paddock 3 and tree planting between Paddocks 2 and 3. ..... 7
Plate 4. Lucerne crop in Paddock 4. ..... 8
Plate 5. Fallow after wheat crop in Paddock 5 ..... 8
Plate 6. Fallow after wheat crop in Paddock 6. ..... 8
Plate 7. Lucerne crop in Paddock 7. ..... 9
Plate 8. Lucerne crop in Paddock 8. ..... 9
Plate 9. Stubble after wheat crop in Paddock 9. ..... 9
Plate 10. Mature lucerne crop in Paddock 10. ..... 10
Plate 11. Lucerne in Paddock 11. ..... 10
Plate 12. Fallow after cropping in Paddock 12 ..... 10
Plate 13. Drought affected wheat crop in Paddock 13. ..... 11
Plate 14. Weed dominated lucerne in Paddock 14. ..... 11
Plate 15. Weedy lucerne in Paddock 15 ..... 11
Plate 16. Weed dominated ground cover in northern laneway. ..... 12
Plate 17. Weed dominated ground cover in southern laneway. ..... 12
Plate 18. Eucalypt planting between Paddocks 12 and 13. ..... 12

## LIST OF ATTACHMENTS

Attachment 1. Fauna Survey and Assessment Report
Attachment 2. BAM Credit Summary Report

# EXECUTIVE SUMMARY

FloraSearch was commissioned by Pitt and Sherry Pty. Ltd. on behalf of Suntop Solar Farm to conduct biodiversity surveys and an ecological assessment on the site of a proposed solar farm at Suntop, approximately 10 kilometres (km) south west of Wellington town centre in the central west of New South Wales. The Project is a State Significant Development for which approval is being sought under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The survey and assessment were conducted using the Biodiversity Assessment Method (BAM) (OEH, 2017a) under the NSW *Biodiversity Conservation Act 2016* (BC Act). Owing to the small areas of native vegetation to be impacted on the Site, the assessment uses the *Streamlined Assessment Module* of the BAM (OEH, 2017a).

Suntop Solar Farm propose to construct and operate a 200 megawatt (MW) solar farm (the Proposal) using photovoltaic (PV) technology at a 517 hectare site (the Study area) in Suntop, NSW (Figure 1). The Proposal would be located adjacent to Suntop Road and contained within Lots 1, 2 and 3 DP506925, Lot 122 DP753238 and Lot 90 DP657805 (the Subject Land) within the Dubbo Regional Council Local Government Area (LGA). The solar farm would occupy 472 hectares (the Site) of the 517 hectares (approximately 91.3% of the Study area).

The survey comprised three days of field survey (29 November 2017, 15 January 2018 and 8 May 2018), searches of relevant State and Commonwealth databases and a literature review to determine which threatened biodiversity has potential to occur on the investigation area.

The key findings of the survey were:

***Flora***

- No patches of remnant vegetation occur within the solar farm footprint, which is confined to cleared agricultural land entirely made up of cultivation paddocks for wheat and lucerne production.

- All that remains of the pre-European native vegetation within the solar farm footprint are 25 scattered remnant old growth paddock trees, 10 of which have hollows suitable for wildlife denning and nesting.

- The Site also has five linear plantings and two small block plantings of native trees totalling 477 individuals, some endemic to the local area and some native to other regions.

- Three introduced species regarded as High Threat Exotic weeds under the BAM (OEH, 2018a) were recorded on the Site, Khaki Weed, Bathurst Burr and Saffron Thistle. None are listed as Priority Weeds under the NSW *Biosecurity Act 2015* or as Weeds of National Significance by the Australian Weeds Committee.

- The original dominant vegetation community on the study area is considered to be Plant Community Type (PCT) 267; *White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion*.

- Upgrade of the intersection of Suntop Road and Renshaw-McGirr Way would disturb remnants of PCT277; *Blakelys Red Gum – Yellow Box grassy tall woodland in the NSW South Western Slopes Bioregion*.

***Threatened Biodiversity***

- No threatened flora species, populations or critical habitat listed under the BC Act or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were identified on the investigation area by the survey, or by a survey of fauna by Biosphere Environmental Consultants Pty. Ltd (Attachment 1).

- No suitable habitat was considered to be present on the Site for any of the threatened flora species returned by the BAM Credit Calculator as having potential to occur.

- Five ecosystem credit fauna species were considered to have a low potential to use the limited resources on the Site; the Little Lorikeet, Swift Parrot, Regent Honeyeater, Scarlet Robin and Flame Robin.

- No species credit fauna species were considered to have potential to utilise the Site owing to a lack of breeding resources.

- One threatened ecological community (TEC) listed under the BC Act and the EPBC Act is considered to once have occupied the Site, but has been reduced by clearing for agriculture to a few scattered paddock trees;

  *White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community* (BC Act), and
  *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community* (EPBC Act).

- Remnant woodland of the above EEC/CEEC, commonly known as Box-Gum Woodland, occupies the disturbance area at the intersection of Suntop Road and Renshaw – McGirr Way.

***Impact Avoidance and Mitigation***

Impact avoidance measures that would be implemented for the Project include;

- Protection measures to avoid damage to discontinuous patches of mature native perimeter trees on all boundaries of the Site.
- Avoidance and protection of the block of planted native eucalypts in Paddock 12.
- Retention and avoidance of a clump of three Fuzzy Box trees within the northern boundary of Paddock 1.

Mitigation measures include:

- Supervised removal of trees with hollows.
- A Vegetation Management Plan to protect old growth trees on the margins of the Site.
- Vegetation enhancement through strategic replanting.
- Development of a weed management strategy.
- Monitoring for feral animals and control as necessary.
- Prohibition of domestic pets on site.
- A site closure and rehabilitation plan.

***Project Impacts***

Direct impacts of the Proposal on biodiversity include;

- Loss of 1.25 ha of eucalypt plantings and six isolated planted eucalypts.
- Loss of 0.04 ha of Box-Gum Woodland at the junction of Suntop Road and Renshaw – McGirr Way.
- Loss of 25 remnant paddock trees and up to 10 isolated roadside trees.

***Cumulative Impacts***

The cumulative impacts of the project on remnant native vegetation loss are negligible whether remnant woodland or plantings of native windbreak trees are considered.

***Biodiversity Credit Report***

The biodiversity credit report of the BAMC indicated that the plantings, which were assumed to represent PCT267 in order to run the calculator, are valued at 20 credits.

Paddock trees for removal were assessed according to Appendix 1 of the BAM (2017a), which valued them at 27.75 credits.

The total credit liability for the Project is 47.75 credits.

***Offset***

Suntop Solar Farm propose to acquit the liability of 47.75 credits by making a lump sum payment of equivalent value to the Biodiversity Conservation Trust Fund.

***Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act)***

Two threatened species considered to have potential habitat on the investigation area are listed under the EPBC Act; the Swift Parrot and the Regent Honeyeater. Neither species would be dependent on the site for breeding and foraging visits would occur rarely, if at all. The small loss of potential habitat on the site is highly unlikely to have an adverse impact on either species and referral of the Project to the Department of Energy and the Environment is not required.

***SEPP 44***

Three of the remnant eucalypt species on and around the Subject Land are recognised as secondary Koala food trees (OEH, 2018e), viz. Inland Grey Box, Fuzzy Box and White Box. The last of these is listed as a Koala feed tree in Schedule 2 of SEPP 44. However, the Site does not have an extant Koala population (Attachment 1) and therefore is not ‘core’ Koala habitat so that a SEPP 44 plan of management is not required.

# 1 INTRODUCTION

FloraSearch was commissioned by Pitt and Sherry Pty. Ltd. on behalf of Suntop Solar Farm to conduct biodiversity surveys and an ecological assessment of the site of a proposed solar farm at Suntop, approximately 10 kilometres (km) south west of Wellington town centre in the central west of New South Wales (Figure 1). The Project is a State Significant Development for which approval is being sought under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The survey and assessment were conducted using the Biodiversity Assessment Method (BAM) (OEH, 2017a) under the NSW *Biodiversity Conservation Act 2016* (BC Act).

## 1.1 PROJECT OVERVIEW

Suntop Solar Farm propose to construct and operate a 200 megawatt (MW) solar farm (the Proposal) using photovoltaic (PV) technology at a 517 hectare site (the Study area) in Suntop, NSW (Figure 1). The Proposal would be located adjacent to Suntop Road and contained within Lots 1, 2 and 3 DP506925, Lot 122 DP753238 and Lot 90 DP657805 (the Subject Land) within the Dubbo Regional Council Local Government Area (LGA). The solar farm would occupy 472 hectares (the Site) of the 517 hectares (approximately 91.3% of the Study area) (Figure 2).

An estimated up to 550,000 PV panels would be installed on a single axis tracker system across the Site. The single axis tracker system would consist of groups of east-west facing PV modules tilted at +/- 60$^{o}$ angle (each approximately 2m x 1m in area) on mounting structures approximately 2 m in height. The mounting structure would be piled steel posts that would extend 1.6 to 4 m below soil surface depending on substrate conditions. The maximum height of the panels during tracking movement would be 4 m.

The following works and infrastructure would be required to support the construction and operation of the solar farm:

- Construction of an access road for all access and egress for the Site and substation.
- Installation of Electrical infrastructure including:
  - A 132kV Substation including two transformers and associated 132kV switchgear.
  - Inverters to collect and convert DC to AC.
  - Cabling and other electrical infrastructure (e.g. security systems).
- A maintenance compound and buildings.
- Fencing, landscaping and environmental works.
- Upgrade of the intersection of Suntop Road and Renshaw-McGirr Way (Figure 3).

Power generated by the facility will be transmitted via existing 132kV transmission lines, in an easement owned by TransGrid that traverses the Site and extends through to the Wellington substation approximately 15 kilometres to the north. A tee off connection will be used to connect the new substation on Site to the existing TransGrid 132kV transmission line via a short section of transmission line.

The operational life of the solar farm is expected to be approximately 30 years at which point the panels are either replaced and operations continue or removed and the site decommissioned and rehabilitated as required.

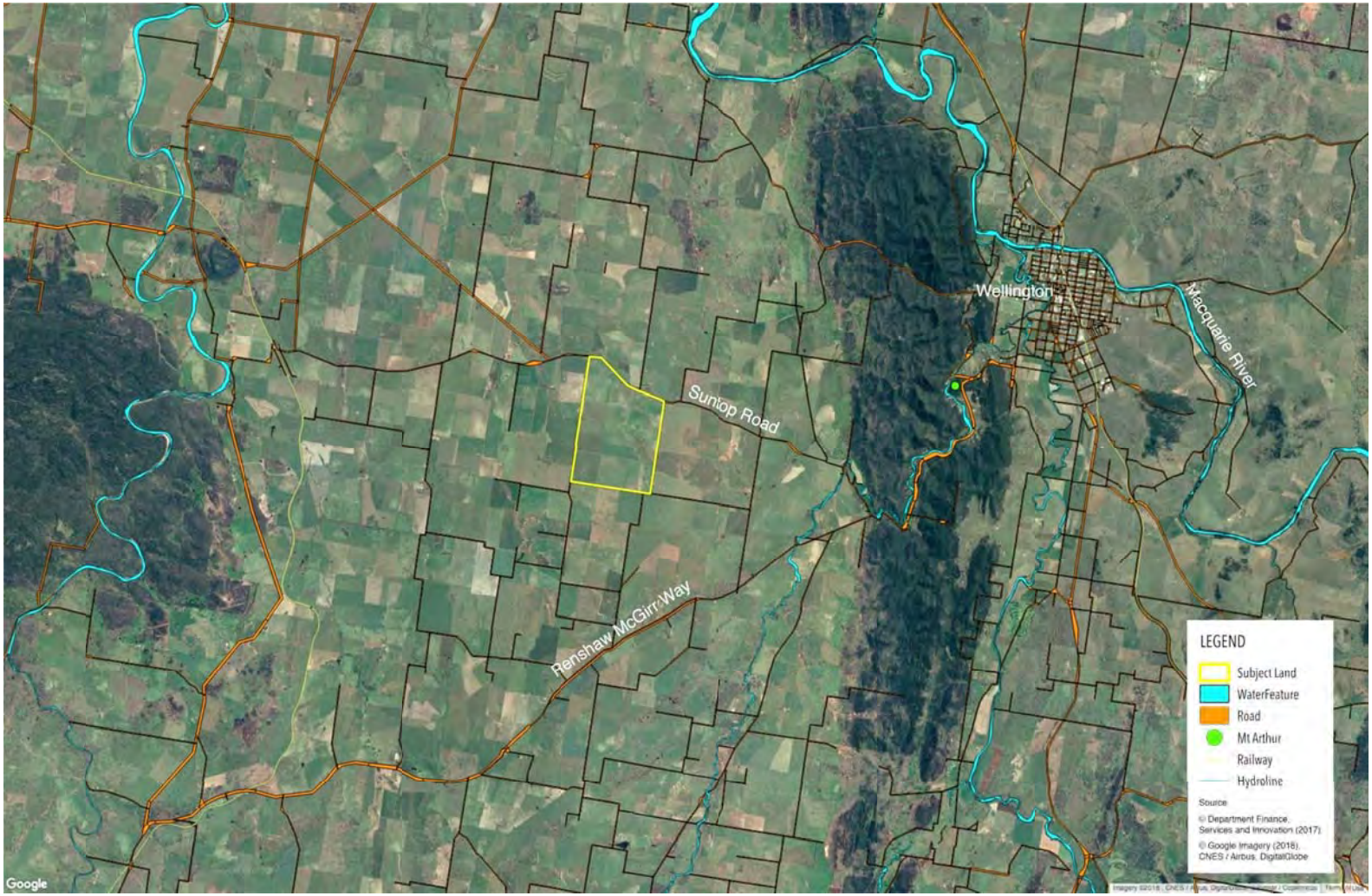



**Figure 1. Regional Location of the Project Site.**

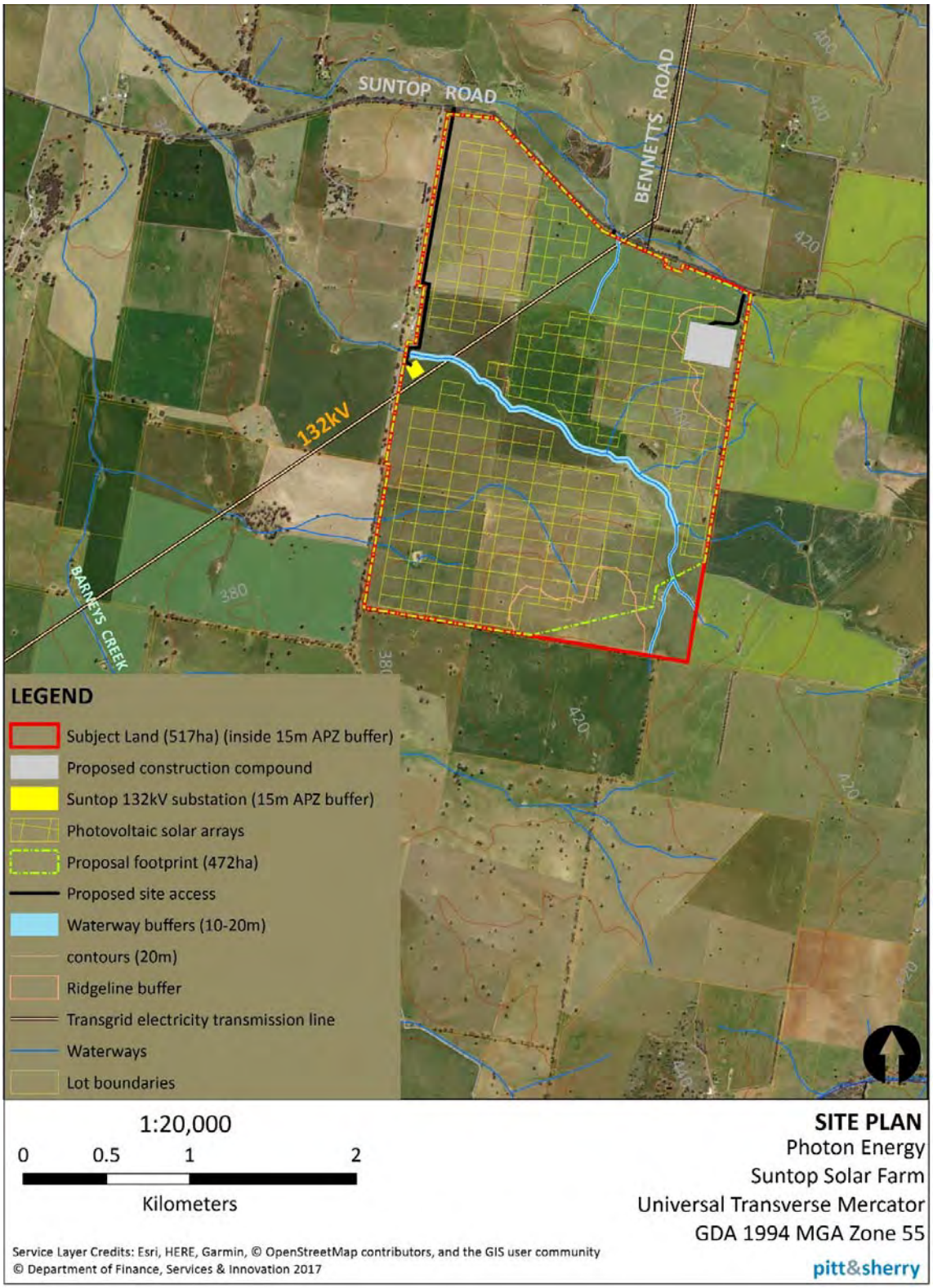



**Figure 2. Site Layout.**

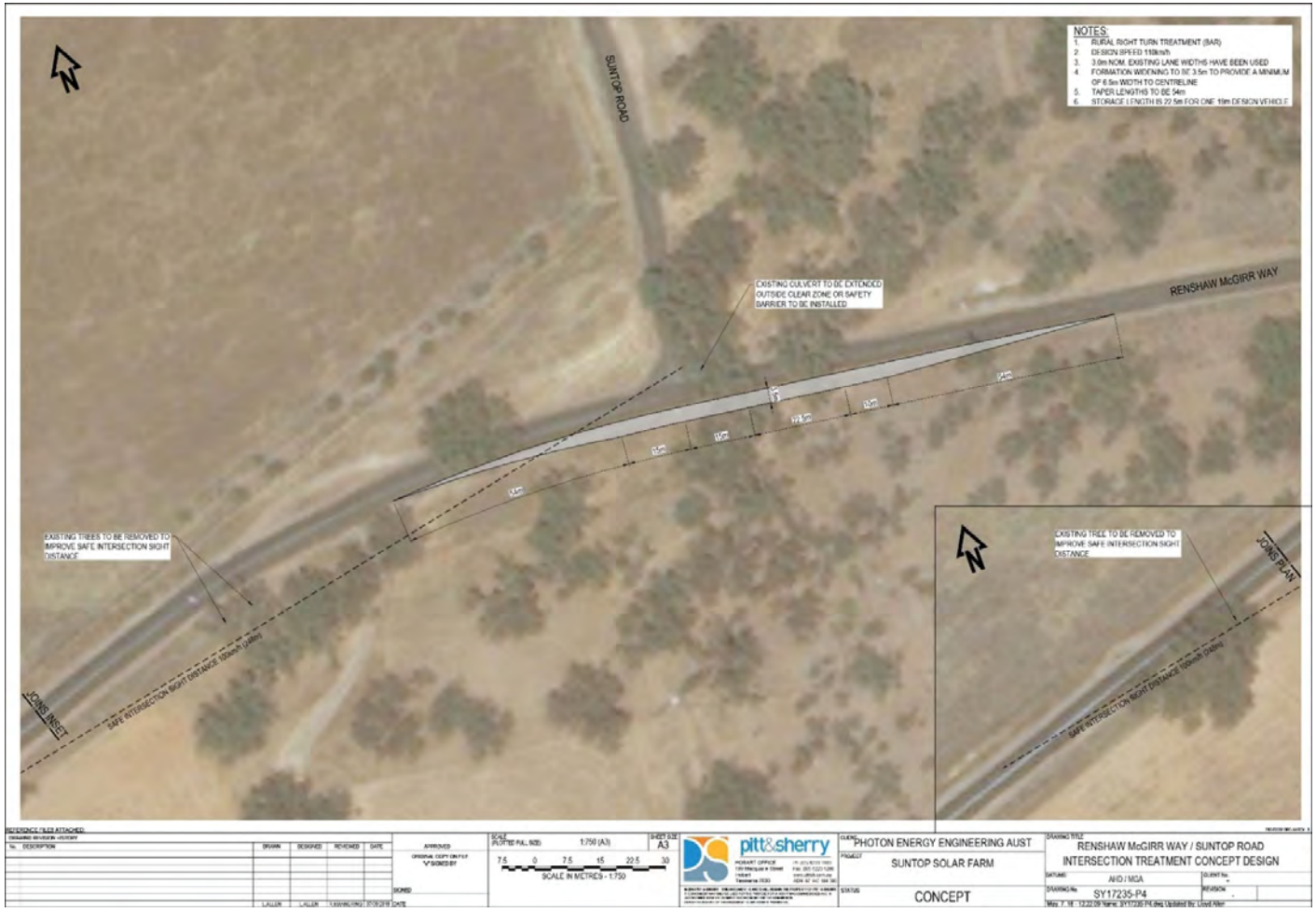



**Figure 3. Proposed Widening of Renshaw - McGirr Way at the Suntop Road Intersection.**

## 1.2 BIODIVERSITY ASSESSMENT METHOD

The Environmental Assessment Requirements issued on behalf of the Secretary of the NSW Department of Planning and Environment to Suntop Solar Farm require that the assessment of impacts from this Project on biodiversity should be conducted in accordance with the Biodiversity Assessment Method (BAM) (OEH, 2017a) established under the *Biodiversity Conservation Act 2016* (BC Act). The BAM outlines the methodology that underpins the NSW Biodiversity Offsets Scheme established under Part 6 of the BC Act.

The BAM (OEH, 2017a) requires the use of an online program (calculator) to assess biodiversity impacts and determine the biodiversity offset requirements for those impacts. The *Biodiversity Assessment Method Calculator* (BAMC or the Credit Calculator) was used for this assessment.

As specified by the BAM (OEH, 2017a), three stages of assessment are outlined in this report:

- Stage 1 summarises the biodiversity values of the BDAR Footprint that are entered into the Credit Calculator (e.g. landscape features, native vegetation and threatened species) (Section 2);
- Stage 2 assesses potential impacts on biodiversity, describes impact avoidance and mitigation measures and determines offset requirements (Section 3); and
- Stage 3 describes the Biodiversity Offset Strategy (Section 4).

This Biodiversity Development Assessment Report (BDAR) has been prepared by Dr Colin Bower (FloraSearch), who is an accredited assessor under section 6.10 of the BC Act (assessor accreditation number BAAS18048).

## 1.3 GENERAL DESCRIPTION OF THE DEVELOPMENT SITE

The Biodiversity Development Assessment Report Site Footprint (BDAR Footprint) (Figure 2) is the development Site construction and operational area comprising approximately 472 hectares (ha). An existing TransGrid easement runs in a north-easterly direction across the Site from the western boundary of Lot 3 DP 506925, through Lot 122 DP 753238, and exiting near the north-eastern corner of Lot 122 (Figure 2). This easement contains existing TransGrid 132kV powerlines on wooden pole structures connecting to the Wellington substation approximately 15km to the north-east of the Site.

The land is divided into 15 fenced paddocks currently used for agriculture, including cropping (e.g. wheat and lucerne) and grazing (Figure 4). It is proposed that grazing activities would continue on the land occupied by the solar farm. The Site has been almost entirely cleared of its original vegetation except for a few scattered paddock trees. Various plantings of eucalypts have been made on the property including a woodlot in the centre east, which will remain within the solar farm, and five narrow linear plantings two tree rows wide along fence lines, which are proposed to be removed (Figures 2 and 4). In addition, some of the scattered paddock trees have been planted historically. The remnant paddock trees and plantings comprise the only native vegetation on the Site.

Plates 1 to 18 illustrate the current condition of the vegetation across the Site according to the paddock numbering in Figure 4. The photos demonstrate that the whole property including two access laneways has been regularly cultivated, cropped and heavily grazed, and lacks remnants of native ground cover.




**Figure 4. Paddock Arrangement on the Development Site.**
[Note the access laneways between paddocks 2/3 and 5/7 in the north and paddocks 9/11 and 13/14 in the south]



**Plate 1. Lucerne crop in Paddock 1.**



**Plate 2. Paddock 2 recently cultivated.**



**Plate 3. Lucerne crop in Paddock 3 and tree planting between Paddocks 2 and 3.**



**Plate 4. Lucerne crop in Paddock 4.**



**Plate 5. Fallow after wheat crop in Paddock 5.**



**Plate 6. Fallow after wheat crop in Paddock 6.**



**Plate 7. Lucerne crop in Paddock 7.**



**Plate 8. Lucerne crop in Paddock 8.**



**Plate 9. Stubble after wheat crop in Paddock 9.**



**Plate 10. Mature lucerne crop in Paddock 10.**



**Plate 11. Lucerne in Paddock 11.**



**Plate 12. Fallow after cropping in Paddock 12.**



**Plate 13. Drought affected wheat crop in Paddock 13.**



**Plate 14. Weed dominated lucerne in Paddock 14.**



**Plate 15. Weedy lucerne in Paddock 15.**



**Plate 16. Weed dominated ground cover in northern laneway.**



**Plate 17. Weed dominated ground cover in southern laneway.**



**Plate 18. Eucalypt planting between Paddocks 12 and 13.**

# 2 STAGE 1 – BIODIVERSITY ASSESSMENT

Stage 1 of the biodiversity assessment summarises the biodiversity values of the BDAR Footprint that are inputs into the Credit Calculator.

## 2.1 LANDSCAPE FEATURES

Landscape features relevant to the Project are described in this section and illustrated on Figures 5 (Site Map) and 6 (Location Map).

This Site is assessed using the site-based assessment module within BAMC. Accordingly, a 1.5 km buffer zone was used to assess the landscape around the development Site (Figure 6).

### 2.1.1 Regional Setting

The Project is located approximately 10.5 km west south west of Wellington town centre in central western NSW (Figure 1), entirely within the following regions:

- the New South Wales South Western Slopes Bioregion and Upper Slopes Sub-region of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995); and
- the Dubbo Regional LGA.

### 2.1.2 Mitchell Landscapes

Details of the Mitchell Landscapes within the solar farm footprint are provided in Table 1 and shown on Figure 6. The footprint is predominantly within the Nangar Ranges Mitchell Landscape (OEH, 2018a) (Table 1).

**Table 1. Mitchell Landscapes in the BDAR Footprint**

| Landscape Name | Percentage Cleared Estimate[1] | Area (ha) | Percent (%) of BDAR Footprint Covered by Landscape |
|---|---|---|---|
| Nangar Ranges | 84 | 408.3 | 94.3 |
| Macquarie Alluvial Plains | 78 | 24.7 | 5.7 |

[1] Sourced from the 'Over-cleared Landscapes Database' within the BioNet Vegetation Classification Database (OEH, 2018b).

### 2.1.3 Native Vegetation Extent

The Project is located in a highly cleared agricultural region. The 1.5 km buffer zone around the Project area encompasses 1,696.4 ha, of which only 50.3 ha (3.0%) is remnant native woodland (Figure 6). Within the development Site the only patches of native vegetation are the five linear plantings and two other small plantings which total 1.1 ha in area, or 0.23 percent of the Site area.

### 2.1.4 Connectivity

No vegetation corridors exist within the Project area or immediate surrounds (Figure 6).




**Figure 5. BAM Site Map of Subject Land.**




**Figure 6. BAM Location Map of Subject Land.**

## 2.2 NATIVE VEGETATION

Native vegetation on the BDAR Footprint is described in this section based on site visits undertaken by FloraSearch on 29 November 2017 and 15 January 2018 (solar farm), and 8 May 2018 (intersection of Suntop Road and Renshaw – McGirr Way).

### 2.2.1 Plant Community Types

All that remains of the original pre-European tree cover on the solar farm Site are 28 remnant scattered paddock trees and remnant perimeter trees on the eastern boundary (Figure 7). From these it is possible to determine what were the likely original Plant Community Types (PCT) (BioNet, 2018a). The remnant paddock trees comprise;

- Fuzzy Box (*Eucalyptus conica*) – a clump of 3 trees in Paddock 1 (not to be removed).
- White Box (*Eucalyptus albens*) – 8 scattered trees on the higher parts of the Site.
- Kurrajong (*Brachychiton populneus*) – 2 trees.
- White Cypress Pine (*Callitris glaucophylla*) – 15 scattered trees in the south west corner of the Site in Paddocks 6, 9 and 13.

In addition, it was observed that the native trees remaining along the main access corridor just outside the western boundary of the Site and along Suntop Road are mainly Inland Grey Box (*Eucalyptus microcarpa*) with some White Box and Fuzzy Box. The above observations suggest that three PCTs are likely to have occurred on the Site prior to its clearance (Table 2) (BioNet, 2018a). All of these PCTs represent Threatened Ecological Communities (Table 2). However, no structurally or floristically representative remnants of these PCTs remain on the Site. Accordingly, it was not possible to conduct flora quadrat sampling to provide data for input to the BAMC.

The native vegetation in the proposed disturbance area at the intersection of Suntop Road and Renshaw – McGirr Way is a roadside remnant of the Box-Gum Woodland Endangered Ecological Community, dominated by Yellow Box (*Eucalyptus melliodora*) (Figure 8, Table 2). This vegetation was in moderate to good condition, was sampled with a single BAM flora quadrat and treated as a separate vegetation zone for input of data to the BAMC.

### 2.2.2 Streamlined Assessment Module

This section provides justification for using the streamlined assessment module of the BAM for this Project. The native vegetation on the Site comprises scattered remnant paddock trees and five linear plantings (1.18 ha) of native trees along fence lines, two small patches (0.07 ha) of plantings and a small area (0.04 ha) of Box-Gum Woodland at the intersection of Suntop Road and Renshaw – McGirr Way (Figures 7 and 8). The total area of the plantings is 1.29 ha, which is above the minimum threshold (1.0 ha) for application of the Biodiversity Offsets Scheme and below the 5 ha maximum area limit for application of the streamlined assessment module (BAM, Appendix 2 [OEH, 2017a]) on a site with a minimum Lot size of 40 ha. Accordingly, this report follows the requirements of the BAM streamlined assessment module (OEH, 2017a), which is applied in two parts;

- The streamlined assessment module for the on-site plantings and the Box-Gum Woodland (Suntop Road intersection), and

- the paddock tree module for;
  - 25 paddock trees that would be removed from the Site, and
  - up to 10 additional roadside trees that would be removed on Renshaw – McGirr Way to improve line of sight for motorists and to facilitate road and culvert widening (Figure 8).

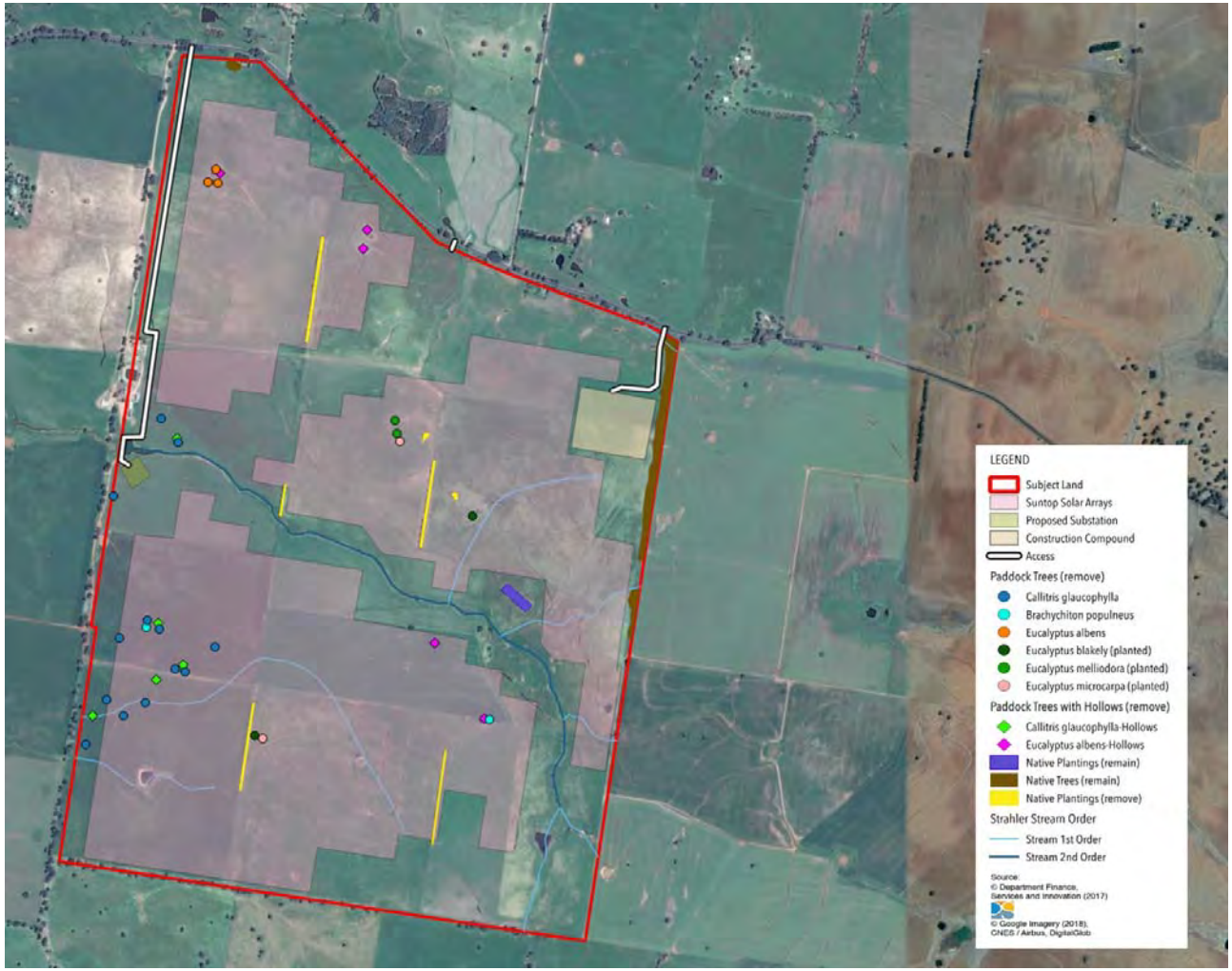



**Figure 7. Native Vegetation on the Subject Land.**




**Figure 8. Flora Quadrat Site, Box-Gum Woodland EEC and Locations of Trees for Removal.**

**Table 2. Likely Pre-European Plant Community Types on the Development Site (BioNet, 2018a).**

| Vegetation Formation | Vegetation Class | PCT | | Dominant tree species | Justification | Threatened Ecological Communities |
|---|---|---|---|---|---|---|
| | | No. | Name | | | |
| Grassy Woodlands | Western Slopes Grassy Woodlands | 201 | Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion. | *Eucalyptus conica,* *E. microcarpa* *E. melliodora* | The north-western tip of the Site is mapped as part of the Macquarie Alluvial Plains Mitchell Landscape (OEH, 2018a), which is habitat for PCT201. | *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions Endangered Ecological Community* (BC Act) |
| | | 267 | White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion. | *E. albens* *E. microcarpa* *Callitris glaucophylla* | The dominant three species of PCT 267 are the dominant trees remaining on and close to the Site, making PCT 267 a good fit for the lower parts of the site, excluding the north west corner. | *White Box Yellow Box Blakely's Red Gum Woodland Endangered Ecological Community* (BC Act) and *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community* (Environment Protection and Biodiversity Conservation Act 1999 [EPBC Act]). [This community is commonly known as Box-Gum Woodland.] |
| | | 266 | White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion. | *E. albens* *Brachychiton populneus* *E. blakelyi* | The higher parts of the Site appear to have been dominated originally by White Box with some Kurrajong. | |
| | | 277 | Blakelys Red Gum – Yellow Box grassy tall woodland in the NSW South Western Slopes Bioregion. | *E. melliodora* *E. blakelyi* *E. bridgesiana* | The native vegetation beside watercourses and on lower slopes at the intersection of Suntop Road and Renshaw – McGirr Way is dominated by *E. melliodora* with occasional *E. blakelyi*, best matching PCT277. | |

### 2.2.3 Plantings

The plantings comprise a total of 477 surviving trees within an area of 1.25 ha. Tree stem diameter at breast height was measured on 167 (35%) of these trees to determine the size distribution of trees across plantings (Table 3). Measurements were spread evenly across all plantings and tree species within them. The data in Table 3 were used to estimate the number of trees in each size class within a representative 1000m$^2$ for input to the BAMC (Table 3).

Other parameters for input to the BAMC were estimated qualitatively as per paragraph 5.3 of Appendix 2 of the BAM (OEH, 2017a) (Table 4). Owing to the small area of the plantings (1.25 ha), an overall estimate of the condition of the plantings was required for the equivalent of one set of quadrat data (Table 4). The estimates were based on field observations across all plantings.

**Table 3. Size Distribution of Planted Native Trees.**

| Planting | Diameter at Breast Height (DBH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | < 5 cm | 5 - 9 cm | 10 – 19 cm | 20 – 29 cm | 30 – 49 cm | 50 – 79 cm | 80 + cm |
| **1** | 0 | 1 | 6 | 5 | 6 | 1 | 1 |
| **2** | 0 | 1 | 11 | 4 | 3 | 4 | 2 |
| **3** | 0 | 2 | 11 | 16 | 1 | 1 | 0 |
| **4** | 0 | 2 | 11 | 15 | 3 | 0 | 0 |
| **5** | 0 | 1 | 12 | 19 | 7 | 1 | 0 |
| **Total** | 0 | 7 | 51 | 59 | 20 | 7 | 3 |
| **Estimate / 1000m$^2$** | **0** | **2** | **15** | **17** | **6** | **2** | **1** |

**Table 4. Estimates of Inputs to BAMC for Farm Plantings.**

| BAM attribute (400m$^2$) | No. of species | Foliage cover (%) |
|---|---|---|
| ***Trees*** | 3 | 30 |
| ***Shrubs*** | 0 | 0 |
| ***Grasses / grass-like*** | 2 | 2 |
| ***Forbs*** | 2 | 0.2 |
| ***Ferns*** | 0 | 0 |
| ***Other*** | 0 | 0 |
| ***High Threat Weeds*** | 2 | 1 |
| ***Litter cover* (1000m$^2$)** | - | 10 |
| ***Length of logs*** | - | 0 m |

For the purposes of inputting the plantings data to the BAMC, it was assumed the plantings represent the likely original dominant PCT on the Site, i.e. PCT267, *White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion*, which they were intended to replace. The resulting vegetation integrity statistics from the BAMC are given in Table 5.

**Table 5. Vegetation Integrity Statistics for Plantings (PCT267).**

| Statistic | Score |
|---|---|
| Composition | 22.4 |
| Structure | 33.1 |
| Function | 36.7 |
| Vegetation Integrity | 30.1 |

### 2.2.4 Roadside Woodland on Renshaw – McGirr Way

One BAM flora quadrat was conducted in remnant Box-Gum Woodland in the disturbance area for road widening on Renshaw – McGirr Way (Tables 6 and 7).

**Table 6. Inputs to BAMC for Roadside Woodland.**

| BAM attribute (400m$^2$) | No. of species | Foliage cover (%) |
|---|---|---|
| ***Trees*** | 1 | 40 |
| ***Shrubs*** | 2 | 0.3 |
| ***Grasses / grass-like*** | 4 | 20.6 |
| ***Forbs*** | 9 | 1.1 |
| ***Ferns*** | 1 | 0.1 |
| ***Other*** | 1 | 0.1 |
| ***High Threat Weeds*** | 1 | 3 |
| ***Litter cover*** (1000m$^2$) | - | 95 |
| ***Length of logs*** | - | 4 m |

**Table 7. Tree Size Distribution in Roadside Woodland.**

| | Diameter at Breast Height (DBH) (cm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | < 5 | 5 - 9 | 10 – 19 | 20 – 29 | 30 – 49 | 50 – 79 | 80 + |
| **No. of trees** | 8 | 2 | 8 | 2 | 3 | 0 | 1 |
| **No. with hollows** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Because this BDAR utilises the streamlined assessment module of the BAM, the credit calculator is configured for only one PCT, the dominant PCT on the Site. For the purposes of inputting the roadside woodland data to the BAMC, it was assumed the woodland belonged to PCT267 instead of PCT277. This is justified on the grounds that the two PCTs belong to the same EEC; Box-Gum Woodland. The planting and woodland data were entered as two separate zones in the calculator. The vegetation integrity statistics for the roadside vegetation are given in Table 8.

**Table 8. Vegetation Integrity Statistics for the Roadside Box-Gum Woodland.**

| Statistic | Score |
|---|---|
| Composition | 72.5 |
| Structure | 81.0 |
| Function | 65.9 |
| Vegetation Integrity | 72.9 |

### 2.2.5 Paddock and Roadside Trees

The scattered remnant trees on the Site are treated as paddock trees for this assessment (Figure 7). Their diameters at breast height (DBH) and the presence of any hollows suitable for wildlife were recorded for input to the Paddock Tree module of the Streamlined Assessment (Appendix 1, BAM [OEH, 2017a]) (Table 9). Some very large remnant trees, probably dating to pre-European times, occur across the Site (Table 9) and around its perimeter. All but one of the remnant paddock trees exceed the lower limit (50 cm) for classification as large trees in PCT267.

In addition to native remnant trees, six isolated planted paddock trees were also recorded (Figure 7, Table 9). The origins of these trees were evident from the remains of tree guards and stakes left over from planting.

Up to ten trees would be removed from the south side of Renshaw – McGirr Way to improve line of sight for motorists to the Suntop Road intersection and as part of the road widening and upgrading works (Figure 8). Eight trees that lie within the road widening disturbance area of 0.04 ha are not considered here. The impact of the project on these trees is accounted for in the BAMC for vegetation clearance.

**Table 9. Paddock and Roadside Tree Sizes and Presence of Hollows.**

| Species | Tree Diameter at Breast Height (cm) (number of trees) | | | | | |
|---|---|---|---|---|---|---|
| | ≤ 20 | 21 – 50 | 51 - 90 | 91 - 130 | 131 - 170 | Total |
| ***Remnant native trees*** | | | | | | |
| *Brachychiton populneus* | - | - | 1 | - | 1 | 2 |
| *Callitris glaucophylla* | - | - | 14 | 1 | - | 15 |
| *Eucalyptus albens* | - | - | 3 | 4 | 1 | 8 |
| **Total** | **0** | **0** | **18** | **5** | **2** | **25** |
| No. with hollows | 0 | 0 | 4 | 5 | 1 | 10 |
| ***Isolated planted trees*** | | | | | | |
| *Eucalyptus blakelyi* | 2 | 1 | 1 | - | - | 4 |
| *Eucalyptus melliodora* | - | 1 | - | - | - | 1 |
| *Eucalyptus microcarpa* | - | 1 | - | - | - | 1 |
| **Total** | **2** | **3** | **1** | **0** | **0** | **6** |
| No. with hollows | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Roadside trees*** | | | | | | |
| *Eucalyptus melliodora* | 4 | - | 3 | 2 | - | 9 |
| *Brachychiton populneus* | 1 | - | - | - | - | 1 |
| **Total** | **5** | **0** | **3** | **2** | **0** | **10** |
| No. with hollows | 0 | 0 | 1 | 1 | 0 | 2 |
| **TOTAL TREES** | **7** | **3** | **22** | **7** | **2** | **41** |
| **TOTAL with hollows** | **0** | **0** | **5** | **6** | **1** | **12** |

### 2.2.6 High Threat, Priority and Nationally Significant Weeds

Three introduced flora species are considered to be High Threat Exotic weeds by OEH (2018g), Khaki Weed, Bathurst Burr and Saffron Thistle. No weeds listed as Priority Weeds for the Dubbo Regional LGA under the NSW *Biosecurity Act 2015* were identified by the survey (DPI, 2018). Similarly, no weeds listed as Weeds of National Significance by the Australian Weeds Committee of the Commonwealth Government (www.weeds.org.au) were identified.

## 2.3 THREATENED SPECIES

Threatened species relevant to the Project are identified in this section. The BAM recognises two categories of threatened species:

- ecosystem credit species (i.e. species predicted to be present based on the PCTs present on the Site); and/or
- species credit species (i.e. species that cannot be reliably predicted by PCTs) (OEH, 2017a).

Threatened species that are ecosystem credit species and/or species credit species are pre-determined in the Credit Calculator and *BioNet Threatened Species Profile Database* (OEH, 2018c).

### 2.3.1 Data Sources

Three data sources were used to compile lists of threatened flora and fauna that may potentially occur on the Site (Tables 10 and 11):

- BAM online calculator – Lists of ecosystem credit species and species credit species generated by the BAMC from the BioNet databases using inputs on IBRA subregion, Site location and vegetation integrity (OEH, 2018d).

- BioNet website – Searches of the NSW Atlas of Wildlife, NSW State Forests, Australian Museum and Royal Botanic Gardens Sydney databases (BioNet, 2018b). The search area comprised a 20 × 20 km square centred on the study area. This search returned a list of threatened species records from within the search area and shown on Figure 9.

- Commonwealth Department of the Environment and Energy (DoEE) website – Protected Matters Search Tool (PMST) (DoEE, 2018a). The search area comprised the same 20 × 20 km square as for the BioNet search. The PMST uses actual records and habitat modelling to return a list of 'protected matters' that are known or predicted to occur in the search area, including threatened species, migratory species, ecological communities, wetlands of international significance, and national and world heritage properties.

BAMC returned 16 ecosystem credit species, all fauna; and 14 species credit species, four flora and 10 fauna species (Tables 10 and 11). Four fauna species are dual ecosystem and credit species. All species returned by the BAMC require assessment within the calculator of the suitability of the habitat on the Site for them.

The BioNet database search returned records of one flora species, the Sandhill Spider Orchid (*Caladenia arenaria*) and one fauna species, the Glossy Black Cockatoo (*Calyptorhynchus lathamii*), close to the Site that were not identified by BAMC (Figure 9). The potential for habitat of these species to occur on the Site is also assessed in Tables 10 and 11.

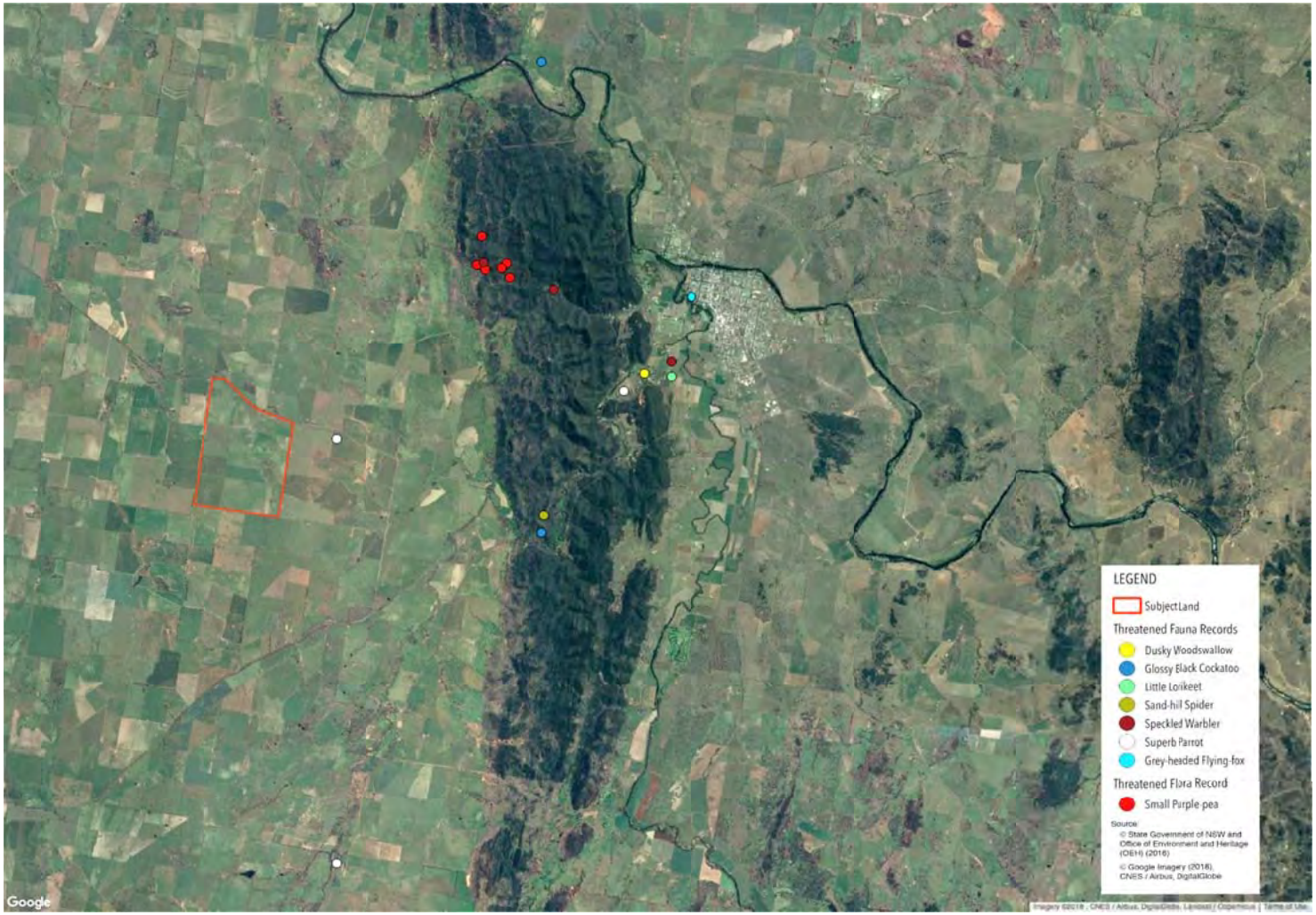



**Figure 9. Locations of Threatened Species within 10 km of the Subject Land.**

**Table 10. Threatened Flora Species Returned by Database Searches of the Surrounding Region.**

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem OR Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Acacia ausfeldii* | Ausfeld's Wattle | ✓ | - | - | V | - | Sp[1] | Nil | Generally confined to an area between Dubbo, Ulan and Mudgee, where it occurs on sandy soils in dry shrubby forests (OEH, 2018e). It is unlikely to have once occurred on the Site. |
| *Austrostipa wakoolica* | - | - | - | ✓ | E | E | Sp | Nil | Confined to the floodplains of the Lachlan, Murrumbidgee and Murray Rivers in central-western and south-western NSW (OEH, 2018e). It typically occurs on floodplain alluvial and stagnant alluvial soils, which do not occur on the Site. |
| *Caladenia arenaria* | Sandhill Spider Orchid | | ✓ | - | E | E | Sp | Nil | Occurs in woodland with sandy soil, especially that dominated by White Cypress Pine (*Callitris glaucophylla*). There is a record of this species 5.7 km east of the Site in undisturbed Cypress Pine habitat in the Mt Arthur Reserve (Althofer and Harden, 1980, where recorded as *C. patersonii*). Suitable habitat is absent from the Site. |
| *Commersonia procumbens* [syn. *Androcalva procumbens*] | - | - | - | ✓ | | V | Sp | Nil | Grows in sandy sites in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with a *Calytrix tetragona* understorey (OEH, 2018e). Also occurs in *Eucalyptus fibrosa* subsp. *nubila, Eucalyptus dealbata, Eucalyptus albens* and *Callitris glaucophylla* woodlands north of Dubbo. Habitats absent from Suntop. |
| *Diuris tricolor* | Pine Donkey Orchid | ✓ | - | - | V | - | Sp | Nil | The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (*Callitris* spp.). It is generally found in sandy soils, either on flats or small rises. The nearest record is at Geurie (BioNet, 2018b) at lower altitudes than the Site. It is unlikely to have occurred around Wellington on the upper slopes. |

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem OR Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Euphrasia arguta* | - | ✓ | - | ✓ | CE | CE | Sp | Nil | *Euphrasia arguta* has been recorded from grassy areas near rivers at elevations up to 700 m above sea level in central western NSW, and grassy forests or regrowth vegetation on the Northern Tablelands (DoEE, 2018b). Suitable habitat is lacking on theSite. |
| *Philotheca ericifolia* | - | - | - | ✓ | - | V | Sp | Nil | *Philotheca ericifolia* grows chiefly in dry sclerophyll forest and heath on damp sandy flats and in gullies. The species has been collected from open woodland, heathland, dry sandy creek beds and rocky ridge and cliff tops. Preferred soils have a sandy, gravelly or rocky component (DoEE, 2018b). The Site lacks suitable habitat for this species. |
| *Prasophyllum petilum* | | - | - | ✓ | E | E | Sp | Nil | Grows in open sites in natural temperate grassland, grassy woodland and in grassy Box-Gum Woodland. Highly susceptible to grazing, being retained only at little-grazed travelling stock reserves and in cemeteries (OEH, 2018e). Habitat occurs on the Site is too disturbed for this species. |
| *Prasophyllum* sp. Wybong (Phelps ORG 5269) | | - | - | ✓ | - | CE | - | Nil | *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) is known from open eucalypt woodland and grassland in northern NSW, exclusively Box-Gum Woodlands (DoEE, 2018b). Suitable habitat is absent from the Site. |
| *Swainsona recta* | Small Purple-pea | ✓ | ✓ | ✓ | E | E | Sp | Nil | Before European settlement Small Purple-pea occurred in the grassy understorey of Box-Gum Woodlands and open-forests dominated by *Eucalyptus blakelyi*, *E. melliodora*, *E. rubida* and *E. goniocalyx* (OEH, 2018e). Populations remain in the Mt. Arthur Reserve, only 6 km north east of the Site, in colluvial and alluvial soils in the lower parts of the reserve. It is not known from cleared and heavily grazed habitats such as those on the Site. |

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem OR Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Swainsona sericea* | Silky Swainson-pea | ✓ | - | - | V | - | Sp | Nil | The Silky Swainson-pea was formerly a widespread, common species in Box-Gum Woodlands and is likely to have been common in the Wellington district (OEH, 2018e). However, the high degree of disturbance to the Site means it is highly unlikely to occur there now. |
| *Tylophora linearis* | - | - | - | ✓ | V | E | Sp | Nil | Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii* (OEH, 2018e). On coarse-grained sediments. Distributed to the north of the study area from east of Boggabri, Pilliga Scrub, Peak Hill and Dubbo. Suitable habitat is absent from the Site. |

[1] Sp=Species Credit Species
[2] Biodiversity Assessment Method Credit Calculator (OEH, 2018d)
[3] NSW Atlas of Wildlife (BioNet, 2018b)
[4] Protected Matters Search Tool (DoEE, 2018a)
[5] *BioNet Threatened Species Profile Database* (OEH, 2018c)
E Endangered.
CE Critically Endangered
V Vulnerable.

**Table 11. Threatened Fauna Species Returned by Database Searches of the Surrounding Region.**

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem and/or Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Galaxias rostratus* | Flathead Galaxia | - | - | ✓ | CE[6] | CE | - | Nil | These fish species were all identified by the PMST and are covered by the *Fisheries Management Act 1994* in NSW. They occur in large permanent rivers with deep waterholes (DoEE, 2018b). No suitable permanent watercourses occur on or near the Site. |
| *Maccullochella macquariensis* | Trout Cod | - | - | ✓ | E[6] | E | - | Nil | |
| *Maccullochella peelii* | Murray Cod | - | - | ✓ | - | V | - | Nil | |
| *Macquaria australasica* | Macquarie Perch | - | - | ✓ | E[6] | E | - | Nil | |
| *Aprasia parapulchella* | Pink-tailed Worm-lizard | ✓ | - | ✓ | V | V | Sp[1] | Nil | The Pink-tailed Worm-lizard inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks (OEH, 2018e). Suitable habitat does not occur on the Site. |
| *Delma impar* | Striped Legless Lizard | - | - | ✓ | V | V | Sp | Nil | Found mainly on the Southern Tablelands and South West Slopes in Natural Temperate Grassland but may also occur in grasslands with a high exotic component. Occasionally found in open Box-Gum Woodland. Shelters beneath logs and/or rocks in winter (OEH, 2018e). Predicted as potentially occurring on the Site by PMST (DoEE, 2018b), but is not known north of Goulburn. Suitable habitat is lacking on the Site. |
| *Leipoa ocellata* | Mallee Fowl | - | - | ✓ | E | V | Ec[1] | Nil | The Mallee Fowl was predicted to potentially occur on the study area by the PMST. Mallee Fowl are found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias. A sandy substrate and abundance of leaf litter are required for breeding (Benshemesh, 2007). Suitable habitat is absent from the Site and surrounding regions. |

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem and/or Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Haliaeetus leucogaster* | White-bellied Sea Eagle | ✓ | - | - | V | - | Sp | Nil | Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Prime foraging habitat is lacking close to the site, as are potential nest trees. |
| *Botaurus poiciloptilus* | Australasian Bittern | - | - | ✓ | E | E | Ec | Nil | Favours permanent freshwater wetlands with tall, dense vegetation, particularly *Typha* spp. and *Eleocharis* spp. (OEH, 2018e). Suitable habitat is absent from the Site. |
| *Rostratula australis* | Australian Painted Snipe | - | - | ✓ | E | V | Ec | Nil | Australian Painted Snipe inhabits freshwater swamps and marshes (Blakers *et al*., 1984). Suitable habitat is absent from the study area. |
| *Calidris ferruginea* | Curlew Sandpiper | - | - | ✓ | E | CE | Ec/Sp | Nil | Forages mainly on coastal estuarine mudflats, but also in inland lakes and lagoons with extensive shallows (OEH, 2018e). Suitable habitat is absent from the Study Area. |
| *Numenius madagascariensis* | Eastern Curlew | - | - | ✓ | - | CE | Ec/Sp | Nil | The Eastern Curlew has a primarily coastal distribution on mudflats in estuaries. The species is found in all states, particularly the north, east, and south-east regions including Tasmania (DoEE, 2017b). Eastern curlews are rarely recorded in inland wetlands, which in any event are absent from the Study Area. |
| *Calyptorhynchus lathamii* | Glossy Black Cockatoo | - | ✓ | - | V | - | Ec/Sp | Nil | Feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species), shredding the cones with the massive bill (OEH, 2018e). Casuarinaceae are absent from the Site. |
| *Glossopsitta pusilla* | Little Lorikeet | ✓ | - | - | V | - | Ec | Low | The Little Lorikeet is widespread on the coast, tablelands and western slopes of NSW, where it is usually encountered in larger bushland remnants (BioNet, 2018b). It is a nomadic species that may occasionally occur on the Site when woodland eucalypts are in flower. |

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem and/or Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Lathamus discolor* | Swift Parrot | ✓ | - | ✓ | E | CE | Ec/Sp | Low | The Swift Parrot is a migratory species that breeds in Tasmania and winters on the mainland, where it feeds on flowering eucalypts (OEH, 2018e). On the western slopes Swift Parrots utilise Mugga Ironbark and White Box trees as nectar sources and Grey Box for lerp and scale insects (Saunders and Tzaros, 2011). Favoured winter flowering eucalypts occur on and near the Site. |
| *Polytelis swainsonii* | Superb Parrot | ✓ | ✓ | ✓ | V | V | Sp | Nil | The Superb Parrot occurs in tall grassy Box-Gum Woodlands and forests on and west of the Tablelands (Blakers *et al*., 1984). There are several records of the species close to Wellington (BioNet, 2018b). Box Woodland and potentially suitable breeding and/or feeding habitat with large old growth trees having hollow limbs is present on the study area. However, the high degree of disturbance of the Site, especially the ground cover, is likely to deter this species. |
| *Climacteris picumnus victoriae* | Brown Treecreeper (eastern subspecies) | ✓ | - | - | V | - | Ec | Nil | The Eastern subspecies of the Brown Treecreeper is widespread through much of NSW avoiding only tall wet forests and alpine regions (BioNet, 2018b) There are multiple records close to Molong (BioNet, 2018b). It favours grassy woodlands with rough-barked trees at close to natural densities, sparse shrub cover and fallen timber on the ground (OEH, 2018e). Habitat in the study areas is considered to be unsuitable. |
| *Pomatostomus temporalis temporalis* | Grey-crowned Babbler (eastern subspecies) | ✓ | - | - | V | - | Ec | Nil | The eastern sub-species of the Grey-crowned Babbler occurs in the Hunter Valley, on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It inhabits open Box Woodlands on the slopes. The study area is at the eastern limits of the known distribution of the species on the upper western slopes (BioNet, 2018e) and the habitat is too disturbed to support it. |
| *Chthonicola sagittata* | Speckled Warbler | ✓ | - | - | V | - | Ec | Nil | A sedentary species of natural relatively undisturbed open woodland on rocky ridges or in gullies. Recorded sparsely but widely in the surrounding region in larger blocks of remnant woodland (OEH, 2018e; BioNet, 2018b). It has been recorded nearby in the Mt. Arthur Reserve but is considered highly unlikely to utilise the Site, which is too highly disturbed. |

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem and/or Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Anthochaera phrygia* | Regent Honeyeater | ✓ | - | ✓ | E | E | Ec/Sp | Low | A nomadic/migratory nectar-dependent species found on flowering eucalypts, which has been recorded rarely in the region around the Site (BioNet, 2018b). It has potential to occasionally visit the study area when Eucalypts are flowering, especially White Box. |
| *Grantiella picta* | Painted Honeyeater | - | - | ✓ | V | V | Ec | Nil | Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*), Box-Gum Woodlands and Box-Ironbark Forests (OEH, 2018e). A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Box Woodland is present, but mistletoes are scarce on the Site. There are very few records on the Central Western Slopes (BioNet, 2018a). |
| *Artamus cyanopterus cyanopterus* | Dusky Woodswallow | ✓ | ✓ | - | V | - | Ec | Nil | Found in larger blocks of woodland and dry open sclerophyll forests, usually dominated by eucalypts (Scientific Committee, 2017). Also recorded in shrublands, heathlands and regenerating forests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs. The habitat on the Site is too highly disturbed for this species. |
| *Melanodryas cucullata cucullata* | Hooded Robin (south eastern subspecies) | ✓ | - | - | V | - | Ec | Nil | The south-eastern subspecies of the Hooded Robin is found throughout much of inland NSW, with the exception of the extreme north-west. It prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas and requires structurally diverse habitats with mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. There are a few records in the Wellington area (BioNet, 2018e). Site habitats are too disturbed to support this species. |
| *Petroica boodang* | Scarlet Robin | ✓ | - | - | V | - | Ec | Low | Breeds in high altitude eucalypt forest with an open understorey (Blakers *et al*., 1984). Juveniles disperse to more open country in autumn. There are relatively few records on the western slopes and one close to Wellington (BioNet, 2018e). It may occasionally occur on the Site in autumn and winter. |

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem and/or Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Petroica phoenicea* | Flame Robin | ✓ | - | - | V | - | Ec | Low | The Flame Robin breeds in high altitude forests and disperses to lower more open habitats in winter. It has been recorded sparingly on the western slopes with few records near Wellington (BioNet, 2018a). It may occasionally occur on the Site. |
| *Stagonopleura guttata* | Diamond Firetail | ✓ | - | - | V | - | Ec | Nil | Widespread in open forest and woodland mostly on the inland side of the Great Dividing Range in eastern NSW (Blakers *et al*., 1984). Recorded widely in the region around Wellington (BioNet, 2018b). Favours open grassy woodlands. Habitat on the Site lacks the native grasses required by this species. |
| *Dasyurus maculatus* | Spotted-tailed Quoll | ✓ | ✓ | ✓ | V | E | Ec | Nil | Generally confined to areas of native forest and woodland where it nests in rock caves or hollow logs (Edgar, 1983). Hollow logs and caves are absent from the Site. |
| *Phascogale tapoatafa* | Brush-tailed Phascogale | ✓ | - | - | V | - | Sp | Nil | Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates (OEH, 2018e). Suitable habitat is lacking on the Site. |
| *Phascolarctos cinereus* | Koala | ✓ | - | ✓ | V | V | Ec/Sp | Nil | Koalas are widespread in eastern NSW. However, there are only a few records near Wellington with scattered records further east in the timbered country around Burrendong Dam and south west in the Curumbenya Ranges (BioNet, 2018b). There is no known population recorded from the vicinity of the Site. |
| *Petaurus norfolcensis* | Squirrel Glider | ✓ | - | - | V | - | Sp | Nil | Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas (OEH, 2018e). Prefers mixed species stands with a shrub or Acacia midstorey. Requires abundant tree hollows for refuge and nest sites. The remnant trees on the Site are too scattered, the ground cover is too disturbed and a suitable mid-storey is lacking for this species. |

| Scientific Name | Common Name | Data Source | | | Conservation Status | | Ecosystem and/or Credit Species[5] | Likelihood to be on Study Area | Assessment of Likelihood |
|---|---|---|---|---|---|---|---|---|---|
| | | BAMC[2] | BioNet[3] | PMST[4] | BC Act | EPBC Act | | | |
| *Petauroides volans* | Greater Glider | - | - | ✓ | V | V | Sp | Nil | There is one record for the Greater Glider south of Wellington BioNet, 2018b). It is found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows (DoEE, 2018a). The Greater Glider favours forests with a diversity of eucalypt species. The study area lacks montane forest and abundant hollows and is unsuitable for this species. |
| *Pteropus poliocephalus* | Grey-headed Flying-fox | ✓ | - | ✓ | V | V | Ec/Sp | Nil | The Grey-headed Flying Fox mostly occurs on the eastern side of the Great Dividing Range and is rarely recorded on the western slopes (OEH, 2018e). There is one record in BioNet (2018b) of a temporary roost along the Bell River at Wellington in 2012. There is a very low possibility this species would utilise the study area on rare occasions. |
| *Nyctophilus corbeni* | Corben's Long-eared Bat | - | - | ✓ | V | V | Ec | Nil | Corben's Long-eared Bat was predicted to potentially occur on the study area by the PMST. It is predominantly a western species in NSW, the nearest records to the study area being in the Hervey Nangar Ranges and Goonoo SCA (BioNet, 2018b) which are at lower altitudes than the study area. It has not been recorded on the upper slopes and tablelands. |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | - | - | ✓ | V | V | Sp | Nil | Large–eared pied Bat is widespread on the Central Coast and Tablelands and reaches its western distributional limit near Wellington (BioNet, 2018b). It roosts in caves, mine tunnels and the abandoned nests of Fairy Martins. The Large-eared Pied Bat forages over areas of continuous forest habitat (Greg Richards and Associates, 2000, 2005). The vegetation on the Site is likely to be too fragmented for this species. |

[1] Ec=Ecosystem Credit Species; Sp=Species Credit Species
[2] Biodiversity Assessment Method Credit Calculator (OEH, 2018d)
[3] NSW Atlas of Wildlife (BioNet, 2018b)
[4] Protected Matters Search Tool (DoEE, 2018a)
[5] *BioNet Threatened Species Profile Database* (OEH, 2018c)
[6] NSW *Fisheries Management Act 1994.*
E Endangered; CE Critically Endangered; V Vulnerable.

The PMST search returned 8 potentially occurring flora species and 21 fauna species. Assessment of these species is required to determine whether there is any obligation to refer the Project to the Commonwealth Department of the Environment and Energy (DoEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The total numbers of potentially occurring threatened species identified by the searches are 12 flora and 34 fauna species.

### 2.3.2 Likelihood of Threatened Species Occurrence on the Site

BAMC allows the assessor to include or exclude from further consideration the candidate threatened species selected by the calculator on the basis of the presence or absence of suitable habitat, and other constraints, on the BDAR footprint. The likelihood of occurrence of each candidate species has been assessed in Tables 10 and 11 based on distribution records in the NSW Atlas of Wildlife (BioNet, 2018b), and information in both the *Threatened Biodiversity Profile Database* (OEH, 2018e) and referenced scientific publications. Knowledge of the Site is based on three days of site visits and surveys by the assessor (29 November 2017, 15 January 2018 and 8 May 2018).

### 2.3.3 Habitat Features of the Site

In assessing the suitability of the habitat on the Site for threatened biodiversity, the following attributes of the Site were considered;

- The native vegetation being assessed comprises very small scattered plantings of native eucalypts, some, but not all, of which are native to the location.
- The choice of PCT267 as a description of the vegetation was made to enable the BAMC to run. The plantings clearly are not remnants of PCT267, which is considered likely to have been the dominant PCT on the Site pre-European settlement.
- The plantings individually cover very small areas from 0.02 ha to 0.4 ha and, as such, are highly unlikely to support a population of a threatened species. Their values for threatened species are most likely as stepping stones for fauna moving through the landscape, or for short term foraging of wide ranging nomadic species.
- The plantings all have very large perimeter to area ratios, being long and narrow, mostly two trees wide.
- All the plantings lack a mid-storey, the ground cover is very sparse or absent and comprises mainly exotic species. The surrounds of the plantings are entirely cultivation paddocks supporting wheat or lucerne crops.

### 2.3.4 Ecosystem Credit Species

No flora species returned by BAMC were ecosystem credit species. Of the 16 ecosystem credit fauna species listed by BAMC, five are considered to have potential foraging habitat on the Site (Table 12).

**Table 12. Ecosystem Credit Fauna Potentially Able to Utilise the Site.**

| Common Name | Scientific Name | Likelihood of Occurrence |
|---|---|---|
| Little Lorikeet | *Glossopsitta pulchella* | Low |
| Swift Parrot | *Lathamus discolor* | Low |
| Regent Honeyeater | *Anthochaera phrygia* | Low |
| Scarlet Robin | *Petroica boodang* | Low |
| Flame Robin | *Petroica phoenicea* | Low |

The species in Table 12 are only likely to utilise the site rarely to occasionally as nomadic foraging visitors.

### 2.3.5 Habitat Features for Species Credit Species

The BAMC identifies specific habitat features essential to particular species credit species and the BAM (OEH, 2017a) requires the assessor to determine if those habitat features occur on the site. The BDAR footprint lacks habitat features identified in the *BioNet Threatened Biodiversity Profile Database* (OEH, 2018c) that are critical for many threatened species, including:

- Burrows
- Caves
- Cliffs
- Claypans
- Dunes
- Epiphytes
- Escarpments
- Rocky areas
- Fallen and standing dead timber
- Swamps
- Termite mounds

Important specific habitat features that are present on the Site are:

- Hollow-bearing trees (totalling 10 scattered paddock trees [Table 9, Figure 7])
- Semi-permanent / ephemeral wet areas (including first and second order streams [Figure 5])
- Waterbodies (including one small farm dam per paddock, varying between 0.2 and 0.5 ha in size)

Given the attributes of the native vegetation (section 2.3.3) and the specific site characteristics (section 2.3.5), very few of the candidate threatened species are likely to utilise the area and those that do would utilise it rarely. This is reflected in the very low number of candidate species in Tables 10 and 11 that are considered likely to utilise the Site.

### 2.3.6 Species Credit Species

The five candidate threatened flora species identified by BAMC are all species credit species and none are considered to have any likelihood of occurring on the Site (Table 10). Accordingly, all have been excluded from further consideration in BAMC.

Only two of the threatened species credit fauna species are considered to have some likelihood of utilising the site, the Little Lorikeet and the Regent Honeyeater (Table 11). However, neither is likely to breed on the Site and are therefore excluded from further consideration as species credit species but remain as ecosystem credit species. Seven other threatened species credit fauna species have also been excluded for further assessment owing to lack of suitable habitat on the Site (Table 11).

### 2.3.7 Targeted Surveys for Threatened Species

The BAM (OEH, 2017a) requires targeted surveys only for threatened species that are species credit species because ecosystem credit species are predicted to occur based solely on habitat.

All candidate threatened flora listed by BAMC are species credit species, therefore, targeted surveys may be required. However, the assessment applied in Table 10 determined that habitat does not exist on the Site for any of these species so that survey and further consideration in the calculator is unnecessary.

Of the candidate threatened species credit fauna species listed by BAMC, two, the Critically Endangered Regent Honeyeater (*Anthochaera phrygia*) and the Vulnerable Little Lorikeet (*Glossopsitta pusilla*), are considered to have a low probability of utilising the Site. Both are nomadic species that may seek out flowering eucalypts to feed on nectar and may occasionally utilise the Site during a high nectar flow event. Neither species would be able to breed on the Site. Accordingly, they are not regarded as species credit species for this assessment and do not require targeted surveys.

### 2.3.8 Threatened Species Listed under the EPBC Act

Two fauna species listed as Critically Endangered under the EPBC Act are considered to have a low probability of utilising the Site; the Swift Parrot and the Regent Honeyeater (Table 10). Both are nomadic species that are only likely to use the Site occasionally, if at all, for foraging when eucalypts are in flower. The Site is unsuitable for breeding by the Regent Honeyeater and the Swift Parrot is a winter migrant to the mainland, breeding only in Tasmania. Potential food resources on the Site are quite limited, being restricted to eight isolated mature White Box trees and plantings of mixed eucalypts. These trees are unlikely to be attractive to either species given their isolation and the preference of both birds for intact woodland and forest habitats. Accordingly, the loss of these trees is highly unlikely to result in a significant adverse impact on either species and referral of the Project to the DoEE is not required.

### 2.3.9 SEPP 44

NSW SEPP 44 aims to protect habitat utilised by the Koala, *Phascolarctos cinereus*, which is known to occur sparsely on the Central West Slopes, mainly in forested habitats (BioNet, 2018b). Three of the remnant eucalypt species on and around the Subject Land are recognised as secondary Koala food trees (OEH, 2018h), viz. Inland Grey Box, Fuzzy Box and White Box. The last of these is listed as a Koala feed tree in Schedule 2 of SEPP 44. Accordingly, there is a requirement under SEPP 44 for consideration of the Site as potential Koala habitat. The Site does not have an extant Koala population (Biosphere Environmental Consultants, 2018). Therefore, it does not include ‘core’ Koala habitat and a SEPP 44 plan of management is not required.

# 3 STAGE 2 – IMPACT ASSESSMENT

Stage 2 involves assessing the potential direct and indirect impacts on biodiversity, describing impact avoidance and mitigation measures and determining the offset requirements.

## 3.1 MEASURES TO AVOID AND MINIMISE IMPACTS

Measures to avoid and minimise Project impacts on biodiversity are summarised in this section and Table 13.

### 3.1.1 Impact Avoidance

Impact avoidance measures that would be implemented for the Project include;

- Protection measures to avoid damage to discontinuous patches of mature native perimeter trees on all boundaries of the Site.
- Avoidance and protection of the block of planted native eucalypts in Paddock 12 (Figure 7).
- Retention and avoidance of a clump of three Fuzzy Box trees within the northern boundary of Paddock 1.

### 3.1.2 Vegetation Management Plan (VMP)

A Vegetation Management Plan (VMP) will be prepared to establish measures that will:

- ensure that harm is minimised to wildlife that may be inhabiting hollows in the ten hollow-bearing trees that are proposed for removal. This will include timing of tree removal outside the nesting season of birds and mammals, i.e. autumn/winter, and supervision of the clearance by a qualified animal carer;
- protect the mature eucalypt trees around the perimeter of the site during the construction of the solar farm;
- enhance the habitat values of the perimeter trees through the establishment of vegetation buffer zones; and
- replace removed trees by selective replanting in the buffer zones around the Site.

### 3.1.3 Weed Management Strategy

A weed management strategy will be developed to prevent unwanted plants from becoming established in and around the solar farm. Several weed control measures will be employed, including regular site inspections, communication with lessees and authorities and annual control of weeds.

### 3.1.4 Animal Pest Management and Monitoring

A number of animal pest management and monitoring procedures would be established, including the following:

- the maintenance of a clean, rubbish-free environment in order to discourage scavenging and reduce the potential for colonisation by non-endemic fauna (e.g. introduced rodents, predators and birds);
- monitoring for feral animals (including pigs, foxes, dogs, rabbits) every two years;
- undertaking pest animal control where necessary;
- domestic pets prohibited in the solar farm; and
- employees and contractors not permitted to encourage fauna through feeding.

### 3.1.5 Rehabilitation

At the completion of the life of the solar farm after 25 years, the site will either be refurbished or be dismantled and rehabilitated to arable agricultural land.

### 3.1.6 Summary of Avoidance and Mitigation Actions

Table 13 summarises avoidance and mitigation actions with expected outcomes, timing and management responsibility.

**Table 13. Avoidance and Minimisation Measures, Responsibility and Timing.**

| Action | Outcome | Timing | Responsibility |
|---|---|---|---|
| ***During Construction*** | | | |
| 1. Place barriers to protect remnant perimeter trees, planting in Paddock 12 and Fuzzy Box clump in Paddock 1<br>2. Inform all employees and contractors during inductions of trees not to be damaged. | No damage to trees earmarked for protection and retention. | Throughout construction phase. | Site manager |
| Removal of hollow-bearing paddock trees supervised by trained wildlife carer. | Harm to hollow-dwelling wildlife minimised during tree falling.<br>Injured wildlife cared for and recovered.<br>Displaced wildlife released into appropriate habitat nearby. | During paddock clearing operations, which should be conducted in the non-breeding season (autumn and winter). | Environmental manager or site manager. |
| ***During Solar Farm Operation*** | | | |
| Preparation of a Vegetation Management Plan. | Long term vegetation management objectives achieved. | Within 12 months of approval. | Environmental manager. |
| Enhancement plantings | Biodiversity values of protected patches of remnant trees improved. | Within first two years of operation. | Environmental manager |
| Weed management | Priority Weeds, Weeds of National Significance and Hight Threat Exotic weeds controlled. | Annual inspections and control as required. | Environmental manager |
| Pest Animal Management:<br>Monitoring and control,<br>Maintain site cleanliness | Pest animals, especially rodents, foxes, rabbits, wild dogs, feral cats and pigs controlled. | Every two years, or as needed. | Environmental manager / site manager. |
| Domestic pets prohibited.<br>Staff and contractors informed during inductions. | No harassment of wildlife or livestock. | Ongoing | Site manager. |
| ***Site closure*** | | | |
| Preparation of a site rehabilitation plan | All solar farm infrastructure removed.<br>Land left in a suitable state for resumption of farming. | At least two years prior to shut down | Site manager / environmental manager. |

## 3.2 SUMMARY OF PROJECT IMPACTS ON BIODIVERSITY

### 3.2.1 Serious and Irreversible Impacts

No threatened ecological communities, populations, flora or fauna species meet the criteria for Serious and Irreversible Impacts as a result of the Project (OEH, 2018f) (sections 2.2 and 2.3).

### 3.2.2 Vegetation Clearance Requiring Offsetting

The following native vegetation on the Site would be impacted adversely by the Project;

- Loss of 1.25 ha of eucalypt plantings which are assumed to represent PCT267 for the purposes of running BAMC.
- Loss of 0.04 ha of Box-Gum Woodland EEC beside Renshaw – McGirr Way.
- Loss of 25 remnant paddock trees, 6 isolated planted native trees and up to 10 roadside trees.

### 3.2.3 Vegetation Clearance Not Requiring Assessment or Offsetting

All other vegetation on the site comprises mainly planted crops and some exotic-dominated ground cover in laneways and on paddock margins and does not require assessment or offsetting.

### 3.2.4 Species Credit Species

No impacts on species credit species are expected.

### 3.2.5 Cumulative Impacts

The cumulative impacts of the project on remnant native vegetation loss are negligible whether remnant woodland or plantings of native windbreak trees are considered (Table 14).

**Table 14. Cumulative Losses of Native Vegetation in Affected Mitchell Landscapes.**

| Mitchell Landscape | Area of Landscape (ha) | Percent Cleared | Project Clearance (ha) | Additional Clearance (%) |
|---|---|---|---|---|
| **Nangar Ranges** | 178,920 | 84 | 0 | 0 |
| **Macquarie Alluvial Plains** | 348,198 | 78 | 0.04 (remnant woodland)<br>1.25 (plantings) | $0.1 \times 10^{-4}$<br>$0.4 \times 10^{-3}$ |

## 3.3 BIODIVERSITY CREDIT REPORT

### 3.3.1 BAM Assessment Number

The Assessment Identification Number within the BAM online calculator is 00010097/BAAS180848/18/00010106.

### 3.3.2 Credits for Removal of Plantings

The biodiversity credit report output from the BAMC for clearance of the blocks of planted trees is provided at Attachment 2. The credit report indicates that the total area of native plantings to be removed from the Site and the roadside of Renshaw – McGirr Way is valued at 20 credits.

### 3.3.3 Credits for Paddock Tree Removal

The number of native paddock trees on the Site is summarised by species, size (DBH) and the presence of hollows in Table 6. The locations of the trees are shown on Figures 7 and 8. Table 15 presents this data in the form required for use in the *Streamlined Assessment Module – Clearing of Paddock Trees* in the BAM (Appendix 1, OEH [2017a]), which values the paddock trees at 27.75 credits.

**Table 15. Paddock Trees Assigned to Classes**

| | Class 1 | Class 2 | Class 3 |
|---|---|---|---|
| Size range | ≤20cm DBH | ≥20 cm & ≤50cm DBH | ≥50cm DBH |
| No. of trees without hollows | 7 | 3 | 19 |
| No. of trees with hollows | 0 | 0 | 12 |
| No. of ecosystem credits[1] | 0 | 1.5 | 26.25 |

[1] Calculated according to Table 12, Appendix 1 of the BAM (OEH, 2017a).

The most likely PCT to which the remnant paddock trees formerly belonged is PCT267; *White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion* (Table 2). This PCT is also assumed for the farm plantings, the roadside woodland and isolated trees on Renshaw – McGirr Way. Accordingly, the remnant paddock trees, farm plantings, roadside woodland and isolated roadside trees are valued at the same rate per credit.

### 3.3.4 Credit summary

Table 16 summarises the combined credit liability for clearance of the native plantings, roadside woodland, remnant paddock trees and isolated roadside trees.

**Table 16. Combined Biodiversity Credits Summary.**

| IBRA sub-region | PCT common name | No. of ecosystem credits |
|---|---|---|
| ***Plantings*** | | |
| Upper Slopes | *White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion* | 20 |
| ***Paddock trees*** | | |
| Upper Slopes | *White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion* | 27.75 |
| **Total credits** | | 47.75 |

# 4 REFERENCES

Althofer, G. W. & Harden, G. J. (1980). *The Flora of Mt. Arthur Reserve.* Trustees of the Mt. Arthur Reserve, Wellington, NSW.

Benshemesh, J. (2007). *National Recovery Plan for Malleefowl.* Department for Environment and Heritage, South Australia.

BioNet (2018a). *BioNet Vegetation Classification*. NSW Office of Environment and Heritage, Sydney. Web address: www.environment.nsw.gov.au/research/Visclassification.htm/. Accessed: March 2018.

BioNet (2018b). *NSW BioNet*. NSW Office of Environment and Heritage, Sydney. Web address: www.bionet.nsw.gov.au/. Accessed: March 2018.

Biosphere Environmental Consultants (2018). *Suntop Solar Farm: Fauna Survey and Assessment.* Report to Pitt and Sherry Pty. Ltd. (Attachment 1 to this report).

Blakers, M., Davies, S.J.J.F. and Reilly, P.N. (1984). *The Atlas of Australian Birds.* Royal Australasian Ornithologists Union. Melbourne University Press.

DoEE (2018a). *Protected Matters Search Tool*. Website: https://www.environment.gov.au/epbc/protected-matters-search-tool. (Accessed: January 2018). Commonwealth Department of Environment and Energy, Canberra.

DoEE (2018b). *Species Profile and Threats Database*. Website: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl (Accessed: January 2018). Commonwealth Department of Environment and Energy, Canberra.

DPI (2018). *NSW Weedwise.* Webpage: http://weeds.dpi.nsw.gov.au/ (Accessed: March 2018). NSW Department of Primary Industries, Sydney.

Edgar, R. (1983). Spotted-tailed Quoll. In Strahan, R. (Ed.). *The Australian Museum Complete Book of Australian Mammals*. The Photographic Index of Australian Wildlife. Angus & Robertson Publishers, Sydney.

Greg Richards and Associates (2000). *An Assessment of the Bat Fauna in Infrastructure Zones at the Ridgeway Mining Project, Central New South Wales*. Appendix K in Cadia Holdings Pty Limited (2000) *Ridgeway Project Environmental Impact Statement*.

Greg Richards and Associates (2005). *Cadia East Study Area Bat Fauna Assessment*. Report to Cadia Holdings Pty Limited.

OEH (2017a). *Biodiversity Assessment Method.* NSW Office of Environment and Heritage, Sydney.

OEH (2017b). *Draft guidance and criteria to assist a decision maker to determine a serious and irreversible impact.* NSW Office of Environment and Heritage, Sydney.

OEH (2018a). *Description of NSW (Mitchell) Landscapes. Version 2 (2002).* Webpage: http://www.environment.nsw.gov.au/resources/conservation/landscapesdescriptions.pdf Accessed: March 2018. NSW Office of Environment and Heritage, Hurstville.

OEH (2018b). *Over-cleared Landscapes Database.* Webpage: https://www.environment.nsw.gov.au/asmslightprofileapp/account/login?ReturnUrl=%2fAtlasApp%2fDefault.aspx. Accessed: March 2018. NSW Office of Environment and Heritage, Sydney.

OEH (2018c). *BioNet Threatened Species Profiles Database.* Webpage: http://www.environment.nsw.gov.au/resources/conservation/landscapesdescriptions.pdf Accessed: March 2018. NSW Office of Environment and Heritage, Hurstville.

OEH (2018d). *Biodiversity Assessment Calculator*. Webpage: https://www.lmbc.nsw.gov.au/bamcalc. Accessed: March 2018. NSW Office of Environment and Heritage, Hurstville.

OEH (2018e). *Threatened species, populations & ecological communities of NSW*. Website: http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species (Accessed: January 2018). NSW Office of Environment and Heritage, Sydney.

OEH (2018f). *Guidance to assist a decision-maker to determine a serious and irreversible impact.* Webpage: http://www.environment.nsw.gov.au/resources/bcact/guidance-decision-makers-determine-serious-irreversible-impact-170204.pdf. Accessed: March 2018. NSW Office of Environment and Heritage, Sydney.

OEH (2018g). *High Threat Weeds List.* Webpage: www.lmbc.nsw.gov.au/bamcalc. Accessed: March 2018. NSW Office of Environment and Heritage, Sydney.

OEH (2018h). *Koala habitat and feed trees.* Web page: http://www.environment.nsw.gov.au/topics/animals-and-plants/native-animals/native-animal-facts/koala/koala-habitat. (Accessed: January 2018). NSW Office of Environment and Heritage, Sydney

Saunders, D.L. & Tzaros, C.L. (2011). *National Recovery Plan for the Swift Parrot* (Lathamus discolor). Birds Australia, Melbourne. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-swift-parrot-lathamus-discolor. Accessed: March 2018.

Scientific Committee (2017). *Dusky Woodswallow, Artamus cyanopterus cyanopterus – vulnerable species listing.* Webpage: http://www.environment.nsw.gov.au/resources/threatenedspecies/determinations/FDDuskWoodVS.pdf (Accessed: January 2018). NSW Office of Environment and Heritage, Sydney.

Thackway, R. and Cresswell, I.D. (eds) (1995). An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves. Version 4.0. Australian Nature Conservation Agency: Canberra.

ATTACHMENT 1

Fauna Survey and Assessment Report

(Biosphere Environmental Consultants Pty. Ltd.)

## Executive Summary

Suntop Solar Farm propose to construct and operate a 200 megawatt (MW) photovoltaic solar (PV) farm (the “Proposal”). The Proposal would be located at 909 Suntop Road, Suntop, NSW, 2820 and contained within Lot 1-2-3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (the “Site”). The Site is approximately 517 hectares and is currently used for agriculture, specifically cropping. The solar farm would occupy approximately 472 hectares (the “development footprint”) out of the 517 hectares (equivalent to approximately 91%) with the remaining land retaining its existing agricultural use.

The construction of the Proposal is estimated to consist of up to 550,000 PV panels which will be installed on a single axis tracker system across the Site.The single axis tracker system option would consist of groups of east-west facing PV modules tilted at +/- 60$^{o}$ angle (each approximately 2m x 1m in area) on mounting structures approximately 4m in height and in rows approximately 11m apart. The mounting structure would be piled steel posts that would extend between 1.6m to 4m below ground depending on geological conditions. The maximum height of panels during tracking movement is approximately 4m.

Associated infrastructure to support the solar farm will include the upgrading of access roads, the construction of a sub-station and power lines to the main electricity grid.

This report presents the results of a fauna assessment of the proposed site. The study involved a desktop assessment and field surveys of the solar farm site and the remainder of the property. It also includes database searches for records of threatened fauna. The current fauna survey included targeted searches for threatened fauna species that could potentially occur on the site and their habitats.

Two broad fauna habitat types were recorded within the site;

- isolated Grey Box (*Eucalyptus microcarpa*) trees were present around the perimeter of the site. These trees could have once been part of a Grey Box Woodland community but no trace remains of the native shrubs and associated vegetation that is normally associated with this community;
- narrow, linear tree plantations comprising an assortment of eucalypts (local and non-endemic species), and
- cleared land with scattered trees. The majority of the project area has been previously cleared for agricultural purposes.

A search of the NSW Wildlife Atlas (26July 2017) identified 3 listed threatened ecological communities and 3 listed threatened species within 10 km of the Site. A search of the EPBC Act Protected Matters (10 July2017) identified 2 listed

threatened ecological communities, 27 listed threatened species and 10 migratory species within 10km of the Site.
The EPBC Protected Matters search also identified16 listed marine species and 29 invasive species.

A fauna assessment of the site was conducted in November 2017 and none of the listed threatened species were found on site. The tree patches around the boundary of the project area could provide seasonal habitat for some of the flying threatened species, including the Regent Honeyeater, Swift Parrot, Painted Honeyeater, Corben's Long-eared Bat and the Grey-headed Flying Fox. The isolated trees inside the project area were too isolated and in poor condition because of their isolation and offered little habitat to these species. The tree plantations on site contained mixed species but were too young to provide hollows or other roosting features for the threatened fauna.

In addition, the surrounds to Dam 5 may provide seasonal habitat for Curlew Sandpipers and Eastern Curlews.

Several mature Western Grey Box (*Eucalyptus microcarpa*) trees occur around the perimeter of the site. This species are regarded as secondary food trees for koalas (OEH 2017a). No evidence was found of koalas in the trees and it appears that the trees are too remote from other koala habitat areas that koalas would be unable to reach them. In addition, the remnant tree patches are quite small, highly exposed and totally surrounded by cleared paddocks. A linear plantation of Yellow Box *E. melliodora* occurs on the site (between fields 2 and 3) but these trees are still young, lack hollows or cavities that could be used by roosting animals but may occasionally flower. This stand will be lost as part of the development of the solar farm.

The main type of impact on fauna that could occur as a result of the Proposal include damage to threatened waterbird potential habitat near Dam 5 and damage to some of the Western Grey Box as a result of vehicle movements about the site. All of the other land to be used for the solar farm is land that has been cleared for agriculture and is devoid of woodland or native grasslands.

The following mitigation measures will be implemented during the preparation of the land for the solar farm:

- tree protection measures will be put in place to conserve the trees around the perimeter of the site;
- enhancement of buffer zones around the perimeter of the site that includes additional planting of replacement trees for those lost due to the clearing of the paddocks;
- protection of Dam 5 such that it is not altered by siltation or wind-blown dust or by accidental spills;

- weed management; and
- animal pest management and monitoring.

The potential impacts of the Proposal are described herein for the range of threatened fauna identified in accordance with the Draft Guidelines for Threatened Species Assessment (DoE, DPI 2005). The results indicate that no threatened fauna are likely to be affected to the point that a local population would be placed at risk of extinction. Key thresholds were assessed as follows:

• The Proposal includes actions to avoid or mitigate impacts by excluding the only mature tree patches (at various locations around the perimeter of the site) from the solar farm footprint,

• All of the threatened fauna that could be potentially affected have been recorded in nearby areas and the tree patches that occur on site are likely to be used as roost sites for Corben's Long-eared Bat or as foraging sites when in flower by Grey-headed Flying Foxes, Swift Parrots, Superb Parrots, Painted Honeyeaters and/or Regent Honeyeaters,

• The Proposal will not place any local population of a threatened species at risk of extinction.

• The Proposal does not affect any critical habitat.

**Contents**

Executive Summary ..... I

1 Introduction ..... 6
1.1 Overview of the Project ..... 6
1.2 Scope and objectives ..... 6
1.3 Location ..... 7
1.4 Site Description ..... 7
1.5 Authorship and acknowledgements ..... 11

2 Methodology ..... 12
2.1 Desktop assessment ..... 12
2.2 Survey techniques and effort ..... 12
2.3 Assessment of impacts ..... 12
2.4 Limitations ..... 14

3 Results ..... 14
3.1 Threatened fauna previously recorded or predicted to occur ..... 14
3.2 Habitat types, condition and features ..... 14
3.3 Fauna recorded during the surveys ..... 14
3.4 Migratory species ..... 14
3.5 Endangered populations ..... 15
3.6 Exotic fauna ..... 15

4 Potential impacts ..... 15
4.1 Direct impacts ..... 16
4.2 Indirect impacts ..... 16
4.3 Cumulative impacts ..... 18
4.4 Significance of impacts on threatened fauna listed under the TSC Act ..... 18
4.5 Significance of impacts on threatened fauna listed under the EPBC Act ..... 19
4.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection ..... 20
4.7 Migratory species ..... 20

5 Mitigation measures ..... 21
5.1 Land Management Plan ..... 21
5.2 Animal pest management and monitoring ..... 21
5.3 Rehabilitation ..... 21
5.4 Other fauna protection and management measures ..... 22

References ..... 22
Appendix A: Likelihood of occurrence of threatened fauna ..... 25
Appendix B: Fauna species recorded ..... 28
Appendix C: Migratory species known or potential occurrence within the study area and/or locality. ..... 30
Appendix D: Assessments of Significance ..... 32

Figures

Figure 1: Location of Solar Farm and Project Area.....8
Figure 2: Location of fields and dams on the Suntop site.....8
Figure 3:  Field 6 looking north..... .....9
Figure 4:  Dam 5 .....10
Figure 5: Solar Farm Footprint and Proposed Buffer Areas. .....11

## Introduction

### 1.1 Overview of the Project

Suntop Solar Farm propose to construct and operate a 200-megawatt (MW) solar farm (the "Proposal") using photovoltaic (PV) technology at a 517-hectare site (the "Subject Land) in Suntop, NSW. The solar farm would occupy 472 hectares (the "Site") out of the 517 hectares (equivalent to approximately 91% of the Site).

The construction of the Proposal is estimated to consist of up to 550,000 PV panels which will be installed on a single axis tracker system across the Site. The single axis tracker system option would consist of groups of east-west facing PV modules tilted at +/- 60$^{o}$ angle (each approximately 2m x 1m in area) on mounting structures approximately 4m in height and in rows approximately 11m apart. The mounting structure would be piled steel posts that would extend between 1.6m to 4m below ground depending on geological conditions. The maximum height of panels during tracking movement is up to 4.03m. The mounting structures for the panels will be 2m high and when the panels are at maximum tilt, the overall height will be approximately 4m.
The following works and infrastructure would be required to support the construction and operation of the solar farm:

- Construction of an access road for all access and egress for the Site and substation
- Installation of Electrical infrastructure including:
    - A 132kV Substation
    - Inverters to collect and convert DC to AC
    - Cabling and other electrical infrastructure (e.g. security systems).
- A maintenance compound and buildings
- Fencing, landscaping and environmental works.

Power generated by the facility will be transmitted via existing 132kV transmission lines, in an easement owned by TransGrid that traverses the Site and extends through to the Wellington substation approximately 15 kilometres to the north. A tee off connection will be used to connect directly into the existing grid located on Site. A tee connector is an electrical connector that joins three cables together.
The operational life of the solar farm is expected to be approximately 30 years at which point the panels are either replaced and operations continue or removed and the site is decommissioned and rehabilitated as required.

The Proposal would be located adjacent to Suntop Road, Suntop, NSW 2820 and contained within Lot 1-2- 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (the "Subject Land"). The Proposal is located within the Dubbo Local Government Area (LGA) and is approximately 10km south-west from the Wellington town centre.

The Subject Land is currently used for agriculture including cropping (e.g. wheat and lucerne) and grazing. It is proposed that grazing activities would also continue on the land occupied by the solar farm.

A full description of the Proposal can be found in the Suntop Solar Farm Environmental Impact Statement (EIS).

### 1.2 Scope and objectives

The primary aim of this assessment is to assess potential impacts on terrestrial fauna, in particular, fauna of conservation significance. Potential impacts of the Proposal on fauna were assessed in accordance with the Guidelines for Threatened Species Assessment (Department of Environment and Conservation and Department of Primary Industries (DEC and DPI, 2005).

Fauna of conservation significance are defined in this report as threatened species or populations listed on the Schedules of the NSW Threatened Species Conservation Act 1995 (TSC Act) and/or are listed as matters of national environmental significance by the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

- The specific objectives of this impact assessment are to consider the terrestrial fauna known or likely to occur in the area that would be affected by the Proposal, including fauna of conservation significance;
- potential impacts of the Proposal on those fauna;
- proposed impact avoidance and mitigation measures.

This scope of this study includes:

- a desktop assessment of the fauna likely to occur in the vicinity;
- fauna surveys and field assessments;

Threatened fauna listed under the NSW Fisheries Management Act 1994 are not discussed further as no habitat exists for threatened fish species on the site.

### 1.3 Location

The Site is located at 909 Suntop Road, Suntop, NSW, 2820, approximately 10km from Wellington town centre in the Wellington Local Government Area (LGA) and approximately 9km west of the Mitchell Highway (A32). The Site is not located in close proximity to urban or dense residential areas. The Proposal would be contained within Lot 1-2-3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (Figure 1).

### 1.4 Site Description

The Site comprises a series of large fenced paddocks containing irrigated crops accessible via Suntop Road to the north. The paddocks have been levelled and largely cleared for agricultural purposes (specifically cropping) and currently contain several built structures including agricultural sheds and one residential dwelling. There is scattered rows and clusters of vegetation across the site as described in Table 1 below.

**Table 1**
**Vegetation Clusters**

| Isolated trees along boundary | Lot 90 DP 657805 |
|---|---|
| Rows of Mature Trees | Western boundary of Lot 2 and 3 DP 506925<br><br>Southern boundary of Lot 1 and 2 DP 506925<br>Western and eastern boundaries of Lot 122 DP 753238<br><br>Eastern border of Lot 90 DP657805 |
| LEP 'Biodiversity Region' | Edge of Suntop Road, located at the northern boundary of Lot 3 DP 506935, Lot 122 DP 753238 and Lot 90 DP 657805. |

There are 8 dams within the Site ranging in size from 0.2 ha to 0.5 ha. The two largest dams are contained in the middle of Lot 2 DP 506925, and the south-west corner of Lot 3 DP 506925. Surface hydrology, landform and soils have been heavily modified by the paddock development and It is understood that the development footprint will avoid the existing surface water bodies on the site where possible including a buffer of 20m between infrastructure and any waterway.

Local topography is generally flat with a gentle slope towards the north-west of the site boundary. Highpoints within 10km of the site; Mount Duke (540m), Mount Arthur (525m) and Bushrangers Hill (406m). Mount Arthur is part of the Mount Arthur Reserve, located 5km east of the Site occupying an area of 2,123ha with dense native vegetation.

The closest major water course is the Macquarie River, which is located approximately 7.7km north of the Site. The creek (unnamed) running through the Site flows into Barney's Creek, approximately 2.5km north of the Site. This creek (unnamed) is classified a first order stream, as it is located at the top of a catchment

as a headwater' flow. Barney's creek, flows into Little River which is a major tributary of the Macquarie River. The head waters of Little River have been historically very saline, although the water quality of the creek running through the site may be slightly higher, due to potential flow granite groundwater flow system. There are also several man-made agricultural dams in neighbouring plots.

The environment around the Site is predominantly cleared agricultural land (Figure 3). The dominant land use for Suntop comprises of grazing (55%) and cropping (21%).A region within the neighbouring eastern lots, of approximately 350ha has been identified as Karst landscape. A Karst landscape is characterised by the presence of underground cavern networks created from the dissolution of bedrock by surface water or groundwater.

**Figure 1: Location of Solar Farm and Project Area**

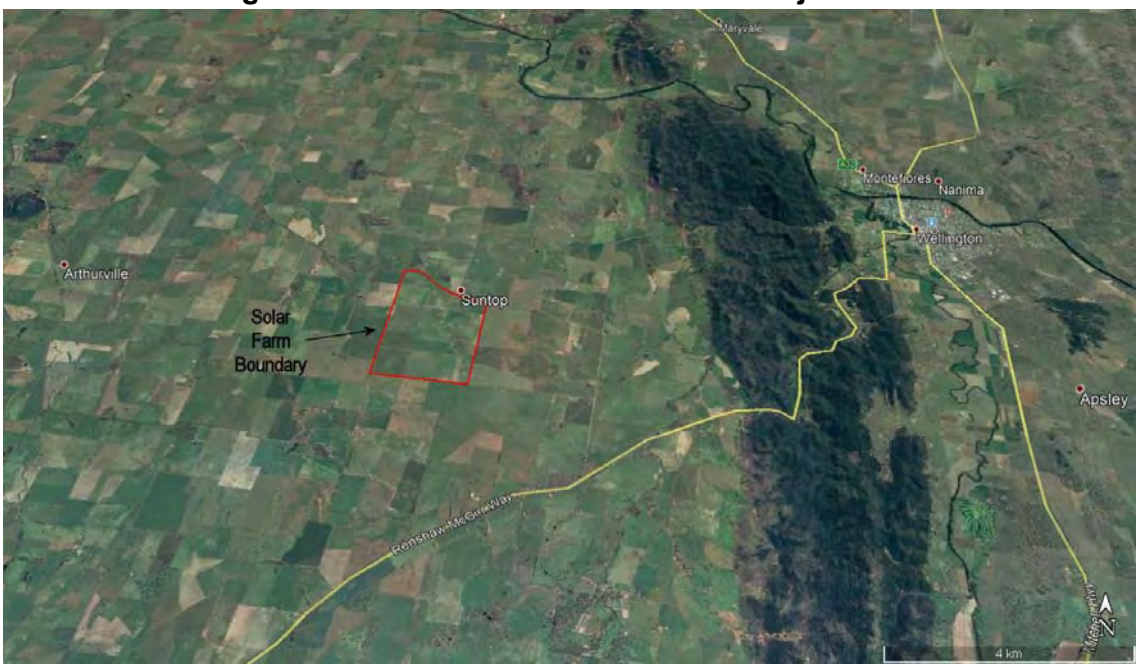



**Figure 2: Location of fields and dams on the Suntop site.**



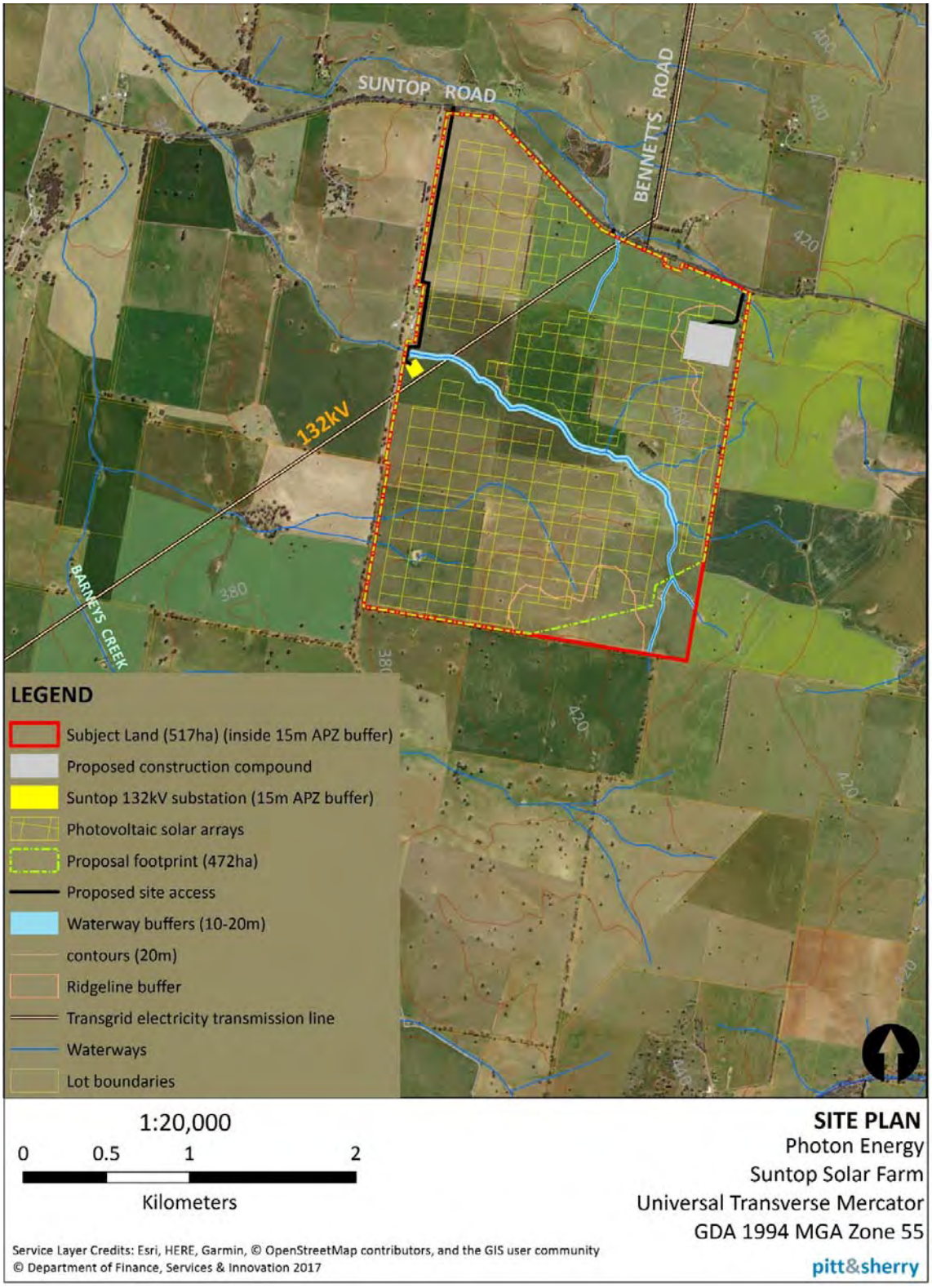
**Figure 3: Field 6 looking north**



**Figure 4: Dam 5**



**Figure 5: Solar Farm Footprint and Proposed Buffer Zones**




There are eight dams on site, many are small and were dry at the time of the site visit in November 2017. Dam 5 is the largest and contains potential habitat for threatened

water birds, Figure 4). Surface hydrology, landform and soils have been heavily modified by the paddock development and irrigation works. Land use within the local area is dominated by rural activities and population density is low.

### 1.5 Authorship and acknowledgements

This fauna assessment was prepared by Dr. Arthur White of Biosphere Environmental Consultants Pty Ltd. for KMH Environmental.

## 2 Methodology

### 2.1 Desktop assessment

A desktop investigation was carried out to identify terrestrial fauna species and habitat that may be affected by the Proposal. This included:

- a search of the Office of Environment and Heritage (OEH) Threatened Species Profiles database (OEH 2017a) for species known or predicted to occur within the Wellington region;
- a search of the OEH Atlas of NSW Wildlife database (OEH 2017b) for records of threatened fauna within the locality;
- a search of the Commonwealth Department of the Environment (DotE) Protected Matters database (DotE 2017) for matters of national environmental significance within the locality (sourced 7 May 2014);
- a search of the Birdlife Australia database for records of threatened birds within the locality (sourced 14 October 2017);

### 2.2 Previous fauna surveys

No fauna studies have been previously conducted on the site.

### 2.3 Fauna Assessment

A fauna assessment was carried out on the entire site on the 22nd of November 2017 by Biosphere Environmental Consultants Pty. Ltd. The assessment commenced with a site familiarisation tour in which all of the roads and tracks on the site were traversed by vehicle. Following this, the site was re-traversed so that areas of potential habitat for threatened species could be mapped. As most of the site consisted of cleared paddocks, there were relatively few areas left that could provide potential habitat for native fauna. Each area was then revisited and traversed on foot.

The assessment included non-threatened species as well as threatened species. No trapping or netting of animals was carried out. All animal species encountered were identified and recorded on map of the site. The assessment components consisted of:

- Arboreal mammals: a search was made of the trees on site and evidence of the presence of arboreal mammals was searched for: these include scratch marks on trees, the presence of used hollows or drays, faecal droppings and chew marks. A particular emphasis was made to search for evidence of koalas on the site and all Yellow Box, Western Grey Box and Blakely's Red Gums were fully checked for signs of koala scratches or faecal pellets.

- Terrestrial Mammals: evidence of terrestrial animals was searched for across the site. This included searching for animal tracks, burrows, digging sites and scats.

- Bats: potential food trees for flying foxes were noted. These included trees that either produce edible fruit that flying foxes could eat or produce flowers with edible nectar. For the smaller insectivorous bats, small hollows or loose bark refuge sites on the trees were sought and investigated to see if there were any signs of current or previous occupation by microbats.

- Diurnal Birds: A constant watch was kept for birds using field binoculars. Birds were identified and their location noted on the field map.

- Nocturnal Birds: No night survey work was conducted. Owl, nightjar and frogmouth roosts were searched for during daylight hours and any potential site found was recorded on the site map.

- Reptiles: a hand search for reptiles was carried out in areas where there was ground cover such as fallen bark, branches, logs or scrap timber or metal that could be used as shelter areas by reptiles. Reptiles were not caught unless this was necessary for positive identification. Other reptiles were encountered opportunistically and their located was also recorded on the site map.

- Frogs: A search of the channels and water collection points on site was examined to see if any evidence of frogs could be found. Standing water was netted using a long-handled net and if tadpole were caught they were identified using Anstis (2002). In clay areas near water points, evidence of frog burrows was also searched for and when found recorded on the site map.

- Fish: Fish sampling was carried out in the larger farm dams using long-handled nets.

### 2.4 Assessment of Impacts

Potential impacts of the Proposal on fauna were assessed in accordance with the Guidelines for Threatened Species Assessment (DEC and DPI, 2005). Given the paucity of potential habitat areas for native species on site, the fauna assessment survey methodology undertaken by Biosphere Environmental Consultants Pty. Ltd. was considered to be sufficient to identify the habitat of threatened species on site.

## 2.5 Limitations

The surveys undertaken by Biosphere Environmental Consultants Pty. Ltd. were short in duration and only conducted during one season (spring). The techniques used were observation-based rather than trapping. Accordingly, it is likely the surveys would not have recorded the full range of fauna on site, particularly those species which may only occur seasonally or occasionally.

# 3 Results

## 3.1 Threatened fauna previously recorded or predicted to occur

Appendix A provides a summary of the threatened fauna species that are known or considered to have potential to occur within the locality and/or region. The table indicates which of those species have been recorded previously within the local area between 1996 and 2017. The table also provides an assessment of the likelihood of each species occurring within the Project area or immediate surrounds. Only those species with the potential to occur within the project area were assessed further.

## 3.2 Habitat types, condition and features

Two broad fauna habitat types were recorded within the Project area or immediate surrounds:

- Tree patches containing Western Grey Box (*E. microcarpa*) occur along the western and southern boundary of the site. These trees are mature and contain hollows.
- Tree patches containing River Red Gum (*E. camaldulensis*) and other eucalypts (probably planted) are present just outside the northern boundary of the site. These are also mature trees with hollows.
- Cleared Land devoid of native vegetation dominates the Project Area. In a few places highly isolated trees may occur but these are in poor condition due to their isolation and exposure.

There are very few rocks on site and no rocky exposures.

## 3.3 Fauna recorded during the surveys

A total of 26 species of vertebrate fauna were recorded during the current (2017) surveys and are listed in Appendix B. This included 21 species of bird (1 of which was non-native), 2 exotic species of mammal, three species of reptile but no species of frog or fish. No threatened fauna species were recorded within the study area or nearby.

### 3.4 Migratory species

No migratory species listed under the EPBC Act was recorded nearby the study area during the current surveys. A summary of migratory species recorded within 10 kilometres of the study area and/or locality is provided within Appendix C.

### 3.5 Endangered populations

There are no endangered populations listed under the TSC Act that are known to occur within the old Wellington Shire boundary, as defined within the NSW OEH Threatened Species Profiles database (OEH 2017a).

### 3.6 Exotic fauna

Three exotic vertebrate species (excluding livestock animals) were recorded within the Project area. These including the European Red Fox (*Vulpes vulpes*), European Starling (*Sturnus vulgaris*) and House Mouse (*Mus musculus*).

## 4 Potential impacts

In general, the range of potential impacts associated with the Proposal are either associated with the construction or operation of the solar farm. These impacts may arise from direct and indirect impacts on the fauna.

### 4.1 Direct impacts

#### 4.1.1 Loss of habitat

Most of the project area is already devoid of native vegetation and the solar farm has been located so that maximal use of previously cleared land is utilised. The Proposal would require the removal of a small few scattered and isolated paddock isolated trees but also the removal of a linear stand of planted Yellow Box (located between fields 2 and 3; Figure 2). The paddock trees are in poor condition, presumably due to their exposure. The Yellow Box trees in the linear plantation are all young trees that lack hollows.

The Yellow Box although young, may provide seasonal habitat for native fauna such as birds and bats when they flower.

**Loss of hollow-bearing trees**

No mature trees bearing hollows will be removed.

**Removal of dead wood and dead trees**

The Proposal would result in the removal of two dead standing trees and dead wood on the ground as a part of the clearing of habitat. Dead wood and fallen branches is not common on the site.

### 4.1.2 Loss of individual animals

The Proposal has the potential to cause mortality of some animals during the removal of fauna habitat. Nocturnal species, species with low mobility, territorial species and some ground-dwelling species (such as lizards and snakes) are particularly susceptible to injury or death during construction and clearing. However, given that the paddock trees to be removed are so depauperate and that there is little fallen timber, this impact should be minimal. Some flying species that use these trees from time to time will lose habitat.

It is considered unlikely that wildlife mortality on roads would substantially increase as a result of the Proposal, given there are existing roads currently in operation with low vehicle speed limits, and no new roads would be created.

### 4.1.3 Animal Injury

In 2016, Harrison *et al*. reviewed the literature for the impact of solar farms on birds and bats in the United Kingdom. They concluded that the studies were not complete but indicated that reflected polarised light from solar panels can cause injury to some birds (particularly water birds). The reflected polarised light appears to be occasionally misinterpreted by water birds as light being reflected from a standing body of water and the birds may attempt to land on the solar panels. Although this is an uncommon occurrence, the potential for birds to be injured exists. Methods to reduce bird impacts were not discussed but it is likely that the establishment of tree buffer zones around the solar farms will discourage water birds from attempting to land there.

Harrison *et al*. (2016) also noted that certain insects are attracted to the reflected polarised light during daylight hours and this may entice some insectivorous birds towards the solar farms. They did not have evidence of injury to insectivorous birds as a result of the concentration of insects around the solar farms.

## 4.2 Indirect impacts

### 4.2.1 Loss of habitat connectivity

Habitat corridors provide essential pathways for the movement of native fauna and play an important role in ensuring the long-term genetic viability of species. The Project is surrounded by occasional mature trees, either inside the property boundary or in road easements along the boundary. These trees provide the only wildlife corridors around the site and no corridors exist across the site because of the removal of so much native vegetation.

Vegetation connectivity in the surrounds of the project area is also highly variable. To the east of the project area is the Mount Arthur Range (Figure 1). These low ranges are fully vegetated and have a continuous tree cover.  But there is no vegetated

corridors leading to the Mount Arthur Ranges and so the Suntop site remains quite isolated.
The removal of some paddock trees from the Project area will not interfere with habitat connectivity as these trees are few in number and are widely spaced. The removal of the linear Yellow Box plantation between fields 2 and 3 may impact some flying species as a potential feeding sources will be lost, however the mature tree around the perimeter of the site offer larger (and safer) feeding stations for dispersing birds and bats.

Mobile terrestrial animals such as Eastern Grey Kangaroos (*Macropus giganteus*) would be capable of crossing the agricultural land but would not remain on site because of the lack of cover.

### 4.2.2 Predation by feral animals

The European Red Fox (*Vulpes vulpes*) was recorded within the project area and throughout the locality. Foxes are a key threatening process under the TSC Act, Predation by the European red fox and Predation by feral cats. The proposed changes to the site are unlikely to result in an increase the impacts of these feral species on native fauna. Few terrestrial species occur in the Project area and the establishment of solar panels there will not assist native species or foxes.

### 4.2.3 Edge effects

Most of the habitats within the project area are already impacted by edge effects (light, noise, dust, etc.). The removal of the paddock trees will not result in increase in dust, noise or light. The emplacement of the solar panels will provide greater ground coverage than currently exists and this may facilitate weed growth in the paddock. The issue of weed management will be incorporated into a Land Management Plan which will be developed to address this and other land management issues across the Site.

### 4.2.4 Noise and Air Quality

There will be some increase in noise and air quality impacts during the construction of the solar farm. However, once the construction is completed, both noise and dust levels will be reduced. The main source of noise during the operation of the solar farm will occur near the sub-station to be established on site. Noise and air quality will not be a factor that will negatively impact on native fauna.

### 4.2.5 Artificial lighting

It is not proposed to undertake works during night time hours therefore, there should be no requirement for night lighting, except for maintenance activities if needed. Artificial lighting during the operation of the solar farm will be negligible and mainly associated with sensor security lighting and ancillary lighting.

### 4.2.6 Changes to hydrology

Some minor land re-surfacing will occur during the establishment of the solar farm. In general, most of the earth works proposed will be minor and will consist of levelling out minor undulations in the ground surface. These changes will not alter the general hydrology of the project area.

## 4.3 Cumulative impacts

Cumulative impacts are the successive, incremental and combined impacts (both positive and negative) of an activity on society, the economy and the environment (Franks *et al*., 2010). They can arise from the compounding activities of a single operation given the interaction of that operation with past, current and future activities that may or may not be related to the existing development. Cumulative impacts may also arise through the interaction of one development with other types of activities and industries, such as grazing and broad scale agriculture. In relation to the Proposal, the cumulative impacts are considered to be the total impact on the environment that would result from incremental impacts (including both direct and indirect impacts) of the Proposal, added to other existing impacts. The main cumulative impact associated with the Proposal will occur during the construction of the solar farm when machinery and vehicle movements will be high. However, the establishment of the vegetation buffers around the perimeter of the site should offset most of this disturbance.

The proposed impact avoidance, mitigation and offset measures described in Sections 5 and 6 of this report are likely to assist with the maintenance of regional fauna biodiversity in the short-term and to potentially enhance it in the medium to long-term once rehabilitation and revegetation programmes become more established.

## 4.4 Significance of impacts on threatened fauna listed under the TSC Act

A total of 19 species of threatened fauna were considered to have potential to occur within the project area or immediate surrounds (Appendix A). For these species assessments were undertaken to determine the significance of potential impacts. Assessment Approach In accordance with the Draft Guidelines for Threatened Species Assessment (DEC and DPI, 2005) six questions require consideration and assessment in relation to each threatened species that could be impacted by the Proposal:

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

2. How is the proposal likely to affect habitat for a threatened species, population or ecological community?

3. Does the proposal affect any threatened species or populations that area at the limit of its known distribution?

4. How is the proposal likely to affect current disturbance regimes?

5. How is the proposal likely to affect habitat connectivity?

6. How is the proposal likely to affect critical habitat?

The potential impacts for each species of threatened fauna is provided in Appendix D. For species where the ecology or habitat requirements are similar, they have been grouped and assessed together.

In relation to 6, the Proposal would not impact on any area of critical habitat. No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2009), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2014).

**Summary**

In summary, the conclusions of the assessment were that the modification would be unlikely to significantly impact any threatened species given;

• the relatively small area of potential habitat that would be impacted (isolated paddock trees);

• this habitat area is not used by many native species, with the exception of flying animals. There are few old growth features observed in the trees and there is scant ground cover available. This area is also highly isolated from other treed areas.

• habitat fragmentation within the locality would be insignificant as a result of the removal of these trees,

• to assist those species that do occur in the local area a vegetation buffer zone will be established around the site, and a buffer zone will be established around the central watercourse that leads to Dam 5.

• impact avoidance and mitigation measures would be implemented.

### 4.5 Significance of impacts on threatened fauna listed under the EPBC Act

This report identifies potential impacts from the Proposal on threatened fauna listed under the EPBC Act and assessed whether the identified impacts would likely result in a significant impact on any Matters of National Environmental Significance. The conclusion of this assessment is that the proposed Modification is not likely to have a significant impact on any threatened fauna (see Appendix D).

### 4.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection

There are two important definitions that apply when considering Koala habitat under SEPP 44:

• "core koala habitat" means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings and historical records of a population; and

• "potential koala habitat" means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Three Schedule 2 Koala feed trees occur in the Suntop area, namely River Red Gum *Eucalyptus camaldulensis,* Yellow Box *Eucalyptus melliodora* and Western Grey *Box Eucalyptus microcarpa.* The Project site contains a few Western Grey Box *E. microcarpa* near the southern and western boundary of the site. These trees will be conserved and included in the vegetation buffer zone.

There are no historic or current observations of koalas within the Project Site. The isolation of the few tree areas that remain makes it extremely difficult for koalas to reach them and their poor condition and exposure means that if koalas were able to reach these trees they could not remain there for long.

### 4.7 Migratory species

Twelve migratory bird species listed under the EPBC Act have been recorded within the locality or predicted to occur in the Protected Matters database (Appendix C). There are no records of any of these species being recorded in the project area. The current survey did not detect any of these species but the limited nature of the survey does not preclude their presence from time to time. The Proposal is not likely to significantly impact any listed migratory species under the EPBC Act, on the basis of the following:

• no ‘important habitat’ exists within the Proposal area for any listed migratory species;

• the Proposal would not result in an invasive species that is harmful to any migratory species becoming established in an area of important habitat; and

• the Proposal would not disrupt the life cycle of an ecologically significant proportion of any population of any migratory species.

## 5 Mitigation measures

A number of impact avoidance and mitigation measures are proposed to alleviate any potential impacts on native species that occur in or over the project area.

### 5.1 Land Management plan

A Land Management Plan (LMP) will be prepared to include measures that will:

- protect the mature eucalypts trees around the perimeter of the site during the construction of the solar farm;
- enhance the habitat values of these trees through the establishment of the vegetation buffer zones; and

  replace the trees lost from field B1 by selective replanting in the buffer zones around the site.
- prevent unwanted plants from becoming established in and around the solar farm.
- schedule regular site inspections and communication with lessees and authorities;
- undertake annual control of weeds

### 5.2 Animal pest management and monitoring

A variety of animal pest management and monitoring procedures, including the following:

• the maintenance of a clean, rubbish-free environment in order to discourage scavenging and reduce the potential for colonisation of these areas by non-endemic fauna (e.g. introduced rodents, predators and birds);

• monitoring of feral animals (including pigs, foxes, dogs, rabbits and newly established exotics species);
• undertaking pest animal control where necessary; and

• employees and contractors are not permitted to encourage fauna through feeding.

### 5.3 Rehabilitation

At the completion of the life of the solar farm, the site will be rehabilitated to either arable agricultural land with/without replanted tree habitat areas.

### 5.4 Other fauna protection and management measures

Other fauna protection and management initiatives include the following:

• setting speed limits (20 km per hour on roads and tracks);

• installing warning signs on roads and tracks in the vicinity of the solar farm to reduce potential vehicle strikes;

• the maintenance of a clean, rubbish-free area; and

• preparation of procedures which detail how to care for animals found at risk of harm or injured at the solar farm site.

### References


Anstis, M. 2002. "Tadpoles of Southeastern Australia, a guide with keys" New Holland Press, French's Forest.

BirdLife Australia (2014) Database. Records sourced 24 October 2017. Department of the Environment and Department of Planning and Infrastructure (2005) Draft Guidelines for Threatened Species Assessment.

Department of the Environment (2009) Register of Critical Habitat. Website: http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl Date Accessed: 13 May 2014.

Department of the Environment (2017). Protected Matters database for matters of national environmental significance. Website: http://www.environment.gov.au/epbc/pmst/ Date Accessed: 7 October 2017.

Department of Environment and Conservation (2004) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft. Department of Environment and Conservation (NSW), Hurstville.

Department of Environment and Climate Change (2008). Recovery Plan for the Koala (*Phascolarctos cinereus*). Hurstville.

Department of the Environment, Water, Heritage and the Arts (2010a) Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act.

Department of the Environment, Water, Heritage and the Arts (2010b) Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act.

Department of the Environment, Water, Heritage and the Arts (2010c) Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the EPBC Act.

Department of Primary Industries (2014) Register of Critical Habitat. Website: www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/register Date Accessed: 14 May 2014.

Department of Sustainability, Environment, Water, Population and Communities (2011a) Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act.

Department of Sustainability, Environment, Water, Population and Communities (2011b) Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act.

Ellis, M.V., Rhind, S.G., Smith, M. and D. Lunney. (2016). Changes in the distribution of reports of the koala (*Phascolarctos cinereus*) after 16 years of local conservation initiatives at Gunnedah, north-west New South Wales, Australia. Pacific Conservation Biology 23(1) 63-70 https://doi.org/10.1071/PC16004.

Harrison, H., Lloyd, H., and C. Field. 2016. Evidence review of the impact of solar farms on birds, bats and general ecology (NEER012). Manchester Metropolitan University.

Office of Environment and Heritage (2014b) Atlas of NSW Wildlife database. Records sourced 7 October 2017.

**Appendix A: Likelihood of occurrence of threatened fauna**

| Scientific Name | Common Name | Conservation Status | | Known or predicted occurrence in region | | Records from the locality | | Survey Records | Potential occurrence in the Modification area or immediate surrounds |
|---|---|---|---|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | NSW OEH Database | Protected Matters | Wildlife Atlas NSW | Birdlife Aust. | | |
| *Anthrochaera phrygia* | Regent Honeyeater | CE | CE | Yes | - | No | No | No | Opportunistic habitat available to Regent Honeyeaters when mature eucalypts around perimeter of site are in flower. |
| *Lathamus discolour* | Swift Parrot | E | CE | Yes | - | No | No | No | Mature eucalypts around perimeter of site possible stopping points for Swift Parrots during migration. |
| *Polytelis swainsonii* | Superb Parrot | V | V | Yes | - | No | No | No | Opportunistic habitat available to Superb Parrots when mature eucalypts around perimeter of site are in flower. |
| *Calidris ferruginea* | Curlew Sandpiper | E | CE | Yes | - | No | No | No | Dam 5 could provide ephemeral habitat. |
| *Numenius madagascarensis* | Eastern Curlew | CE | CE | Yes | - | No | No | No | Dam 5 could provide ephemeral habitat. |
| *Grantiella picta* | Painted Honeyeater | V | V | Yes | - | No | No | No | Opportunistic habitat available to Painted Honeyeaters when mature eucalypts around perimeter of site are in flower. |
| *Rostratula australis* | Australian Painted Snipe | E | E | Yes | - | No | No | No | No habitat available. |
| *Botaurus poiciloptilus* | Australasian Bittern | E | E | Yes | - | No | No | No | No habitat available. Insufficient tree cover. |
| *Leipoa ocellata* | Malleefowl | V | V | Yes | - | No | No | No | No habitat available. |
| *Maccullochella peelii* | Murray Cod | V | V | Yes | - | No | No | No | No habitat available. |
| *Maccullochella macquarensis* | Trout Cod | V | V | Yes | - | No | No | No | No habitat available. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Galaxia rostrratus* | Flathead galaxia | V | V | Yes | - | No | No | No | No habitat available. |
| *Macquaria australasica* | Macquarie Perch | V | V | Yes | - | No | No | No | No habitat available. |
| *Petauroides volans* | Greater Glider | V | V | Yes | - | No | No | No | No habitat available. Insufficient tree cover. |
| *Phascolarctos cinereus* | Koala | V | V | Yes | - | No | No | No | Habitat inaccessible to koalas. Larger tree stands contains secondary food trees, but trees are inaccessible to koalas. |
| *Chalinolobus dwyeri* | Large Pied Bat | V | V | Yes | - | No | No | No | No habitat available. Insufficient tree cover. |
| *Dasyurus maculatus maculatus* | Spotted-tail Quoll | V | - | Yes | - | No | No | No | No habitat available. Insufficient tree cover or ground cover available. |
| *Nyctophilus corbeni* | Corben's Long-eared Bat | V | V | Yes | - | No | No | No | Mature eucalypts around perimeter of site may provide habitat for these bats. |
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | V | V | Yes | - | No | No | No | No habitat available. |
| *Pteropus poliocephalus* | Grey-headed Flying Fox | V | V | Yes | - | No | No | No | Opportunistic habitat available to Grey-headed Flying when mature eucalypts around perimeter of site are in flower. |
| *Aprasia parapulchella* | Pink-tailed Worm-lizard | V | V | Yes | - | No | No | No | No habitat available. Little surface rock available; no exfoliations. |
| *Delma impar* | Striped Legless Lizard | V | V | Yes | - | No | No | No | No habitat available. |

CE = Critically Endangered
E = Endangered
V = Vulnerable

**Appendix B Fauna Detected On Site**

| Class | Common Name | Scientific Name | TSC Act | EPBC Act |
|---|---|---|---|---|
| Mammalia | House Mouse | *Mus musculus* | I | - |
| | Red Fox | *Vulpes vulpes* | I | - |
| | | | | |
| Aves | | | | |
| | Pacific Black Duck | *Anas superciliosa* | P | |
| | Australasian Grebe | *Tachybaptus novaehollandiae* | P | |
| | Australian Maned Duck | *Chenonetta jubata* | P | |
| | Black-shouldered Kite | *Elanus axillaris* | P | |
| | Crested Pigeon | *Ocyphaps lophotes* | P | |
| | Eastern Rosella | *Platycercus exemius* | P | |
| | Red-rumped Parrot | *Psephotus haematonotus* | P | |
| | Galah | *Eolophus rosiecapilla* | P | |
| | Yellow-rumped Thornbill | *Acanthiza chrysorrhea* | P | |
| | Superb Fairy Wren | *Malurus cyaneus* | P | |
| | Noisy Miner | *Manorina melanocephala* | P | |
| | Blue-faced Honeyeater | *Entomyzon cyanotus* | P | |
| | White-plumed Honeyeater | *Lichenostomus penicillatus* | P | |
| | Magpie-lark | *Grallina cyanoleuca* | P | |
| | Welcome Swallow | *Hirundo neoxena* | P | |
| | Australian Reed-warbler | *Acrocephaus australis* | P | |
| | Common Starling | *Sturnus vulgaris* | I | |
| | Australasian Pipit | *Anthus novaeseelandiae* | P | |
| | Grey Butcherbird | *Cracticus torquatus* | P | |
| | Australian Magpie | *Cracticus tibicens* | P | |
| | Australian Raven | *Corvus coronoides* | P | |
| | | | | |
| Reptiles | Eastern Brown Snake | *Pseudonaja textilis* | P | |
| | Inland Snake-eyed Skink | *Cryptoblepharus pannosus* | P | |
| | Grass Skink | *Lampropholis guichenoti* | P | |
| | | | | |
| Frogs | Spotted Grass Frog | *Limnodynastes tasmaniensis* | P | |
| Fish | Nil | | | |

Note: P = protected, V = vulnerable, I = introduced, M = migratory.

**Appendix C: Migratory Species known or potential occurrence within the study area and/or locality.**

| Scientific Name | Common Name | Conservation Status | | Known or predicted occurrence in region | Records from the Locality | | Current Survey |
|---|---|---|---|---|---|---|---|
| | | TSC Act | EPBC Act | Protected Matters | Wildlife Atlas | Birdlife Australia | |
| | | | | | | | |
| *Apus pacificus* | Forked-tailed Swift | - | M | ✓ | - | - | - |
| *Hirundapus caudacutus* | White-throated Needletail | - | M | ✓ | - | - | - |
| *Actitis hypoleucos* | Common Sandpiper | - | M | ✓ | - | - | - |
| *Calidris acuminata* | Sharp-tailed Sandpiper | - | M | ✓ | - | - | - |
| *Monarcha melanopsis* | Black-faced Monarch | - | M | ✓ | - | - | - |
| *Motacilla flava* | Yellow Wagtail | - | M | ✓ | - | - | - |
| *Myiagra cyanoleuca* | Satin Flycatcher | - | M | ✓ | - | - | - |
| *Pandion haliaetus* | Osprey | - | M | ✓ | - | - | - |
| *Rhipidura rufifrons* | Rufous Flycatcher | - | M | ✓ | - | - | - |
| *Rostratula benghalensis* | Painted Snipe | E | M | ✓ | - | - | - |

Note: E = endangered, M = migratory.

# Appendix D: Assessments of Significance

**Birds**

Three of the threatened species that have been recorded within 10 kilometres of the project area have been excluded from this assessment as there is no habitat available for these birds in the project area. Those species were the Australasian Bittern, Mallee Fowl and Australian Painted Snipe.

**Wetland-associated Birds**

Two threatened wetland bird species have the potential to occur in the Study Area:

• Eastern Curlew *Numenius madagascarensis*
• Curlew Sandpiper *Calidris ferruginea*

Habitat for both of these birds is extremely limited and confined to the area around Dam 5 (Figure 2).

**1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

Both of the threatened birds listed above are known or predicted to occur in the region (Appendix A) but neither were detected during the fauna assessment in November 2017. Habitat for both species is limited to the area around Dam 5. Dam 5 will be excluded from the development footprint. In addition, silt fences will be erected to prevent dust or silt from being transported into the dam and catchment. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

**2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

No water bodies would be directly impacted by the proposal.

**3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

Neither of the threatened waterbird species listed above are at the limit of their known distribution (OEH 2017a).

**4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited already cleared agricultural land and the loss of trees that will occur will occur in areas not frequented and out of reach of these birds.

**5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these birds. The only dam that provides potential habitat for them will be conserved and protected during the construction and operation of the solar farm.

**6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

**Woodland Birds**

Two threatened woodland birds have the potential to occur within the Study Area:

• Painted Honeyeater *Grantiella picta*
• Superb Parrot *Polytelis swainsonii*

**1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

Both woodland species listed above have been recorded or are predicted to occur in the region (Appendix A) but neither were detected on site during the fauna assessment carried out in November 2017. Habitat for these birds is restricted to the few remaining mature eucalypts around the margins of the site and these trees will be retained and conserved. The small tree plantation areas on site are too young to provide habitat for these birds. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

**2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

The mature trees around the perimeter of the site will retained and includes in a vegetation buffer zone. The management of the buffer zone will improve the habitat value of these trees. The proposal will not adversely affect the habitat of these species.

**3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution**?

Both of these species have wide distributions in NSW and none are at the limit of their known distribution (OEH 2017a).

**4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited already cleared agricultural land and the loss of trees that will occur will occur in areas not frequented and out of reach of these birds. The trees that may provide habitat are located around the margins of the site and will be conserved.

**5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these birds. The mature eucalypts around the perimeter of the project area will remain and be conserved and potential movement corridors will be retained. All potential habitat for these birds will be conserved and protected during the construction and operation of the solar farm .

**6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

**Regent Honeyeater and Swift Parrot**

The following birds are considered to have the potential to occur within the Study Area:

• Swift Parrot *Lathamus discolor*
• Regent Honeyeater *Anthochaera phrygia*

**1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

The Swift Parrot is a non-breeding autumn-winter migrant to mainland Australia (breeds in Tasmania), where they forage primarily on nectar from winter flowering plants (OEH 2017a). Similarly, within NSW the Regent Honeyeater is known to breed in the Capertee Valley and the Bundarra-Barraba regions during spring and summer but can move large distances during the non-breeding season to forage on winter nectar resources (OEH 2017a). Both species would forage lerp and/or insects when nectar resources are scarce.

Suitable vegetation for these species within the project area is limited to the few remaining mature eucalypts that occur around the perimeter of the site. These trees will be retained and conserved. The small tree plantation areas on site are too young to provide habitat for these birds. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

**2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

The mature trees around the perimeter of the site will retained and includes in a vegetation buffer zone. The management of the buffer zone will improve the habitat value of these trees. The proposal will not adversely affect the habitat of these species.

**3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

Within the Study Area, neither of these species are at the limits of their known distribution (OEH 2017a).

**4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited already cleared agricultural land and the loss of the few paddock trees that will occur will occur in areas not frequented by these birds. The trees that may provide habitat for Swift Parrots and Regent Honeyeaters are located around the margins of the site and will be conserved.

**5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these birds. The trees that may provide habitat for Swift Parrots and Regent Honeyeaters are located around the margins of the site and will be conserved. The creation of vegetation buffer zones should enhance potential movement corridors for these birds.

**6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

**Mammals**

Four of the threatened species that have been recorded within 10 kilometres of the project area have been excluded from this assessment as there is no habitat available for these birds in the project area. Those species were the Spotted-tail Quoll, Large-eared Pied Bat, Koala and Greater Glider.

Two threatened mammal species have the potential to occur in the Study Area:

• Corben's Long-eared Bat *Nyctophilus corbeni*
• Grey-headed Flying Fox *Pteropus poliocephalus*

**Grey-headed Flying-fox**

The Grey-headed Flying-fox (*Pteropus poliocephalus*) has the potential to occur within the project area.

**1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

The Grey-headed Flying-fox is known to occur in the region and records exist for the locality. The species was not recorded during the fauna assessment conducted in November 2017. Grey-headed Flying-foxes feed on nectar and pollen of native trees as well as fruits and occur in a wide range of habitats (OEH 2017a). During the day individuals aggregate in camps, which are important for mating, giving birth and rearing young. Camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy (OEH 2017a). The Grey-headed Flying-fox can travel large distances (up to 50 km) from their camp to forage (OEH 2017a). No camps were observed within or near the study area.

The only habitat trees available to the flying foxes are the mature eucalypts that occur around the perimeter of the site. They could provide nectar when in flower. These trees will be retained and conserved. The small tree plantation areas on site are too young to provide much food t for these bats. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

**2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

The mature trees around the perimeter of the site will retained and includes in a vegetation buffer zone. The management of the buffer zone will improve the habitat value of these trees. The proposal will not adversely affect the habitat of these species.

**3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

The Grey-headed Flying-fox occurs in a 200 km broad band along the east coast of Australia from Bundaberg, QLD to Melbourne, VIC (OEH 2017a). Thus, the species is not at the limits of its known distribution.

**4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited already cleared agricultural land and the loss of the few paddock trees that will occur will occur in areas not frequented by these bats. The trees that may provide habitat for flying foxes are located around the margins of the site and will be conserved.

**5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these bats. The trees that may provide habitat for Grey-headed Flying Foxes are located around the margins of the site and will be conserved. The creation of vegetation buffer zones should enhance potential movement corridors for these bats.

**6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

**Corben's Long-eared Bat**

Corben's Long-eared Bat (*Nyctophilus corbeni*) has the potential to occur within the project area.

**1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?**

Corben's Long-eared Bat has not been recorded in the immediate vicinity of Suntop. These bats will often seek shelter in small terminal or mid-branch hollows. The only trees on the project area that have such hollows are the few mature eucalypts that are present around the margins of the site. These trees will be retained and conserved. The small tree plantation areas on site are too young to provide hollows for these bats. The proposed establishment of the solar farm is unlikely to affect the lifecycle of these threatened species.

**2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?**

The mature trees around the perimeter of the site will retained and includes in a vegetation buffer zone. The management of the buffer zone will improve the habitat value of these trees. The proposal will not adversely affect the habitat of these species.

**3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?**

Corben's Long-eared Bat is widely distributed around the western slopes and semi-arid of New South Wales; its distribution coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species (OEH 2017a). Thus, the species is not at the limits of its known distribution.

**4. How is the proposal likely to affect current disturbance regimes?**

As indicated in 4.2 the construction and operation of the solar farm would not result in a significant change to existing disturbance regimes, given impacts would be limited already cleared agricultural land and the loss of the few paddock trees that will occur will occur in areas not frequented by these bats. The trees that may provide habitat for Corben's Long-eared Bat are located around the margins of the site and will be conserved.

**5. How is the proposal likely to affect habitat connectivity?**

As indicated in 4.2 the construction and operation of the solar farm would not result in an adverse impact on habitat connectivity for these flying foxes. The trees that may provide habitat for them are located around the margins of the site and will be conserved. The creation of vegetation buffer zones should enhance potential movement corridors for these bats.

**6. How is the proposal likely to affect critical habitat?**

No area of critical fauna habitat occurs near the study area as designated by the Register of Critical Habitat held by the Commonwealth Minister of the DotE (DotE, 2014), Register of Critical Habitat held by the Director-General of the OEH (OEH 2017), or the Register of Critical Habitat held by the Director-General of the DPI-Fisheries (DPI-Fisheries, 2017).

**Reptiles**

Two threatened species of legless lizard have the potential to occur in the project area:

- Pink-tailed Worm Lizard *Aprasia parapulchella*
- Striped Legless Lizard *Delma impar*

Habitat does not exist for either species on the project site and so neither species is further assessed for potential impacts.

**Fish**

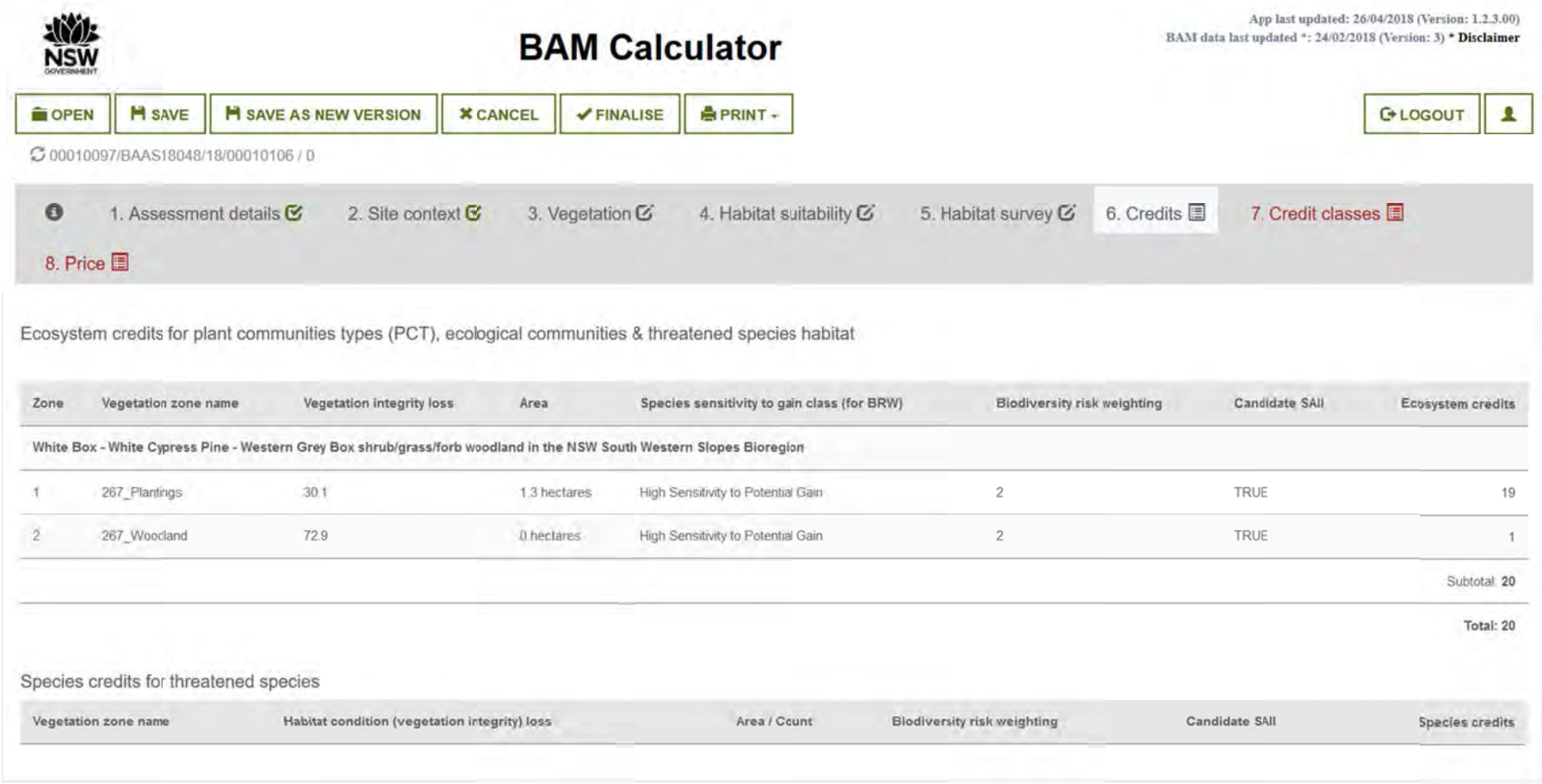
Four threatened species of fish have the potential to occur in the project area:

- Flathead Galaxia *Galaxia rostratus*
- Trout Cod *Macculochella macquarensis*
- Murray Cod *Maccullochella peelii*
- Macquarie Perch *Macquaria australasica*

As no habitat is present on the project site for any of these fish species, they are not considered any further in this assessment.

ATTACHMENT 2

BAM Credit Summary Report



BAM Calculator

App last updated: 26/04/2018 (Version: 1.2.3.00)
BAM data last updated *: 24/02/2018 (Version: 3) * **Disclaimer**

OPEN | SAVE | SAVE AS NEW VERSION | CANCEL | FINALISE | PRINT | LOGOUT

00010097/BAAS18048/18/00010106 / 0

1. Assessment details 2. Site context 3. Vegetation 4. Habitat suitability 5. Habitat survey 6. Credits 7. Credit classes 8. Price

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

| Zone | Vegetation zone name | Vegetation integrity loss | Area | Species sensitivity to gain class (for BRW) | Biodiversity risk weighting | Candidate SAII | Ecosystem credits |
|---|---|---|---|---|---|---|---|
| White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion | | | | | | | |
| 1 | 267_Plantings | 30.1 | 1.3 hectares | High Sensitivity to Potential Gain | 2 | TRUE | 19 |
| 2 | 267_Woodland | 72.9 | 0 hectares | High Sensitivity to Potential Gain | 2 | TRUE | 1 |
| | | | | | | Subtotal: | 20 |
| | | | | | | Total: | 20 |

Species credits for threatened species

| Vegetation zone name | Habitat condition (vegetation integrity) loss | Area / Count | Biodiversity risk weighting | Candidate SAII | Species credits |
|---|---|---|---|---|---|

# SUNTOP SOLAR FARM

## Aboriginal Heritage Assessment

Prepared for Photon Energy

Dubbo Regional Council Local Government Area

May 2018

Ref. 1711.05

**KELLEHER NIGHTINGALE CONSULTING PTY LTD**
**Archaeological and Heritage Management**
ACN 120 187 671

Level 10, 25 Bligh St
SYDNEY NSW 2000
Phone 02 9232 5373

## Document Information

| | |
|---|---|
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| Project Number | 1711.05 |
| Revision | 5 |
| Client Name | Photon Energy |
| Recipient | Jessica Berry |
| Issue Date | 21 May 2018 |
| Prepared by | Dr Matthew Kelleher; Ana Jakovljevic; Cristany Milicich; Ben Anderson |
| Approved by | Dr Matthew Kelleher |

## Contents

**CONTENTS** ..... III

**TABLES** ..... IV

**1 INTRODUCTION** ..... 1

1.1 PROJECT BACKGROUND ..... 1
1.2 SUMMARY OF FINDINGS ..... 1
1.3 INVESTIGATORS AND CONTRIBUTORS ..... 4

**2 DESCRIPTION OF DEVELOPMENT PROPOSAL** ..... 4

**3 ABORIGINAL COMMUNITY CONSULTATION AND PARTICIPATION** ..... 5

**4 PREVIOUS ARCHAEOLOGICAL INVESTIGATION** ..... 6

4.1 DATABASE SEARCH (AHIMS) AND KNOWN INFORMATION SOURCES ..... 6
4.2 DISCUSSION OF AHIMS AND OTHER HERITAGE REGISTERS SEARCH RESULTS ..... 8
4.3 PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS ..... 9
4.4 IMPLICATIONS FOR THE STUDY AREA ..... 11

**5 LANDSCAPE CONTEXT** ..... 12

**6 REGIONAL CHARACTER** ..... 15

**7 PREDICTIONS** ..... 15

**8 METHODS AND SURVEY COVERAGE** ..... 16

8.1 SAMPLING STRATEGY ..... 16
8.2 FIELD METHODS ..... 16
8.3 SURVEY COVERAGE ..... 18

**9 RESULTS** ..... 24

9.1 SUNTOP IF 1 ..... 26
9.2 SUNTOP IF 2 ..... 27

**10 DISCUSSION** ..... 28

**11 SCIENTIFIC VALUES AND SIGNIFICANCE ASSESSMENT** ..... 29

11.1 ASSESSMENT CRITERIA ..... 29
11.2 STATEMENT OF SIGNIFICANCE ..... 29

**12 IMPACT ASSESSMENT** ..... 30

**13 CONCLUSIONS AND RECOMMENDATIONS** ..... 32

**REFERENCES** ..... 33

**APPENDIX A WELLINGTON LOCAL ABORIGINAL LAND COUNCIL REPORT** ..... 34

**APPENDIX B AHIMS SEARCH RESULTS** ..... 41

## Figures

Figure 1. Study area location ..... 2
Figure 2. Detail of study area ..... 3
Figure 3. AHIMS search results ..... 7
Figure 4. Geology and soil landscapes of the study area ..... 13
Figure 5. Landforms and survey units of the study area ..... 17
Figure 6. Aboriginal archaeological sites and culturally significant tree within the study area ..... 25
Figure 7. Proposed development and identified Aboriginal heritage ..... 31

## Tables

Table 1. Investigators and contributors ..... 4
Table 2. Frequency of site types from OEH AHIMS database search ..... 6
Table 3. Survey coverage ..... 23
Table 4. Landform summary ..... 23
Table 5. Identified archaeological and cultural heritage features in the study area ..... 24
Table 6. Artefact at Suntop IF 1 ..... 26
Table 7. Artefact at Suntop IF 2 ..... 27

## Plates

Plate 1. Survey Unit 1 - Hillslope with low spurline, visibility and exposures, facing south east ..... 18
Plate 2. Survey Unit 1 - Vehicle track west of the farm buildings and crops to the east, showing ground surface visibility and erosion conditions, facing north ..... 18
Plate 3. Survey Unit 1, central part - rocky outcrop, facing north ..... 18
Plate 4. Survey Unit 1, western section - farm buildings, facing south west ..... 18
Plate 5. Survey Unit 1, northern section – transmission line, facing south ..... 19
Plate 6. Survey Unit 1, northern section – irrigation channels, facing north ..... 19
Plate 7. Survey Unit 2, eastern section - second order creek line, visibility within the creek bed, facing south east ..... 19
Plate 8. Survey Unit 2, eastern section - erosion visible within creek banks ..... 19
Plate 9. Survey Unit 2 - cluster of trees, northern bank of the creek and areas of erosion, facing north west ..... 20
Plate 10. Survey Unit 2 - water tanks and windmill in the south west of the study area, facing south ..... 20
Plate 11. Survey Unit 2 – dam at the western extent of the study area, general visibility and conditions, facing east ..... 20
Plate 12. Survey Unit 2 – track west of dam, facing north towards the silos ..... 20
Plate 13. Survey Unit 3 – Facing north west towards the hill and silos, general ground conditions ..... 21
Plate 14. Survey Unit 3 – lower slopes of the hillslope, facing north towards the cluster of trees in Survey Unit 2 across the second order creek line, general ground surface visibility ..... 21
Plate 15. Survey Unit 4 – Facing south towards tree with cultural significance ..... 21
Plate 16. Survey Unit 4 – identified culturally significant tree on western boundary of study area ..... 21
Plate 17. Survey Unit 5 – Facing south towards culvert beneath Renshaw McGirr Way ..... 22
Plate 18. Survey Unit 5 – surface exposure along edge of Renshaw McGirr Way ..... 22
Plate 19. Chert core identified at Suntop IF 1 ..... 26
Plate 20. Suntop IF 1, exposure in foreground, facing south east ..... 26
Plate 21. Chert flake identified at Suntop IF 2 ..... 27

# 1 Introduction

## 1.1 Project background

Photon Energy (Photon) proposes to construct and operate a solar farm at 909 Suntop Road, Suntop NSW. The proposal was deemed State Significant Development (SSD) and an Environmental Impact Statement (EIS) was required to support the project application, prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued on 21 September 2017 (SSD 8696). The project SEARs required an assessment of the likely Aboriginal heritage (cultural and archaeological) impacts of the development and include adequate consultation with the local Aboriginal community.

The subject land, was located adjacent to Suntop Road and comprised Lot 1-2-3 DP506925, Lot 122 DP753238 and Lot 90 DP657805 It covered a total area of 517 hectares, bounded by Suntop Road to the north, unnamed road to the west and private properties to the south and east. The proposed works would also include an upgrade of the intersection of Renshaw McGirr Way and Suntop Road to improve safety. The subject land and proposed intersection upgrade, hereafter referred to as the study area, are located within the Dubbo Local Government Area (LGA), approximately 7 kilometres south west from the Wellington town centre (Figures 1 and 2).

To inform the EIS and fulfil the SEARs, Kelleher Nightingale Consulting Pty Ltd (KNC) was engaged to carry out an Aboriginal heritage assessment of the land. The assessment included background research and an archaeological field survey conducted in accordance with Office of Environment and Heritage (OEH) requirements including:

*Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010a)

*Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b).

The assessment was undertaken in consultation with Wellington Local Aboriginal Land Council, who also participated in the field surveys.

## 1.2 Summary of findings

No impact to Aboriginal heritage will occur as a result of the proposed Suntop Solar Farm or proposed upgrade works at the intersection of Renshaw McGirr Way and Suntop Road.

Background research, desktop assessment and archaeological field survey identified three heritage sites within the study area, but the sites are not within the project footprint and are not impacted by the proposal:

- Aboriginal archaeological sites, Suntop IF 1 and Suntop IF 2, two isolated artefacts identified along a creek bank; and
- Culturally significant tree as identified by the Wellington Local Aboriginal Land Council.

All of the other areas within the study area exhibited low archaeological potential due to combinations of archaeologically unfavourable topography, agricultural activity, past road construction activities and contemporary disturbance of the land.

Proposed works associated with the solar farm development will not impact on identified areas of Aboriginal cultural heritage significance. The culturally significant tree will be retained along the western boundary of the study area and the two isolated finds will be retained within the riparian corridor.

It is recommended that the identified site locations (Suntop IF 1, Suntop IF 2 and culturally significant tree) should be included within the construction environment management plan.

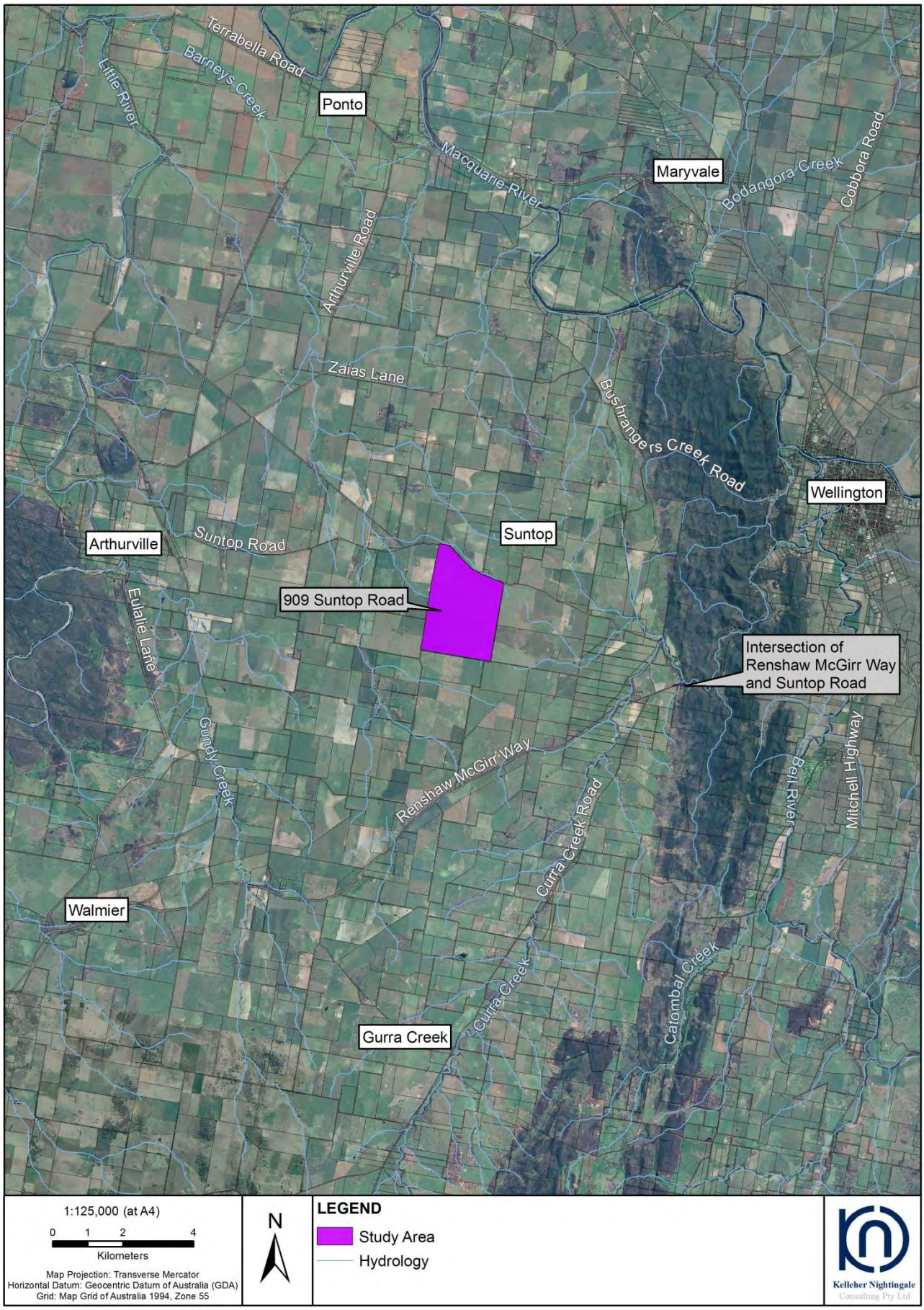



**Figure 1. Study area location**




**Figure 2. Detail of study area**

### 1.3 Investigators and contributors

A list of investigators and contributors to the study is included in Table 1 below.

**Table 1. Investigators and contributors**

| Investigator/Contributor | Affiliation | Role |
|---|---|---|
| Dr Matthew Kelleher | KNC | Survey, advisor and review |
| Alison Nightingale | KNC | Advisor and review |
| Ana Jakovljevic | KNC | Reporting |
| Cristany Milicich | KNC | Reporting |
| Ben Anderson | KNC | GIS mapping, Reporting, Survey |
| Mike Nolan | WLALC | Survey, Cultural Heritage Advisor |
| Tyarara Talbot | WLALC | Survey |

## 2 Description of Development Proposal

The Suntop Solar Project will include the installation of up to 550,000 photovoltaic (PV) panels which will be installed on a single axis tracker system across the study area. The single axis tracker system option would consist of groups of east-west facing PV modules tilted at +/- 60$^{o}$ angle (each approximately 2m x 1m in area) on mounting structures approximately 2m in height and in rows approximately 11m apart. The mounting structure would be piled steel posts that would extend between 1.6m to 4m below ground depending on geological conditions. The maximum height of panels during tracking movement is up to 4.03m.

The proposal would consist of the following elements:

- Solar Components including:
  - Up to 550,000 PV panels on mounting structures
  - Electrical connections and inverter stations (where the inverters are within containers at the end of solar PV rows)
  - Underground cabling / collection circuits.
- Electrical infrastructure including:
  - Transmission kiosk
  - A 132kV Substation
  - 33kV switchgear
- An access road
- Ancillary facilities and construction compounds
- Perimeter security fencing
- Two maintenance storage containers.

During the construction period, some additional temporary facilities would be located within the study area and may include:

- Material laydown areas.
- Construction site offices.
- Parking area.

The proposal would also include the upgrade of the intersection of Renshaw McGirr Way and Suntop Road to improve safety and may include:

- Removal of trees
- Installation of crash barriers on either side of Suntop Road at the intersection with Renshaw McGirr Way
- Rural Basic Right turn treatment to widen the shoulder of Renshaw McGirr Way

Power generated by the facility will be transmitted via existing 132kV transmission lines, in an easement owned by TransGrid that traverses the Site and extends through to the Wellington substation approximately 15 kilometres to the north.

A tee off connection will be used to connect directly into the existing grid located on Site. A tee connector is an electrical connector that joins three cables together.

The operational life of the solar farm is expected to be approximately 30 years at which point the panels are either replaced and operations continue or removed and the site is decommissioned and rehabilitated as required.

# 3 Aboriginal Community Consultation and Participation

The Aboriginal heritage assessment included consultation with the local Aboriginal community. The proponent sought to prepare the assessment in consultation with the relevant Local Aboriginal Land Council to identify any Aboriginal archaeological sites or areas of cultural significance and assess the potential impact of the proposal on Aboriginal heritage values.

The assessment was undertaken in consultation with Wellington Local Aboriginal Land Council (WLALC) whose boundaries covered the study area. WLALC was contacted at the commencement of the project to discuss the development proposal and invited to participate in site survey. Land Council representative Mike Nolan participated in a survey of 909 Suntop Road on Monday 26 February 2018.

WLALC identified a mature tree within the study area that has cultural significance to local Aboriginal people. The tree is located along the western boundary of the study area, outside of the proposed solar farm footprint.

The survey also identified two archaeological sites, isolated artefacts Suntop IF 1 and Suntop IF 2, situated within the central eastern part of the study area, along an unnamed creek line.

WLALC representative Tyarara Talbot participated in a survey of the intersection of Renshaw McGirr Way and Suntop Road on Monday 14 May 2018. The WLALC had no objections to the proposed intersection upgrade.

A written report was provided by WLALC summarising the outcomes of the site inspection and is included as Appendix A. The WLALC had no objections to the proposed solar farm development provided that impacts are avoided to the identified archaeological sites (Suntop IF 1 and Suntop IF 2) and the culturally significant tree.

The WLALC recommended that the location of the identified archaeological sites and the culturally significant tree be provided to the property owner to ensure that they are not impacted by other activities. The WLALC also recommended that if further culturally significant materials area identified during the construction of the solar farm, the WLALC and OEH be notified and that works cease.

# 4 Previous Archaeological Investigation

## 4.1 Database search (AHIMS) and known information sources

### *4.1.1 AHIMS web services*

The Aboriginal Heritage Information Management System (AHIMS) is a database operated by OEH, regulated under section 90Q of the *National Parks and Wildlife Act 1974*. AHIMS contains information and records related 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 5 March 2018 to identify registered (known) Aboriginal sites or declared Aboriginal places within or surrounding the study area (AHIMS Client Service ID: 331634). Search results are attached as Appendix B.

The AHIMS Web Service database search was conducted with the following coordinates (GDA, Zone 55):

Eastings: 0660300 to 0682700
Northings: 6381900 to 6405250

The AHIMS search results showed:

| | |
|---|---|
| **47** | **Aboriginal sites are recorded in or near the above location** |
| **0** | **Aboriginal places have been declared in or near the above location** |

The distribution of recorded Aboriginal sites within these coordinates is shown on Figure 3. The frequencies of site types (site context/features) within the AHIMS database search area are listed in Table 2.

**Table 2. Frequency of site types from OEH AHIMS database search**

| Site Context | Site Features | Number | *%* |
|---|---|---|---|
| Open | Modified Tree (Carved or Scarred) | 17 | *36.2* |
| | Artefact Scatter | 9 | *19.2* |
| | Restricted Site | 8 | *17* |
| | PAD; Artefact Scatter | 3 | *6.4* |
| | Grinding Groove | 2 | *4.3* |
| | Burial | 2 | *4.3* |
| | Stone Quarry; Stone Arrangement | 1 | *2.1* |
| | Stone Arrangement; Stone Quarry; Artefact Scatter | 1 | *2.1* |
| | Shell Midden; Artefact Scatter | 1 | *2.1* |
| | Hearth; Artefact Scatter | 1 | *2.1* |
| | Ceremonial Ring; Artefact Scatter | 1 | *2.1* |
| | Aboriginal Ceremony and Dreaming; Stone Arrangement | 1 | *2.1* |
| | **Total** | **47** | ***100*** |

No previously recorded sites were situated within or adjacent to the study area. Six AHIMS registered Aboriginal sites were located within three kilometres of the study area, including modified (scarred) trees, a grinding groove site, three artefact scatters and one isolated artefact. These are discussed further in section 4.2.

AHIMS confirmed that the study area did not contain any of the Restricted Aboriginal Sites listed within the search area (email correspondence from David Gordon, Senior Heritage Information Officer (Aboriginal), Management Operations, Heritage Division, OEH dated 7 March 2018).

### *4.1.2 Other heritage registers and databases*

Other sources of information including heritage registers and lists were also searched for known Aboriginal heritage in the vicinity of the study area. These included:

- Wellington Local Environment Plan (WLEP) 2012
- State Heritage Register
- State Heritage Inventory
- Commonwealth Heritage List
- National Heritage List
- Australian Heritage Places Inventory and
- Historic Heritage Information Management System (HHIMS).

No items of Aboriginal heritage were listed on these databases within the study area.

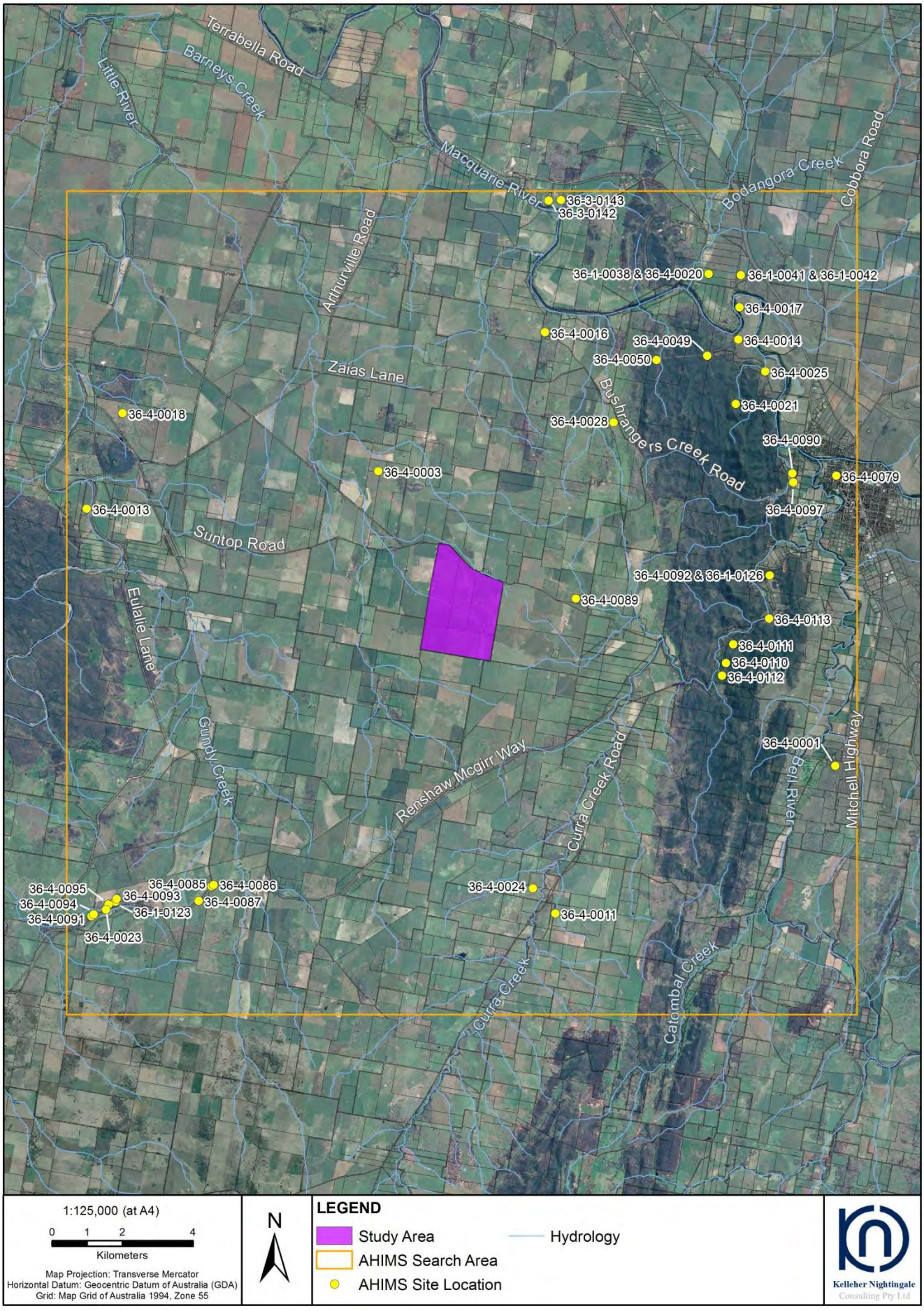



**Figure 3. AHIMS search results**

## 4.2 Discussion of AHIMS and other heritage registers search results

As well as determining if there are any registered (known) sites within a given area, an AHIMS search also helps to characterise local archaeology by illustrating the distribution of known sites within the local landscape. This can aid in the development of predictive models used at the desktop stage of archaeological investigation and is integrated with known regional trends to help identify where archaeology may be present within a given area.

Archaeological sites listed on the AHIMS database often represent a record of archaeological survey effort, rather than a comprehensive or complete depiction of an area's archaeology, but provide a useful starting point for further investigation. Search results for the current study area and its surroundings indicated the predominance of modified trees (n=17, 36.2%), followed by open sites with artefacts (n=9, 19.2%) and restricted sites (n=8, 17%). Areas of potential archaeological deposit (PAD) associated with artefact scatters were represented by 6.4% (n=3), followed by burials and grinding grooves (n=2, 4.3%). There was a variety of complex site types including ceremonial sites, stone arrangements, stone quarry sites and shell middens, represented by 2.1% (n=1) each. The location of the most common site type, modified or scarred trees was directly dependent on the preservation of native vegetation, as much of the area has been previously cleared and cultivated. A relatively high number of restricted sites recorded on AHIMS indicate the landscape contains many culturally significant sites. Artefact scatter sites were the second most common site type in the area. These were also often recorded in association with other site types, such as quarries, stone arrangements, hearths and ceremonial sites. Particular site types, such as grinding grooves, quarries and stone arrangements are identified within areas of sandstone outcrops and other suitable geological formations.

Six recorded Aboriginal sites were identified within three kilometres of the study area.

*Suntop Road Scarred Trees* (AHIMS 36-4-0089)
This site comprised two modified (scarred) trees located approximately 2.5 kilometres east of the study area. One tree was within the road easement on the northern side of Suntop Road and the other approximately 23 metres north east within a farm paddock, on a lower slope of the rolling hills landform. They were approximately 30 metres from a drainage line that flowed to Barneys Creek to the west. Each tree had a single scar, one oval in shape and considered to be for a large coolamon and one narrow and long, possibly for a shield.

*Suntop* (AHIMS 36-4-0003)
This site comprised axe grinding grooves documented from a local (Dubbo) informant in 1955 as being "10 miles W. of town". The AHIMS site record noted that the registered coordinates were approximate only, being "only guessed v. general location", placing it around 2.9 kilometres north west of the study area. The only other site detail provided was that the grooves covered an area "4' across" (approx. 1.2m).

*WETL – IF 1* (AHIMS 36-4-0110)
This site was an isolated surface artefact which was located approximately 1.3 kilometres north east of the intersection of Renshaw McGirr Way and Suntop Road. The artefact was a situated on a mid slope landform and was made from greywacke.

*WETL – OS1 with PAD* (AHIMS 36-4-0113)
This site was a moderate density surface artefact scatter and associated area of potential archaeological deposit located approximately 3 kilometres north east of the intersection of Renshaw McGirr Way and Suntop Road. The site was situated on a toe slope and creek terrace landform overlooking the confluence of Curra Creek and an ephemeral stream. The artefact scatter comprised at least 27 stone artefacts which were identified within disturbed exposures which encompassed an area of 60 x 60 metres. The artefacts included flakes and flaked pieces made from chert, mudstone, greywacke and quartz. The site had visible disturbance due to the use of existing tracks in addition to fence and dam construction.

*WETL – OS2 with PAD* (AHIMS 36-4-0111)
This site was a moderate density surface artefact scatter and associated area of potential archaeological deposit located approximately 1.8 kilometres north east of the intersection of Renshaw McGirr Way and Suntop Road. The site was situated on a creek flat at the confluence of two ephemeral creeks. The artefact scatter comprised at least 10 artefacts including flakes and cores which were made from quartz, greywacke, chert, hornets and secrete. The site had visible disturbance from an existing power easement, grazing and a European camp.

*WETL – OS3* (AHIMS 36-4-0112)
This site was a moderate density surface artefact scatter and associated area of potential archaeological deposit located approximately 1 kilometre east of the intersection of Renshaw McGirr Way and Suntop Road. The site was situated on an elevated flat plain and toe slope landform adjacent to an unnamed creek. The artefact scatter comprised 31 artefacts which were made from quartz, greywacke, chert, hornfels and silcrete. The site had visible disturbance from an existing power easement and access tracks.

These previously recorded Aboriginal sites within three kilometres of the study area were located across different landforms. Grinding grooves and scarred trees are site types that are directly dependent on environmental conditions: grinding grooves are within geologic formations where water is easily accessible and scarred trees in areas with remnant mature vegetation. The recorded artefact scatters were located on elevated landforms in close proximity to water sources while the isolated artefact was identified on a mid slope landform.

Background information also reveals that the wider Macquarie River and Wellington area comprise numerous sites of significance to local Aboriginal people. Carved trees, stone arrangements, burials, ceremonial ring/Bora ring and Aboriginal Ceremony and Dreaming sites have all been recorded within the wider area. Site Macquarie River 2 (AHIMS 36-4-0006) was located within the township of Wellington and consisted of a bora/ceremonial ground and 28 carved trees. It was originally recorded in the early 1900s by ethographer Etheridge and subsequently recorded by Bell in the 1980s.

In addition, one historic site of significance to local Aboriginal people is listed on the State Heritage Register (SHR) located at University Road, in Wellington, approximately 7 kilometres north east of the current study area. The item is listed as 'Blacks Camp' (SHR Listing No. 01865), situated on an alluvial terrace on the western bank of the Macquarie River and being of state significance due to the historical, social and cultural significance to local Aboriginal people. It is also listed on the Wellington LEP 2012 as Item no. I144. 'Blacks Camp' is the earliest remembered Aboriginal camp in the Wellington area. It was one of the post-contact Aboriginal settlements where local Wiradjuri people were moved off their traditional lands to camps on vacant land and reserves on the fringes of the newly established township. The site is highly significant to the local Aboriginal community as it tells the story of the Wiradjuri People after the arrival of non-Aboriginal settlers in the Wellington Valley and loss of traditional lands. The former camp site is also significant as it contains a burial, a scarred tree and a shell midden site. There are no above ground structures present at the site, which has also been subject to flooding and a section of the site has been cropped.

While there were no previously recorded Aboriginal sites located within the study area, the presence of recorded sites in the general vicinity demonstrates that the local landscape was used by Aboriginal people in the past and that material traces of this landscape use have survived in the form of Aboriginal objects and culturally significant sites.

### 4.3 Previous archaeological investigations

Several archaeological surveys and test excavations have been carried out across the region. This section summarises what is known from existing and available data. The majority of previous assessments were associated with infrastructure developments.

The presence of Aboriginal people in the Darling Basin has been dated to 40,000 years ago (Hope 1981 in Haglund 1985). Three major studies of the Upper Macquarie, Dubbo and northern-central rivers region have been carried out by Pearson (1981), Koettig (1985) and Balme (1986).

Pearson (1981) was the most comprehensive for the Wellington area, as it is focussed on the Upper Macquarie; however the study was biased towards the large and/or obtrusive sites often directed by information provided from local residents. Three rock shelters were excavated as part of Pearson's study that were dated to around 5,000 years ago. Pearson developed a site pattern model based on occupation and non-occupation sites. Non-occupation sites included grinding grooves, scarred or carved trees, ceremonial sites and burial sites. According to Pearson's model, the following can be expected regarding the location of Aboriginal sites within the landscape:

- site distance to water varied from 10 to 500 metres, but in general larger sites were found closer to water;
- good soil drainage and views over watercourses were important site location criteria;
- most sites were located in contexts which would originally have supported open woodland;
- burial sites and grinding grooves were situated as close to habitation areas as geological constraints would allow;
- scarred trees were variably located with no obvious patterning other than proximity to watercourses where camps were more frequently located;
- ceremonial sites such as earth rings ('bora grounds') were located away from campsites;
- stone arrangements were also located away from campsites in isolated places and tended to be associated with small hills or knolls or were on flat land;
- quarry sites were located where stone outcrops with desirable working qualities were recognised and were readily accessible; and
- based on ethnohistoric information, it was considered that Aboriginal campsites were seldom used for longer than three nights and that large archaeological sites probably represented an accumulation of material over a series of short visits.

Koettig (1985) completed a comprehensive study of the wider Dubbo area that included detailed recording of various site types across all topographic landform units and different stream order associations. The site prediction model developed as a result of her study was that:

- all site types can be found along watercourses;
- stone arrangements occur more frequently on knolls or prominent landscape features;
- larger campsites were more frequent along permanent watercourses, near springs and wetlands, although small campsites may be found anywhere. Because occupation was more intensive along major watercourses, more complex sites can be found there;
- modified trees can be found anywhere there are remnants of mature native vegetation;
- campsites would become smaller and more sporadic near the headwaters of creeks;
- grinding grooves were most frequent in association with appropriate sandstone outcrops;
- quarries may be found where there are reliable sources of suitable stone; and
- shell middens will only be found along the rivers or 4$^{th}$ order streams.

In general, environmental factors that determined site locations included:

- proximity to water: the largest campsites were located close to permanent water, although sites can be found everywhere across the landscape including hills and ridges away from watercourses;
- geological formations: certain sites required specific conditions, such as grinding grooves within sandstone outcrops, quarries where suitable stone resources were accessible and burials within sandy deposits; and
- availability of food resources: generally around permanent watercourses although some foods were seasonal and available further from waterways.

Aboriginal heritage assessment for the proposed gas pipeline from Alectown to Wellington (Australian Museum Business Services [AMBS] 2008) identified four Aboriginal archaeological sites. They consisted of three low density artefact scatters and one scarred tree. The sites were located in immediate proximity to creek line water sources and it was concluded that creek banks within the study area had moderate potential to contain Aboriginal stone artefacts although they would be in highly disturbed context. In addition, farmed areas had low archaeological potential to contain intact, undisturbed Aboriginal sites. The three artefact scatters were assessed as having low archaeological significance, being located within erosional areas in highly disturbed context. The scarred tree was assessed as having high archaeological and cultural significance. It was recommended that all impacts to the scarred tree were to be avoided, with a buffer zone of at least 10 metres. The survey covered a 200 metre wide corridor and part of the alignment ran across the north western corner of the current study area. No Aboriginal sites were identified in this area.

OzArk (2009) completed an Aboriginal heritage assessment for the proposed electricity transmission line south west of Wellington. The alignment followed the lower valley slopes of Mt Duke within Mt Arthur Reserve, finishing at Curra Creek approximately four kilometres south east of the current study area. The assessment included background review and a field survey. Four Aboriginal sites were identified during the survey. They consisted of three artefact scatters with PAD and one isolated find: WETL-OS1 with PAD, WETL-OS2 with PAD, WETL-OS3 with PAD and isolated artefact WETL-IF1. Extensive surface artefact scatters were identified on elevated creek bank landforms. The isolated artefact was located on an elevated mid hill slope. These locations confirm the site prediction model that sites are expected to occur on elevated creek confluences and spur crests overlooking water. Sites WETL-OS1 and WETL-OS3 consisted of large numbers of flakes and cores (27 and 31 respectively) and a range of raw materials including silcrete, quartz, greywacke, chert and hornfels. It was considered that further subsurface archaeological deposits were present that would indicate more permanent or repeated occupation. Scientific significance of these two sites was assessed as moderate to high. Sites WETL-OS2 and WETL-IF1 were assessed to have low scientific significance due to their disturbed nature (OzArk 2009:32-3). It was recommended that an AHIP should be issued if any impacts were proposed to the four identified Aboriginal archaeological sites. A number of additional areas were identified as having high and moderate archaeological sensitivity. Consultation with Gallanggabang Aboriginal Corporation revealed that all sites are culturally significant to local Aboriginal people as they show the physical evidence of Aboriginal occupation of the local area. It was recommended that all sites and areas of PAD be included in the general induction for all construction activities and relevant management plans be implemented.

CNC Project Management (2010) prepared an Aboriginal cultural heritage assessment for the proposed ERM Power Pty Ltd Young to Wellington gas pipeline, covering a total length of 218 kilometres. The alignment ran along the valleys and eastern side of the Catumbal Range, approximately 12 kilometres east of the current study area. Eighteen sites were recorded during the field survey, including 13 scarred trees and five artefact scatters: Within the Wellington area, relevant to this assessment, seven scarred trees and three artefact scatters were identified. Two of the scarred tree sites were located within the current AHIMS search area: Power Station CMT 1 (AHIMS 36-4-0117) and Power Station CMT 2 (AHIMS 36-4-0118), situated 55 metres apart. They were located approximately 1.5 kilometres north of the Wellington township and Macquarie River (Figure 3). No further recommendations were made considering these trees as they were located outside the footprint of the proposed development. Three artefacts scatter sites were located in association with Watson's and Baker's Swamp Creeks. All sites were assessed as having high cultural significance to the local Aboriginal community. Recommendations included site avoidance, collection of particular objects and monitoring of identified archaeologically sensitive areas.

The Wellington area is within what Tindale mapped as Wiradjuri territory (1974). Wiradjuri is the largest Aboriginal language group in NSW and means “people of the three rivers”, referring to the Macquarie, Lachlan and Murrumbidgee rivers (NPWS 2003:121). Local movement of people was associated with several purposes: hunting and gathering, social activities and ceremonial gatherings. Resources were utilised seasonally when family groups would be drawn to the riverine environment and would have camped nearby. In times of less abundance, visits to an area would generally be short and associated with a particular activity. This implies that areas around permanent and reliable water sources, such as rivers and larger creeks were revisited periodically over time, while smaller ephemeral creeks were visited only seasonally but not necessarily returned to regularly. Ridgelines and crests were also visited as passing corridors with very short or transient occupation events.

### 4.4 Implications for the study area

The previous archaeological investigations described above have been undertaken across the wider region and landscapes comparable to that of the study area. Not many previously recorded Aboriginal archaeological sites are located in the immediate vicinity of the study area due to the limited number of previous archaeological assessments. Site prediction models based on the wider area and Wellington Valley indicate that larger sites are likely to be concentrated in proximity to reliable and permanent watercourses. Sites identified close to the Macquarie and Little rivers appear to represent more frequent or long term occupation by Aboriginal people. Smaller creeks and ephemeral drainage lines would have been used less frequently and have a sparse archaeological record, such as background scatter from a specific activity or discarded material. Non-occupational Aboriginal sites within the region were numerous and their location determined by a number of environmental factors, including geological formation and levels of recent disturbance. Grinding grooves were located within sandstone country with an available water source for grinding purposes. Quarry sites would be in locations with suitable stone raw material used for flaking or sources of ochre. Stone arrangements were located away from occupation areas in isolated places on small hills or knolls. Scarred trees were located in areas not affected by recent land use modifications, primarily land clearing. Burials would be located within sandy, usually deep deposits and may be associated with midden deposits. Middens were located in proximity to the resources, such as river banks and estuaries. Aboriginal Ceremony and Dreaming sites were known to occur in the area, mainly associated with initiation ceremonies and/or activities of ancestral beings during the Dreamtime.

Archaeological potential in the local area has been affected by various factors, primarily the extent of historical disturbances. Extensive land clearing activities would have removed native mature vegetation and therefore directly impacted on the preservation of culturally modified trees. Agricultural activities would have also affected subsurface cultural material through disturbances to the upper soil horizons. Spatial and stratigraphic movements of cultural material could be expected, but these processes do not remove or destroy archaeological material. Some post-depositional movement of cultural material can also be expected due to erosion, especially on hillslope landforms and fluvial processes along stream channels. Construction of roads, farm buildings, artificial dams, irrigation channels and installation of fences has also caused ground disturbance and may have removed and/or displaced soils containing cultural material.

# 5 Landscape Context

The study area is located within South Western Slopes Bioregion (SWSB), an extensive area of foothills and isolated ranges comprising the lower inland slopes of the Great Dividing Range extending from north of Cowra through southern NSW into western Victoria. It is bounded by six bioregions: the Riverina and Cobar Peneplain Bioregions to the west, Darling Riverine Plains and Brigalow Belt South Bioregions to the north, Sydney Basin to the north east and the South Eastern Highlands Bioregion along much of the eastern boundary. Several major rivers flow through the SWSB including the Macquarie, Murray, Murrumbidgee and Lachlan Rivers.

Geologically SWSB lies within the eastern part of the Lachlan Fold Belt which consists of a complex series of north to north westerly trending folded bodies of Cambrian to Early Carboniferous sedimentary and volcanic rocks. Granites are common and occur either as central basins surrounded by steep hills formed on contact metamorphic rocks, or as high blocky plateau features with rick outcrops and tors. The valleys between ranges are either in granite or generally softer rocks such as shale, phyillite or slate. Limited areas of Tertiary basalt with underlying river gravels and sands occur, and as the terrain becomes lower to the west and north, wide valleys filled with Quaternary alluvium and occasional lakes become the more dominant landscape form.

The study area is within the Upper Slopes subregion, characterised by Ordovician to Devonian folded and faulted sedimentary sequences with inter-bedded volcanics rocks and large areas of intrusive granite. The predominant geology of the study area is Canowindra Volcanics (Scv), Silurian in age (443-419mya), bounded to the east by the Cudal Fault and extending from south of Cumnock through to Geurie. These volcanics are characterised by massive, rounded tors and form broad strike ridges. The dominant lithology is massive rhyolite porphyry. It is overlain in many areas by the Hanover Formation that occurs to the immediate west of the study area. This formation is mostly shale, sandstone and siltstone which indicate a deep marine depositional environment. There are also a number of isolated limestone outcrops.

The geology within the eastern portion of the study area comprises Garra Formation (Dgg) and Curra Creek Conglomerates (Dtcu). The Garra Formation is an Early Devonian Volcanic that outcrops on shallow valleys and low broad ridges and is comprised of fossiliferous limestone that formed under shallow marine conditions. The Curra Creek Conglomerates form part of the Late Devonian Catombal Group and overly Garra Formation geologies. The Curra Creek Conglomerates were formed from the high energy deposition of alluvial fans from the east.

Soils within the study area comprise the Arthurville soil landscape in the west and the Tillings Lane soil landscape in the east (Figure 4). The Arthurville soil landscape is formed from in situ, colluvial and alluvial parent rock and are characterised by Red-Brown Earths with some Yellow Podzolic-Solodic soils in depressions and on lower slopes. The soils are erosional particularly in tilled conditions or with poor cover. The Tillings Lane soil landscape is formed from in situ, colluvial and alluvial parent rock and are characterised by Red-Brown Earths. The soils are erosional due to long slopes particularly in tilled conditions or with poor cover. The characteristics of the Arthurville and Tillings Lane soil landscape indicate they would preserve archaeological material where natural process and modern disturbance is limited.

The study area is located in the Central West subregion within the Northern Inland Catchments bioregion. The main rivers are Macquarie, Castlereagh and Bogan rivers of the Murray-Darling Basin. The subregion extends from the plains around Dubbo across the low lying plains of the Macquarie and Castlereagh river systems north west to the Barwon River floodplain. The study area lies within the Macquarie River catchment system. Macquarie River is located approximately seven kilometres north and east of the study area. One second order drainage line flows east–west through the central part of the western portion of study area, which empties into Barneys Creek approximately two kilometres west of the study area. Barneys Creek is a tributary of Little River that empties into the Macquarie River, approximately 20 kilometres north west of the study area. The eastern portion of the study area encompasses a portion of an unnamed second order creek which joins Curra Creek approximately 100 metres north of the study area. Curra Creek flows north east for approximately 6 kilometres before joining Bell River and Macquarie River near Wellington.

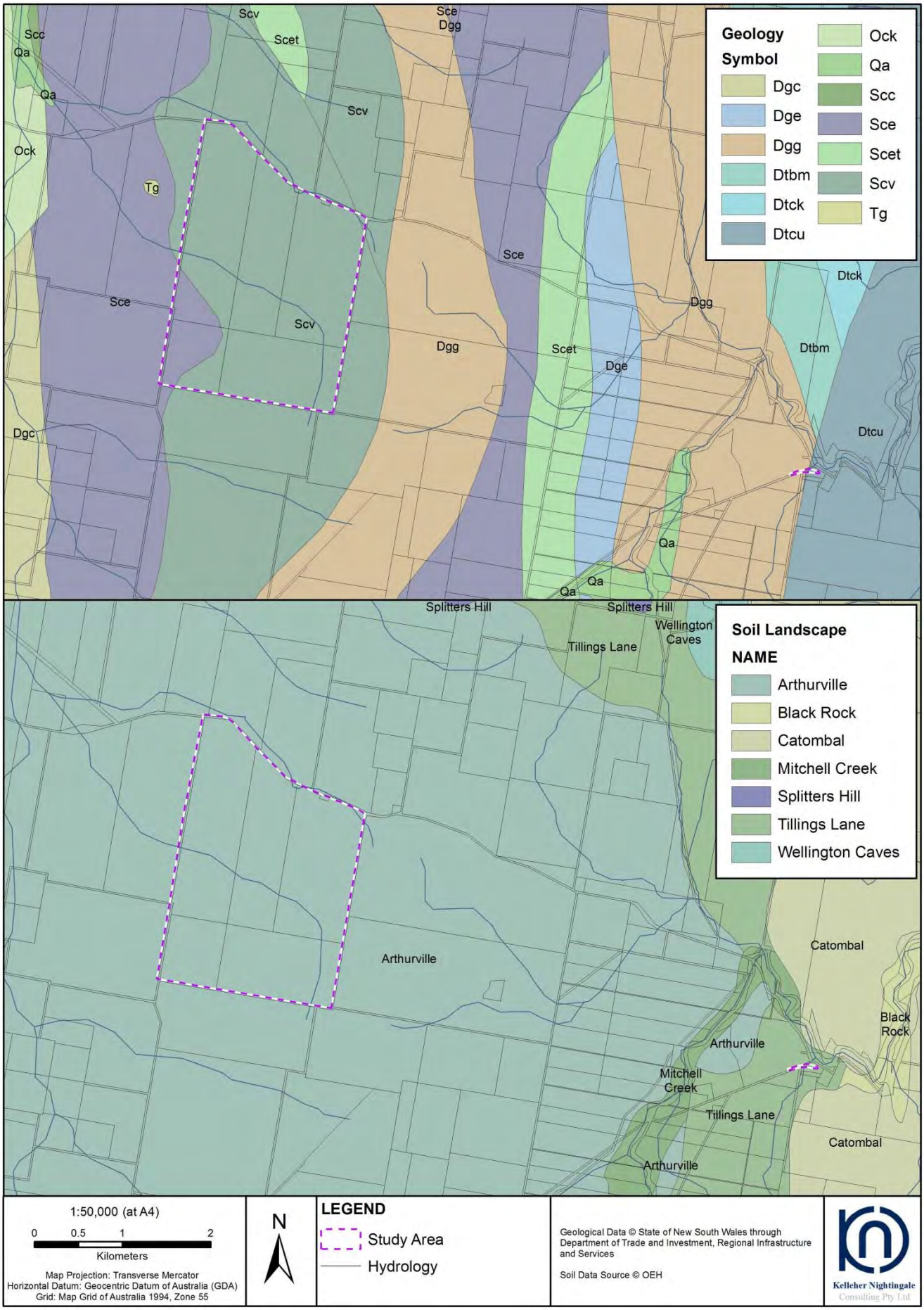



**Figure 4. Geology and soil landscapes of the study area**

Existing native vegetation of the Little River catchment was surveyed in 2002 as part of the TARGET project (Tools to Achieve Landuse Redesign using Environmental/Economic Targets). According to the vegetation mapping, the study area was within *Grey Box – White Cypress-pine Woodland* vegetation community. Woodland plant communities were associated with flat terrain on better soils at lower elevations and had moderate structural diversity. It was dominated by Grey Box *(Eucalyptus microcarpa)* and White Cypress-pine *(Callitris glaucophylla)*. Other species included Fuzzy Box *(E.conica)*, Bull-oak *(Allocasuarina luehmannii)* and White Box *(E.albens)*. Understorey was most commonly small White Cypress-pine, often in dense patches. It was estimated that due to the extensive clearing of land in the recent past less than 10% remains of the estimated pre-clearing distribution of *Grey Box – White Cypress-pine Woodland* (NSWP 2002:6).

In addition to these plant species within the study area, the surrounding area would have sustained a larger number and greater variety of floral and faunal resources that were utilised based on their seasonal availability. Riverine environments were fundamental for Wiradjuri subsistence needs. Macquarie and Little River as well as their tributaries contained an abundant variety of natural resources that were used seasonally. Waterways offered reliable sources of fish and shellfish along with fresh water supply even in drought events. They would have also attracted a variety of animals such as birds, kangaroos and emus that would have been hunted for food and materials. Seasonal fresh foods such as yam daisies, nuts, fruits, wattle seeds and orchid tubers could have been gathered around the rivers and their tributaries. Other resources such as medicinal plants, animal skins, tree bark and plant fibres were also highly utilised for a variety of purposes.

Sources of lithic raw materials suitable for artefact manufacture occurred in proximity to the study area, from river and creek beds as well as sedimentary and volcanic rocks from the hilly areas. Materials commonly used for making stone tools included quartzite, quartz, greywacke, chert and silcrete obtained from exposed sedimentary formations or as loose rock on the surface. Volcanic rock outcrops also occur in the vicinity of the study area and provided raw materials for ground stone tools such as stone axes.

Since European occupation of the Wellington area, fertile river flats were extensively used for pastoralism and agricultural activities. As the population in the region increased, the need for meat and wheat supply also increased, that led to further occupation and clearing of the land by early settlers as well as construction of dams, sinking wells and fences. Market gardens are still expansive and produce a variety of vegetables, irrigated fodder and cash crops including lucerne, maize and peas. Much of the land in the area is used for mixed farming of winter cereals, cattle and sheep and several dairies. The impact of both pastoralism and agriculture has been significant on the original natural Wiradjuri environment.

The study area comprises large fenced paddocks that contain irrigated crops and the road corridors of Renshaw McGirr Way and Suntop Road. Paddocks have been levelled and largely cleared for agricultural purposes (mainly cropping) and currently contain several built structures, including an agricultural shed and residential dwelling. There were some stands of mature native trees within the study area. There were seven dams within the study area as well as irrigation channels. An electricity transmission line ran through the northern section of the study area. These recent land use practices would have impacted on possible Aboriginal cultural material in the study area. Agricultural practices, including ploughing, grazing and land clearing in addition to the construction of roads and culverts may have displaced Aboriginal artefacts and removed modified or scarred trees. If artefacts were present within these areas, they would likely not be in their original context. The remnant stands of mature trees within the study area may retain Aboriginal modified or scarred trees.

# 6 Regional Character

Previous archaeological studies and field surveys in the region have provided data on variable use of local landforms as known sites indicate ephemeral, casual or limited use, while other sites indicate more intensive or repeated use. Artefact distribution and lithic raw material use aid in assessing the archaeological character of the region.

Investigations in the Wellington Valley have revealed a rich settlement history. Site frequency and density can be related to key landscape factors and assessing the combination of these present in a particular area, based on what is known for the region, allows for an assessment of the likely archaeology in a given area. For the Wellington Valley, the chief landscape factors include geological formation, distance to water, landform and proximity to environmental resources. Additionally, historical land use practices and disturbance must be taken into account.

Archaeological sites in the region generally occur as open camp sites or surface scatters and as isolated finds across the landscape. Landforms along the margins of creeks, especially those offering permanent water and associated environmental resources would have been favourable for occupation by Aboriginal people, as well as good soil drainage and views over the watercourses. This is reflected in the archaeological record by higher artefact densities and more complex sites recorded at these sites, especially along the major rivers and creek lines, wetlands and springs, potentially reflecting repeated or more intensive use of these locations. Headwaters of creeks and lower order creek lines tend to display a different archaeological signature, chiefly a sparser artefact distribution and less evidence for 'everyday' or utilitarian activities, suggesting that these areas were often used differently. Other types of non-occupational sites would be directly dependent on the environmental conditions. Stone arrangements and ceremonial sites would have been often located further away from campsites. Grinding grooves and quarry sites occur within landforms with suitable geological formations. Burials occur within sandy conditions as close to the occupation areas as environmental constraints would allow.

Numerous raw material sources have been documented in the wider region, known to have been utilised by Aboriginal people in the past. The prevalence of silcrete, chert, quartz, quartzite and volcanics in regional artefact assemblages is related to the availability of these raw materials in regional geologies and their wide distribution across the Wellington Valley. The variety of trees and grasses previously abundant within the area was extensively used by Aboriginal people for food and raw material. Animal food resources used to be plentiful particularly in or near the Macquarie and Little rivers and its numerous tributaries and billabongs. Large game, such as kangaroos and wallabies would have been present within open plains and woodland surrounding the study area, mainly the Mt Arthur hills to the east. Aboriginal Ceremony and Dreaming sites can be found within prominent features across the landscape or associated with initiation ceremonies, meetings and other important social activities. Some areas form an important part of the cultural landscape for local Aboriginal people.

Regional archaeology has been variably impacted by historical and current land use practices as well as by natural processes. Preservation of archaeological sites in open contexts is difficult because of the adverse effects of erosion, flooding and disturbance from various recent land use activities. Conversely, ground surface visibility is often increased by these processes, leading to increased identification of artefacts in these areas, primarily on the banks of minor creeks. Some site types, such as artefact scatters, are poorly represented among site data from previous investigations in the region and may reflect limited survey coverage and not necessarily a paucity of these site types in the region.

# 7 Predictions

The information outlined in previous sections allows several predictions to be made about the nature of the archaeology that may be expected in the study area:

- Archaeological sites are likely to consist of open artefact scatters or isolated finds in proximity to waterways, scarred trees within areas of remnant mature vegetation and grinding grooves in areas with suitable geological formations.
- Silcrete, quartz, quartzite, chert and volcanics will be the most commonly encountered artefact raw material.
- Clearing of the majority of original vegetation lessens the likelihood of culturally modified trees, but some old growth trees may be present in the study area and have the potential to display scars of Aboriginal origin.
- Grinding grooves and rock shelters can be found in areas with appropriate geological formations.
- Stone arrangements and bora grounds can be expected on knolls or prominent landscape features.
- Archaeological sites are more likely to be identified in areas that have been subject to less intensive disturbance.
- The identification of archaeological sites is likely to be affected by differential visibility of the ground surface, but successful assessment of areas of potential archaeological deposit can be made based on landform and other environmental factors such as distance to water.

# 8 Methods and Survey Coverage

## 8.1 Sampling strategy

The aim of the survey was to conduct an archaeological inspection of the study area and identify any Aboriginal sites or areas of potential archaeological deposit.

The majority of the study area was covered in thick grasses. Field assessment focused on areas of surface exposure, where there was a greater chance of identifying artefactual material due to increased visibility. The very poor visibility of the remainder of the study area led to a focus on landform and topography.

Based on the archaeological background and landform context, several areas were targeted for close inspection. In particular, lower slopes in proximity to watercourses and exposed areas around creek banks were closely inspected for artefacts. Areas of high surface visibility were also targeted for close inspection, including exposures such as vehicle tracks, driveways, stock tracks, sheet wash erosion scours and dam edges. While much of the study area had been cleared, close inspection was carried out in all areas that retained trees in order to identify any culturally modified trees in the study area, including the line of trees located along the western boundary of the study area, a small stand of trees north of the central creekline and the vegetated areas adjacent to the intersection of Renshaw McGirr Way and Suntop Road.

Assessment of archaeological potential was also carried out, focusing on a combination of factors such as landform and topography, aspect, distance to water and relation to identified Aboriginal sites. The level of soil disturbance was also assessed, as this has the potential to impact upon any subsurface archaeology that may be present.

## 8.2 Field methods

Field survey of the western portion of the study area at 909 Suntop Road was completed on 26th February 2018 by KNC archaeologist Dr Matthew Kelleher and Wellington Local Aboriginal Land Council representative Mike Nolan. Field survey of the eastern portion of the study area at the intersection of Renshaw McGirr Way and Suntop Road was completed on 14th May 2018 by KNC archaeologist Ben Anderson and Wellington Local Aboriginal Land Council representative Tyarara Talbot

A desktop review of AHIMS registered Aboriginal sites found that site types in the vicinity of the study area were predominantly open artefact scatters, often identified in exposures along the margins of creeks; scarred trees located within areas of remnant native vegetation and grinding grooves within areas of sandstone outcrops in the vicinity of waterways. For this reason, areas of high surface visibility were targeted for close inspection, including exposures such as vehicle tracks, driveways, road edges, stock tracks, sheet wash erosion scours, dam edges and creek banks, particularly on those landforms mentioned above but also wherever they were present. Large mature or dead trees, including those apparently felled some time ago, were also inspected for the possibility of being a culturally modified tree. Particular attention was paid if any stone outcrops occur anywhere across the landscape within the study area.

The western portion of the study area was divided into four survey units, for ease of reference, based on landform while the eastern portion of the study area was surveyed as a single unit (Figure 5).

Survey Unit 1 included hillslopes on the northern side of the study area, comprising simple slopes and a low spurline extending east-west, located between a creek within the study area and the creek to the immediate north, two parallel streams emptying into Barneys Creek. The survey unit included farm structures along the western boundary of the study area, as well as an artificial dam to the south.

Survey Unit 2 comprised the central part of the study area around the second order creek, within the stream channel, its bed and banks. It also included first order drainage lines to the north of the creek.

Survey Unit 3 encompassed two hillslopes comprising of low spurline and valley flat to the west located between the second order drainage line to the north and the first order drainage line at the south of the study area and a hillslope at the southern end of the study area consisting of a low spurline running north west to south east.

Survey Unit 4 comprised a stream channel associated with the first order drainage line at the southern of the study area, its bed and banks.

Survey Unit 5 encompassed the portion of the study area at the intersection of Renshaw McGirr Way and Suntop Road. The survey unit comprised a stream channel associated with a second order tributary of Curra Creek and the adjacent slopes.

The study area was traversed by pedestrian survey in a series of transects. High resolution colour aerial photographs, topographic maps and geological maps were used for reference in the field. Site locations were plotted using handheld GPS units, mapped and photographed, including landform context and site contents. Site recording forms were completed for each site, listing details of artefacts observed, site extent and field sketches. Notes were taken during the survey of landform, exposures, nearest water, vegetation, current land use, aspect, previous ground disturbance and areas of potential for intact subsurface archaeological deposit.

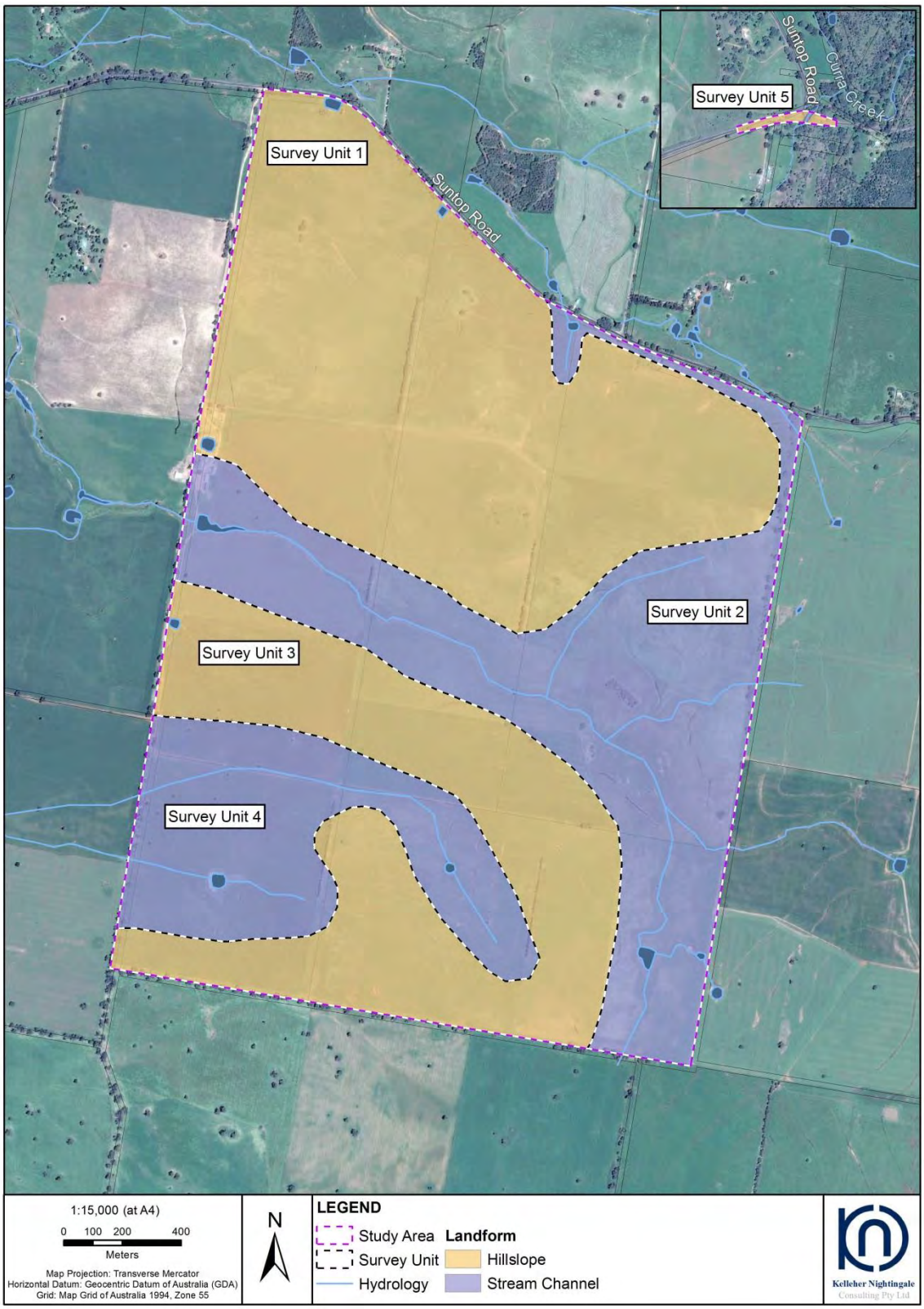



**Figure 5. Landforms and survey units of the study area**

## 8.3 Survey coverage

**Survey Unit 1 - Hillslope**

Field survey commenced at the north western part of the study area, within Lot 3 along the western boundary of the study area. Survey Unit 1 (Figure 5) revealed varied levels of ground surface visibility, from zero within cropped areas and 100% within roads and ploughed areas, averaging 40% across the entire unit. Exposure was generally limited to tracks and around trees, buildings and fences (Plates 1 and 2). The majority of Survey Unit 1 was covered with short grass or crops, with occasional ploughed areas. The entire survey unit was extensively cleared with only limited trees along lines running north-south marking the borders between lots. A prominent rocky outcrop was observed at the highest point on the landscape, within the central part of the survey unit (Plate 3). The area was carefully inspected for any features containing Aboriginal objects or areas of cultural significance to Aboriginal people, such as bora grounds, although none were identified at this location. Significant ground disturbance was observed within areas that contained the farm buildings, including the residential dwelling, outbuildings, shed and silos (Plate 4). Construction of these structures had involved removing or displacing the natural soils.



**Plate 1. Survey Unit 1 - Hillslope with low spurline, visibility and exposures, facing south east**



**Plate 2. Survey Unit 1 - Vehicle track west of the farm buildings and crops to the east, showing ground surface visibility and erosion conditions, facing north**



**Plate 3. Survey Unit 1, central part - rocky outcrop, facing north**



**Plate 4. Survey Unit 1, western section - farm buildings, facing south west**

Particular attention was paid to the northern part of Survey Unit 1 where the proposed substation will be situated. The area was covered with patchy very dry crops (Plate 5) and intersected with irrigation channels for agricultural purposes (Plate 6). Two small artificial dams were located immediately south of Suntop Road and associated with irrigation channels throughout the northern part of the study area. These land use practices have caused significant ground disturbance to the natural soil layers that would directly impact on the preservation of archaeological deposits in this area. An electricity transmission line ran across the north western part of the study area. Its installation would have impacted ground conditions within pole locations as well as clearing of vegetation within the easement.

All exposure across Survey Unit 1 was closely inspected for soil conditions and Aboriginal cultural material. Soils were noted to be clayey silty loams and erosional due to water runoff within informal vehicle tracks, irrigation channels, dams and around fences and trees. All exposed areas were carefully inspected for any exposed Aboriginal cultural material, but none was observed. Survey Unit 1 was assessed as having low potential for containing archaeological deposits.



**Plate 5. Survey Unit 1, northern section – transmission line, facing south**



**Plate 6. Survey Unit 1, northern section – irrigation channels, facing north**

**Survey Unit 2 – Stream Channel (second order creek)**

The survey team moved to Survey Unit 2, from west to east along the drainage line that was a second order creek running across the central part of the study area (Figure 5). The majority of the creek bed contained no water at the time of inspection, with only a limited amount of water present in some low lying parts. Ground surface visibility in the creek bed was nil, as the creek bed was overgrown with vegetation (Plate 7) with no areas of exposure. Creek banks offered better ground surface visibility of approximately 50%, with exposures of about 20% (Plate 8). Isolated artefacts were identified in two separate exposures over 115 metres apart along the southern bank of the creekline. They were recorded as isolated finds Suntop IF 1 and Suntop IF 2 (AHIMS ID pending). These are described further in section 9. No other Aboriginal cultural material was observed within this survey unit.



**Plate 7. Survey Unit 2, eastern section - second order creek line, visibility within the creek bed, facing south east**



**Plate 8. Survey Unit 2, eastern section - erosion visible within creek banks**

A small stand of trees was situated on the northern side of the creek (Plate 9). The trees were fenced off and consisted of mainly young, replanted Eucalyptus species. They were all inspected, but none contained evidence of modification or scarring and it was noted that there were no trees of suitable age. Significant erosion was also visible around the fence line due to water runoff and pedestrian traffic (Plate 9). Within the western part of the study area, significant land modifications were observed in association with irrigation for agricultural purposes. Two water tanks and a windmill were located in proximity to other farm buildings (Plate 10). Two artificial dams for agricultural purposes were constructed within the western extent of the study area, one within the second order creek line and the other within a very small drainage line (Plate 9). Ground surface visibility was good with some patches covered in dry grass,

averaging around 70%. Areas of exposure included around the dam walls and along dirt tracks (Plate 11 and 12). The areas of exposure were closely inspected but no Aboriginal cultural material was observed. Construction of the dams and modifications to the creek bed, including construction of the informal track above the waterway had involved significant ground works that would have removed or displaced the majority of the natural soils and therefore any possible Aboriginal cultural material in the area.



**Plate 9. Survey Unit 2 - cluster of trees, northern bank of the creek and areas of erosion, facing north west**



**Plate 10. Survey Unit 2 - water tanks and windmill in the south west of the study area, facing south**



**Plate 11. Survey Unit 2 – dam at the western extent of the study area, general visibility and conditions, facing east**



**Plate 12. Survey Unit 2 – track west of dam, facing north towards the silos**

**Survey Unit 3 - Hillslope**

Survey Unit 3 encompassed two hillslopes, a low spurline extending between a second order creek to the north and first order drainage to the south, sloping up towards the south eastern extent of the study area and then gently sloping down towards the north west between two first order drainage lines (Figure 5). The majority of the survey unit was covered with short dry grass with moderately good visibility of 50% across the entire unit (Plates 13 and 14). Limited areas of exposure of about 5% were observed around fence lines and the few trees. The area was used for agricultural and grazing purposes with disturbance most likely limited to upper soil layers. Erosion was visible within patches not covered in grass due to the water runoff. Within the southern part of this unit, irrigation channels were visible across the landscape. No Aboriginal cultural material or areas of archaeological potential was identified in Survey Unit 3.



**Plate 13. Survey Unit 3 – Facing north west towards the hill and silos, general ground conditions**



**Plate 14. Survey Unit 3 – lower slopes of the hillslope, facing north towards the cluster of trees in Survey Unit 2 across the second order creek line, general ground surface visibility**

**Survey Unit 4 – Stream Channel (first order drainage lines)**

Survey Unit 4 encompassed two stream lines (first order drainage lines) located within the southern portion of the study area (Figure 5). It consisted of creek beds and banks, with one small artificial dam constructed at the head of the southernmost drainage line. There was no water within the drainage lines at the time of inspection. Survey Unit 4 was extensively cleared of vegetation and used for agricultural and grazing purposes. Ground surface visibility was on average 40% with areas of exposure 10% limited to around trees and fence lines. Only a few trees were located across the entire unit, with the exception of the western border of the study area where some trees of mature age were observed. One tree was identified as having cultural significance to local Aboriginal people by Mike Nolan, Wellington LALC representative (Plate 15). The tree contained a scar although it could not be positively identified as being of cultural origin. It was recommended that the tree be conserved *in situ* and all proposed impacts avoid the location of the tree. No other Aboriginal cultural material was identified within Survey Unit 4.



**Plate 15. Survey Unit 4 – Facing south towards tree with cultural significance**



**Plate 16. Survey Unit 4 – identified culturally significant tree on western boundary of study area**

**Survey Unit 5 – Intersection of Renshaw McGirr Way and Suntop Road**

Survey Unit 4 encompassed the stream line of a second order north flowing tributary of Curra Creek and adjacent slopes (Figure 5). The survey unit consisted of the heavily modified road corridors of Renshaw McGirr Way and Suntop Road with embankments and a culvert beneath Renshaw McGirr Way (Plate 17), several piles of sediment and a deeply incised stream line. There was no water within the drainage line at the time of inspection. The survey unit was predominantly covered in new growth trees with some older trees present. No culturally modified trees were identified.

Ground surface exposures were relatively frequent within the survey area with visibly restrictions from plat detritus, gravels and blue metal. Areas of surface exposure included the creek banks and along the road edges (Plate 18). The areas of exposure were closely inspected; however, no Aboriginal cultural material was observed. Construction of the current roads and the previous alignment of Renshaw McGirr Way (located approximately 10 metres north of the survey area) had involved significant ground works that would have removed or displaced the majority of the natural soils and therefore Aboriginal cultural material in the area.



**Plate 17. Survey Unit 5 – Facing south towards culvert beneath Renshaw McGirr Way**



**Plate 18. Survey Unit 5 – surface exposure along edge of Renshaw McGirr Way**

Overall, surface exposures were relatively frequent in the study area, located within ploughed areas, erosion scours bordering drainage lines, stock and vehicle tracks, along the edges of sealed roads and in patches of bare earth where vegetation had died off. Exposures were generally in fair condition, although water runoff had impacted soil preservation as well as stock trampling, weed and grass growth. Surface visibility was likewise moderate with the majority of the study area covered in short, patchy and dry grass or plant detritus. The majority of the study area had been subject to cultivation for a considerable period of time, including extensive clearing, cropping and construction of farm buildings, dams and irrigation channels while the eastern portion of the study area had been subject to extensive disturbance from the original construction of Renshaw McGirr Way and its subsequent realignment. A summary of survey coverage by survey unit and landform is presented in Tables 3 and 4.

**Table 3. Survey coverage**

| Survey Unit | Landform | Survey Unit Area (sq m) | Visibility % | Exposure % | Effective Coverage Area | Effective Coverage % |
|---|---|---|---|---|---|---|
| 1 | Hillslope | 1,973,880 | 40 | 20 | 157,910 | 8 |
| 2 | Stream Chanel | 1,405,346 | 25 | 10 | 35,133 | 2.5 |
| 3 | Hillslope | 1,194,148 | 50 | 5 | 29,853 | 2.5 |
| 4 | Stream Channel | 696,486 | 40 | 10 | 27,859 | 4 |
| 5 | Hillslope | 9,551 | 50 | 10 | 478 | 5 |
| 5 | Stream Channel | 639 | 60 | 20 | 77 | 12 |

The survey coverage table above demonstrates some limitations imposed on the effectiveness of the survey by infrequent exposures but generally moderate to good visibility of the ground surface. Hillslopes exhibited fairly consistent levels of ground surface visibility with exposures varying between 5 and 20%. Hillslopes within the northern part of the study area exhibited higher level of exposure due to extensive agricultural activity including ploughing, cropping and construction of irrigation channels. In general, stream channels had better ground surface visibility within first order than second order streams. This was mainly due to the amount of moisture within them. First order creek lines revealed very dry conditions with low or nil vegetation cover; second order creeks had occasional puddles of water within the creek bed, but the majority was covered in thick, long grasses. Exposures in both first and second order creeks were limited to creek banks and around dams. This was not the case with the second order tributary of Curra Creek which was dry and had had good surface visibility. Overall, hillslope landform elements revealed slightly better survey coverage due to the intensive land use practices, land clearing and dry conditions during the field survey. A summary of effective coverage and results by landform is presented in Table 4.

**Table 4. Landform summary**

| Landform | Landform Area (sq m) | Area Effectively Surveyed | % of landform effectively surveyed | Number of sites | Number of artefacts or features |
|---|---|---|---|---|---|
| Hillslope | 3,177,579 | 188,241 | 6 | nil | nil |
| Stream Channel | 1,102,471 | 63,069 | 5.7 | 2 | 2 |

# 9 Results

Field inspection identified two Aboriginal archaeological sites within the study area. These were two isolated artefacts (isolated finds) located on the bank of a second order creek, labelled Suntop IF 1 and Suntop IF 2. These are described further in sections 9.1 and 9.2 following.

One tree assessed as having cultural significance to local Aboriginal people was identified within the study area. It was located within the easement on the western boundary of the study area, adjacent to Lot 2 DP506925, with coordinates 670437E 6392967N, GDA 95 MGA 55. The tree holds cultural significance to local Aboriginal people and should be avoided by proposed activities.

Aboriginal archaeological and cultural sites identified in the study area are listed in Table 5 and locations shown on Figure 6.

**Table 5. Identified archaeological and cultural heritage features in the study area**

| Site ID | Feature | Survey Unit | Landform |
|---|---|---|---|
| Suntop IF 1 | Isolated artefact | 2 | Stream Channel |
| Suntop IF 2 | Isolated artefact | 2 | Stream Channel |
| Suntop Culturally Significant Tree | Culturally significant tree | 4 | Stream Channel |




**Figure 6. Aboriginal archaeological sites and culturally significant tree within the study area**

## 9.1 Suntop IF 1

Suntop IF 1 comprised a single chert core. It was located on the southern banks of the second order creek line, a tributary to Barneys Creek, within the southern part of Lot 90 DP657805. The artefact was observed in an exposure approximately 20 metres south of the unnamed creek (Plates 19 and 20). The ground gently inclined to the south to a low spurline extending south east to north west and intersected with irrigation channels. The site was located approximately 1.4 kilometres south of Suntop Road within an open paddock with no tree cover. A stand of young replanted trees was located approximately 350 metres to the north west, on the northern side of the creek.

Visibility across the surface of the exposure was moderate, with swamp tussocks within the creek bed and short dry grass cover bordering the exposure. Site condition was generally poor, with the area affected by stock movement and continued sheet erosion from fluvial movement along the drainage line. Sediment observed both in and along the margins of the exposure consisted of yellowish grey sandy loams soil, derived from the natural parent material. The artefact had been exposed by erosion processes and likely displaced by fluvial movement. The area was highly disturbed by natural processes and retained no potential for intact archaeological deposit. Suntop IF 1 is described in Table 6.

**Table 6. Artefact at Suntop IF 1**

| Artefact type | Raw material | Length (mm) | Width (mm) | Thickness (mm) | Notes |
|---|---|---|---|---|---|
| Core | Chert | 45 | 40 | 20 | Yellowish grey chert unidirectional core, cortex 26-51% |




**Plate 19. Chert core identified at Suntop IF 1**



**Plate 20. Suntop IF 1, exposure in foreground, facing south east**

## 9.2 Suntop IF 2

Suntop IF 2 comprised a single chert flake. The site was also located on the southern banks of the second order creek line, a tributary to Barneys Creek, within the southern part of Lot 90 DP657805, approximately 115 metres south of Suntop IF 1. The artefact was observed in an exposure approximately 20 metres south of the unnamed creek. The ground gently inclined to the south to a low spurline extending south east to north west that was also intersected with irrigation channels. The site was located around 1.4 kilometres south of Suntop Road within an open area with no tree cover. A small stand of young replanted trees was located approximately 350 metres to the north west, on the northern side of the creek.

Visibility across the surface of the exposure was moderate, with swamp tussocks within the creek bed and short dry grass cover bordering the exposure area. Site condition was generally poor, with the area affected by stock movement and continued sheet erosion from fluvial movement along the drainage line. Sediment observed both in and along the margins of the exposure consisted of yellowish grey sandy loams soil, derived from the natural parent material. The artefact had been exposed by erosion processes and likely displaced by fluvial movement. The area was highly disturbed by natural processes and retained no potential for intact archaeological deposit. Suntop IF 2 is described in Table 7 and shown in Plate 21.

**Table 7. Artefact at Suntop IF 2**

| Artefact type | Raw material | Length (mm) | Width (mm) | Thickness (mm) | Notes |
|---|---|---|---|---|---|
| Flake | Chert | 43 | 32 | 4 | Pale brown flake |




**Plate 21. Chert flake identified at Suntop IF 2**

# 10 Discussion

Field survey of the study area identified two Aboriginal archaeological sites, both isolated chert artefacts in disturbed contexts. These findings were consistent with the known archaeology of the local and regional area, namely, isolated artefacts and low density artefact scatters can be found anywhere across the landscape in association with waterways, consisting of chert, silcrete and occasional quartz and volcanics artefacts. Density of artefact scatters are directly influenced by stream order, with density and complexity of sites increasing with higher order streams. The identified artefacts were located on a creek bank of a second order drainage line within the Macquarie River catchment area. Site locations within the drainage channel were affected by various erosional and depositional processes. The artefacts had been exposed by erosion processes and likely displaced by flood events or fluvial movement. The surrounding area was highly disturbed by natural processes and retained no potential for intact archaeological deposit.

Field inspection also located one culturally significant tree at the western extent of the study area. The tree had a scar which could not be positively identified as being culturally modified, however it was identified by Wellington LALC as being of high cultural significance to local Aboriginal people. It was recommended the tree be avoided by proposed activities.

No other Aboriginal archaeological sites, Aboriginal cultural heritage items or areas of archaeological potential were identified within the study area.

An assessment of archaeological potential within the study area was conducted during the archaeological survey. The characterisation of archaeological potential was based on several factors known to influence both the location and preservation of archaeological sites within the study area. These factors included landform context, gradient, erosion, distance to water, integrity of the ground surface and assessment of past land use disturbance.

Previous Aboriginal cultural and archaeological assessments within the wider region recorded very sparse evidence of past occupation within lower order waterways. According to the predictive model for the Wellington Valley, density and complexity of sites were directly related to landform, soils, distance to waterways, geological formations and levels of past land use disturbance. Overall, higher density and complex Aboriginal sites were recorded along permanent watercourses, as occupation was more intensive along major waterways. Smaller open sites were located along intermittent creeks, with isolated artefacts found along minor drainage lines, on slopes and ridge crests, representing less intensive occupation. Geological formations were determinants for particular site types. Grinding grooves and stone arrangements were located in areas with suitable stone outcrops. Raw material and ochre quarries were located in areas where natural sources of stone and ochre occur. Scarred trees were located in areas of remnant mature vegetation. The closest previously recorded Aboriginal sites to the study area included scarred trees, low density artefact scatters and grinding groove sites.

In assessing the preservation of archaeological deposits, depth of topsoil and its nature should be considered. Some soils are subject to erosion and not prone to preserving subsurface deposits. Previous land use practices can also influence preservation of archaeological material. Land clearance including removal of trees would have impacted on the topsoil and mixed deposits, therefore possibly exposing subsurface cultural material and causing a loss of archaeological context. This practice often resulted in removal of big native trees that had been possibly culturally modified. Land used for agricultural purposes has also gone through some level of previous disturbance where topsoil has been displaced and mixed and although any archaeological material present may not be removed, it would not be in its primary (archaeological) context. Where significant ground disturbance has occurred associated with construction of houses, infrastructure, dams and irrigation channels, it is likely that any archaeological deposits would have been removed or displaced.

The study area was located within undulating rises, hillslopes and second and first order creek lines. Drainage lines within the study area formed part of the Macquarie River catchment. Due to an abundance of resources within the surrounding landscapes including the riverine environments of Little River and Macquarie River, as well as the surrounding hills, Mt Duke and Mt Arthur, it is most likely that Aboriginal people had used the study area as a transient corridor. Soils present within the study area are red earths that are colluvial-alluvial derived from the parent rock. The erosional nature of these soils has the potential to expose archaeological material. Fluvial processes have also likely displaced Aboriginal cultural material. Previous land use practices including extensive land clearing would have removed mature native vegetation including any mature trees that could have contained Aboriginal cultural modifications.

The study area was assessed as having low archaeological sensitivity. Its past use by Aboriginal people was likely transient and occasional. Artefacts identified represent a background scatter, or cultural material that was lost or discarded. The study area had been highly disturbed by past land use practices and natural processes and retained no potential for intact archaeological deposit. Landforms surrounding the study area on the other hand were extensively used in the past by Aboriginal people and attest to the high cultural significance of the wider Macquarie River and Wellington area.

# 11 Scientific Values and Significance Assessment

## 11.1 Assessment Criteria

One of the primary steps in the process of cultural heritage management is the assessment of significance. Not all sites are equally significant and not all are worthy of equal consideration and management (Sullivan and Bowdler 1984; Pearson and Sullivan 1995:7). The determination of significance can be a difficult process as the social and scientific context within which these decisions are made is subject to change (Sullivan and Bowdler 1984). This does not lessen the value of the heritage approach, but enriches both the process and the long term outcomes for future generations as the nature of what is conserved and why, also changes over time.

The assessment of significance is a key step in the process of impact assessment for a proposed activity as the significance or value of an object, site or place will be reflected in resultant recommendations for conservation, management or mitigation.

The *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010b) requires significance assessment according to criteria established in the *Australia ICOMOS Burra Charter* (Australia ICOMOS 2013). The *Burra Charter* and its accompanying practice notes are considered best practice standard for cultural heritage management, specifically conservation, in Australia. 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; and
- 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. "Social or cultural value can only be identified though consultation with Aboriginal people" (OEH 2011:8).

The assessment of these values are brought together to form a comprehensive assessment of significance.

## 11.2 Statement of significance

Two Aboriginal archaeological sites, isolated finds Suntop IF 1 and Suntop IF 2, were identified in the study area during the field inspection. Artefacts consisted of one core and one flake, both of chert. The artefacts were situated approximately 115 metres apart on the second order creek bank, within erosional scours. Artefacts had been subject to post-depositional movement, including erosion and fluvial processes and were not *in situ*. The area was highly disturbed by natural processes and retained no potential for intact archaeological deposit. Due to their disturbed context, the sites displayed low archaeological significance. Very low density scatters and isolated artefacts associated with low order drainage lines were a common site type within the wider region. The finds were consistent with the predictive model for the study area.

A culturally significant tree was also identified at the western extent of the study area. The tree was a *Eucalyptus sp.* and contained one scar that could not be positively identified as being of cultural origin. The tree holds high cultural significance to local Aboriginal people. It was recommended that the tree be conserved *in situ* and all proposed impacts avoid the location of the tree.

The types of sites identified in the study area were consistent with known Aboriginal heritage across the Wellington Valley, specifically within the Little River area and with predictions made for the study area. All identified Aboriginal heritage features are consistent with the known archaeological record for the immediate locality. They are not considered to be rare or unique, however, they can be seen to be representative of the types of sites in the area.

The sites hold value to the local Aboriginal community. Wellington Local Aboriginal Land Council stated that all Aboriginal objects, archaeological sites and items of cultural significance contained within the study area hold very high cultural significance and should be avoided by the proposed works.

# 12 Impact Assessment

The impact footprint of the proposed solar panels, substation, maintenance compound and buildings, fencing and access roads will be situated within the Solar Farm Boundary in addition to the area of the proposed upgrades works at the intersection of Renshaw McGirr Way and Suntop Road are shown on Figure 7. The proposed solar farm will occupy approximately 91% of the western study area with the remaining land retained as existing agricultural land. Based on this proposal, an impact assessment can be made for the identified Aboriginal archaeological and cultural heritage features at 909 Suntop Road, Suntop.

Identified Aboriginal archaeological sites, isolated finds Suntop IF 1 and Suntop IF 2 were located within the riparian corridor associated with the second order creek line that ran east-west across the central part of the study area. This corridor, including the Aboriginal sites, is outside the Solar Farm Boundary proposed impact footprint. Sites Suntop IF 1 and Suntop IF 2 will not be impacted by the proposed solar farm development.

A tree that was identified as holding cultural significance to local Aboriginal people is located within the western extent of the study area that will not be impacted by the proposed solar farm development. The tree is located approximately 35 metres west of the proposed Solar Farm Boundary, within an easement adjacent to Lot 2 DP506925.

The remainder of the study area was assessed as exhibiting low archaeological potential due to combinations of archaeologically unfavourable topography, agricultural activity, previous road construction activities and contemporary disturbance of the land.

Based on desktop review, consultation with the local Aboriginal community, archaeological survey of the study area and proposed impact footprint, provided the identified Aboriginal archaeological sites and culturally significant tree are avoided, the proposed construction and operation of the Suntop Solar Farm and the upgrade works to the intersection of Renshaw McGirr Way and Suntop Road would not impact on Aboriginal heritage.

**Cumulative Impacts**
The proposed Suntop solar farm will avoid impact to Aboriginal heritage objects, in this regard, no cumulative impact will occur to Aboriginal heritage.

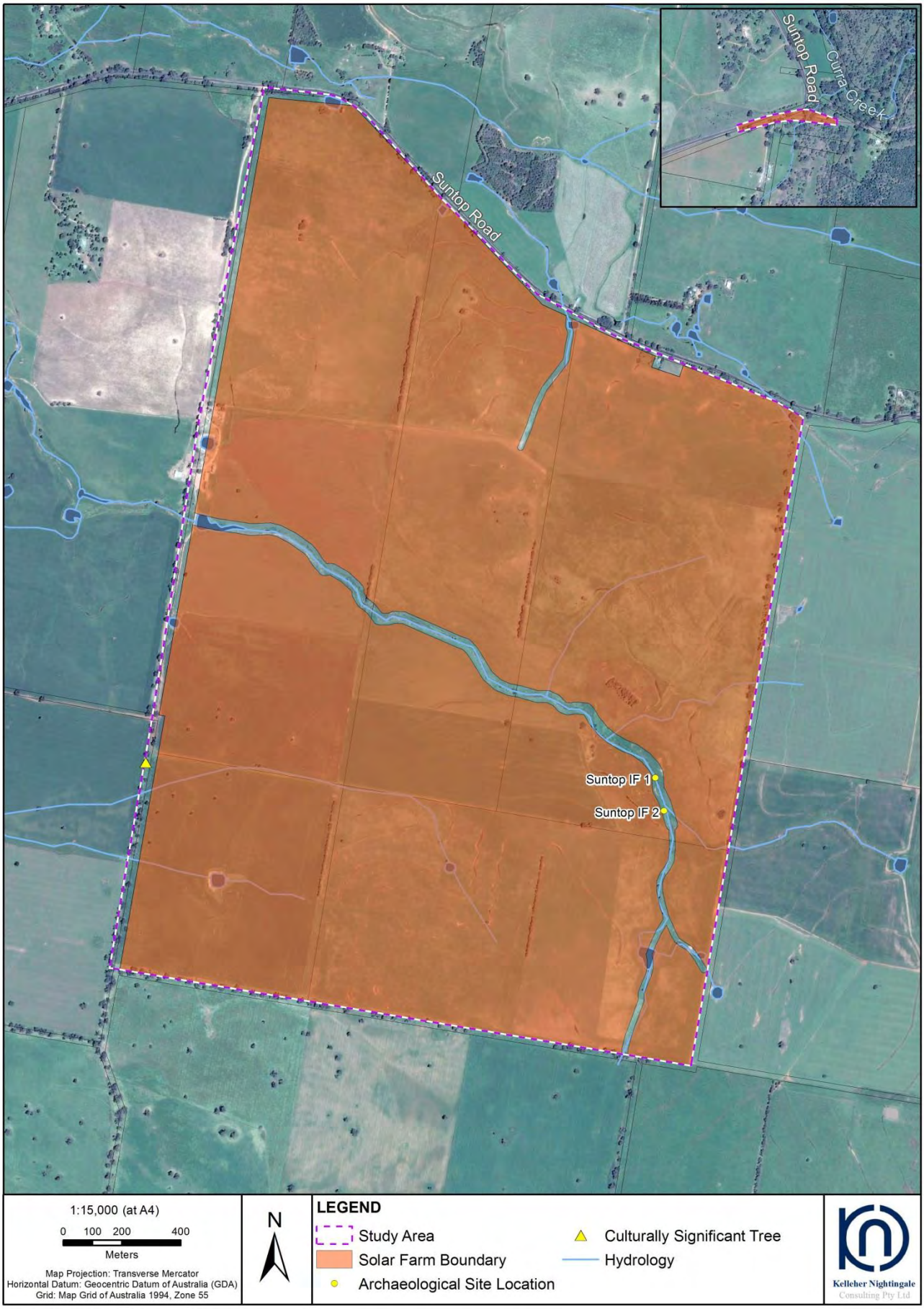



**Figure 7. Proposed development and identified Aboriginal heritage**

# 13 Conclusions and Recommendations

No impact to Aboriginal heritage will occur as a result of the proposed Suntop Solar Farm and upgrade works to the intersection of Renshaw McGirr Way and Suntop Road.

Background research, desktop assessment, consultation with the local Aboriginal community and archaeological field survey identified three heritage sites within the study area, but the sites are not within the project footprint and are not impacted by the proposal:

- Aboriginal archaeological sites, Suntop IF 1 and Suntop IF 2, two isolated artefacts identified along a creek bank and retained within the riparian corridor; and
- Culturally significant tree as identified by the Wellington Local Aboriginal Land Council, situated outside the proposed solar farm boundary in an adjacent easement.

All of the other areas within the study area exhibited low archaeological potential due to combinations of archaeologically unfavourable topography, agricultural activity, past road construction activities and contemporary disturbance of the land.

Proposed works associated with the solar farm development will not impact on identified areas of Aboriginal cultural heritage significance. The culturally significant tree will be retained in its current setting along the western boundary of the study area and the two isolated finds will be retained within the riparian corridor of the central drainage line.

Provided the identified Aboriginal archaeological sites and culturally significant tree are avoided, the proposed construction and operation of the Suntop Solar Farm and upgrade works to the intersection of Renshaw McGirr Way and Suntop Road would not impact on Aboriginal heritage. In accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* the proposed activities can proceed with caution.

It is recommended that the identified site locations (Suntop IF 1, Suntop IF 2 and culturally significant tree) should be included within the construction environment management plan for the Suntop Solar Farm.

## References


Australia ICOMOS 2013. *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*. Australia ICOMOS Incorporated, Burwood, Victoria.

Australian Museum Business Services (AMBS) 2008. Wellington Gas Pipeline, Power Station & Compressor Station Heritage Assessment. Prepared for Parsons Brinckerhoff.

Balme, J. 1985. A Preliminary Archaeological Assessment of the Moree Plains Shire Council Region.

Bell, D. 1982. Aboriginal Carved Trees in South Eastern Australia. Report to NSW National Parks and Wildlife Service.

Bell, D. 1979-1980. Aboriginal Carved Trees in New South Wales. 2 parts. Report to NSW National Parks and Wildlife Service.

CNS Project Management 2010. ERM Power Pty Ltd Young to Wellington Gas Pipeline: Cultural Heritage Assessment and Consultation. Report for ERM Power Pty Ltd.

Department of Environment, Climate Change and Water (DECCW) 2010a. *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*. Department of Environment, Climate Change and Water, Sydney, NSW.

DECCW 2010b. *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales: Part 6 National Parks and Wildlife Act 1974*. Department of Environment, Climate Change and Water NSW, Sydney.

Department of Environment and Conservation (NSW) 2005. Aboriginal scarred trees in New South Wales: a field manual. Andrew Long, Department of Environment and Conservation (NSW), Hurstville, NSW.

Etheridge, R. 1918. The 'Dendroglyphs' or 'carved trees' of New South Wales. *Memoirs of the Geological Survey of New South Wales*. Ethnological Series No. 3. Government Printer, Sydney.

Haglund, L. 1985. Assessment of the prehistoric heritage in Mudgee Shire.

Koettig, M. 1985. Assessment of Aboriginal sites in the Dubbo City area. Report to Dubbo City Council.

Murphy, B.W. and J.W.Lawrie. 1998. *Soil Landscape of the Dubbo 1:250 000 Sheet.* Department of Land and Water Conservation.

NSW National Parks and Wildlife Services (NPWS) 2003. The Bioregions of NSW: Their Biodiversity, Conservation and Histories.

NSW NPSW 2002. Little River Catchment Biodiversity Assessment. Report for TARGET project.

NSW NPSW 1993. Aboriginal People at Wellington: Holding on to Land and Heritage. Barbara Le Maistre, NSW National Parks and Wildlife Service, Aboriginal Heritage Branch.

Office of Environment and Heritage (OEH), 2011. *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW: Part 6 National Parks and Wildlife Act 1974*. Office of Environment and Heritage, Department of Premier and Cabinet, Sydney South, NSW.

OzArk Environmental and Heritage Management Pty Ltd 2013. Aboriginal Heritage Assessment: Gunnedah Second Road Over Rail Bridge. Report to Kellogg Brown and Root Pty Ltd for Roads and Maritime Services Grafton.

Pearson, M. 1981. Seen through different eyes, unpublished PhD Thesis, Department of Archaeology and Anthropology, ANU, Canberra.

Pearson, M. and S. Sullivan, 1995. *Looking after heritage places: the basics of heritage planning for managers, landowners and administrators*. Carlton, VIC: Melbourne University Press.

Speight, J.G. 1998. 'Landform' in McDonald *et al*. 1998. *Australian Soil and Land Survey Field Handbook*. CSIRO Australia.

Sullivan, S. and Bowdler, S. 1984. *Site Survey and Significance Assessment in Australian Archaeology*. Research School of Pacific Studies, Australian National University, Canberra.

Tindale, N.B. 1974. *Aboriginal Tribes of Australia*. ANU Press, Canberra.

# Appendix A Wellington Local Aboriginal Land Council Report

1

# Suntop Cultural Survey

## 26 February 2018



**Mike Nolan**

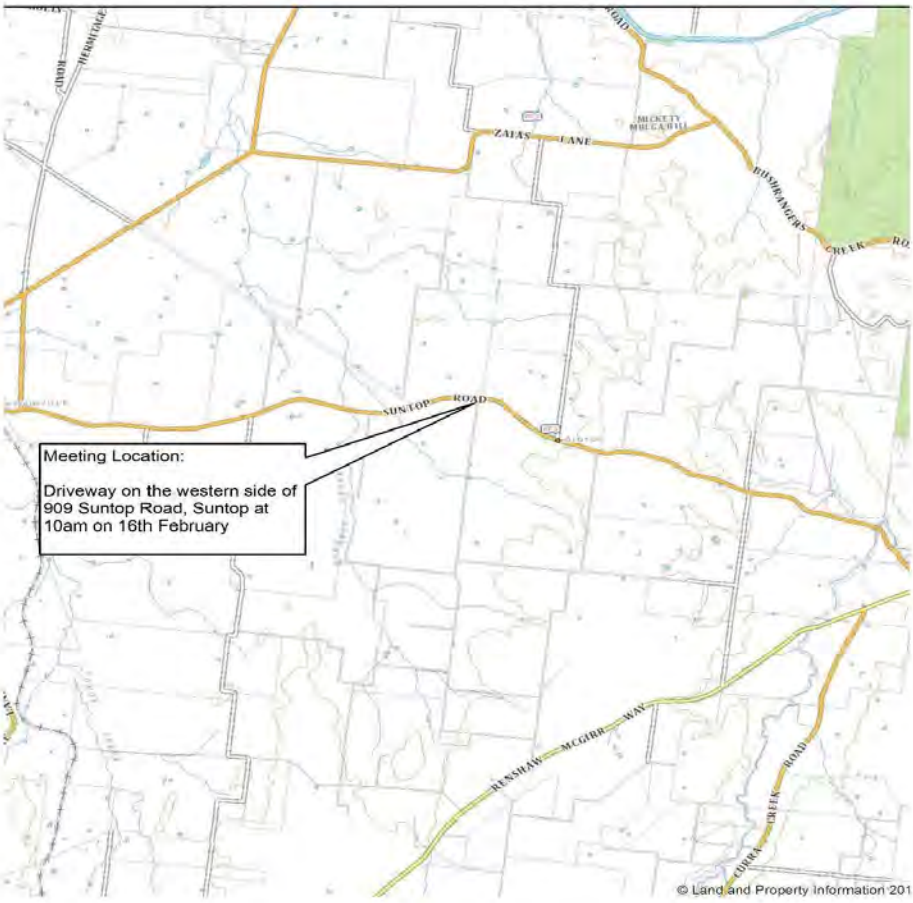
**Rep from Wellington Aboriginal Land Council**

2

# Introduction.

I have been engaged by the Wellington LALC to participate in a cultural heritage assessment for a proposed development on a property to the west of Wellington at 909 Suntop Road, Suntop. The proposed activity is the construction of a Solar farm. The archaeological consultants carrying out the main assessments are Kelleher Nightingale Consulting Pty Ltd. The archaeologist accompanying myself was Dr Matthew Kelleher. The assessment was conducted on the 26th of February 2018.

Location of the survey:



**Considerations of the survey**

Prior to carrying out the survey, a number of considerations were made. Given my local knowledge of the area and the landscape in which Suntop is located, particular attention was taken when identifying the following site types:

- Open camp sites
- Culturally significant modified trees
- Grinding grooves
- Quarry sites
- Stone arrangements
- Isolated artefacts

The site is located some distance from permanent creeks and the Wambool (Macquarie) River where there is a greater concentration of culturally significant materials and sites. It is also noted that there have been no recorded sites registered on the Aboriginal Heritage Information Management System (AHIMS) managed by the Office of Environment and Heritage within the survey area.

The survey area has been greatly modified. It appears that land clearing has been carried out along with farming/agricultural activities. This has included the constructions of buildings, fences, power lines, internal roads, dams, and activities such as grazing, cropping and rock picking (rocks have been collected and placed in piles). The southern end of the property also has a large construction of what seemed to be culverts.

**Conducting the Survey**

The method in which the survey was to be conducted was discussed onsite. It was decided that the survey would be done both from the vehicle and on foot. Particular attention was given to the following:

- Water sources, creeks, channels, dams, springs
- High and low points (it is my practice to inspect both the highest and the lowest points on the property)
- Old growth trees, any trees with a decent girth and in particular Box trees
- Places showing significant erosion

4

- Any area where there will be significant disturbance to the ground

Survey Area



5

**Findings**

During the survey two isolated artefacts were found on the eastern side of the property and one culturally significant modified tree on the western boundary.



**Recommendations**

1. Isolated artefacts

Both artefacts were found along a creek line on the eastern boundary. As this area will not be impacted by the proposed development, the Wellington LALC have no concerns in relation to the development impacting on this site. The LALC requests that the artefacts be recorded and that the property owner be informed.

2. Modified Tree

This tree is also outside the footprint of the proposed development. The LALC has no concerns for this tree in relation to the proposed development. The LALC requests that the site be recorded and that the property owner be informed to ensure that it is not impacted by other activities.

3. Other Material

If further culturally significant materials are identified during the construction of the solar farm, the LALC requests that OEH and the Wellington LALC itself be informed immediately and that works will cease.

**In Conclusion**

The Wellington Local Aboriginal Lands Council have no objections to the proposed solar farm development as presented to the LALC provided that the cultural values identified are not impacted on.

# Appendix B AHIMS Search Results

Office of Environment & Heritage

# AHIMS Web Services (AWS)

## Extensive search - Site list report

Your Ref/PO Number : 1711_05

Client Service ID : 331634

| SiteID | SiteName | Datum | Zone | Easting | Northing | Context | Site Status | SiteFeatures | SiteTypes | Reports |
|---|---|---|---|---|---|---|---|---|---|---|
| 36-4-0085 | Raroo | AGD | 55 | 664293 | 6385357 | Open site | Valid | Modified Tree (Carved or Scarred) : 1 | | |
| | Contact | Recorders | Miss.Rebeeca Ogden-Brunell | | | | | Permits | | |
| 36-4-0086 | Raroo 2 | AGD | 55 | 664345 | 6385396 | Open site | Valid | Modified Tree (Carved or Scarred) : 1 | | |
| | Contact | Recorders | Miss.Rebeeca Ogden-Brunell | | | | | Permits | | |
| 36-4-0087 | Raroo 3 | AGD | 55 | 663923 | 6384944 | Open site | Valid | Modified Tree (Carved or Scarred) : 1 | | |
| | Contact | Recorders | Miss.Rebeeca Ogden-Brunell | | | | | Permits | | |
| 36-4-0088 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | | | | | Open site | Valid | | | |
| | Contact | Recorders | Miss.Rebeeca Ogden-Brunell,Mr.Bradley Bliss,Wellington Valley Wiradjuri Aborigir | | | | | Permits | | |
| 36-4-0089 | Suntop Road Scarred Trees | AGD | 55 | 674612 | 6393510 | Open site | Valid | Modified Tree (Carved or Scarred) : 1 | | |
| | Contact | Recorders | Miss.Rebeeca Ogden-Brunell,Mr.Bradley Bliss,Wellington Valley Wiradjuri Aborigir | | | | | Permits | | |
| 36-4-0091 | PR-ST-05 | AGD | 55 | 660880 | 6384510 | Open site | Valid | Modified Tree (Carved or Scarred) : - | | |
| | Contact | Recorders | LNolan | | | | | Permits | | |
| 36-4-0092 | PR-ST-01 same as 36-1-0126 | AGD | 55 | 680110 | 6394170 | Open site | Valid | Modified Tree (Carved or Scarred) : - | | |
| | Contact | Recorders | LNolan | | | | | Permits | | |
| 36-4-0093 | PR-ST-02 | AGD | 55 | 661570 | 6384920 | Open site | Valid | Modified Tree (Carved or Scarred) : - | | |
| | Contact | Recorders | LNolan | | | | | Permits | | |
| 36-4-0094 | PR-ST-04 | AGD | 55 | 660950 | 6384560 | Open site | Valid | Modified Tree (Carved or Scarred) : - | | |
| | Contact | Recorders | LNolan | | | | | Permits | | |
| 36-4-0095 | PR-ST-03 | AGD | 55 | 661370 | 6384840 | Open site | Valid | Modified Tree (Carved or Scarred) : - | | |
| | Contact | Recorders | LNolan | | | | | Permits | | |
| 36-4-0097 | STP-1F-1 | AGD | 55 | 680780 | 6396810 | Open site | Valid | Artefact : - | | 102779 |

**Report generated by AHIMS Web Service on 05/03/2018 for Benjamin Anderson for the following area at Datum : GDA, Zone : 55, Eastings : 660300 - 682700, Northings : 6381900 - 6405250 with a Buffer of 0 meters. Additional Info : Archaeological Assessment. Number of Aboriginal sites and Aboriginal objects found is 47**

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Page 1 of 4

Office of Environment & Heritage

# AHIMS Web Services (AWS)

## Extensive search - Site list report

Your Ref/PO Number : 1711_05

Client Service ID : 331634

| SiteID | SiteName | Datum | Zone | Easting | Northing | Context | Site Status | SiteFeatures | SiteTypes | Reports |
|---|---|---|---|---|---|---|---|---|---|---|
| | Contact | Recorders | Central West Archaeological and Heritage Services Pty Ltd | | | | | Permits | | |
| 36-3-0143 | Spring Ck.; | AGD | 55 | 674190 | 6404810 | Open site | Valid | Artefact : - | Open Camp Site | 1333 |
| | Contact | Recorders | Warren Bluff | | | | | Permits | | |
| 36-4-0081 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | | | | | Open site | Valid | | | 102211,102779 |
| | Contact | Recorders | Lloyd Nolan,Mr.Bradley Bliss,Wellington Valley Wiradjuri Aboriginal Corporation | | | | | Permits | | |
| 36-4-0025 | Wellington;WF1;Baalbek; | AGD | 55 | 679980 | 6399950 | Open site | Valid | Artefact : - | Open Camp Site | 975,102779 |
| | Contact | Recorders | Mr.Allan Lance | | | | | Permits | | |
| 36-4-0028 | Macquarie Park/WF4;Macquarie Park; | AGD | 55 | 675690 | 6398510 | Open site | Valid | Artefact : - | Open Camp Site | 975,102211 |
| | Contact | Recorders | Mr.Allan Lance | | | | | Permits | | |
| 36-1-0038 | Maryvale Creek | AGD | 55 | 678375 | 6402718 | Open site | Valid | Stone Arrangement : -, Stone Quarry : -, Artefact : - | Quarry | 102211 |
| | Contact | Recorders | Michael Pearson | | | | | Permits | | |
| 36-1-0041 | Maryvale Creek 2 | AGD | 55 | 679288 | 6402684 | Open site | Valid | Modified Tree (Carved or Scarred) : - | Scarred Tree | 102211 |
| | Contact | Recorders | Michael Pearson | | | | | Permits | | |
| 36-1-0042 | Maryvale Creek 1 | AGD | 55 | 679288 | 6402684 | Open site | Valid | Modified Tree (Carved or Scarred) : 1 | Scarred Tree | 102211 |
| | Contact | Recorders | Michael Pearson | | | | | Permits | | |
| 36-4-0049 | Baalbek/WF 2;Wellington; | AGD | 55 | 678340 | 6400400 | Open site | Valid | Artefact : - | Open Camp Site | 975,102211 |
| | Contact | Recorders | Mr.Allan Lance | | | | | Permits | | |
| 36-4-0050 | Macquarie Park/WF3;Wellington;Macquarie Park; | AGD | 55 | 676900 | 6400280 | Open site | Valid | Artefact : - | Open Camp Site | 975,102211 |
| | Contact | Recorders | Mr.Allan Lance | | | | | Permits | | |
| 36-3-0142 | Spring Ck; | AGD | 55 | 673840 | 6404800 | Closed site | Valid | Shell : -, Artefact : - | Shelter with Midden | 1333 |
| | Contact | Recorders | Warren Bluff | | | | | Permits | | |
| 36-4-0009 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | | | | | Open site | Valid | | | 65,102779 |
| | Contact | Recorders | David Bell,Mr.Bradley Bliss,Wellington Valley Wiradjuri Aboriginal Corporation | | | | | Permits | | |
| 36-4-0011 | Yullundry Road; | AGD | 55 | 674034 | 6384589 | Open site | Valid | Modified Tree (Carved or Scarred) : - | Carved Tree | 65 |
| | Contact | Recorders | David Bell | | | | | Permits | | |
| 36-4-0013 | Arthurville; | AGD | 55 | 660749 | 6396064 | Open site | Valid | Artefact : - | Open Camp Site | |
| | Contact | Recorders | Mr.Warwick Pearson | | | | | Permits | | |

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Page 2 of 4

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## Extensive search - Site list report

Your Ref/PO Number : 1711_05

Client Service ID : 331634

| SiteID | SiteName | Datum | Zone | Easting | Northing | Context | Site Status | SiteFeatures | SiteTypes | Reports |
|---|---|---|---|---|---|---|---|---|---|---|
| 36-4-0014 | Baalveck;Micketymulga Hill; | AGD | 55 | 679219 | 6400857 | Open site | Valid | Ceremonial Ring (Stone or Earth) : -, Artefact : - | Bora/Ceremonial,Open Camp Site | 102211 |
| | Contact | Recorders | Michael Pearson | | | | | Permits | | |
| 36-4-0003 | Suntop; | AGD | 55 | 669019 | 6397125 | Open site | Valid | Grinding Groove : - | Axe Grinding Groove | |
| | Contact | Recorders | Bert Button | | | | | Permits | | |
| 36-4-0007 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | | | | | Open site | Valid | | | 65 |
| | Contact | Recorders | David Bell,D.H Simmons,Mr.Bradley Bliss,Wellington Valley Wiradjuri Aboriginal C | | | | | Permits | | |
| 36-4-0075 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | | | | | Open site | Valid | | | 1333 |
| | Contact | Recorders | Warren Bluff,Mr.Bradley Bliss,Wellington Valley Wiradjuri Aboriginal Corporation | | | | | Permits | | |
| 36-1-0123 | Walmer; | AGD | 55 | 661600 | 6385000 | Open site | Valid | Modified Tree (Carved or Scarred) : - | Scarred Tree | 1333 |
| | Contact | Recorders | Warren Bluff | | | | | Permits | | |
| 36-1-0126 | Curra Creek; | AGD | 55 | 680110 | 6394170 | Open site | Valid | Modified Tree (Carved or Scarred) : - | Scarred Tree | 1333 |
| | Contact | Recorders | Warren Bluff | | | | | Permits | | |
| 36-4-0016 | Macquarie Park; | AGD | 55 | 673740 | 6401063 | Open site | Valid | Hearth : -, Artefact : - | Open Camp Site | 102211 |
| | Contact | Recorders | G.W. Althofer,Michael Pearson | | | | | Permits | | |
| 36-4-0017 | Maryvale Creek;Micketymulga Hill; | AGD | 55 | 679254 | 6401770 | Open site | Valid | Artefact : - | Open Camp Site | 102211 |
| | Contact | Recorders | Mr.Warwick Pearson | | | | | Permits | | |
| 36-4-0018 | Arthurville;Bushrangers Hill; | AGD | 55 | 661765 | 6398769 | Open site | Valid | Grinding Groove : - | Axe Grinding Groove | |
| | Contact | Recorders | Mr.Warwick Pearson | | | | | Permits | | |
| 36-4-0020 | Maryvale Creek; | AGD | 55 | 678375 | 6402718 | Open site | Valid | Stone Quarry : -, Stone Arrangement : - | Stone Arrangement | 102211 |
| | Contact | Recorders | G.W. Althofer,Michael Pearson | | | | | Permits | | |
| 36-4-0021 | Baalveck; | AGD | 55 | 679151 | 6399030 | Open site | Valid | Aboriginal Ceremony and Dreaming : -, Stone Arrangement : - | Stone Arrangement | 102779 |
| | Contact | Recorders | G.W. Althofer,Michael Pearson | | | | | Permits | | |
| 36-4-0023 | Walmer;Wellington; | AGD | 55 | 661300 | 6384700 | Open site | Valid | Modified Tree (Carved or Scarred) : - | Carved Tree | |

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Page 3 of 4

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## Extensive search - Site list report

Your Ref/PO Number : 1711_05

Client Service ID : 331634

| SiteID | SiteName | Datum | Zone | Easting | Northing | Context | Site Status | SiteFeatures | SiteTypes | Reports |
|---|---|---|---|---|---|---|---|---|---|---|
| | Contact | Recorders | P Gresser | | | | | Permits | | |
| 36-4-0024 | Mountain View;Wellington; | AGD | 55 | 673400 | 6385300 | Open site | Valid | Modified Tree (Carved or Scarred) : - | Carved Tree | 975 |
| | Contact | Recorders | Michael Pearson | | | | | Permits | | |
| 36-4-0161 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | | | | | Open site | Valid | | | |
| | Contact | Recorders | Mr.Bradley Bliss,Wellington Valley Wiradjuri Aboriginal Corporation | | | | | Permits | | |
| 36-4-0162 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | | | | | Open site | Valid | | | |
| | Contact | Recorders | Mr.Bradley Bliss,Wellington Valley Wiradjuri Aboriginal Corporation | | | | | Permits | | |
| 36-4-0133 | Restriction applied. Please contact ahims@environment.nsw.gov.au. | | | | | Open site | Valid | | | |
| | Contact | Recorders | Mr.Bradley Bliss,Wellington Valley Wiradjuri Aboriginal Corporation | | | | | Permits | | |
| 36-4-0079 | Wellington | AGD | 55 | 682000 | 6397000 | Open site | Valid | Burial : - | Burial/s | 2641,102779 |
| | Contact | Recorders | Ms.Adrienne Howe-Piening | | | | | Permits | | |
| 36-4-0001 | Bell River;Triplet Cave; | AGD | 55 | 681966 | 6388772 | Open site | Valid | Burial : - | Burial/s | 102779 |
| | Contact | Recorders | Osbourne | | | | | Permits | | |
| 36-4-0090 | W/STP-ST-1 | AGD | 55 | 680750 | 6397060 | Open site | Valid | Modified Tree (Carved or Scarred) : 1 | | 97979,102779 |
| | Contact | Recorders | Jim Kelton | | | | | Permits | | |
| 36-4-0110 | WETL-IF1 | GDA | 55 | 678987 | 6391870 | Open site | Valid | Artefact : 1 | | 101691 |
| | Contact | Recorders | Doctor Jodie Benton | | | | | Permits | | |
| 36-4-0111 | WETL-OS2 with PAD | GDA | 55 | 679188 | 6392398 | Open site | Valid | Artefact : 1, Potential Archaeological Deposit (PAD) : - | | 101691 |
| | Contact | Recorders | Doctor Jodie Benton | | | | | Permits | | |
| 36-4-0112 | WETL-OS3 | GDA | 55 | 678876 | 6391510 | Open site | Valid | Artefact : 1, Potential Archaeological Deposit (PAD) : - | | 101691 |
| | Contact | Recorders | Doctor Jodie Benton | | | | | Permits | | |
| 36-4-0113 | WETL-OS1 with PAD | GDA | 55 | 680208 | 6393131 | Open site | Valid | Artefact : 1, Potential Archaeological Deposit (PAD) : - | | 101691 |
| | Contact | Recorders | Doctor Jodie Benton | | | | | Permits | | |

**Report generated by AHIMS Web Service on 05/03/2018 for Benjamin Anderson for the following area at Datum : GDA, Zone : 55, Eastings : 660300 - 682700, Northings : 6381900 - 6405250 with a Buffer of 0 meters. Additional Info : Archaeological Assessment. Number of Aboriginal sites and Aboriginal objects found is 47**

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Page 4 of 4

# Suntop Solar Farm Bushfire Risk Assessment

Prepared for
**Pitt & Sherry (Operations) Pty Ltd**

15 May 2018







BPAD
Bushfire
Planning & Design
Accredited Practitioner
Level 3

## DOCUMENT TRACKING

| Item | Detail |
|---|---|
| Project Name | Suntop Solar Farm Bushfire Risk Assessment |
| Project Number | 17HNG_8591 |
| Project Manager | Rod Rose<br>0402 054 751<br>1/51 Owen Street, Huskisson NSW 2540 |
| Prepared by | Adrian Pyrke |
| Reviewed by | Bruce Horkings FPAA BPAD-A Certified Practitioner No. BPAD29962-L3 |
| Approved by | Bruce Horkings |
| Status | Final |
| Version Number | 4 |
| Last saved on | 15 May 2018 |

This report should be cited as 'Eco Logical Australia May 2018. *Suntop Solar Farm Bushfire Risk Assessment*. Prepared for Pitt & Sherry (Operations) Pty Ltd.'

## ACKNOWLEDGEMENTS

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Template 08/05/2014

# Contents

**Glossary of Terms** ..... **v**

**Abbreviations** ..... **vi**

**1 Introduction** ..... **7**
1.1 Background ..... 7
1.2 Aims and objectives ..... 7

**2 Bushfire Risk Assessment** ..... **8**
2.1 Fire climate ..... 8
2.2 Fuel hazard ..... 10
2.3 Fire behaviour potential ..... 11
2.4 Fire ignitions ..... 13
2.5 Fire history ..... 14
2.6 Assets at risk ..... 14
2.7 Fire-fighter and public safety ..... 14
2.8 Bushfire scenarios ..... 15

**3 Mitigation Strategies** ..... **15**
3.1 Overview ..... 15
3.2 Asset Protection Zone ..... 16
3.3 The substation ..... 17
3.4 Solar farm construction ..... 17
3.5 Solar farm ongoing operations ..... 17
3.6 Shielding of solar farm components ..... 18
3.7 Fire risks from PV system ..... 18
3.8 Water storage ..... 19
3.9 Summary of recommended mitigation strategies ..... 19

**4 Cumulative Impacts** ..... **20**

**References** ..... **21**

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# List of Tables

Table 1: Where the SEARs requirements are addressed in this document ..... 7

Table 2: Average number of days per year of daily Grassland Fire Danger Rating and GFDI categories at 3 pm at Wellington (D&J Rural) ..... 8

Table 3: Number of days in each month of daily Fire Danger Rating and GFDI categories at 3 pm at Wellington (D&J Rural) ..... 9

Table 4: Number of days in eight wind direction categories with significant grass fire weather at 3 pm at Wellington (D&J Rural) ..... 10

Table 5: Fire behaviour predicted for grassland fires for 'cut/grazed' fuel (Cheney et al 1998) ..... 12

Table 6: Fire behaviour predicted for grassland fires for 'eaten out' fuel (Cheney et al 1998) ..... 13

Table 7: Summary of recommended mitigation strategies and actions ..... 19

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# Glossary of Terms

| Term | Description |
|---|---|
| Assets | Anything valued by people which includes houses, crops, forests and, in many cases, the environment. |
| Bushfire | Unplanned vegetation fire. A generic term which includes grass fires, forest fires and scrub fires both with and without a suppression objective. |
| Bushfire Attack Level (BAL) | A means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, which is the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire. |
| Contained | The status of a bushfire suppression action signifying that a control line has been completed around the fire, and any associated spot fires, which can reasonably be expected to stop the fire's spread. |
| Fire management | All activities associated with the management of fire prone land, including the use of fire to meet land management goals and objectives. |
| Fuel hazard | Fine fuels in bushland that burn in the continuous flaming zone at the fire's edge. These fuels contribute the most to the fire's rate of spread, flame height and intensity. Typically, they are dead plant material, such as leaves, grass, bark and twigs thinner than 6 mm thick, and live plant material thinner than 3 mm thick. |
| Head fire | The part of the fire where the rate of spread, flame height and intensity are greatest, usually when burning downwind or upslope. |
| Intensity | The rate of energy release per unit length of fire front usually expressed in kilowatts per metre (Kw/m). |
| Residence time | The time required for the flaming zone of a fire to pass a stationary point; the width of the flaming zone divided by the rate of spread of the fire. |
| Spotting | Behaviour of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire. |

Most terms are taken from the Bushfire Glossary prepared by the Australasian Fire and Emergency Service Authorities Council Limited (AFAC).

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# Abbreviations

| Abbreviation | Description |
|---|---|
| APZ | Asset Protection Zone |
| BAL | Bushfire Attack Level |
| ERP | Emergency Response Plan |
| GFDI | Grassland Fire Danger Index |
| RFS | New South Wales Rural Fire Service |

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# 1 Introduction

## 1.1 Background

Photon Energy (Photon) propose to construct and operate a 220-megawatt (MW) solar farm using photovoltaic (PV) technology at a 502-hectare site (the "Subject Land) in Suntop, NSW. The solar farm would occupy 472 hectares (the "Site") out of the 517 hectares (equivalent to approximately 91% of the Site). An estimated 550,000 PV panels would be installed at a fixed angle or on a single axis tracker system across the Site.

**Map 1** indicates the location of the site which is approximately 10 km southwest of the town of Wellington.

A detailed description of the site and the proposal was prepared by Pitt and Sherry (2018). The descriptions provided here relate specifically to the fire environment and risks.

## 1.2 Aims and objectives

This bushfire management plan has the following aims:

- Address the requirements identified in the Secretary's Environmental Assessment Requirements (SEARs) (**Table 1**)
- Recommend mitigation actions to
    - Protect fire-fighters in the event of a fire within the site
    - Reduce the likelihood of a bushfire impacting the site or spreading from the site

**Table 1: Where the SEARs requirements are addressed in this document**

| SEAR | Section of this document |
|---|---|
| Bushfire hazard (although not mapped as Bushfire Prone Land) | 2.2, 2.3, 2.4, 2.5 |
| 10 m trafficable defendable space (fire break) | 3.2 |
| Water storage | 3.8 |
| Setback requirements (Clause 45 SEPP) | 3.3 |
| An assessment of potential hazards and risks associated with bushfires | 2.1 to 2.8 |

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# 2 Bushfire Risk Assessment

## 2.1 Fire climate

Fire climate strongly influences the likelihood of ignitions and how often, here expressed as the average number of days per year, when fires will be uncontrollable without mitigation measures. Data from the Bureau of Meteorology weather station at Wellington (site 065034 D&J Rural), which is 10 km from the solar farm site, indicate the frequency of occurrence of grassland fire weather **Table 2**. A GFDI of 25 to 49 (Very High fire danger) occur on average 1.0 days per year, while days of GFDI >50 are very rare – three Severe/Extreme days recorded in 38 years. GFDI could not be calculated for 18.4% of the 3 pm records because of incomplete data and a random distribution of missing records should be assumed (i.e. 1.2, not 1.0, days per year of GFDI 25-49).

**Table 2: Average number of days per year of daily Grassland Fire Danger Rating and GFDI categories at 3 pm at Wellington (D&J Rural)**

| Fire Danger Rating & GFDI | Average Days per Year |
|---|---|
| Catastrophic (150+) | 0.0 |
| Extreme (100-149) | 0.03 |
| Severe (50-99) | 0.1 |
| Very High (25-49) | 1.0 |
| High (12-24) | 4.4 |
| Low-Moderate (0-11) | 285.2 |
| Incomplete | 65.4 |
| **Total** | 356.1 |

Daily records at 3 pm from 1980 to 2017.

High fire danger conditions or worse for grass fires occur in the months of December, January, February and March and rarely, if at all, in the other months (**Table 3**).

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**Table 3: Number of days in each month of daily Fire Danger Rating and GFDI categories at 3 pm at Wellington (D&J Rural)**

| | Incomplete | Low-Moderate (0-11) | High (12-24) | Very High (25-49) | Severe (50-99) | Extreme (100-149) | Catastrophic (150+) |
|---|---|---|---|---|---|---|---|
| January | 284 | 821 | 65 | 17 | 0 | 0 | 0 |
| February | 194 | 843 | 31 | 5 | 1 | 0 | 0 |
| March | 257 | 872 | 38 | 9 | 1 | 1 | 0 |
| April | 200 | 940 | 0 | 0 | 0 | 0 | 0 |
| May | 174 | 1004 | 0 | 0 | 0 | 0 | 0 |
| June | 144 | 996 | 0 | 0 | 0 | 0 | 0 |
| July | 121 | 1057 | 0 | 0 | 0 | 0 | 0 |
| August | 266 | 912 | 0 | 0 | 0 | 0 | 0 |
| September | 194 | 946 | 0 | 0 | 0 | 0 | 0 |
| October | 239 | 939 | 0 | 0 | 0 | 0 | 0 |
| November | 202 | 938 | 0 | 0 | 0 | 0 | 0 |
| December | 277 | 855 | 37 | 9 | 0 | 0 | 0 |
| **Totals** | **2552** | **11123** | **171** | **40** | **2** | **1** | **0** |

Daily records at 3 pm from 1980 to 2017.

The wind directions associated with Very High or worse grassland fire danger are predominantly west but significant fire weather from all other wind directions can occur (**Table 4**). Days of significant grassland fire danger with a southwest wind direction that would carry a fire towards the town of Wellington are very rare (approximately 1.3 per decade).

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**Table 4: Number of days in eight wind direction categories with significant grass fire weather at 3 pm at Wellington (D&J Rural)**

| Wind Direction | Total | Total No. of days GFDI >=25 | Avg. No. days per year GFDI >=25 | Total No. of days GFDI >=50 | Avg. No. days per year GFDI >=50 |
|---|---|---|---|---|---|
| N | 3420 | 5 | 0.13 | 0 | 0.00 |
| NE | 771 | 1 | 0.03 | 0 | 0.00 |
| E | 785 | 2 | 0.05 | 0 | 0.00 |
| SE | 649 | 1 | 0.03 | 0 | 0.00 |
| S | 912 | 2 | 0.05 | 0 | 0.00 |
| SW | 2502 | 5 | 0.13 | 0 | 0.00 |
| W | 1683 | 19 | 0.49 | 3 | 0.08 |
| NW | 1377 | 7 | 0.18 | 0 | 0.00 |
| Incomplete | 1790 | | | | |
| Totals | 13889 | 42 | 1.08 | 3 | 0.077 |

Daily records at 3 pm from 1980 to 2017.

## 2.2 Fuel hazard

Although the surrounding vegetation is not mapped as bushfire prone land, there is still a bushfire risk. The area surrounding the site is entirely modified agricultural land utilised primarily for cropping and grazing with very little native vegetation. Scattered trees are located throughout the site but the intention is to remove all of these; there is a small number of scattered trees on adjoining land. The boundary of the site has many avenues of planted eucalypts and the intention is to retain these and plant more for screening. Several small areas of forest and woodland are located more than 140 m from the site boundary.

Any significant bushfire around the site would occur in crops, stubble or pasture. The main crops in the area are wheat and lucerne.

The PV panels will be made of glass with aluminium frames. Photon provided the following information regarding the fire risk for the PV panels:

‘All electrical components are required to be manufactured in material that does not allow self-combustion and ignition and should self-extinguish. In addition, the electrical equipment is fitted with over current protection devices and isolation switches along with earth leakage protection devices. Photon Energy has installed large scale solar farms across Europe and has no issues with fires.’

The proponent also advised that the solar panels to be used meet the IEC 61730 (Class C) and UL1703 (Type 1) fire resistance test standards under fire conditions.

It is intended that the vegetation fuel under and between the PV panels will be maintained in a low fuel state by sheep grazing and other land management activities such as mowing and application of pesticides. A fire could still spread in this fuel under severe fire weather conditions (see **Section 2.3**).

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The likelihood of a fire spreading within the area of the proposed PV panels, by propagating from panel to panel in a solar farm installation, is difficult to assess at this stage, because a case history (i.e. previous fire records from fire agencies and solar farm sites) and or experiments are required for similar environments, climate and solar farm components, ideally from within Australia. No data was found from within Australia, however, the risk of a fire spreading widely from panel to panel is likely to be very low because of the panel construction materials (i.e. fire resistance rating) and the time of flame exposure to initiate these materials.

## 2.3 Fire behaviour potential

Crops and pasture surround the site and are the main fuel for bushfires. There will be periods when the site will be non-flammable because they are either fallow, too green to burn or are recently planted. There will also be periods when some crops are cured and highly flammable. However, given the variability in time and space of crops as a potential fuel, the grassland fire spread model for 'cut/grazed pastures' (Cheney et al 1998) has been chosen for predicting bushfire behaviour potential (Cruz et al 2015).

The fire behaviour potential for this site in crops and pasture is summarised in **Table 5** applying the following parameters:

- grassland fire spread model for 'cut/grazed pastures';
- the range of weather conditions that could occur at the site during the bushfire season (**Section 2.1**); and
- Upslope fire run (1.5 degrees) because the site rises gently from west to east on the west side of the site (**Map 2**).

The rate of spread and fire intensity values in **Table 5** indicate that fires in cured pasture and crops at this site can be very fast moving and intense; and direct attack on such a grass fire will usually fail at GFDI >49 (Cheney and Sullivan 2008). An ignition point takes some time to build to a quasi-steady state rate of spread, however, under extreme weather conditions a grass fire can be expected to reach maximum rate of spread within 30 minutes or even less (Cheney and Sullivan 2008), by which time the fire is probably uncontrollable.

**Table 5** shows the firebreak width required for a 99% probability of holding a head fire in grass, applying and extrapolating from the model developed by Wilson (1988). Fire breaks can be effective at stopping grass fires, however, at wind speeds greater than 25 km/h even very wide fire breaks can fail (Cheney and Sullivan 2008). Under the worst weather conditions that could be expected at this site (**Section 2.1**), a fire break of even 40 m width may fail to stop a grass head fire (Cheney and Sullivan 2008). The trees within 20 m of a fire break would significantly increase the spotting potential (**Map 2**). Therefore, the fire break widths indicated in **Table 5** may only be reliable up to Very High fire danger and in the absence of trees.

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**Table 5: Fire behaviour predicted for grassland fires for 'cut/grazed' fuel (Cheney et al 1998)**

| Grassland Fire Danger Rating and GFDI[1] | Wind speed (km/h)[2] | Temperature (°C) | Relative Humidity (%) | Fuel Moisture Content (%) | Rate of Spread (km/h) | Head Fire Fireline Intensity (kW/m)[3] | Firebreak Width (m)[4] |
|---|---|---|---|---|---|---|---|
| Extreme (100-149) | 60 | 40 | 17 | 3.7 | 16.4 | 22,583 | 13.7 |
| Severe (50-99) | 45 | 40 | 17 | 3.7 | 12.7 | 17,525 | 12.0 |
| Very High (25-49) | 35 | 34 | 17 | 5.0 | 8.9 | 12,249 | 10.2 |
| High (12-24) | 30 | 28 | 28 | 7.7 | 5.8 | 7,909 | 8.7 |
| Low-Moderate (0-11) | 20 | 23 | 38 | 10.1 | 3.0 | 4,161 | 7.4 |

1. GFDI value within the range for the given fire danger rating, based on wind speed, temperature and relative humidity typical for Wellington (**Section 2.1**).
2. 10 m height measurement for wind speed.
3. Upslope fire spread 1.5 degrees.
4. Heat yield for fuel kJ/kg = 16,500; fuel load = 3 t/ha.
5. Firebreak width required for 99% probability of holding a head fire, relative to fire intensity (after Wilson 1988, extrapolated for Severe and Extreme).

It should be assumed that, under the most extreme weather, a fire would spread between and under solar panels even in heavily grazed grass and embers may breach any fire break.

**Table 6** indicates the rate of spread and fire intensity values for 'eaten out pastures' and while the rates of spread are considerably lower compared to 'cut/grazed pastures', significant fires can still develop. The residence time for flames in heavily grazed pasture are likely to be very short, probably less than five seconds (Cheney and Sullivan 2008), so the solar farm components will have a similarly short time of exposure to flame contact and high radiant heat.

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**Table 6: Fire behaviour predicted for grassland fires for 'eaten out' fuel (Cheney et al 1998)**

| Grassland Fire Danger Rating and GFDI[1] | Wind speed (km/h)[2] | Temperature (°C) | Relative Humidity (%) | Fuel Moisture Content (%) | Rate of Spread (km/h)[3] | Head Fire Fireline Intensity (kW/m)[4] | Firebreak Width (m)[5] |
|---|---|---|---|---|---|---|---|
| Extreme (100-149) | 60 | 40 | 17 | 3.7 | 8.5 | 5,836 | 8.0 |
| Severe (50-99) | 45 | 40 | 17 | 3.7 | 6.6 | 4,529 | 7.5 |
| Very High (25-49) | 35 | 34 | 17 | 5.0 | 4.6 | 3,166 | 7.1 |
| High (12-24) | 30 | 28 | 28 | 7.7 | 3.0 | 2,044 | 6.7 |
| Low-Moderate (0-11) | 20 | 23 | 38 | 10.1 | 1.6 | 1,075 | 6.4 |

1. GFDI value within the range for the given fire danger rating, based on wind speed, temperature and relative humidity typical for Wellington (**Section 2.1**).
2. 10 m height measurement for wind speed.
3. Upslope fire spread 2 degrees.
4. Heat yield for fuel kJ/kg = 16,500; fuel load = 1.5 t/ha.
5. Firebreak width required for 99% probability of holding a head fire, relative to fire intensity (after Wilson 1988).

The preceding discussion identifies the potential consequence (in fire behaviour terms) of a fire burning under different weather and an assumed site condition. The likelihood of a fire ignition at a point where the pattern of existing crops can carry a fire to or from the site under the wind and weather conditions investigated has not been calculated. However, it is expected to be a low probability and the ignition risk and fire history discussed below seem to support this assumption.

## 2.4 Fire ignitions

Bushfires occur in most years in this district, typically started by accidents such as escaped burns, machinery and hot works (e.g. welding). Lightning fires are uncommon. There are no ignition occurrence records for the site or nearby that provide statistical validity or a guide to likelihood of nearby ignition.

Earth moving equipment, power tools (e.g. welders, grinders), mowers and slashers are well known for starting bushfires under conditions of high temperature, low humidity and high wind. Therefore, construction and ongoing maintenance of the solar farm will be a potential source of ignitions from December to March.

The solar panels are non-reflective and present no risk of ignitions from concentrated solar energy. Ignitions from other PV equipment is theoretically possible from electrical faults such as arc faults, short circuits, ground faults and reverse currents (Allianz Risk Consulting 2012). The proponent advised that arcing issues are normally created from the following:

- incorrect connecting of the inter module connectors
- corroded inter module connectors caused from incorrect storage of modules on site
- electrical connections on isolators / DC combiners
- miss match of inter module connectors causing insufficient electrical connections

The proponent also advises that: 'All the above issues are caused during the installation process but are standard issues that will be picked up during the DC testing phases of the install before commissioning'.

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It is conceivable that arcs or melted components resulting from a fault could ignite grass fuels under or surrounding installations and start a bushfire. However, the level of risk from faults cannot be assessed at this stage because there is no case history available and it is not possible to compare the ignition risk from farm operations (e.g. crop harvesting) relative to solar farm operation (see also **Section 2.2**).

## 2.5 Fire history

Mapped fire records of the Rural Fire Service from 2001 to 2017 were examined and indicate that there were 14 grass or bush fires within 20 km of the site over this period, ranging in size from 0.3 to 56 ha, none closer than 3 km from the solar farm site. The area is regarded as low risk for bushfires; fires are usually small and controlled by direct attack (Peter Fothergill RFS, pers. comm.).

## 2.6 Assets at risk

The following assets are located on site or within 2 km of the proposed solar farm:

- various agricultural crops
- stock (sheep and cattle)
- fences
- 6 residences (within 1 km)
- radio receivers

The town of Suntop is located approximately 10 km to the northeast.

All of these assets, including the PV panels and other components of the solar farm, are at risk from a bushfire that may propagate within the solar farm, or from an external fire threat.

## 2.7 Fire-fighter and public safety

The usage of the general area surrounding the site is mostly limited to landowners, who are farmers, and the operators of the solar farm site.

The fire-fighters likely to respond to a bushfire in this area would be volunteers from the Rural Fire Service and or individual property owners. If the solar farm is designated by Fire & Rescue NSW as major infrastructure, then brigades from Wellington town could respond.

The risks to fire-fighter safety associated with a fire burning the solar panels and associated equipment include:

- electrocution – solar panels would be energised under any natural or artificial light conditions – isolation of DC current can only occur external to any solar array because there is no single point of disconnect internally (Backstrom and Dinni 2011);
- safe use of water spray or foam application is only possible from the perimeter of the solar panelled portion of the farm and could not reach the 250 to 500 m required to reach the furthest internal distance; and
- inhalation of potentially toxic fumes and smoke from any plastic components such as cables (although the main structure of the panels will be glass and aluminium) or other decomposed products of the panels (Allianz Risk Consulting 2012).

The materials for individual components within the solar farm infrastructure have not yet been finalised, therefore, the flammability and toxicity of burning components cannot be determined in detail at this time. The proponent, however, advises that ‘the burning of materials such as the backing sheet and ethylene vinyl acetate (EVA) will produce hazardous gasses and therefore may require breathing apparatus’. Thus,

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the level of risk from burning solar panel components is difficult to quantify, exacerbated by the limited experience in Australia with bushfires in similar installations. Any fire-fighters from the Rural Fire Service or neighbouring farms attending bushfires in this area will not be equipped with breathing apparatus and are unlikely to be trained in structural and electrical fire-fighting.

### 2.8 Bushfire scenarios

Two worst case bushfire scenarios have been considered for the purpose of understanding risk based on the fire climate, fuels, fire behaviour potential and fire history; they assume no risk mitigation strategies:

1. A large, landscape scale bushfire occurs on a day with GFDI of 49 or similar, west wind direction and at a time when crops adjacent to the solar farm are cured. The fire started well to the west and the entire solar farm boundary on the approach side is impacted by head fire. The likelihood of such a fire occurrence is low, given the fire history of the area, but it is still possible given the fire climate and fire behaviour potential. A substantial or complete fire encroachment on all PV equipment could be expected. The impact of this relatively short (but potentially intense) fire exposure on the PV equipment is not known.

2. An electrical fault ignites grass under a PV panel on a day with GFDI of 49 or similar, west wind direction and at a time when crops adjacent to the solar farm are cured. The fire spreads to the east for several kilometres destroying many crops, stock and fences. Liability for losses and potentially suppression costs are potentially sought from those responsible for the ignition cause e.g. as occurs with electricity distribution companies. As for the first scenario, the likelihood of such a fire is low.

A risk of a major fire spreading from the solar farm in the direction of the township of Wellington is low, based on the wind direction associated with significant fire weather, but still possible (**Table 4**).

# 3 Mitigation Strategies

### 3.1 Overview

Mitigation strategies are guided by knowledge of the factors that contribute to bushfire risk:

- Fuels, weather, topography, predicted fire behaviour;
- Spatial patterns and frequency of unplanned ignitions;
- Suppression capability: resources (air and ground), access (roads, tracks) and water; and
- Values and assets: people, buildings, commerce, industry, services and the natural environment.

Mitigation strategies are also guided by evidence of efficacy of available treatment options. Mitigation must be a combination of complementary strategies, all of which are required to provide the best possible protection outcome for the solar farm and the community.

During the preparation of this plan, discussions were held with officers of the Rural Fire Service at Gunnedah and Dubbo. Advice from these officers was provided on the following:

- fire history and causes: this is a low risk site
- local fire-fighting resources: primarily RFS volunteers
- mitigation measures: recommended fire breaks, water storage and emergency response plan
- fire suppression: fire-fighters unlikely to operate amongst solar panels

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## 3.2 Asset Protection Zone

An Asset Protection Zone (APZ) is typically designed to separate a vulnerable asset from the bushfire hazard (vegetation/fuel). An APZ is either a lower fuel hazard such as mown or heavily grazed grass or a fire break of ploughed or fallow ground. APZs do not eliminate the fire risk, but may lower it to an extent where fire control is more feasible or damage to the asset is reduced or eliminated.

Understanding the value and limitations of APZ is important, and as is the understanding that bushfires attack built assets by either flame contact, radiant heat or burning debris. An APZ can be used to lower or eliminate the bushfire attack from flame contact and radiant heat around the perimeter of the solar farm, but under winds of >25 kph burning debris can result in a fire breaching a perimeter APZ to ignite grassy fuel within the solar farm itself. A fire emanating from the PV panels may also jump a perimeter APZ by burning debris under similar conditions

Despite the limitations of any APZ it is recommended that a perimeter APZ/fire break be established around the solar farm. An APZ/fire break will significantly reduce the likelihood of a bushfire spreading into the solar farm or from the solar farm into surrounding farmland.

The specifications recommended for the perimeter APZ/fire break are as follows:

- 15 m width for the entire perimeter of the solar farm footprint, with 20 m wide abutting the remnant or planted treed areas.
- the external edge of the APZ setback at least 25 m from the external edge of PV panels or other components.
- mineral earth fire break i.e. dirt or gravel.
- no trees and shrubs planted on the internal side of the fire break.
- APZ preferably located external to any security fence.
- access track located on the internal edge of the APZ, that is trafficable by Category 1 fire appliances.

These specifications will ensure the risk of a fire propagating across the APZ is minimised and that burning embers will not spot across the APZ, except under very high winds.

Trees and shrubs abutting the APZ on the side of an approaching fire will significantly increase the risk of burning embers carrying across the fire break and therefore the fire continuing to spread on the other side (Cheney and Sullivan 2008). Therefore, the planting of trees and shrubs for visual screening on the external side of the APZ will increase the risk of burning embers from an external fire entering the solar farm but not vice versa. Any of the following measures will mitigate the risk of planted or remnant trees carrying embers into the solar farm:

- use species suitable for the environment that have low fire spotting characteristics (e.g. smooth bark)
- increase the width of the APZ (hence the 20 m stated above)
- increase the distance between the trees and the APZ

The objective for the setback of the APZ is to reduce the radiant heat to less than 10 kW/m$^2$ which is the level at which plastics and rubber components are expected to melt/burn. This is based on a fire intensity of 22,583 kW/m. The placement of the access track on the inside of the APZ is to ensure safety to fire-fighters by reducing radiant heat exposure to fire-fighters.

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## 3.3 The substation

The substation should have a 20 m asset protection zone around all potentially critical components e.g. anything rubber or plastic or with a lower ignition point. There is to be no combustible vegetation within the substation APZ e.g. a gravel surface.

## 3.4 Solar farm construction

Should construction of the solar farm take place between 1 December and 31 March (see **Table 3** for data on seasonal occurrence of fire weather), the following measures are recommended to control the risk of grass fire ignitions:

- the APZ/fire break is constructed as the first stage of development;
- all plant, vehicles and earth moving machinery are cleaned of any accumulated flammable material (e.g. soil and vegetation);
- a suitable fire appliance is present on site with at least two personnel trained in bushfire fighting;
- on days when Very High fire danger or worse is forecast for Wellington, the "fires near me' app is to be checked hourly for the occurrence of any fires likely to threaten the site; and
- all operations involving earth moving equipment, vehicles, slashers and hot works (e.g. grinders, welders) cease while the GFDI is or forecast to be 35 or greater (Rural Fire Service 2018).

## 3.5 Solar farm ongoing operations

*Fuel management within solar farm*

It is assumed that a grass fire may start and spread within the footprint of the solar farm (see **Sections 2.3 and 2.4**); ignitions could include lightning fires, human error or electrical faults. For this reason, it is recommended that vegetation fuels internal to the APZ and throughout the solar farm are maintained in a minimal condition by grazing, slashing or mowing. This will minimise the radiant heat exposure to solar farm components and reduce the risk of a fire spreading beyond the solar farm. If grazing or slashing is not possible under the panels other lower risk ground cover should be considered e.g. gravel or a non-curing ground cover and/or a very low above ground biomass.

*Days of Very High or worse fire danger*

To minimise the risk of grass fire ignitions, all operations on the site involving earth moving equipment, vehicles, slashers and hot works (e.g. grinders, welders) should cease while the GFDI is or forecast to be 35 or greater. This will require establishing an operational procedure for onsite recording of temperature, relative humidity and wind speed, as well as associated training.

*Fire-fighter safety*

The safety hazards for fire-fighters from PV panels (**Section 2.7**) and local fire-fighting capability are such that fire suppression within the footprint of the solar farm cannot be expected or relied upon. The only exception to this would be aerial water bombing that is compliant with air operations safety procedures; however, these resources may not be available at short notice for a fire that could spread several kilometres within an hour (**Section 2.3**). Fire suppression is most likely only to be feasible from the APZ or beyond and no internal access for fire-fighting is proposed.

Given the possible toxicity of smoke from burning solar farm components, fire-fighters, farm workers and neighbours should avoid working down wind of any fire burning within the solar farm.

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Given these safety concerns for fire-fighters, it is not recommended that fire-fighting equipment for fire-fighters be located permanently on site because such equipment could not be utilised safely and effectively.

An Emergency Response Plan (ERP) should be prepared for the solar farm that provides the following:

- addresses foreseeable on-site and off-site fire events
- activation of water spray systems and any other response/protection measures
- clearly states work health safety risks and procedures to be followed by fire-fighters, including
    - personal protective clothing
    - minimum level of respiratory protection
    - minimum evacuation zone distances
    - a safe method of shutting down and isolating the PV system (or noting if this is not possible for safe internal access)
    - any other risk control measures required to be followed by fire-fighters
- evacuation triggers and protocols
- suppression response strategies and tactics, including aerial suppression options/management

Two copies of the ERP should be permanently stored in a prominent 'Emergency Information Cabinet' to be located at the main entrance point to the solar farm, external to any security fence or locked gate, and a copy provided to local emergency responders (**Map 2**).

Once constructed and prior to operation, contact should be made by the site operator with the Local Emergency Management Committee to establish emergency management procedures with relevant authorities for the safety hazards presented by the site. The operator of the solar farm should brief the local volunteer fire brigades and neighbouring farmers at appropriate intervals, for example, at annual pre-season fire meetings, on safety issues and procedures.

## 3.6 Shielding of solar farm components

Solar panels and other components (e.g. cables) will be exposed to flame contact in the event of a bushfire spreading within the solar farm footprint (see **Section 2.3**). Therefore, it is recommended that components that are vulnerable to damage from temperatures associated with flame contact are shielded as far as possible. Design should consider the following features:

- burial of cables underground
- shielding of above ground cables and circuitry (e.g. metal conduit)

Design of shielding should ideally be informed by experimental testing of components in a laboratory situation that simulates the flame temperature and residence time of a grass fire under extreme weather conditions (e.g. GFDI 100) and low fuel load (1.5 t/ha).

## 3.7 Fire risks from PV system

All electrical equipment will comply with relevant construction standards and design; installation of electrical equipment such as junction boxes, inverters, transformer and electrical cabling is to be in accordance with AS 3000:2007 Wiring Rules.

It is recommended that research be undertaken into the ignition, flammability and toxicity risks of the solar farm components once the design has been finalised. This information will be required to improve or streamline bushfire mitigation measures for the solar farm. For example, design of shielding of

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components and schedules for routine maintenance checks may benefit from evidence on potential equipment caused ignitions.

## 3.8 Water storage

Whilst the likelihood of a damaging fire impacting the solar farm is considered low, the consequence could be significant e.g. large number of panels and/or related electrical systems damaged.

The risk of a fire starting from the solar farm and spreading to surrounding areas is also considered low. Water supply should be designed to provide filling points for fire tanker units near the solar farm entrance A storage of 50,000 litres is recommended, based on refilling six tanker units (4,000 litres) twice each (local RFS Superintendent pers. comms).

## 3.9 Summary of recommended mitigation strategies

**Table 7** summarises the bushfire mitigation strategies and recommendations made in this document.

**Table 7: Summary of recommended mitigation strategies and actions**

| Mitigation Strategy | Section of Plan | Action |
|---|---|---|
| Asset Protection Zone (APZ) | 3.2 | APZ of mineral earth firebreak, 15 to 20 m wide, setback 25 m from perimeter of solar farm components. |
| Substation | 3.3 | APZ 20 m with no internal vegetation (i.e. gravel surface). |
| Solar farm construction | 3.4 | If construction occurs from December to March: APZ constructed first, fire appliance on site and machinery/hot works suspended when GFDI >=35. |
| Solar farm ongoing operations | 3.5 | Maintain minimal fuel load by grazing, slashing or mowing. Under panel fuels minimised. No vegetation within the Substation.<br>Suspend site maintenance operations when GFDI >=35. |
| Fire-fighter safety | 3.5 | Avoid fire-fighting within footprint of solar farm.<br>Avoid operating downwind of smoke from burning solar farm components.<br>Emergency Response Plan prepared and stored at 'Emergency Information Cabinet' at main entrance to solar farm and provided to local emergency responders. Include aerial suppression options/management. |
| Shielding of solar farm components | 3.6 | Shield all heat sensitive components from potential flame contact. |
| Investigate further the fire risks from solar farm components | 3.7 | Research ignition, flammability and toxicity risks of solar farm components. |
| Water storage | 3.8 | Designed to supply fire tanker units (50,000 litre storage) near solar farm entrance. |

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# 4 Cumulative Impacts

The cumulative impacts related to bushfire mitigation and other major developments in the area are as follows:

- *Volunteer fire-fighter workload* – Response call outs should not increase because the ignition risk will be very low and possibly lower than the risk from surrounding agricultural activities. There will, however, be an ongoing requirement for briefing on the Emergency Response Plan.
- *Construction stage transport and road use* – The bushfire mitigation infrastructure (i.e. fire breaks, and water storage) will add a small percentage to the total construction traffic and road use.
- *Ongoing operations* – there would not be any cumulative operational impacts.

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# References

Allianz Risk Consulting 2012. *Understanding the Fire Hazards of Photovoltaic Systems*. Allianz Global Corporate & Specialty.

Backstrom R. and Dinni D.A. 2011. *Firefighter Safety and Photovoltaic Installations Research Project.* Underwriters Laboratories Inc., Northbrook, USA.

Cheney N.P., Gould J.S. Catchpole W.R. 1998. *Prediction of Fire Spread in Grasslands*. International Journal of Wildland Fire 8, 1-13.

Cheney N.P., Sullivan, A.L. 2008. *Grassfires: Fuel weather and fire behaviour*. CSIRO Publishing 2nd Edition, Collingwood, Vic.

Cruz, M.G., Gould, J.S., Alexander, M.E., Sullivan, A.L., McCaw, W.L. and Matthews, S. 2015. *A Guide to Rate of Fire Spread Models for Australian Vegetation*. CSIRO Land and Water, Canberra ACT and AFAC, Melbourne, Vic, 125 pp.

Pitt and Sherry 2018. *Project Description – Suntop Solar Farm.* Version 3.0 unpublished report.

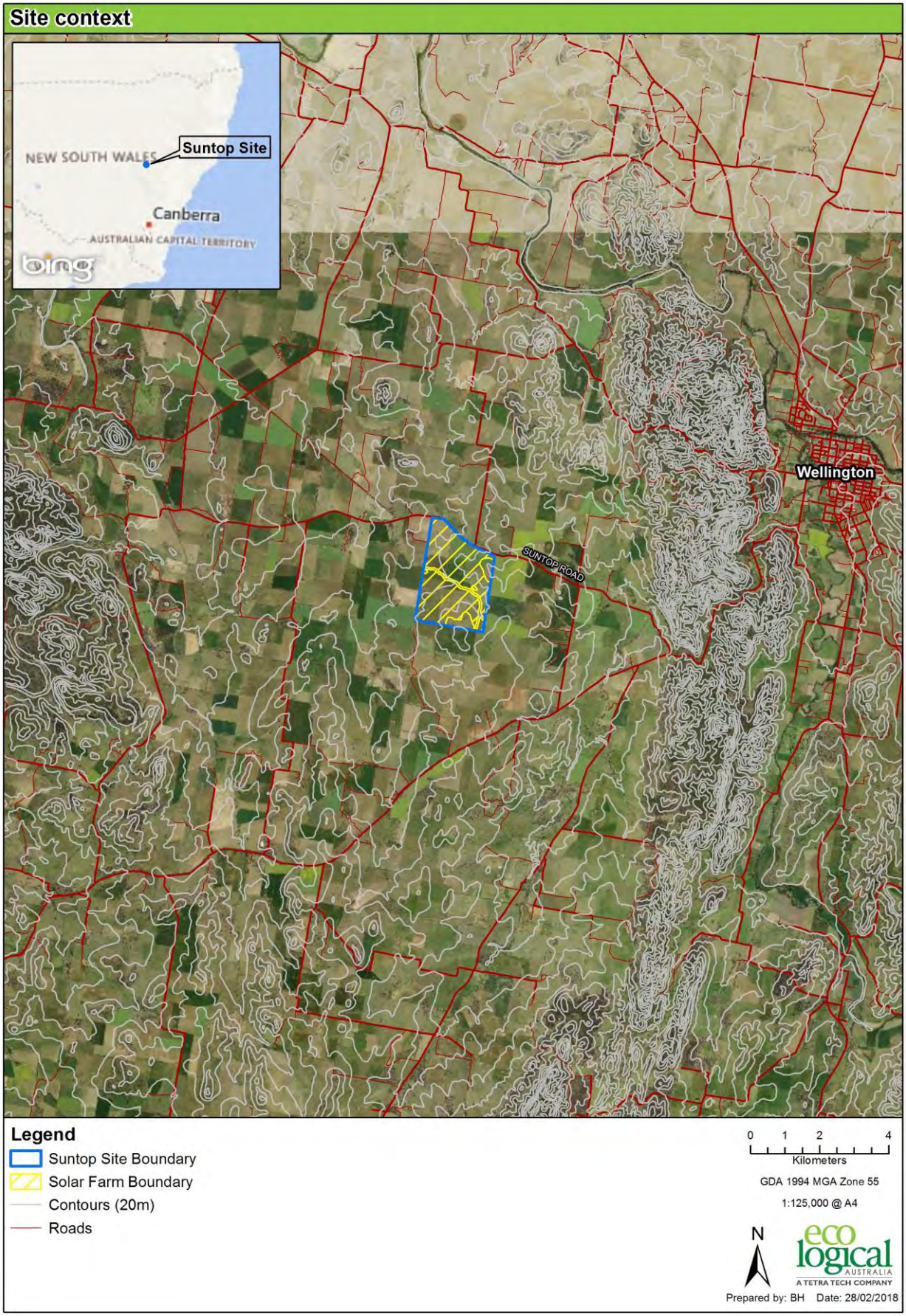
Rural Fire Service (2018). *Harvest fires.* https://www.rfs.nsw.gov.au/plan-and-prepare/farm-fire-safety/grain-harvesting-guide accessed 9/02/2018.

Wilson, A.A.G. 1988. *Width of firebreak that is necessary to stop grassfires: some field experiments.* Canadian Journal of Forest Research 18, 682–687.

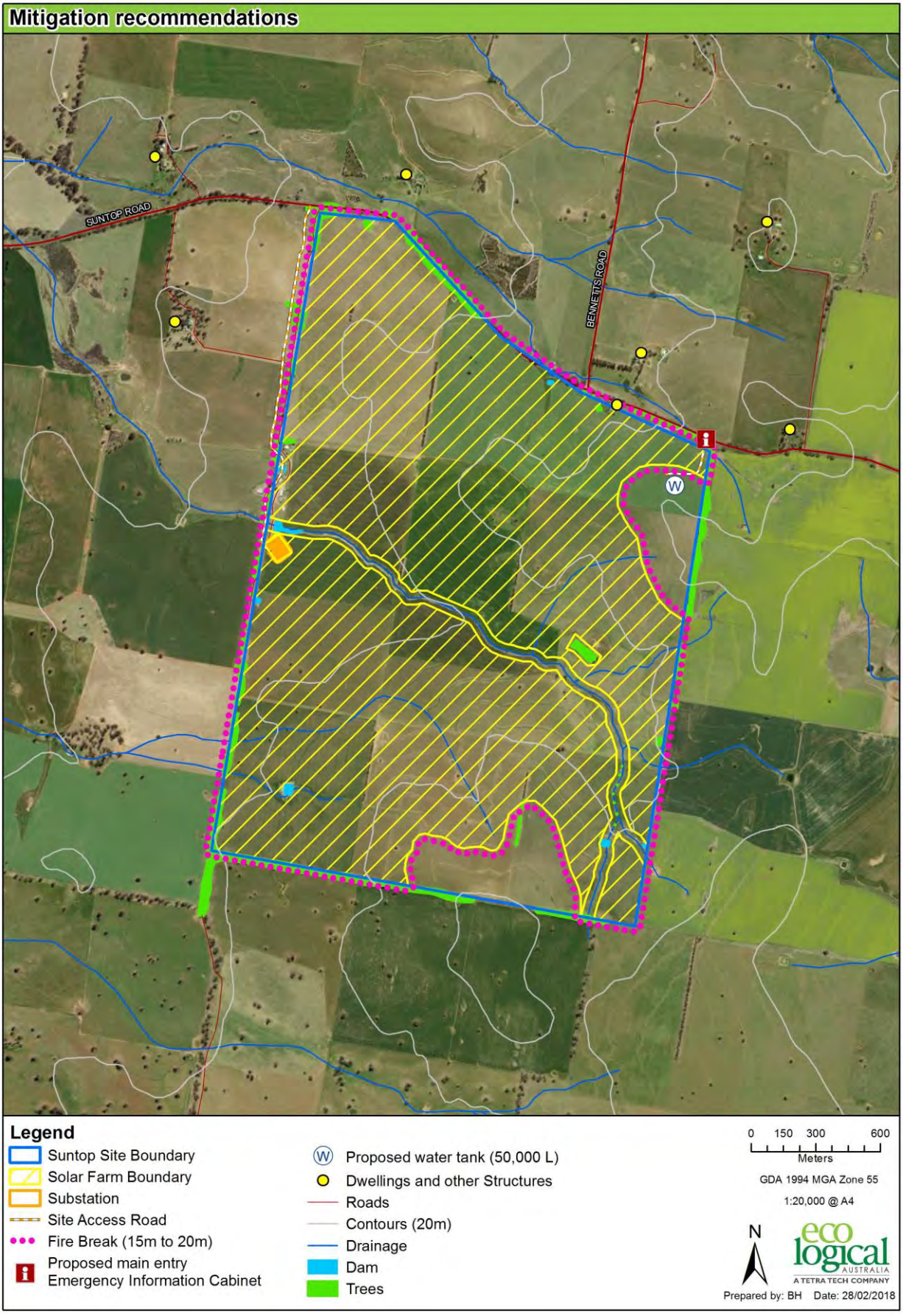
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# Appendix A - Maps

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**Map 1: Site Context**




**Map 2: Mitigation recommendations**

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ISO 14001 Environmental Management

AS/NZS 4801:2001 Occupational Health and Safety Management

ISO 9001 Quality Management


**HEAD OFFICE**
Suite 2, Level 3
668-672 Old Princes Highway
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

**CANBERRA**
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 9542 5622

**COFFS HARBOUR**
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

**PERTH**
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 02 9542 5622

**MELBOURNE**
Level 1, 436 Johnston St
Abbotsford, VIC 3076
T 1300 646 131

**SYDNEY**
Suite 1, Level 1
101 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9542 5622

**NEWCASTLE**
Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 9542 5622

**ARMIDALE**
92 Taylor Street
Armidale NSW 2350
T 02 8081 2685
F 02 9542 5622

**WOLLONGONG**
Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 9542 5622

**BRISBANE**
Suite 1, Level 3
471 Adelaide Street
Brisbane QLD 4000
T 07 3503 7192

**HUSKISSON**
Unit 1, 51 Owen Street
Huskisson NSW 2540
T 02 4201 2264
F 02 9542 5622

**NAROOMA**
5/20 Canty Street
Narooma NSW 2546
T 02 4302 1266
F 02 9542 5622

**MUDGEE**
Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1234
F 02 6372 9230

**GOSFORD**
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1221
F 02 9542 5622

**ADELAIDE**
2, 70 Pirie Street
Adelaide SA 5000
T 08 8470 6650
F 02 9542 5622

1300 646 131
www.ecoaus.com.au

# 1. Implementation Plan

Table 6 illustrates the Implementation Plan for the CSE Plan. It's important to note that this plan may change to provide flexibility depending on the constraints and opportunities that are identified by the community and other stakeholders through the development of the project. Please note this plan only covers the EIS stage of the project. The plan will be updated for the post-approvals after the key concerns are determined.

Table 6 Implementation Plan

| Purpose / objective | Method | Program | Who is responsible |
|---|---|---|---|
| Understanding key environmental, social and economic concerns of the community | Provide the project rationale / project description – through social media platforms | Next newsletter, Scheduled for September 17. | SSF Project Manager |
| | Consider comments made during initial consultation activities during design of the facility e.g. buffer areas; streams; trees; weed management. | Ongoing. | Environmental specialists and engineering design team. |
| | Update the project website and send out flyers to residents to keep them informed on the environmental assessment. | Ongoing. Website to be updated when required. | SSF Project Manager / pitt&sherry |
| | Site visit with environmental specialists to gain an understanding of constraints, risk and opportunities. | November 2017. | SSF Project Manager and Environmental Project Manager. |
| | Organise and attend a Community meeting to introduce the project and get initial community feedback. | August 2017. | SSF Project Manager & team. |
| | Organise and attend additional Community meeting as required | Adhoc | SSF Project Manager. To be attended by key environmental specialists and engineering team. |
| | One on one meetings with surrounding residents. | At least two sessions, include outcomes of specialist reports | SSF Project Manager/ pitt&sherry |
| | Provide a project update to surrounding residents through a newsletter (on line, through an | Ongoing. | SFF Project Manager, pitt&sherry |

| Purpose / objective | Method | Program | Who is responsible |
|---|---|---|---|
| | update to the project website or as a flyer) | | |
| Understanding other relevant matters or local knowledge that the community and other stakeholders believe should be considered in the EIS. | Site visit with environmental specialists to gain an understanding of constraints, risk and opportunities. | November 2017. | SSF Project Manager and Environmental Project Manager. |
| | Meetings with DPE and other stakeholders (including DPI and TransGrid) to clarify the scope of works after the site visit. This will be communicated back to the community through the newsletter. | December 2017 / January 2018 (potentially later given the holiday season) | SSF Project Manager and the Environmental Project Manager. |
| | Community meeting. | August 2017. | As above. |
| | Council meeting to discuss council SEARS requirements including transport to and from the site. | Ongoing | SSF Project Manager. |
| | Letters to<br>• Water NSW<br>• Mining titleholders (Lachlan Star Ltd. / Ascent Capital) | December 2017/ January 2018 | SSF project manager/ pitt&sherry |
| | Subconsultant engagement with<br>• Roads and Maritime (RMS)<br>• LALC<br>• OEH (Biodiversity)<br>• OEH (Heritage) | November/ December 2017 | Various subconsultants |
| | Research regarding other projects in the area under development and previously identified. This is to understand community expectations in the past. | November 2017. | Environmental Project Manager. |
| Asking the Community how they would like to participate during the preparation of | Community meeting in August identified methods including regular updates on the website, newsletters and another community meeting. | Ongoing. | SSF Project Manager |

| Purpose / objective | Method | Program | Who is responsible |
|---|---|---|---|
| the EIS and exhibition phase. | | | |
| Having a conversation with the Community on the benefits of the proposed development. | Community meetings; newsletters; website updates; one on one meetings. Describing how the Community's concerns have been implemented in design considerations. | Ongoing. | SSF Project Manager/ pitt&sherry |
| Other | Media releases – local papers, social media platforms. | At significant hold points through the project life cycle e.g. EIS submission to DP&E for public exhibition; determination; post approvals and construction. | SSF Project Manager and Managing Director/ pitt&sherry |
| | Feedback forms on the website and newsletters – including those by post. | As newsletters are sent out. | SSF Project Manager / pitt&sherry |
| | Facebook / social media. Opportunity for feedback. | Ongoing. | SSF Project Manager / pitt&sherry |

03 May 2018

Macquarie Headquarters
State Emergency Services
160 Bultje Street
Dubbo, New South Wales 2830

To whom it may concern,

## Suntop Solar Farm

Photon Energy Australia (Photon) propose to construct and operate a 200-megawatt (MW) (200MW DC or 170MW AC) solar (PV) farm. The Proposal would be located at 909 Suntop Road, Wellington, NSW 2820 and contained within:

- Lots 1,2 and part Lot 3 DP 506925
- Lot 122 DP 753238
- Lot 90 DP 657805

pitt&sherry has been engaged to prepare the Environmental Impact Statement (EIS) under Part 4.1 of the *Environmental Planning and Assessment Act, 1979*. Due to the investment required the proposal is deemed as a State Significant Development.

The Preliminary Environmental Assessment (PEA) and the Secretary's Environmental Assessment Requirements (SEARs) are on the NSW Department of Planning and Environment (DP&E) major projects website and can be viewed at:

http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8696

As a result of the Proposal and as requested by DP&E, we would appreciate any advice or comments of the proposed development on the community emergency management arrangements in the Wellington region.

We look forward to your response. Should you wish to discuss further please don't hesitate to contact me or Malinda Facey on 0438 752 476.

Yours sincerely



Jessica Berry
**Project Manager and Senior Environmental Consultant**
**Phone number 0438 598 793**

pitt&sherry

transport
community
mining
industrial
food & beverage
energy

**Sydney**
Suite 902
Level 9, North Tower
Chatswood Central
1-5 Railway Street
Chatswood NSW 2067
PO Box 5487
West Chatswood
NSW 2067
T (02) 9468 9300

Offices in:
**Brisbane**
T (07) 3221 0080

**Devonport**
T (03) 6424 1641

**Hobart**
T (03) 6210 1400

**Launceston**
T (03) 6323 1900

**Melbourne**
T (03) 9682 5290

**Newcastle**
T (02) 4910 3600

KMH ENVIRONMENTAL
KMH as part of the pitt&sherry group

E info@pittsh.com.au
www.pittsh.com.au
1300 pittsh

Incorporated as
Pitt & Sherry
(Operations) Pty Ltd
ABN 67 140 184 309

## Genevieve Daneel

**From:** Michelle Howarth <Michelle.Howarth@environment.nsw.gov.au>
**Sent:** Tuesday, 27 February 2018 12:15 PM
**To:** Genevieve Daneel
**Cc:** Samantha Wynn; Ivan Rivas Acosta
**Subject:** RE: Request for Meeting to discuss OEH input in to SEARS: SSD 8277, SSD 8696, SSD 17_8777 & SSD 8757

Hi Genevieve

Your email below is consistent with what was discussed and agreed to this morning. While sections 10 – 14 of the SEAR's are not required for these projects, It is understood that the EIS will contain a comprehensive analysis of impacts and potential mitigation to surface water, hydrology and groundwater (if groundwater applicable).

Thanks

NSW GOVERNMENT | Office of Environment & Heritage

**Michelle Howarth**
Senior Conservation Planning Officer
North West
Regional Operations Division

48–52 Wingewarra Street, Dubbo 2830
PO Box 2111, Dubbo 2830
**T** 02 68835339
**F** 02 6884 8675




**From:** Genevieve Daneel [mailto:gdaneel@pittsh.com.au]
**Sent:** Tuesday, 27 February 2018 11:28 AM
**To:** Michelle Howarth <Michelle.Howarth@environment.nsw.gov.au>
**Cc:** Jessica Berry <jberry@pittsh.com.au>; Malinda Facey <mfacey@pittsh.com.au>
**Subject:** FW: Request for Meeting to discuss OEH input in to SEARS: SSD 8277, SSD 8696, SSD 17_8777 & SSD 8757

Hi Michelle,

Thank you for your, Samantha and Ivan's time on the phone.

As discussed, I would like to confirm that due to each of the four proposed solar farms (Brewongle, Suntop, Maryvale and Mumbil Solar) residing outside of Council mapped LEP 'Flood Planning Area', the following SEARs conditions will not be required to be undertaken during the Environmental Impact Assessment (EIS) process:

All conditions under the **'Flooding and Coastal Erosion'** section of Attachment A Standard Environmental Assessment Requirements (10 – 14).

Hydrological impacts of the proposed development will be assessed for each site, including assessment of stream/creek and dam behaviour. Each EIS will have a chapter dedicated to comprehensive analysis of impacts and potential mitigation to surface water, hydrology and groundwater (if groundwater applicable).

If you have any further questions, please do not hesitate to give me a call – 0438 693 279.

Kind regards,
Genevieve

**Genevieve Daneel** BSc(Hons)
Environmental Consultant
**pitt&sherry**
| M: 0438 693 279
E: gdaneel@pittsh.com.au | W: www.pittsh.com.au

**From:** Michelle Howarth [mailto:Michelle.Howarth@environment.nsw.gov.au]
**Sent:** Thursday, 22 February 2018 1:21 PM
**To:** Genevieve Daneel <gdaneel@pittsh.com.au>
**Cc:** Samantha Wynn <Samantha.Wynn@environment.nsw.gov.au>
**Subject:** RE: Request for Meeting to discuss OEH input in to SEARS: SSD 8277, SSD 8696, SSD 17_8777 & SSD 8757

Hi Genevieve

As discussed on the phone the SEARs provided are our agencies standard requirements, therefore our flood engineer has not yet been involved with any of these projects. I will provide site details for each of the projects to our flood engineer so that he can familiarise himself with each project. Once he has had time to review we would be happy to arrange a meeting with you to discuss.

Thanks

NSW GOVERNMENT Office of Environment & Heritage
**Michelle Howarth**
Senior Conservation Planning Officer
North West
Regional Operations Division
48–52 Wingewarra Street, Dubbo 2830
PO Box 2111, Dubbo 2830
**T** 02 68835339
**F** 02 6884 8675




**From:** Genevieve Daneel [mailto:gdaneel@pittsh.com.au]
**Sent:** Thursday, 22 February 2018 10:28 AM
**To:** Michelle Howarth <Michelle.Howarth@environment.nsw.gov.au>
**Cc:** Jessica Berry <jberry@pittsh.com.au>; Malinda Facey <mfacey@pittsh.com.au>
**Subject:** Request for Meeting to discuss OEH input in to SEARS: SSD 8277, SSD 8696, SSD 17_8777 & SSD 8757

Hi Michelle,

Thank you for your time on the phone.

To follow up, pitt&sherry would like to organise a meeting with OEH to discuss the flood modelling requirements as part of OEH's input in to the following SEARS:

- Brewongle Solar SSD 8277
- Suntop Solar SSD 8696
- Maryvale Solar SSD 17_8777
- Mumbil Solar SSD 8757

As discussed, could you please liaise with the appropriate OEH members and suggest a meeting time for the discussion. If you have any further questions, please do not hesitate to give me a call – 0438 693 279.

Kind regards,
Genevieve

**Genevieve Daneel** BSc(Hons)
Environmental Consultant
**pitt&sherry**
| M: 0438 693 279
E: gdaneel@pittsh.com.au | W: www.pittsh.com.au



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## Genevieve Daneel

**From:** Windebank, Matthew <Matthew.Windebank@casa.gov.au>
**Sent:** Monday, 22 January 2018 11:06 AM
**To:** Genevieve Daneel
**Cc:** robert.ibrahim@photonenergy.com
**Subject:** FW: Maryvale, Mumbil & Suntop Solar Farms [SEC=UNCLASSIFIED]
**Attachments:** Letter to CASA.PDF

UNCLASSIFIED

Good morning Genevieve,

As requested, CASA has reviewed all three solar farms as mentioned below.

All three are sufficient distance from Dubbo Airport to not be of any concern to air navigation.

In addition, CASA reviewed the three proposals in regard to operations to and from Bodangora Airfield on the outskirts of Wellington. Once again all three solar farm sites are sufficiently distant from Bodangora Airfield to not be of significant concern to air navigation.

Modern solar panels are designed to absorb light and not to reflect it and in addition the majority of designs on the market also have an anti-glare coating to further reduce visual impact. None of the solar farm locations are under the approach paths to Bodangora Airfield and therefore pose little threat to pilots on approach or departing from the airfield.

Regards

**Matthew Windebank**
Aerodrome Engineer
Air Navigation, Airspace & Aerodromes Branch
CASA \ Aviation Group
GPO BOX 2005 CANBERRA ACT 2601

**T - 02 6217 1183**
F - 02 6217 1500

Australian Government
Civil Aviation Safety Authority

**From:** Genevieve Daneel [mailto:gdaneel@pittsh.com.au]
**Sent:** Tuesday, 16 January 2018 9:35 AM
**To:** Sydneyregion
**Cc:** Cathy Lestrange; Jessica Berry; robert.ibrahim (robert.ibrahim@photonenergy.com)
**Subject:** Maryvale, Mumbil & Suntop Solar Farms

To whom it may concern,

As previously discussed below, Photon Energy (photon) have invited CASA to review and respond to the proposed development of the Gunnedah Solar Farm at 765 Orange Grove Road, Gunnedah.

Photon Energy are also proposing to construct and operate the following three solar farms, located in the Dubbo Local Government Area:

1. A 220-megawatt (MW) solar farm (the "Proposal") using photovoltaic (PV) technology at a 517-hectare site in Suntop, NSW. The Proposal would be located adjacent to Suntop Road, Suntop, NSW 2820, and is approximately 10km south-west from the Wellington town centre.
2. A 115-megawatt (MW) solar farm using photovoltaic (PV) technology at a 250 hectare site in Maryvale, NSW. The Proposal would be located at "Waroona" 121 Maryvale Road, Maryvale 2820 and "Scarborough House", 801 Cobbora Road, Maryvale, NSW, 2820, and is approximately 15 km north-west of the Wellington town centre.
3. A 138-megawatt (MW) solar farm using photovoltaic (PV) technology at a 280 hectare site in Mumbil, NSW. The Proposal would be located at "Easterfield", 7391 Burrendong Way, Mumbil, NSW, 2820, and is approximately 15 km south-east from the Wellington town centre.

As a potentially affected stakeholder we welcome your review of the above and attached and would greatly appreciate letter of response to these developments.

I have attached a correspondence letter from our project manager Jessica Berry which gives the Lot and DP locations of each development, and provides contact details should you wish to discuss the matter further.

A full description of each project can be found on the major projects website, which currently has the PEA and SEARs on display.

Suntop: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8696
Maryvale: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8777
Mumbil: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8757

Kind Regards,
Genevieve

**Genevieve Daneel** BSc(Hons)
Environmental Consultant
**pitt&sherry**
| **M:** 0438 693 279
**E:** gdaneel@pittsh.com.au | **W:** www.pittsh.com.au

29 November 2017

Ascent Capital
Level 1, 33 Ord Street,
West Perth, WA
6005, AUSTRALIA

To whom it may concern,

## RE: Suntop Solar Farm and Minerals Exploration Licence (EL8463)

We are contacting you on behalf of Photon Energy, as it has come to our attention that you will be acquiring Lachlan Star Limited in early 2018. Photon Energy intend on constructing and operating a solar farm in Suntop (NSW) which intersects with a current minerals exploration licence (EL8463) held by Lachlan Star Limited (Lachlan Resources).

Photon Energy propose to construct and operate a 260-megawatt (MW) photovoltaic solar (PV) farm. The Proposal would be located at 909 Suntop Road, Suntop, NSW, 2820 and contained within:

- Lot 1-2-3 DP 506925
- Lot 122 DP 753238
- Lot 90 DP 657805

The Preliminary Environmental Assessment (PEA) and the Secretary's Environmental Assessment Requirements (SEARs) are on the NSW Department of Planning and Environment (DP&E) major projects website and can be viewed at:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8696

Within the SEARs, the Department of Resources and Geoscience (DRG) have identified Lachlan Resources as a titleholder of minerals exploration licence (EL8463). This licence covers a fraction of the land identified for the proposed solar farm and DRG have requested that Photon consult with the titleholder. As Lachlan Resources are subject to a Deed of Company Agreement, it is our understanding Ascent Capital will be the future titleholders.

As such, could you please review the above and attached provide a letter of response to this development. Should you wish to discuss further please don't hesitate to contact me or Robert Ibrahim at Photon Energy on 0423 688 337.

Yours sincerely

Jessica Berry
**Project Manager and Senior Environmental Consultant**
**0438 598 793**

**pitt&sherry** ref: Letter to PEL(001) titleholder/JBERRY/word processor



pitt&sherry

transport
community
mining
industrial
food & beverage
energy

**Sydney**
Suite 902
Level 9, North Tower
Chatswood Central
1-5 Railway Street
Chatswood NSW 2067
PO Box 5487
West Chatswood
NSW 2067
T (02) 9468 9300

Offices in:
**Brisbane**
T (07) 3221 0080

**Devonport**
T (03) 6424 1641

**Hobart**
T (03) 6210 1400

**Launceston**
T (03) 6323 1900

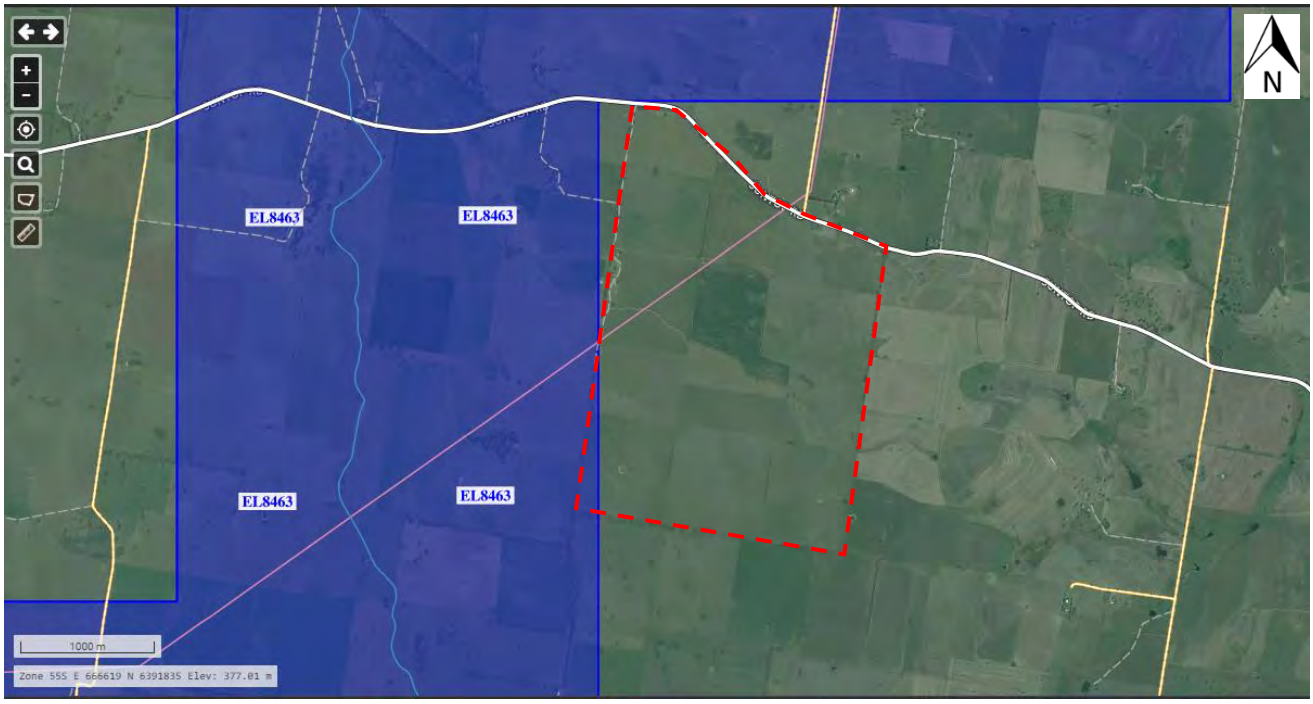
**Melbourne**
T (03) 9682 5290

**Newcastle**
T (02) 4910 3600

KMH as part of the pitt&sherry group

E info@pittsh.com.au
www.pittsh.com.au
1300 pittsh

Incorporated as
Pitt & Sherry
(Operations) Pty Ltd
ABN 67 140 184 309




**Legend**

- Proposal location
- Current exploration licence
- Highway
- Electricity Transmission lines

17 May 2018

Adam Walters
Emmerson Resources Ltd
awalters@emmersonresources.com.au
(08) 9381 7838

To Adam,

## RE: Suntop Solar Farm and Minerals Exploration Licence (EL8463)

We are contacting you on behalf of Photon Energy who propose constructing and operating a solar farm in Suntop (NSW) which intersects with a current minerals exploration licence (EL8463) held by Lachlan Resources Pty Ltd. I understand this is a subsidiary of Emmerson Resources Pty Ltd.

Photon Energy propose to construct and operate a 200-megawatt (MW) photovoltaic solar (PV) farm. The Proposal would be located at 909 Suntop Road, Suntop, NSW, 2820 and contained within:

- Lot 1-2-3 DP 506925
- Lot 122 DP 753238
- Lot 90 DP 657805

The Preliminary Environmental Assessment (PEA) and the Secretary's Environmental Assessment Requirements (SEARs) are on the NSW Department of Planning and Environment (DP&E) major projects website and can be viewed at:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8696

Within the SEARs, the Department of Resources and Geoscience (DRG) have identified Lachlan Resources as a titleholder of minerals exploration licence (EL8463). This licence covers a fraction of the land identified for the proposed solar farm and DRG have requested that Photon consult with the titleholder. As Lachlan Resources are subject to Deed of Company Agreement, it is our understanding Emmerson Resources are now the titleholders.

As such, could you please review the above and attached provide a letter of response to this development. Should you wish to discuss further please don't hesitate to contact me or Robert Ibrahim at Photon Energy on 0423 688 337.

Yours sincerely



Jessica Berry
**Project Manager and Senior Environmental Consultant**
**0438 598 793**

**pitt&sherry** ref: Letter to EL8463 titleholder/JBERRY/word processor



pitt&sherry

transport
community
mining
industrial
food & beverage
energy

**Sydney**
Suite 902
Level 9, North Tower
Chatswood Central
1-5 Railway Street
Chatswood NSW 2067
PO Box 5487
West Chatswood
NSW 2067
T (02) 9468 9300

Offices in:
**Brisbane**
T (07) 3221 0080

**Devonport**
T (03) 6424 1641

**Hobart**
T (03) 6210 1400

**Launceston**
T (03) 6323 1900

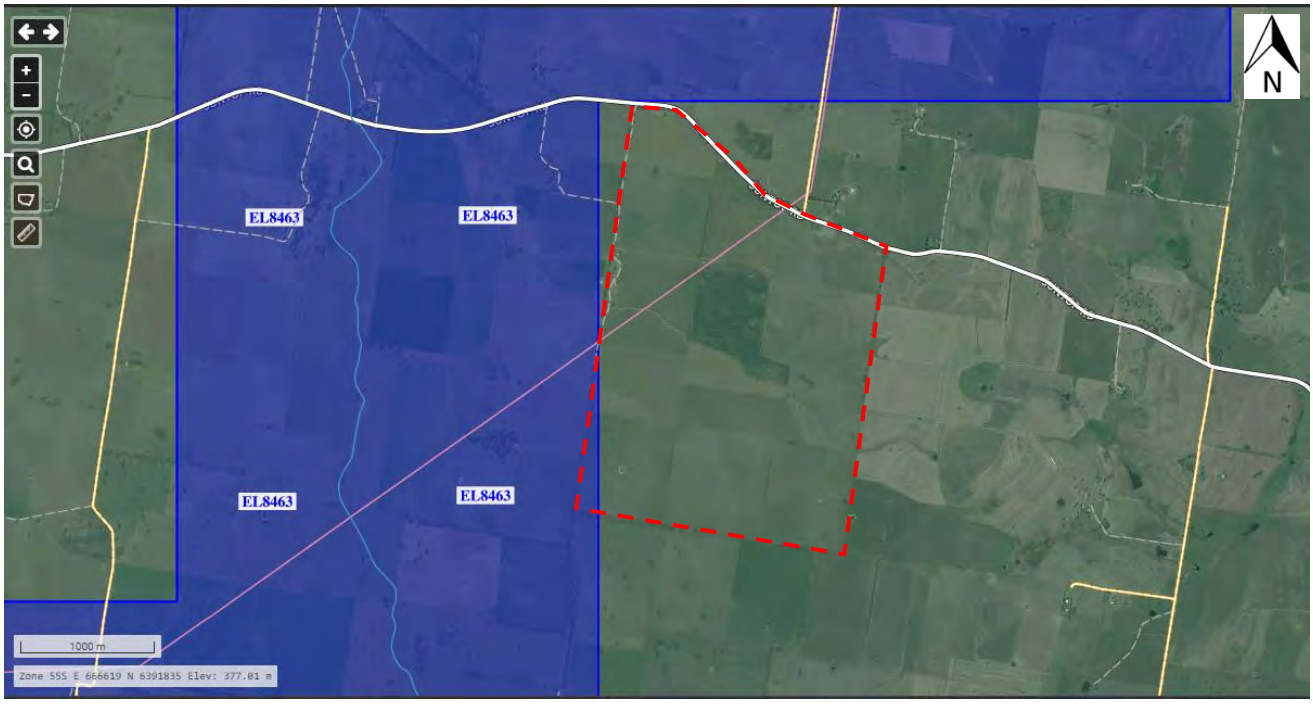
**Melbourne**
T (03) 9682 5290

**Newcastle**
T (02) 4910 3600

KMH as part of the pitt&sherry group

E info@pittsh.com.au
www.pittsh.com.au
1300 pittsh

Incorporated as
Pitt & Sherry
(Operations) Pty Ltd
ABN 67 140 184 309




**Legend**

- Proposal location
- Current exploration licence
- Highway
- Electricity Transmission lines

3 Kimberley Street, West Leederville, WA 6007
PO BOX 1573 West Perth WA 6872
Telephone 08 9381 7838  Facsimile 08 9381 5375
Email: admin@emmersonresources.com.au
Website: www.emmersonresources.com.au
ABN 53 117 086 745

Pitt & Sherry
Suite 902, Level 9, North Tower
Chatswood Central
1 – 5 Railway Street
Chatswood, NSW 2067

To whom it may concern,

**RE: RESPONSE TO 'LETTER TO TITLE HOLDER' – EL 8463**

I refer to your letter dated 17 May 2018, outlining you are contacting Emmerson on behalf of Photon Energy in regard to a proposal for the construction and operation of a solar farm on;

- Lot 1-2-3 DP 506925
- Lot 122 DP 753238
- Lot 90 DP 657805

Emmerson has reviewed the letter, proposed project location and assessed any impact it may have on our mineral exploration activities.

The proposed location of the project, as per the correspondence letter which gives the Lot and DP location, has been deemed to have no impact on any of our current or future proposed activities.

For any further information in relation to this matter please feel free to contact me on any of the below details.

Regards

*Adam Walters*
**Manager - Projects**
**Emmerson Resources Ltd**
**awalters@emmersonresources.com.au**
**(08) 9381 7838**

PHOTON ENERGY

EXPERTS FOR THE SOLAR AGE.

FACT SHEET

Estimated capacity: 286 MWp
Power for equivalent of 86,200 homes
Annual CO2 savings: 405,654 tonnes

# SUNTOP SOLAR FARM UPDATE MARCH 2018

Suntop Road



## Location

The proposed solar farm is approximately 20km from Wellington town centre along Suntop Road.

The proposed site covers approximately 500 hectares, of which 400 hectares may be used for solar panels. The site was selected due to its location to the TransGrid 132 KV powerline and site accessibility.

Agricultural activities, specifically grazing, will continue in conjunction with its new function as a solar farm. Combined land use has been highly successful around the world, including on other Photon Energy solar farms.

## Energy generation and capacity

The Suntop Solar Farm will generate 503 GWh of clean, renewable energy per annum. That's enough energy to power more than 86,000 households – approximately 43 times the number of homes in the Wellington local government area, and will help to supply all of NSW with clean energy.

Photovoltaic Solar is now recognised as the most cost-efficient form of energy generation. It is expected that the proposed solar farm will also help reduce power prices by increasing supply. Suntop Solar Farm is one of the first in Australia to be developed without government subsidy and is a fully commercial operation.

## Community benefits

This solar farm will create approximately 100 jobs during construction and support up to 10 jobs during operation. Photon Energy is committed to employing locally wherever possible. This project will help develop experience in skilled electrical trades and best practices for combined land use solar farming.

## Photon Energy solar farms

Drawing on a team with over ten years of global solar farm experience, Photon Energy is one of Australia's leading solar farm designers and managers. The company has installed major Australian commercial solar systems and European solar farms. The Photon Energy team in NSW is currently completing a new solar farm in Leeton. Photon has recently joined with Canadian Solar for this project. Canadian Solar are one of the largest solar developers in the world.

# Estimated project approval timeline

**SEP 2017**

**Feasibility**
Secretary's Environment Assessment Requirements (SEARs) issued by Department of Planning and Environment (DP&E). The SEARs provided a framework for the Environmental Impact Statement (EIS).

**NOV 2017 to FEB 2018**

**Site Visits and Investigations**
Site visits were conducted by a team of environmental specialists in November 2017. The results of these investigations are currently being documented. This included a site visit by DP&E representatives.

**FEB 2018 to APR 2018**

**EIS Preparation and Community & Stakeholder Consultation**
Based on the outcomes of the Environmental specialists reports, stakeholder engagement and one on one meetings with adjacent landholders, the Environmental Impact Statement (EIS) is prepared. This includes revision of the proposed solar farm footprint and landscape and visual mitigation plans.

**MAY 2018 to JUNE 2018**

**Submission to DPE and Public Exhibition**
After the EIS is complete, it is submitted to DP&E. After review, the EIS will be placed on public exhibition. The expected duration of this will be approximately four weeks. Community members have the opportunity to submit feedback to DP&E on the project.

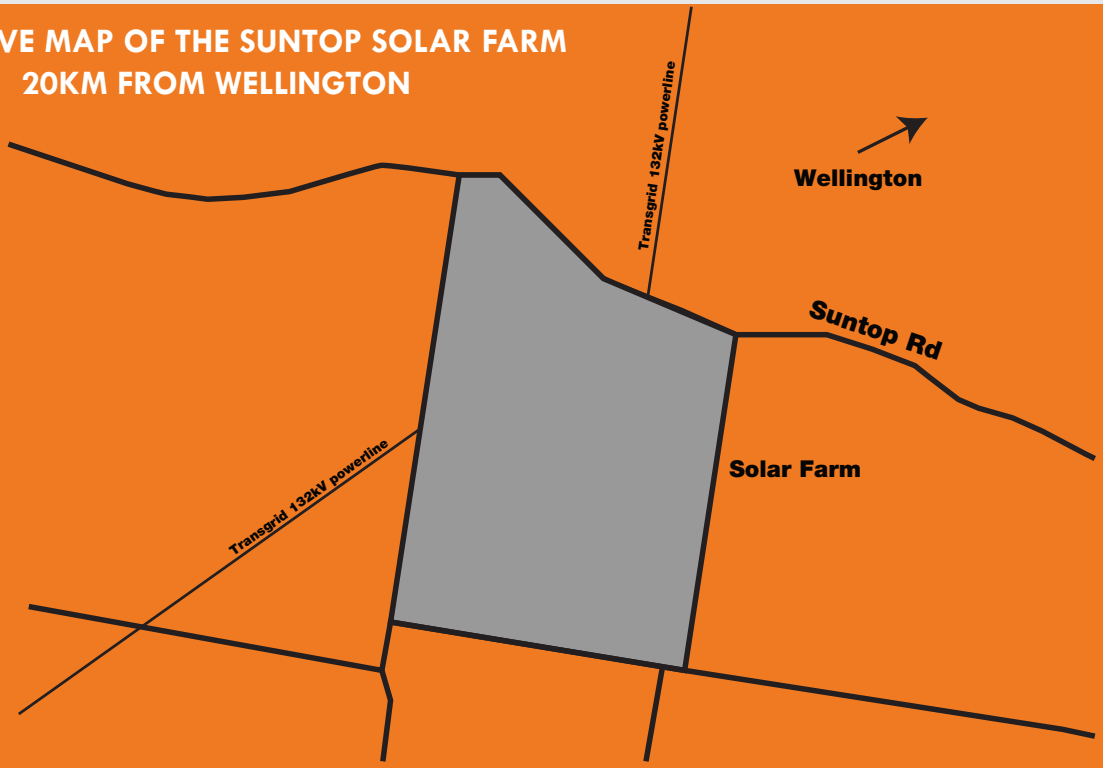
**JUN 2018 to JUL 2018**

**Assessment**
After reviewing the feedback and Photon responds, DP&E will complete their assessment and provide a Determination for the development. If required, the development will be referred to the Independent Planning Commission (IPC).

**NOV 2018**

**Determination**
The DP&E (or, if applicable, the IPC) will announce their decision. There may be conditions included to mitigate and address issues raised by the community.

## INDICATIVE MAP OF THE SUNTOP SOLAR FARM 20KM FROM WELLINGTON




PHOTON ENERGY
EXPERTS FOR THE SOLAR AGE.

**Email:** suntopsolarfarm@photonenergy.com
**Web:** www.photonenergy.com.au/current-projects/suntop-solar-farm

**Phone: 1300 881 045**

Photon Energy Australia Pty Ltd | Level 2 / 55 Grafton Street | Bondi Junction NSW 2022 | Australia

# MINUTES

## Suntop Solar Farm Community Consultation

**Date: 30 August 2017 – 6:30pm**
**Venue: Arthurville Rural Fire Service Shed, Cnr of Bennetts Road and Suntop Road, Suntop**

*Hosted by Photon Energy:*
Michael Gartner – Managing Director Australia
Chris Guzowski – Project Development Director
Nick Guzowski – Project Development Manager

21 Registered Attendees – see external attendee list.

Presentation shown on projector screen and supported by presentation by Photon Energy representatives.

Agenda:

1. Introduction to Photon Energy
    a. Background
    b. Experience
2. Description of proposed Solar Farm
    a. Site selection
    b. Solar Farm technology
    c. Solar Farm benefits
    d. Photon Energy Commitments / community consultation process
    e. Reference Images and visualizations
    f. Development / planning process and next steps
    g. Contact details

Comments:

1. Suntop Road is closed to B-Double trucks during the times which school buses use the road. I hope that any construction activities will respect these rules as children of residents will be travelling in these school buses.

Questions

Q1: How much of the land will be used as a foot print for the solar farm?
A1: Currently we have secured land tenure of approximately 500 hectares. The layout and placement of the solar farm on the site has not yet been finalised, however we expect that the foot print of the solar farm will around 280 hectares,

**PHOTON ENERGY AUSTRALIA P/L**
Level 2 / 55 Grafton Street
Bondi Junction NSW 2022

T +61 2 8021 3383

info.aus@photonenergy.com
www.photonenergy.com.au

ABN: 47 150 054 069



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AU001006-1, AU001007-1, AU001008-1, AU001009-1

which is less than 60% of the total land. We anticipate that the design will incorporate a buffer area between Suntop Road and the border of the Solar Farm, to minimise visual impact from Suntop Road.

Photon Energy Australia Pty Ltd | Level 2 / 55 Grafton Street | Bondi Junction NSW 2022 | Australia

20-12-17

**Dear interested party,**

I write to you in regards to the proposed solar farm in Suntop being developed by Photon Energy. Since the public meeting held at the Arthurville Rural Fire Shed in Suntop on 30th August 2017, there has been progress on the project, of which we would like to provide you updates, as set out below.

*Environmental Assessment*

Our principal environmental consultant, pitt&sherry, has performed their on-site assessment during the week of the 20th November, with consultants assessing flora, fauna, heritage, visual, noise and traffic impact, testing soils on site and assessing waterways. They have collected data for their input into the Environmental Impact Statement (EIS), which will be prepared for assessment of the proposed development by NSW Department of Planning and Environment.

*Community Consultation*

We have been in contact with individuals and special interest groups both in support, and who have raised concerns about the project. We continue to progress conversation with interested parties and stakeholders about the project with the aim of addressing any concerns.

*Planning Timeline*
We estimate the following timeline.

In August 2017 we held a community meeting in Suntop to open discussion about the proposed solar farm development.

In September 2017 we received the Secretary's Environment Assessment Requirements (SEARs) issued by Department of Planning and Environment. The SEAR's outline the requirements of the EIS.

In November 2017 site visits were completed by the environmental specialists. Engagement with the community and stakeholders continued.

Moving forward from December 2017 to March 2018 the EIS will be prepared. The EIS will consider all of the specialists' studies and assesses the potential impact of the development and propose mitigation measures. The EIS will be drafted and submitted to NSW Department of Planning and Environment for review. During this time we will continue to liaise and discuss the proposed development with the Suntop Community.

**PHOTON ENERGY AUSTRALIA P/L**
Level 2 / 55 Grafton Street
Bondi Junction NSW 2022

T +61 2 8021 3383

info.aus@photonenergy.com
www.photonenergy.com.au

ABN: 47 150 054 069



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March 2018 to April 2018
The EIS will be placed on Public Exhibition by DP&E. This is expected to be about 4 weeks. Community members and stakeholders will have the opportunity to submit comments and feedback to the DP&E on the project.

May 2018 to June 2018
After receiving all of the submissions, Photon Energy will prepare a Submission Report to address the comments and feedback received during the Public Exhibition.

July 2018 to August 2018
DP&E will complete a full assessment of the EIS. If required, the development will be referred to the Planning Assessment Commission (PAC). If the PAC is not required, DP&E will complete their assessment and make a Determination for the development.

September 2018
DP&E will announce their decision. There may be conditions included to mitigate and address issues raised by the community.

We are interested in your feedback and welcome your comments, concerns and questions. We have a website for the proposed Suntop solar farm development. Please contact us at suntopsolarfarm@photonenergy.com or 1300 881 045.

Best regards,



Nick Guzowski
Project Developer



# Proposed Solar Farm,

# Suntop Road, Suntop, near Wellington

pitt and sherry (Operations) Pty Ltd

## Traffic Impact Assessment and Management Plan

May 2018

SECA solution

# Solar Farm Project, Suntop NSW

# Traffic Assessment Report

Author: Sean Morgan

Client: pitt and sherry (Operations) Pty Ltd

Issue: Ver03/11052018

Reference: P0987D

14 May 2018

## Quality Review and Document History

| Version | Date | Description | Prepared By | Checked By |
|---|---|---|---|---|
| **Ver01** | 4/2/18 | Draft | S Morgan | C.Thomas |
| **Ver02** | 3/4/18 | Draft | S Morgan | C Thomas |
| **Ver03** | 14/5/18 | Final | S Morgan | C Thomas |
| | | | | |

Ground Floor, 161 Scott Street Newcastle NSW 2300
Ph (02) 4032 7979
www.secasolution.com.au

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# Contents


1 Introduction ..... 2

1.1 Consultation and Authority Requirements ..... 1

2 Existing Road Network and Local Characteristics ..... 4

2.1 Traffic Volumes and Road Operation ..... 7

2.2 Road Safety ..... 7

2.3 Mitigation Measures ..... 13

3 Construction Activities ..... 15

3.1 Timing ..... 16

3.2 Working Hours ..... 16

3.3 Construction staff numbers ..... 16

3.4 Heavy vehicle requirements ..... 16

3.5 Vehicle movements ..... 18

4 Traffic Management Assessment ..... 20

4.1 Impact Assessment ..... 21

4.2 Cumulative impacts ..... 24

4.3 Impacts on road pavement ..... 27

Appendix A. Safe Construction Actvities ..... 29

Appendix B. Drivers Code of Conduct ..... 33

1.1 General Requirements ..... 33

1.2 Vehicle Speeds ..... 33

1.3 Driver Fatigue ..... 33

1.4 Operating Hours ..... 35

1.5 Transport Routes ..... 35

1.6 Vehicle Departure and Arrival ..... 36

1.7 Overtaking ..... 36

1.8 Breakdowns and Incidents ..... 36

1.9 Penalties and Disciplinary Action ..... 37

1.10 Emergency Contact Numbers ..... 37

1.11 Driver Declaration ..... 38

Appendix C. Concept for upgrade of Intersection of Renshaw McGirr Way and Suntop Road ..... 39

Appendix D. Traffic Control Plan for Works at Site Access on Suntop Road ..... 40

Appendix E. Plan for Site Access upgrade works ..... 41




Quality Traffic Advice

# 1 Introduction

Seca Solution have been commissioned by Pitt and Sherry (Operations) Pty Ltd to review the traffic impacts associated with the construction and operational phase of a new Solar Farm development and to determine traffic management measures associated with the construction activities for the project. The project involves construction, operating and eventually decommissioning of a 200 megawatt (MW AC) solar farm to the south-west of Wellington in NSW.

The following works and infrastructure would be required to support the construction and operation of the solar farm:

- Construction of a main access road for all access and egress for the Site and substation off Suntop Road
- Installation of Electrical infrastructure including:
- A 132kV Substation including two transformers and associated 132kV switchgear.
- Inverters to collect and convert DC to AC.
- Cabling and other electrical infrastructure (e.g. security systems).
- A maintenance compound and buildings.
- Fencing, landscaping and environmental works.

The operational life of the solar farm is expected to be 30 years at which point the panels are either replaced and operations continue or removed, and the site is decommissioned and rehabilitated.

An estimated 550,000 PV panels would be installed on a single axis tracker system across the Site.

Construction of the site will take approximately 12 months.

Power generated by the facility will be transmitted via existing 132kV transmission lines, in an easement owned by TransGrid that traverses the Site and extends through to the Wellington substation approximately 15 kilometres to the north. A tee off connection will be used to connect the new substation on Site to the existing TransGrid 132kV transmission line via a short section of transmission line.

As part of the development consent and prior to work on site a Traffic Management Plan will need to be prepared to the satisfaction of the road authorities (Dubbo Regional Council and the Roads and Maritime Services (RMS)). The busiest period associated with the development with regards to traffic is during construction, with the operational phase of the project only requiring between 6-10 staff on site for the majority of the time. Seca Solution has prepared this Construction Traffic Management Plan (CTMP) for the project to ensure traffic issues can be safely and efficiently managed during the construction activities on site.

This CTMP has been developed for the construction activity for the project and the potential decommissioning element for the project, which may occur in 30 years' time. The potential decommissioning of the project site will require a similar level of activity, although will probably require less staff and would be completed over a shorter timeframe. The requirements and protocols for the decommission stage of the project will be as per the construction phase, although it is acknowledged these may need to be reviewed and altered in 30 years to suit the road conditions at that time as well as the work requirements.

The site is located within the locality of Wellington south of Dubbo and is shown in Figure 1-1 and 1-2 below.

The site is currently arable land and has road frontage to Suntop Road only.

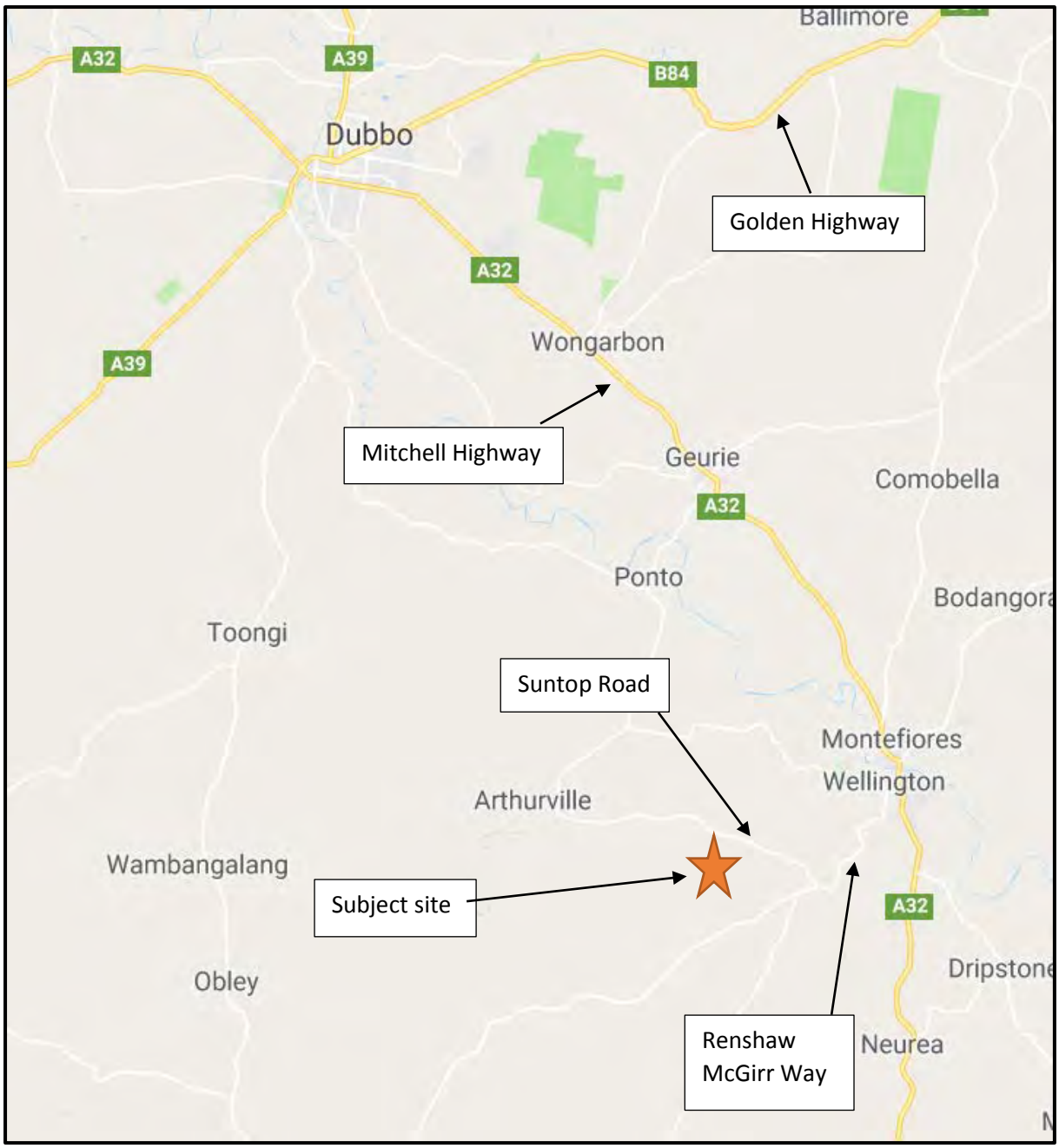



*Figure 1-1 – Site Location within the greater road network*



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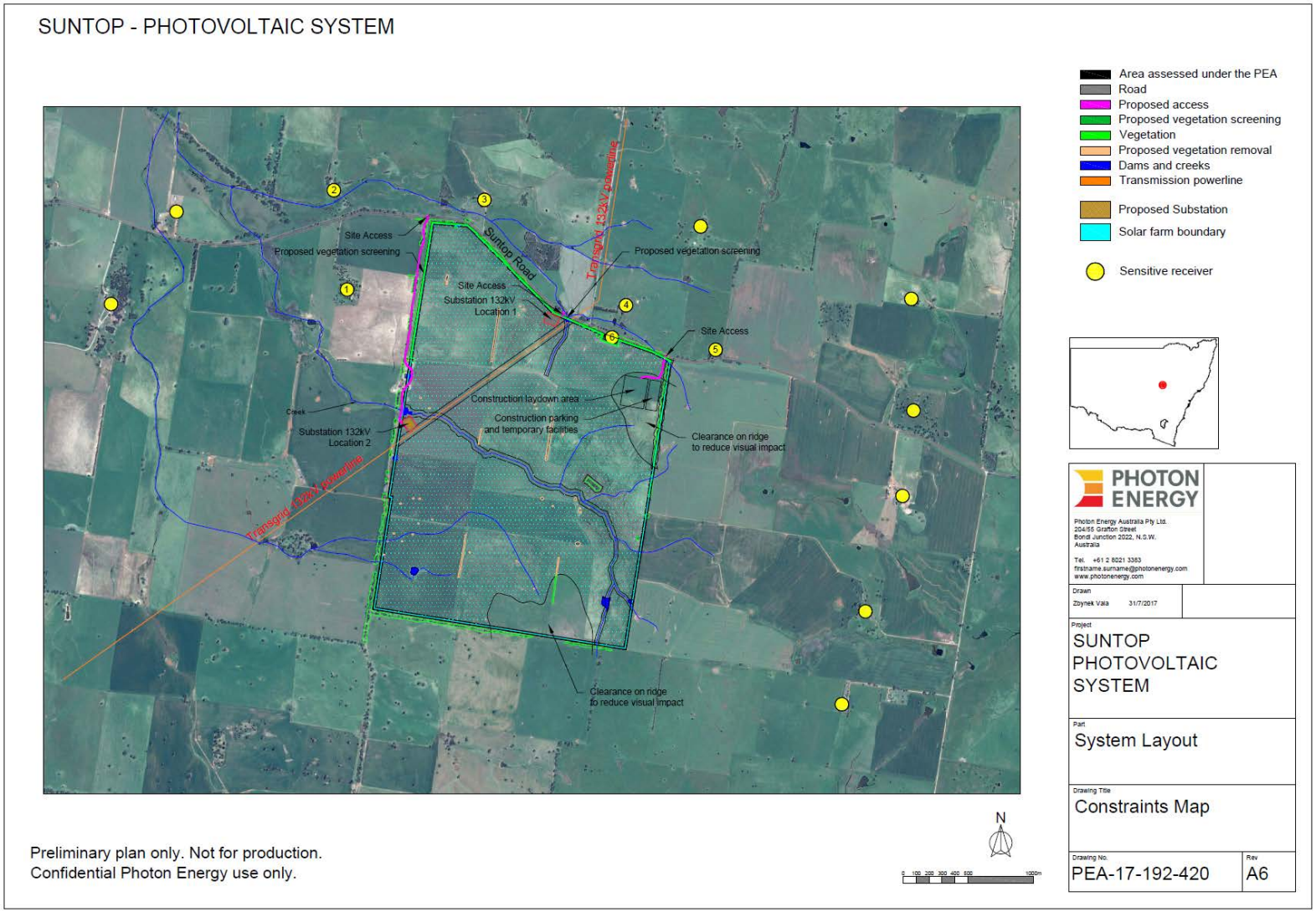



*Figure 1-2 – detailed site location*

## 1.1 Consultation and Authority Requirements

As part of the project, there has been consultation with the Department of Planning and Environment by the project manager and SEARs have been issued. A summary of the SEARs as they relate to traffic and access issues is presented below and the response is provided within this table.

| SEARs issue | Response / Section of report |
|---|---|
| The total impact of the existing and proposed development on the road network and 10 year horizon | The major impact of the project is during the construction phase which will be over approximately 12 months. The impact of this construction phase has been assessed based on current traffic flows.<br>For the 10 year horizon the traffic will be that associated with the on-going maintenance / operation of the facility. 10 staff will be located on the site once the facility is operational.<br>Refer Section 3.1.1 |
| The volume and distribution of traffic | The volume of traffic has been assessed for both the construction and operational phase.<br>*Construction*: 70 light vehicles and 20 heavy vehicle inbound movements per day and similar outbound.<br>*Operational*: 10 light vehicles per day inbound and outbound. Infrequent heavy vehicle for specific maintenance work only<br>*Distribution:* Heavy vehicles via the designated heavy vehicle route to connect with Golden Highway and Mitchell Highway to Wellington then via the designated route via Showground Road, Renshaw McGirr Way and Suntop Road.<br>Refer Section 2.3, 2.4 3.1.1 |
| Intersection sight distances at key intersections on the haulage route | Sight distances have been assessed on site during the site visit along the haulage route between the Mitchell Highway and the site access.<br>Refer Section 1.4.1/2/3/4 |
| Existing and proposed site access arrangements | A new access will be provided for the construction work direct off Suntop Road. Existing access will be upgraded as part of the project construction work.<br>Refer Section 1.5 |
| Servicing and parking | Once operational the servicing demands will be met with 10 staff located on site.<br>All parking will be contained on site within a temporary parking area adjacent to the site office.<br>Refer Section 2 |
| Impact on public transport (public and school bus routes) and consideration of walking and cycling | Existing school bus run on Suntop Road will have minimal interaction with construction traffic. Drivers will be advised of presence of school bus run and will drive in accordance with all road rules.<br>Location of the site is relatively remote and no footpaths available for walking to the site. Cycling to the site is an option as site is within 45 minutes of centre of Wellington. Cyclists can ride on the road due |



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| | |
|---|---|
| | to low traffic flows and can park bikes on site as required.<br>Refer Section 3.1.1, 3.1.3 |
| Transport Management Plan to manage impacts of construction and operational traffic. Include any Traffic Control Plans. A Driver Code of Conduct:<br>a) Map of primary access routes<br>b) Safety initiatives for transport through residential and school zones<br>c) Consideration of coordination of construction traffic with seasonal agricultural haulage<br>d) Induction process for vehicle operators<br>e) Complaint resolution and discipline process<br>f) Any community consultation measures during peak construction | Map of route for heavy vehicles provided – Refer Section 3 Figure 3.1.<br>All drivers will sign code of conduct which specifies all road rules must be obeyed including driving through school zones - Refer Appendix A<br>Given the volume of vehicle movements associated with the construction phase of the project no coordination with agricultural haulage is considered necessary - Refer Section 3.1.1<br>All staff and delivery drivers will be inducted to site and sign a driver code of conduct – Refer Appendix A<br>The contractor on site shall establish a complaint handling process and resolution process.<br>During construction activities all properties along the local haulage route from the Mitchell Highway will be notified via a letter drop of on-going construction work on a fortnightly basis – Refer Appendix A. |
| Road Safety Audit at any specific locations identified as safety concern on haulage route | No specific road safety issues were identified along the haulage route. The intersection of Suntop Road and Renshaw McGirr Way has reduced sight line distances and is proposed to be upgraded to provide a sheltered right turn lane and vegetation trimmed to allow for adequate sight distance. |

*RMS Consultation*

Consultation has been held via a phone conversation with Andrew McIntyre, manager Land Use Assessment, Western Region with regard to a number of solar farms proposed to be constructed across rural NSW. The relevant outcome of the discussion with Andrew McIntyre is provided below:

- The critical phase for the assessment is the construction activities as this involves heavy vehicle access to the site along regional and local roads as well as a high number of workers;
- Consideration to the movement of staff to and from the site must be given. In remote areas where the solar farms are constructed, there are a large number of staff who can be drive in/drive out re-locating for temporary work from the established east coast centres such as Sydney and Newcastle. This requires staff to drive a long-distance home after working on the site for long hours for a week or more – consideration to controls for staff driving home after working on site should be considered;
- Provide details on the access routes to the site for heavy vehicles and the size / number of heavy vehicle movements associated with the construction and operation of the site;
- Provide details on the operational characteristics of the project – it is recognised that the staff levels and traffic volumes for the operational stage of the project are low;
- Provide comment with regard to the decommissioning stage of the project and the potential traffic impacts;
- Prepare a driver code of conduct for the project to control vehicle access and maintain safety;
- Assess impacts on road safety, including pedestrians and cyclists and any bus routes impacted
- Review alternative transport options for the site including pedestrians, cyclists and bus use
- Provide details on any road upgrades identified as part of the project and include a Road Safety Audit as required

*Council Consultation*

Consultation has been held with Dubbo Regional Council by staff from the project team and the following issues were raised by Council:

- The intersection of Suntop Road and Renshaw McGirr Way was raised as a safety concern and should be considered for upgrade;
- Access to the site off Suntop Road must be considered to maintain road safety
- Council have requested a dilapidation survey be completed along the length of the haul route between Wellington and the Site prior to construction work commencing



Quality Traffic Advice

# 2 Existing Road Network and Local Characteristics

Suntop Road is a local road (managed by Dubbo Regional Council) which runs along the northern border of the Site. The north, east and west boundaries of the Subject lands are defined by neighbouring agricultural lots with some sections of unnamed, unsealed rural roads. Suntop Road connects with Renshaw McGirr Way to the west of the site via a simple give way controlled intersection with Renshaw McGirr Way being the priority road. Suntop Road is sealed (refer Photo 1 below) and provides a width of approximately 6 metres allowing for 2-way traffic movements as required. It operates under the speed limit of 100 km/h.



*Photo 1 – View along Suntop in the vicinity of the proposed site access*

Renshaw McGirr Way to the west of the site is a sealed two-way road with an overall width in the order of 7 metres (refer Photo 2 and 3 below). It intersects with Suntop Road via a simple give way controlled intersection with Renshaw McGirr Way being the priority road. In this location Renshaw McGirr Way provides a straight alignment to the east of the intersection while to the west is a vertical and horizontal curve that partially impacts upon the visibility available for drivers turning in and out of Suntop Road. Renshaw McGirr Way runs generally in a north south direction and connects with Showground Road and Bushrangers Creek Road at a T intersection. Showground Road / Bushrangers Creek Road is the priority road and provides access to Wellington and the Mitchell Highway.



*Photo 2 – Typical cross section on Renshaw McGirr Way*



*Photo 3 - Typical cross section on Renshaw McGirr Way at intersection with Showground Road*



Quality Traffic Advice

Showground Road provides direct access to Wellington and the Mitchell Highway. Showground Road provides a sealed pavement with a width of approximately 7 metres (refer Photo 4 below) allowing for 2-way traffic movements and connects over the bridge crossing over the Bell River on the western edge of Wellington. There are no weight restrictions on this bridge and the width of this bridge permits two opposing heavy vehicles to pass.



*Photo 4 – View along Showground Road showing typical cross section.*

These roads all operate under the posted speed limit of 100 km/h, except for the urban speed limit of 60 km/h which is effective from the Wellington Horse Race track on Renshaw McGirr Way through to Wellington.

As part of the project, it is proposed that all heavy vehicles will travel via the roads identified above.

There are a number of rural residential lots and farms located along this route between the subject site and Wellington. During the site work, a number of heavy vehicles were observed on this road including semi-trailers associated with farm activities.

Showground Road connects with the Mitchell Highway via a 4-way roundabout. The Mitchell Highway forms part of the regional and State road network that is a key freight route in NSW and forms part of the road network designated by the Roads and Maritime to carry oversize, over mass vehicles. It typically provides a single lane of travel in both directions and operates under the posted speed limit of 110 km/h outside of the urban areas where the alignment permits. As part of the regional road network, the Mitchell Highway carries a mixture of local and regional traffic with a significant number of trucks including B-double combinations. Based on RMS data from the count station on the Mitchell Highway to the south of Wellington (station I.D 6170) the road carries a high level (23%) of heavy goods vehicles.

The Mitchell Highway runs through the centre of Wellington with no bypass for heavy vehicles.

Staff and local supplies may be sourced from Dubbo and access to Dubbo is provided via the Mitchell Highway.

## 2.1 Traffic Volumes and Road Operation

Traffic volumes in the immediate vicinity of the subject site are very low, reflective of the rural environment. Suntop Road provides access to a number of rural land holdings and does not provide a direct access for through traffic movements nor does it provide access to a town or village. As such the traffic flows on this road are considered to be less than 100 vehicles per day two-way. Renshaw McGirr Way similarly carries low traffic flows but does provide local access to Yeoval. Whilst it would carry higher traffic flows than Suntop Road it is still considered that it would carry less than 500 vehicles per day two-way.

As part of the regional road network, it can be seen that the Mitchell Highway carries higher traffic flows, associated with both local and regional demands. The RMS web page for traffic count data shows that in 2017 the 2-way traffic flow south of Wellington was 2,428 vehicles per day (count I.D 6170) with 23% heavy vehicle content. The traffic data shows that the split in traffic flows north and south in this location are even, as to be expected.

Observations on site during a typical morning peak period (22nd November 2017) shows that the current road network in the vicinity of the subject site and around Wellington operates very well with minimal delays and congestion. The route proposed to be used for the project carries low traffic flows and operates with no delays except for those associated with drivers slowing down to observe traffic flows on the approaches to the various intersections and negotiating the intersections. The only delays noted were along the Mitchell Highway through the centre of Wellington, mainly associated with semi-trailers and B-doubles manoeuvring through the two roundabouts on the Mitchell Highway through town.

## 2.2 Road Safety

It is recognised that as part of the project work, there will be a significant number of heavy vehicle movements associated with the construction work which will impact along the local road network. All heavy vehicle access to the project site will be via the Mitchell Highway – Showground Road – Renshaw McGirr Way to Suntop Road. No alternative route for heavy delivery vehicles has been considered nor is appropriate.

The major road safety impact is associated with the delivery trucks accessing the site and their impact upon the operation of the intersections. The trucks will be accessing the site from either Newcastle or Port Botany in Sydney, where the solar panels will be shipped to. The trucks will then access Wellington via the regional road network which will include the New England Highway to the Golden Highway to then travel through to Dubbo. From Dubbo the trucks will then travel south along the Mitchell Highway to Wellington. These regional roads currently provide a high standard of road and allow for the movement of local, regional and national road freight and carry B-double trucks. It is considered that the additional truck movements associated with the construction activities for the project will have a minimal and acceptable impact upon road safety along these roads.

For the local traffic impacts, consideration has been given to the existing alignment of the road, intersection layouts, current traffic flows and existing users along the route between Wellington through to the site. Observations on site with regard to road safety are summarised below:

- Existing traffic flows on the local road are very low
- The sealed width of the road allows for two-way traffic movements
- The alignment of the road is generally good although there are areas along the edges of the road pavement showing wear due to tyre run off breaking the edge of the seal
- There are a couple of sub standard curves where there are advisory signs provided in advance with 55 and 65 km/h speed limit guidance signs
- A number of heavy vehicles were observed travelling along Renshaw McGirr Way associated with farm requirements which included semi-trailers

This route is provided below (Figure 2-1) and will be included within the Driver's Code of Conduct which will form part of the project inception meeting for the project for all staff and drivers.



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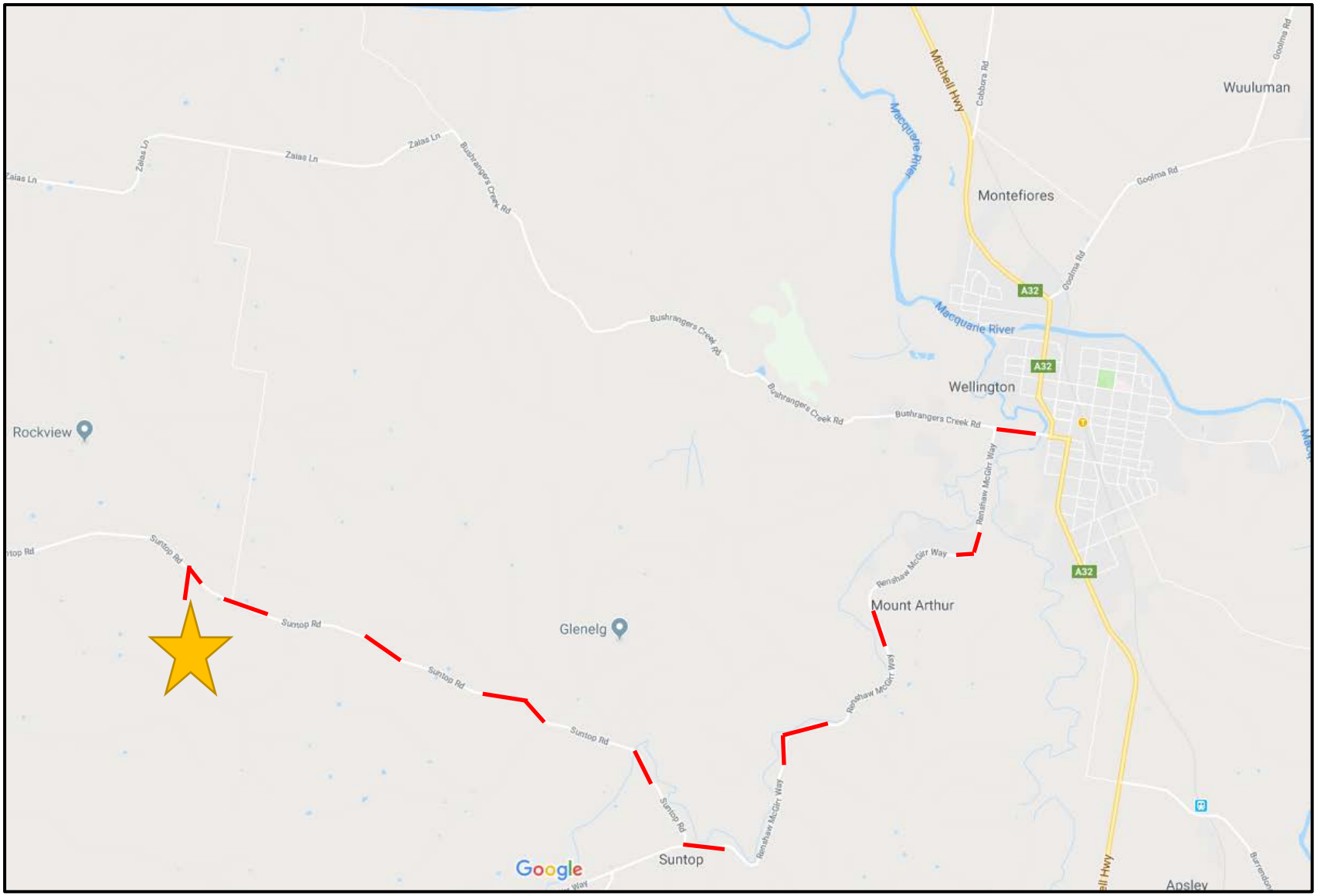



*Figure 2-1 – Designated Heavy Vehicle route to project site*

The vehicle route through Wellington currently caters for a large number of heavy vehicles including B-double combinations. This route provides a wide road pavement to cater for kerb side parking in a mixture of parallel and angle parking and the safe 2-way movement of trucks along the road. The intersections along this route are well laid out and provide good visibility in all directions to allow for the safe turning movements of vehicles. It is considered that this route through town can safely accommodate the additional traffic movements associated with the project.

### 2.2.1 Intersection of Mitchell Highway and Showground Road

The intersection of the Mitchell Highway and Showground Road is controlled by a roundabout and is very well laid. It allows for all turning movements and as part of the main transport route through town caters for the swept path of B-double combinations. It also allows for the turning movements associated with large horse floats accessing the Wellington Racecourse located off Showground Road. This intersection is located within the centre of Wellington and operates under the posted speed limit of 60 km/h. The sight line requirements for drivers approaching the roundabout and observing approaching vehicles on adjacent legs have been assessed against the requirements of Austroads Guidelines and these requirements are met for this roundabout.

Overall it is considered that this intersection provides a high level of control and operates to a high safety standard and as such no upgrade works are required at this intersection to accommodate the traffic movements associated with the proposed solar farm (construction and operation phase).

### 2.2.2 Intersection of Showground Road and Renshaw McGirr Way

This intersection operates as a T intersection with Renshaw McGirr Way being the minor approach road. It is well laid out and provides good visibility in both directions for drivers exiting the side road. All traffic movements associated with the project will be left turns into Renshaw McGirr Way and then right turns out onto Showground Road. The drivers turning right out require visibility to the left and right in accordance with Austroads Guidelines and based on the posted speed limit of 60 km/h the sight distance requirement is 123 metres desirable and 114 metres minimum.

The sight lines have been assessed and site and exceeds 200 metres in both directions (refer Photo 5 and 6 below).



*Photo 5 – View to left for drivers turning out of Renshaw McGirr Way onto Showground Road*



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*Photo 6 - View to right for drivers turning out of Renshaw McGirr Way onto Showground Road*

Whilst this intersection does not provide a sheltered right turn lane, the traffic associated with the project will be all turning left off Showground Road and right out of Renshaw McGirr Way and as such will not be turning right into Renshaw McGirr Way. Given the low overall traffic flows at this location it is considered that there is no requirement for a sheltered right turn lane to be provided due to the project traffic movements. The existing demand for right turns from Bushrangers Creek Road into Renshaw McGirr Way is negligible and therefore there shall be no impact on turn movements associated with the development traffic. It is considered that no upgrade to this intersection is required on road safety grounds to accommodate the traffic movements associated with the proposed solar farm (construction and operation phase).

### 2.2.3 Intersection of Renshaw McGirr Way and Suntop Road

The intersection of Renshaw McGirr Way and Suntop Road is a simple give way controlled T intersection with Suntop Road being the minor road. Trucks associated with the project will be turning right on to Suntop Road off Renshaw McGirr Way (laden) and then left turn from Suntop Road (unladen) into Renshaw McGirr Way. From the site work the following points are made:

- Current traffic flows in this location are very low and drivers experience minimal delays at this location
- There is no sheltered right turn lane, however with good forward visibility for drivers on Renshaw McGirr Way combined with the low traffic flows it can be seen that a sheltered right turn lane is not required for the current traffic demands
- The visibility splays for traffic turning right into and left out of Suntop Road are inadequate for the posted speed limit of 100 km/h, due to the vertical and horizontal curve to the immediate west of the intersection on Renshaw McGirr Way (refer Photo 7 below). The existing visibility splay is approximately 130-150 metres.
- Whilst there is an advanced sign to warn drivers approaching this intersection on Renshaw McGirr Way (for eastbound drivers) there is no signage indicating for drivers to slow down for this curve and as such vehicles could be travelling at 100 km/h in this location



*Photo 7 – View to right for drivers turning out of Suntop Road into Renshaw McGirr Way*

It is considered that this intersection layout is not satisfactory – whilst it currently provides access for large vehicles associated with farm activities, the project will increase the frequency of these movements and could impact upon road safety at this location.

Two options have been considered for this intersection:

- Provide a Traffic Control Plan to be implemented for this intersection, to reduce vehicle speeds and highlight the increased traffic flows at this location. By reducing the vehicle speeds the sight distance requirements decreases and drivers on Renshaw McGirr Way would be able to brake and avoid a potential collision with a turning vehicle. Reducing the posted speed limit through the intersection to 60 km/h for the duration of the construction work would ensure that road safety is maintained.
- Upgrade the intersection with shoulder widening to safely cater for vehicles turning right into Suntop Road, together with vegetation removal to ensure that the required sight distance for 100 km/h is provided.

These options have been discussed with Council and the RMS and it has been determined that this intersection should be upgraded to allow for the shoulder widening. The RMS has indicated that the option to reduce the speed limit through this location as part of the temporary traffic control plan is not satisfactory.

The concept plan for the upgrade of this intersection is provided in Appendix C to this report. A full detailed plan will be developed as part of the project design work and constructed prior to construction commencing on site.

### 2.2.4 Site access on Suntop Road

The access to the site will be via a new access Road which will be constructed within the property to the immediate east of the existing gated access to the project site. This new access will provide access for the construction work as well as form the permanent access for the substation. The existing access is an unsealed farm road that will be retained to continue to provide access for the neighbouring property. The new access will connect direct with Suntop Road with the alignment of Suntop Road in this location being straight and flat, ensuring good visibility is provided in both directions. Drivers accessing the site will be left turns in and then right turns out along Suntop Road. In this location Suntop Road operates under the posted speed limit of 100 km/h and under Austroads Guidelines the visibility requirement is 248 metres.



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The sight distances have been assessed on site and exceed 300 metres in both directions (refer Photo 8 and 9 below)



*Photo 8 – View to left along Suntop Road for drivers exiting the project site*



*Photo 9 - View to right along Suntop Road for drivers exiting the project site*

This site access will be upgraded to allow for a length of sealed section of driveway within the site together with a shaker to stop dirt being carried from the site onto the road.

## 2.3 Mitigation Measures

From the details above the following mitigation measures are proposed.

- Upgrade the intersection of Suntop Road and Renshaw McGirr Way to allow for shoulder widening to safely accommodate the right turning traffic into Suntop Road. Vegetation will also be removed to ensure that the minimum sight distance is available for drivers turning into Suntop Road and left out of Suntop Road onto Renshaw McGirr Way. The concept plan for these works is provided in Appendix C to this report;
- Provide a temporary TCP on the site frontage on Suntop Road adjacent to the site access for construction work associated with upgrading the access and for traffic entering and exiting the site. This TCP shall only be in place during construction and signs shall be removed or covered outside of construction activities on the site. Once the construction work is complete this TCP shall be fully removed. his TCP will be prepared in accordance with "Traffic Control at work sites" published by the RMS dated June 2010. This TCP is provided in Appendix D to this report;
- Provide regular community updates for residents along Suntop Road and Renshaw McGirr Way (between Suntop Road and Showground Road) to advise of construction activities and increased heavy vehicle movements along these two roads;
- Agree a maintenance schedule with Dubbo Reginal Council for the construction period to allow for increased wear along the edges of the sealed pavement due to the increased passage of heavy vehicles; and
- Agree a maintenance procedure at the intersection of Renshaw McGirr Way and Showground Road for the road surface. The existing road surface in this location is damaged and extensive pot holing is visible (refer Photos 10 and 11 below).



*Photo 10 – Visible pavement damage at intersection of Renshaw McGirr Way and Showground Road*



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*Photo 11- Visible pavement damage at intersection of Renshaw McGirr Way and Showground Road*

### 2.3.1 Light Vehicle Route

For light vehicles associated with workers, the proposed access route will be via the designated heavy vehicle shown in Figure 2-1 above. This route provides a safe and acceptable route for light vehicles which can safely and conveniently access the site.

The project will be utilising workers local to the site from the main centres e.g. Wellington and Dubbo who will use this route. Additional specialist staff may be required, and these staff members would be located in temporary accommodation in either Dubbo or Wellington. These workers would also use the designated heavy vehicle route to the site.

# 3 Construction Activities

The construction and commissioning phase is expected to last approximately 9 to 12 months with expected commencement in the 1st quarter of 2019. The main construction activities would include:

- Site establishment and preparation for construction:
  - Installation of security measures including fencing.
  - Establishment of site compound and material layout areas.
  - Ground preparation.
- Installation of environmental controls
  - A detailed Construction Environmental Management Plan (CEMP) would outline the environmental controls required.
- Minor vegetation clearing (grasses, shrubs and isolated trees).
  - Targeted clearance of low laying vegetation around trenching areas to steel post installation to minimise disturbance to existing ground cover.
  - Establishment of tree and vegetation protection measures as required.
  - Clearance of larger vegetation such as bushes and isolated trees.
  - Establishment of additional sedimentation and erosion controls as required.
- Preliminary civil works including:
  - Drainage works
  - Setting up foundations for the substation
  - Earthing works (see below)
- Installation of steel post and rail foundation system for the solar panels.
- Installation of PV panels and DC wiring beneath the panels.
- Installation of underground cabling (trenching) and installation of inverter stations.
- Construction of 132kV substation.
  - Site Establishment and clearing (if required)
  - Bulk earthworks via a range of plant that may include scrapers, bulldozers, excavators, rollers, trucks and loaders
  - Detailed civil works including drainage, earthing, foundations etc. generally using excavators, piling rigs, trucks and cranes
  - Erection of steelwork, equipment, demountable buildings and transformer generally using trucks, EWP's and cranes
  - Electrical connections generally EWP's and other minor plant
  - Testing and commissioning generally EWP's and other minor plant
- Connection of substation to existing 132 kV transmission line
- Testing of electrical infrastructure
- Removal of temporary construction facilities and rehabilitation of disturbed areas.

The project does not require any concrete footings to be provided for the solar panels construction. The substation will require a hardstand base with material imported for this.

A site office and compound will be established on site for the duration of the works with temporary access tracks provided to allow for access across the site as required.

All staff vehicles will be able to park within the site adjacent to the site office with no external parking demands. The car park area will allow for up to 80 vehicles to park within this compound area. This area will have solar panels installed towards the end of the construction phase requiring vehicles to be parked away from this area. The size of the overall site footprint however will allow for all construction staff vehicles to park on site. As part of the project construction it is proposed to maximise the local workers content (from Wellington and Dubbo) and car-pooling will



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be encouraged and supported as part of these trips. With 3 or 4 people arriving in a single vehicle it can be seen that the parking demands can be contained within the site.

The access road to the site will be via a newly constructed road off Suntop Road near the western boundary of the site in the north-west corner of the project site. This access road would be utilised as the Main Access Road following upgrade of the site access with Suntop Road.

TransGrid will utilise this new access road off Suntop Road for the new substation.

### 3.1 Timing

The construction of the solar farm is expected to commence in the 1st quarter of 2019 and be completed within a 9-12 month timeframe.

The first stage of the project works requires the road upgrade work for access to Suntop Road to be completed prior to commencement of construction activities on site

### 3.2 Working Hours

Construction hours are in accordance with the *Interim Construction Noise Guidelines* (DECC 2009) (ICNG) with standard construction hours being

- 7:00am and 6:00pm Monday to Friday
- 8.00 AM to 1.00 PM on a Saturday
- No construction work is to be carried out on a Sunday or public holiday.

No construction work, upgrading or decommissioning activities will be undertaken outside of these hours with the exception of:

- The delivery of material as requested by the NSW Police Force to other authorities for safety reasons; or
- Emergency work to avoid the loss of life, property and / or material harm to the environment.

### 3.3 Construction staff numbers

Peak demand levels for the construction work will vary with a peak of 250 people for a 6 month duration and a lower level outside of this peak period. The staff will be sourced locally where appropriate with some specialist and project management staff being temporarily located in Dubbo or Wellington. Staff will be encouraged and supported to car pool as appropriate with other staff transferred to and from the site via mini coaches to reduce vehicle demands. Due to the size of the site footprint, these same vehicles will also be used on site to move staff across the site.

With a peak of 250 staff, a vehicle occupancy rate of 4 people per vehicle has been assumed based upon carpooling and the use of a mini bus e.g. Toyota Coaster. This would give 65 vehicle movements inbound and outbound for staff movements.

All construction light vehicles will be able to park on site within the office compound area as required.

### 3.4 Heavy vehicle requirements

The level of heavy vehicles accessing the site will vary throughout the project timeframe. At the beginning of the project there will be a requirement for some earthwork moving equipment to construct the access road and some minor earthworks across the site as required. This may require a scraper or bull dozer which will be transported to site on a low loader. This machinery will remain on site for the duration of the earthworks portion of the project construction work.

While extensive earthworks are not proposed, some land forming (including localised cut and fill areas) may be undertaken to achieve more consistent gradients beneath the PV modules. Additionally, earthworks are required for trenching works.

In total, approximately

- Approximately 15,000 $m^3$ of gravel would be required to cap the access road
- Approximately 13,612 $m^3$ of sand (subject to detailed design) would be required for the bedding of cables that are to be buried throughout the site

Should any excavated material not be suitable for reuse or additional fill material is required, the maximum amount of fill is estimated to be 12,000 $m^3$.

Once the earthworks have been completed, the balance of the construction work will commence requiring machinery including:

- Pile driver (20)
- Piling rig
- All terrain fork-lift (20)
- All terrain utility vehicles (10)
- Backhoe (10)
- Flatbed trucks (10)
- Mobile crane (1)

Other equipment if required may include an elevated work platform, scraper, roller and winches. All of the plant will be located on site and will therefore be only required to access the site once for the construction works.

The solar panels are expected to be all delivered from the Port of Newcastle or Port Botany in Sydney. Other specialist equipment is generally sourced from Newcastle or Greater Sydney as required whilst consumables such as concrete and general material supplies will be local from the Dubbo or Wellington area.

A summary of the expected vehicle movements associated with the construction work is provided below and shows the full movements for the duration of the project. These movements are spread out across the project, with the site set up and earthworks commencing at the beginning of the project. Once this work is complete, the balance of the construction work will commence with deliveries of the specialist equipment etc with the import of backfill material being over a number of weeks to suit the construction timeframe.



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## 3.5 Vehicle movements

A summary of the vehicle movements is provided below.

| Phase | Purpose | Vehicle Type / Trailer Type | No. of one-way vehicle movements |
|---|---|---|---|
| Site Set-Up and Demobilisation | Portacabin delivery and removal | Low loader | 20 |
| | Skip delivery and removal | Low loader | 40 |
| | Generator delivery and removal | Semi-trailer | 4 |
| | General deliveries | Semi-trailer | 40 |
| | Crane mobilization and demobilization | Crane | 4 |
| | Water tank delivery and removal | | 4 |
| Roads and hardstands | Delivery of imported capping for road laydowns and crane hardstands | Truck and dog | 500 |
| | Plant delivery and removal: excavators, compactors drill rig | Low loader | 40 |
| | Concrete deliveries for maintenance container hardstands | Concrete agitator | 120 |
| Generating Equipment | Tool container delivery and removal | Low loader | 4 |
| | Module deliveries | Semi-trailer | 2000 |
| | Mounting structure and pile deliveries | Semi-trailer | 1600 |
| | Inverter Station deliveries | Low loader | 40 |
| | DC cabling trays and combiner boxes | Semi-trailer | 400 |
| AC Cable Installation | AC Cable delivery | Semi-trailer | 400 |
| | Backfill material delivery | Dump Truck | 1800 |
| Plant delivery and removal | Telescopic handler and excavator | Low loader | 50 |
| Overhead Line | Conductor delivery | Semi-trailer | 25 |
| | Pole deliveries | RAV | 6 |
| | Pole dressing delivery | Semi-trailer | 2 |
| Other | Miscellaneous deliveries | Light vehicle | 40 |
| | Monitoring equipment fibre SCADA servers etc | Truck | 2 |
| | Waste Collection | Truck | 400 |
| | Consumables (Oil and Fuel) | Truck | 40 |
| | | **TOTAL** | **7,581** |

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The traffic numbers provided above are based on the concept design work for the project and could alter through the detailed design phase of the project.

In summary, average vehicle movements are in the order of 70 light and 20 heavy vehicles two-way (70/20 inbound, 70/20 outbound) per day. For the light vehicles, the vast majority of these will be inbound movements in the morning bringing workers to the site with these vehicles then remaining on site for the full working day before leaving at the end of the working day. It is expected that there will be limited light vehicle movement outside of these periods, other than support staff e.g. office staff or the occasional visitor to the site.

For the heavy vehicles, these will typically be spread out across the working day. For the solar panel deliveries, these trucks are arriving from either the Port of Sydney or the Port of Newcastle and the journey length will be over 5 hours, seeing a spread of these vehicles not all arriving at the same time. Allowing for each truck to be emptied on site one at a time, the outbound movements will also be spread out and not all leave at the same time. All other heavy vehicles will also be spread out over the normal working day with no concentration of heavy movements expected.



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# 4 Traffic Management Assessment

The proposed traffic management measures allow for all access off Suntop Road only. The access to be used will be for the construction traffic movements as well as the future on-site operational demands. This access is to be provided in accordance with the requirements for the site operations (including swept path requirements for delivery vehicles) and take into account the design requirements of Dubbo Regional Council.

The designated access route to the site will be used by both light and heavy vehicles.

All vehicle movements in and out of the site are as shown below in Figure 4-1.

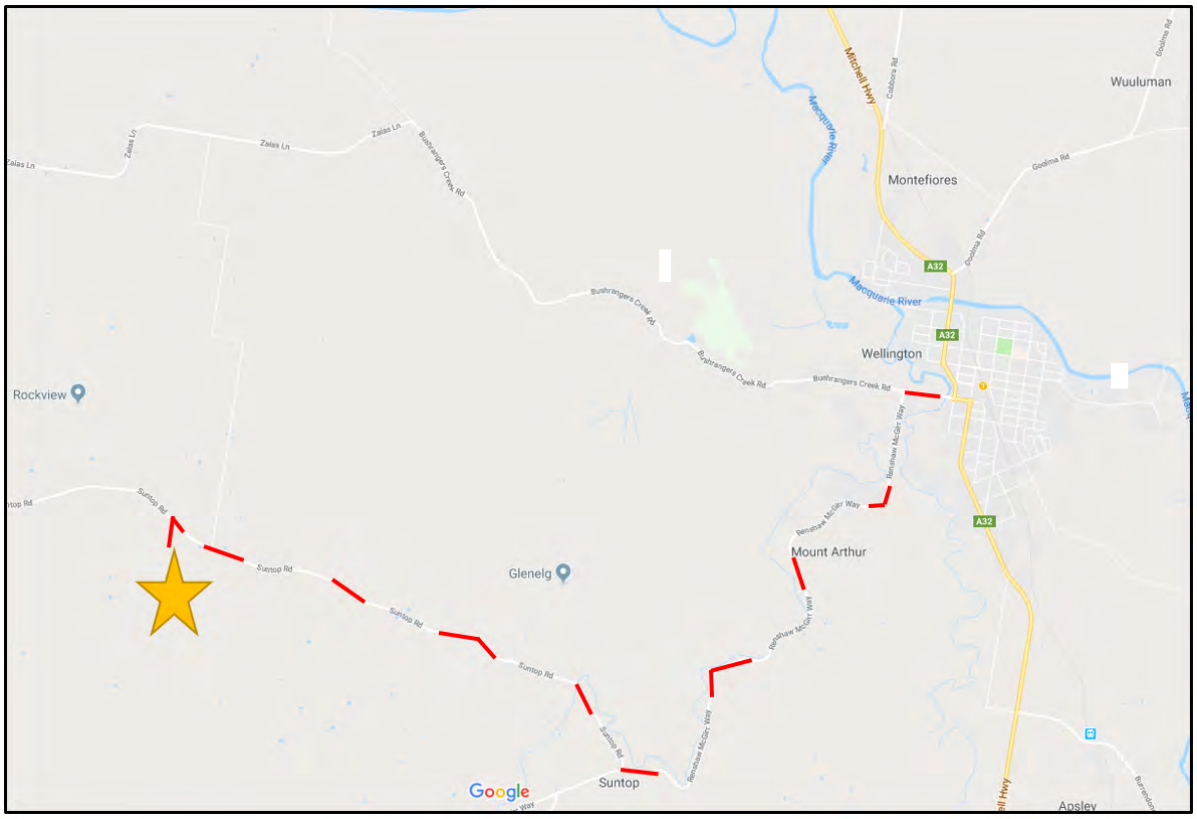



*Figure 4-1 – Heavy and Light Vehicle access route to subject site*

## 4.1 Impact Assessment

The project will require the delivery of the solar panels and other specialist equipment from Newcastle or Sydney with the access route via:

- Newcastle or Sydney metropolitan regional road network;
- M1 Motorway to Hunter Expressway (Sydney source);
- Hunter Expressway / New England Highway
- New England Highway to turn off for the Golden Highway;
- Golden Highway to Dubbo;
- Mitchell Highway from Dubbo to Wellington.

These roads all form part of the road freight routes within the State road network and all currently carry heavy vehicle movements including B-double access for the full length of the routes. These routes will be documented as the Haulage Route for all delivery vehicles to enter and exit the site for the vehicles associated with haulage of the solar panels for the project site.

These roads carry a high number of heavy vehicles, including B-doubles associated with local and regional agricultural demands. These agricultural demands are seasonal in nature and occur 24 hours a day often involving night travel and operations. There are a number of farms in the general locality of the project site as well as in the wider Wellington area that use these local and regional roads during these seasonally high demand periods. Due to the seasonal nature of this work and the requirement for quick turnaround of crop deliveries it is considered that it is not appropriate to limit truck movements for these existing farms. Similarly, it is considered that it is not appropriate to limit truck movements to and from the project site at these times as the traffic movements on the local roads will continue to remain low.

For the regional road network e.g. Mitchell Highway, Golden Highway and New England Highway / Hunter Expressway the total traffic flows will remain well within acceptable limits and as such will continue to operate to a good level of service for all road users. Current daily traffic flows on these highways are summarised below, based on data available from the RMS web page:

| Road | Location | Daily flow | Heavy vehicle content (%) | Peak hour flows (based on 10% daily flows) |
|---|---|---|---|---|
| Mitchell Highway | South of Wellington | 2,428 | 23 | 243 |
| Golden Highway | East of Merriwa | 2,086 | 21 | 209 |
| Hunter Expressway | Sawyers Gully | 18,334 | 15 | 1,833 |
| Hunter Expressway | Buchanan | 30,180 | 11 | 3,018 |
| M1 Motorway | Somersby | 66,114 | 15 | 6,611 |

The RMS Guide to Traffic Generating Developments indicates that for rural roads, allowing for 15% heavy vehicles the 2-way flow for a level of service of B is 530 vehicles. This value is considered appropriate for both the Michell and Golden Highway. With the additional traffic associated with the critical construction period on the site the level of service on these roads will remain at B.

The traffic flows along the local roads giving access for the heavy and light vehicle movements associated with the project are currently very low based on-site observations. Therefore, the additional 70 light vehicle movements associated with the staff movements and 20 daily truck movements (per direction) will have a minimal and acceptable impact upon the operation of these local roads during construction. Once operational, the traffic movements are much lower with a maximum of 10 staff on site per day and as such the impact will be negligible.

For the length of the Hunter Expressway, the additional truck movements will have a minimal and acceptable impact on the daily and hourly flows. The increase in flows created by the construction work will be less than 1%



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and as such existing drivers will experience a negligible increase in any delays. The impact upon the M1 Motorway is less as the existing traffic flows are higher than on the Hunter Expressway.

There is minimal background traffic growth in this location. The RMS count data from the station south of Wellington on the Mitchell Highway (Station I.D. 6170) shows traffic flows of 2,428 in 2017 and 2,380 in 2015, representing an increase of around 0.7% per annum. Other counts along the regional road network show similar or lower increases in values. For the assessment of the future impacts in 10 years-time, it can be seen that the site at that time will be operational with 10 staff located on the site. The impact of these ten staff will be very low on the local road network.

The site is expected to be operational for more than 10 years so that the impact of the decommissioning of the site cannot be assessed in detail at this stage. The site could remain operational beyond 10 years and the impact will remain low beyond the10 year design horizon.

There will be no public vehicle access within the work site during the construction works, with a fence provided at the commencement of the project along the entire site boundary. This fence will remain once the project is constructed for security purposes with a locked gate to be provided at the site access off Suntop Road.

There will be no pedestrian access to the site for the general public. There are no pedestrian paths in the locality of the site or expected demands in this remote rural area so there will be no impacts for pedestrians created by the project works.

There is school bus that runs along Suntop Road along the site boundary, with one bus in the morning at around 7.55 AM and one bus in the afternoon at around 3.45 PM. The majority of the heavy vehicle route proposed for the project does not form part of the local school bus run. The only interaction will be along Suntop Road and on Showground Road in Wellington. Whilst there may be some deliveries occurring in the morning during the school bus operation, very limited deliveries are expected in the afternoon period. All staff will be on site prior to the morning bus run and will depart site after the afternoon bus run. As such it is considered that there is very limited interaction with the school bus. On the regional and state road network all school zones will be delineated in accordance with RMS Guidelines with reduced speed limits in accordance with normal NSW road rules. All drivers associated with the project construction work will adhere to the road rules as applicable and will be advised of the school bus operation on Suntop Road.

The upgrade of the intersection of Suntop Road and Renshaw McGirr Way will significantly improve the safety of this intersection and will provide a significant safety benefit to the existing bus route via this intersection.

There will be no impact upon public transport services with no diversions required. There are no bus stops impacted upon by the proposal. Wellington is not serviced by a train and is reliant upon a coach link with infrequent operation.

There will be minimal impact for emergency vehicles and heavy vehicles with no diversions required.

There will be minimal impact upon any other development within the locality of the site.

There will be minimal impact upon adjoining Council areas. Traffic routes in and out of the locality will be along the arterial road network which will experience minimal impacts due to the works.

There are no residential dwellings in the immediate locality of the site access that will be impacted upon by the project and construction work. There are a number of residences along the heavy and light vehicle access routes and these residents will be notified in writing of the construction works and the activities as required.

Construction vehicle movement on internal roads could lead to dust generation. A water truck will be used for dust suppression to minimise the production of dust, with the amount of water spreading adjusted accordingly to reflect the conditions. Additionally, any significant deposits of dirt and other construction materials will be promptly removed from public roadways.

Post construction, the traffic numbers generated by the project are very low, with staffing levels varying daily with a maximum on-site workforce of 10 people on any one day. There will not be any need for regular heavy vehicle access to the site once the solar farm is operational except for the occasional heavy vehicle for emergency repairs or irregular maintenance.



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## 4.2 Cumulative impacts

A search of the Major Projects Register on the DPE website was undertaken on the 9th March 2018 to identify any other major projects within the vicinity of the development site which would likely to contribute to cumulative impacts. A search was completed for the former Wellington LGA now under the Dubbo Regional Council LGA. This search identified the following projects in the council area that may add to cumulative impacts.

- Wellington Solar
- Wellington North Solar Plant
- Mumbil Solar Farm
- Maryvale Solar Farm
- Young to Wellington Gas Pipeline
- Wellington Gas-Fired Power Station Project Application
- Wellington Gas-Fired Power Station Modification 1

| Project | Cumulative construction Impacts | Cumulative operational Impacts |
|---|---|---|
| Wellington Solar<br><br>This includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 174 MW of electricity. The project site is approximately 2km to the north of Wellington on the Goolma Road. | Additional construction traffic along the main haulage route being Mitchell Highway and Golden Highway. These impacts would be temporary and are acceptable as the overall traffic flows on both of these regional roads will remain within acceptable limits. Both of these roads currently carry high volumes of heavy vehicles and are designated for carrying vehicles upto B-doubles in size. | Operational traffic impacts associated with the solar farm will be very low and generally between Dubbo / Wellington and the site along the nominated route in Figure 4.1 above.<br><br>The only cumulative impact will be on the Mitchell Highway and the operational traffic will be less than 20 vehicle movements per day. |
| Wellington North Solar Plant<br><br>This includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 300 MW of electricity. The proposal footprint is approximately 650 ha with the site approximately 7 km to the north of Wellington on the Goolma Road. | Additional construction traffic along the main haulage route being Mitchell Highway and Golden Highway. These impacts would be temporary and are acceptable as the overall traffic flows on both of these regional roads will remain within acceptable limits. Both of these roads currently carry high volumes of heavy vehicles and are designated for carrying vehicles upto B-doubles in size. | Operational traffic impacts associated with the solar farm will be very low and generally between Dubbo / Wellington and the site along the nominated route in Figure 4.1 above.<br><br>The only cumulative impact will be on the Mitchell Highway and the operational traffic will be less than 20 vehicle movements per day. |

| | | |
|---|---|---|
| Mumbil Solar Farm<br><br>This includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 138 MW of electricity. The proposal footprint is approximately 201 ha with the site approximately 20 km to the south east of Wellington on the Burrendong Way and 2km north of the Village of Mumbil. | Due to the timeframe of this application there are no expected construction impacts. | Due to the timeframe of this application there are no expected operational impacts. |
| Maryvale Solar Farm<br><br>This includes the construction, operation and decommissioning of a photovoltaic (PV) solar farm that would produce up to 115 MW of electricity. The proposal footprint is approximately 150 ha with the site approximately 15 km to the north west of Maryvale and Seatonville Roads. | Due to the timeframe of this application there are no expected construction impacts. | Due to the timeframe of this application there are no expected operational impacts. |
| Young to Wellington Gas Pipeline<br><br>The proposed pipeline corridor covers a distance of 220 km from Wellington to Young. The proposed pipeline alignment will see the line run to the eastern side of Wellington to the south and will supply gas to the Wellington power station on the north side of town.<br><br>This was approved in 2011 but never constructed due to the gas fired power station not being constructed. | As this development, did not proceed to construction, there will be no cumulative construction impacts. | As this development did not proceed, there will be no cumulative operational impacts. |
| Wellington Gas-Fired Power Station Project Application<br><br>This development was for the construction and operation of 660MW open cycle gas -fired power station at Wellington. | As this development, did not proceed to construction, there will be no cumulative construction impacts. | As this development did not proceed, there will be no cumulative operational impacts. |



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| | | |
|---|---|---|
| This was to be constructed adjacent to the TransGrid substation located to the north of Wellington township.<br><br>This was approved in 2009 but never constructed due to conflict over the proposed site with local residents. | | |
| Wellington Gas-Fired Power Station Modification 1<br><br>This modification was to install two 255 MW gas turbines as an alternative to the previously approved four turbines and allow extended operation as an intermediate plant with a 40% capacity factor.<br><br>This application was approved in September 2010, but did not proceed to construction. | As this development, did not proceed to construction, there will be no cumulative construction impacts. | As this development did not proceed, there will be no cumulative operational impacts. |

### 4.2.1 Delivery vehicles

All deliveries for the project will be via 19 metres semi-trailers. Whilst the regional road network permits the use of B-double combinations it is not considered appropriate to use these vehicles along Renshaw McGirr Way or Suntop Road. The access routes along the regional / state road network to the site are all along approved B double routes whilst the local roads between the Mitchell Highway and the project site carries semi-trailers associated with local agricultural demands and as such the use of semi-trailer trucks for deliveries to the site are considered appropriate.

Delivery vehicles would be required throughout the project period. The travel time between the ports (Newcastle or Sydney) and the site for the solar panels is approximately 4 to 6 hours and these deliveries will be spaced out over the construction period, to minimise the impact upon the road network and to reduce the need to store the panels on site. Other deliveries will include the metal structures for the solar panels, sand and gravel for the foundations and internal tracks and cabling. There will also be some deliveries of specialist equipment such as photovoltaic boxes or skids and delivery stations.

The trucks associated with the delivery of the supplies will all travel along the State and regional road network. There are a number of schools located along these routes, however all have marked school zones and speed limit restrictions as per State guidelines. As these routes are all on the State and regional road network it can be seen that heavy vehicles currently operate on these roads safely. It is considered that there will be no noticeable impact upon road safety adjacent to these schools associated with the additional truck movements associated with the construction work.

There is no requirement to divert traffic as part of this construction work.

### 4.2.2 Construction staff movements

For the construction work, the staffing levels will peak at 250 on site and as part of the project, staff will be encouraged and supported to carpool as part of the Code of Conduct for the project and use mini buses provided to allow for shared trips from shared accommodation in Wellington and Dubbo to the site, approximately 17 and 65 kilometres respectively. There will be 70 vehicles inbound in the morning associated with on-site staff and a similar number departing at the end of the working day.

The site is located approximately 17 kms from the centre of Wellington (and further to Dubbo) and with no footpaths provided on any of the local roads construction staff are unlikely to walk to the site. Some construction staff however could cycle to the site from Wellington, as the 17 km ride would take 45 minutes or less to complete. The route to the site could be used by cyclists with the sealed pavement allowing for a safe cycling environment. Cyclists will be able to park their bikes on site close to the site office and showers should be provided together with work lockers to cater for cyclists. It is however considered that this demand would be very low.

The vehicle numbers associated with the construction work are relatively low and it is considered that the movement of vehicles in and out of the site for construction works can occur in a safe manner. No limitation on truck access times is considered appropriate for the project. Given the journey length between the port and the subject site, the vehicles as they are approaching the site will be spread out ensuring the impact is not occurring all together. With unloading of vehicles taking 30 minutes or more, trucks exiting the site will also be spread out.

## 4.3 Impacts on road pavement

A protocol will be provided for both undertaking dilapidation surveys and making any necessary repairs following construction to Suntop Road, Renshaw McGirr Way and Showground Road (refer Figure 4-3 below). The dilapidation surveys will assess the existing condition of road surface prior to construction and the repair of the road pavement should it be identified in the dilapidation surveys to have been damaged during construction.

With regards to any emergency repairs required, the contractor on site would contact the relevant authorities and will ensure the road is safe. Repairs will be made in accordance with the relevant authority standard.



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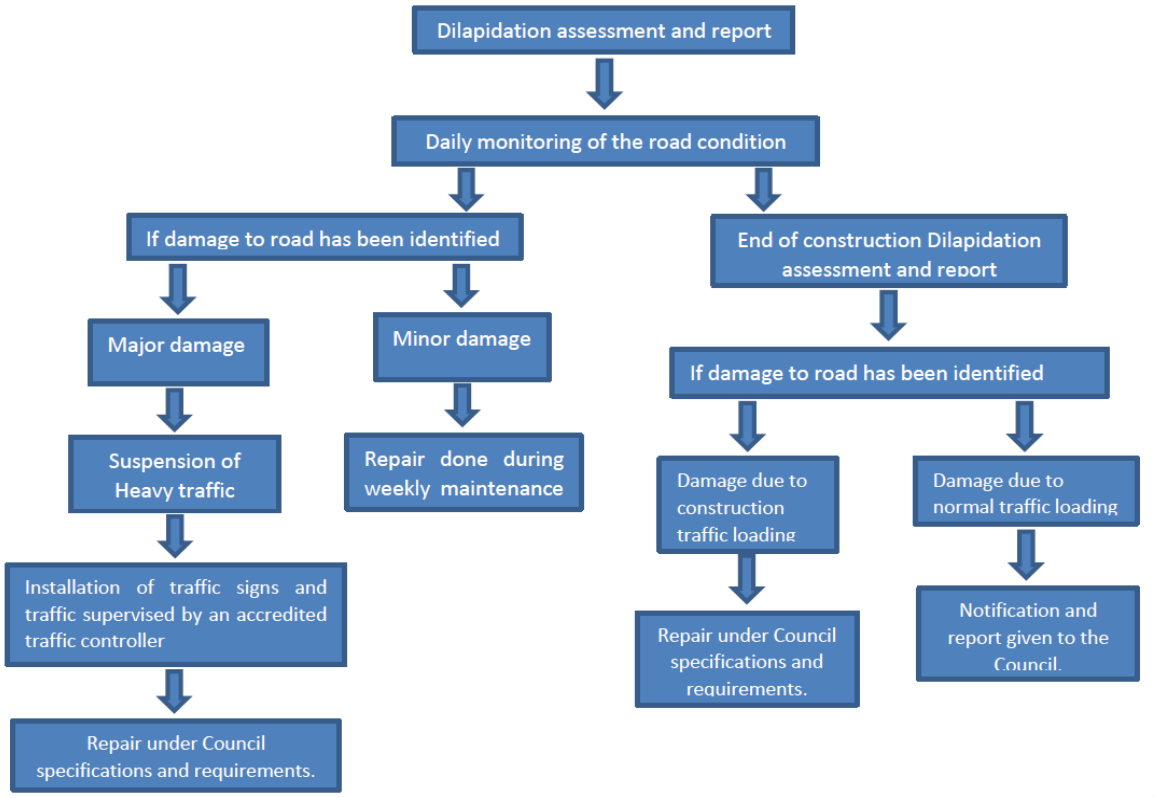



*Figure 4-2 Dilapidation Assessment Protocol*

# Appendix A. Safe Construction Actvities

The contractor on site is responsible for the management of all traffic in connection with its activities and the construction works conducted on the site. The Contractor will provide all traffic management, safety warnings and signage including such persons as necessary to direct traffic, as required by AS 1742:2009 – Manual of uniform traffic control devices.

*External traffic movements*

The Contractor will:

Ensure traffic management controls are established, maintained and monitored to underpin the safety of workers, other personnel and the general public

Establish traffic management controls in consultation with relevant stakeholders

Ensure traffic management controls comply with regulatory and legislative requirements

Ensure traffic management controls comply with the contract

Ensure traffic management controls maintain the flow of traffic within the site and on surrounding public roads

Reinstate any areas affected by the temporary construction access requirements to their original condition

The primary drivers for determining the traffic management controls during the construction period are:

- Safety of personnel, the general public and construction workers
- Minimising impact (if any) on operations
- Contractual requirements (including site access)
- Road traffic authority and local government requirements
- OHS requirements in relation to the movement of all vehicular traffic and pedestrians either within or adjacent to sites
- Environmental management requirements
- The impact construction traffic has on the local community in the surrounding area, and
- The need to meet construction requirements (including any schedule and cost constraints)

The traffic management controls will be communicated to appropriate stakeholders which will include the local community in the site vicinity via a letter box drop.

The Contractor will ensure:

Any significant deposit of dirt and other materials caused by construction traffic and other operations (in relation to the works) will be promptly removed from existing public roadways

Suitable precautions are taken to ensure no rock is dislodged onto any roadway from construction vehicles

Construction plant and equipment do not park on or within the pavement or shoulders of any existing trafficked roadway

Construction vehicles (when loaded) comply with the mass, loading and access requirements of the road traffic authority

Construction traffic will cause the least possible obstruction to public and other traffic



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Directional signage will be installed to direct construction traffic, and warn other motorists of construction traffic.

This signage is positioned in accordance with the approved Traffic Control Plans.

All drivers will be provided with a copy of the access routes to and from the site as part of their induction for the project;

A Vehicle Movement Strategy has been developed to eliminate the impact on local roads arising from additional construction traffic (e.g. solar panel delivery vehicles). The Vehicle Movement Strategy directs all drivers to access the site from the Mitchell Highway at Wellington to eliminate the impact on the local roads. There is no requirement to restrict the direction of flow and/or time of day for movements.

The Contractor will comply with any client or Road Traffic Authority signage requirements for traffic control. Where construction work is to be undertaken either on or adjacent to a public roadway that is open to traffic, the work must be undertaken in accordance with all regulatory and legislative requirements that govern the movement of vehicles and pedestrians on any public roadway.

*Within the Worksite*

All employees, subcontractors, suppliers and any other persons connected with the project must adhere to all such Statutory Requirements and comply with all lawful directions. Any breach of such requirements may result in disciplinary action of the persons concerned.

The maximum speed limits within the Worksite are:

40 kph on formed roads
20 kph during foggy/dusty conditions with headlights on
10 kph when passing pedestrians

The Contractor will manage access to and from the site by all employees, subcontractors, suppliers and any other persons connected with its activities and the works; and all occupants within the worksite and through each area of the site.

The Contractor shall provide for safe and continuous operation of normal pedestrian and vehicular traffic along all roads, pedestrian paths and vehicular access to the worksite and must provide and maintain all necessary watchmen, lights, barriers, notices and signs.

The Contractor will not unnecessarily obstruct any side road, branch track, drain or watercourse and will not break down or remove any fences or gates without prior notification to the client. If unavoidable, the Contractor will remove such obstruction or repair such breakage as soon as possible, or as directed by the Client.

A Vehicle and Traffic Management Procedures briefing will be included in the Project Site Induction.

*Pedestrian Traffic*

The Contractor may encounter pedestrian traffic at and near to the site. The Contractor will ensure that sites are appropriately isolated and secured from unauthorised entry; and that the Site is appropriately sign-posted and controlled. Given the location of the site it is considered that any pedestrian activity will be negligible.

*Site Construction Traffic*

Traffic within the Site will be managed in accordance with the Site Management Plan. The Sites Layout Plans will indicate site access and egress points and detail any required separation of construction plant and personnel. These plans will be communicated during Tool Box Meetings and/or Daily Pre-start Meetings.

The Site Layout Plan will incorporate details of parking arrangements for the site construction workers, speed limits within the construction works or through access roads established for vehicular and plant construction traffic.

The Sites Layout Plan will detail traffic management controls that are appropriate within each site.

Traffic controls shall be regularly reviewed for effectiveness and will be amended to maintain or improve a safe work environment. Traffic management controls established for sites will be inspected at ***weekly intervals*** to verify that a safe work environment is being maintained. Records of inspections shall be maintained.

*Access Roads and Site M**ovement***

Unless sign-posted otherwise, load limits on public roads adjoining the sites apply within them.

If required the Contractor shall request approval from the client prior to any over-dimensional load, or load in excess of load limits entering the site, or using the roads within the site.

All workers must travel to and from the site via the nominated access roads.

*Parking*

All workers must park in the Designated Parking Areas as specified in the Site Management Plan. The Contractor shall ensure no persons (in connection with its activities) parks in any other area of the site or in any other area without prior written consent.

*Monitoring, Measurement and Review*

The purpose of Monitoring and Measurement is to ensure that all construction works, including subcontracted activities, are being performed in accordance with the contract requirements, statutory requirement and in a controlled and safe environment. Ongoing monitoring and audit of Traffic Management procedures and the worksite implementation of traffic control shall be conducted.

Audits of the Traffic Control measures under differing operating conditions are to be carried out including during overcast and rainy weather, at night or at any other restrictive times where conditions may change in accordance with the requirements of AS1742.3.

Results of audits, inspections and improvements are to be reported in the reporting cycle of the contract to enable assessment of the adequacy of the implementation of the Traffic Control within contract performance and system review meetings.



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*Inspection and Auditing of Traffic Control Plan (TCP)*

Regular Site Inspections by designated supervisory and field staff of worksite protection are to be arranged on a ***daily frequency*** depending on the complexity of traffic control on the site.

Site Inspections will be carried out and the following Traffic Management Forms completed:

Traffic Control Daily Checklist
Traffic Control Weekly Checklist

A daily record of the inspections should be kept. This should include:

- When traffic controls were erected
- When changes to controls occurred and why the changes were undertaken
- Any significant incidents or observations associated with the traffic controls and their impacts on road users or adjacent properties
- Where significant changes to the work or traffic environment or adverse impacts are observed, the controls should be reviewed as a matter of urgency.

The monitoring program should generally incorporate inspections:

- Before the start of work activities on site
- During the hours of work
- Closing down at the end of the shift period

The inspection program shall be adjusted to suit changing circumstances and/or risk environment such as during times of increased traffic flows or speeds, contra-flow arrangements or when changed controls are introduced.

The Audits of the implemented Traffic Management features will be undertaken following setup in accordance with the TCP and prior to the TCP being put into service.

# Appendix B. Drivers Code of Conduct

## 1.1 General Requirements

All vehicles / drivers accessing the site must:

i) Be registered and hold a valid driver's licence for the class of vehicle being operated;
ii) Operate the vehicle in a safe and appropriate manner whilst travelling to / from the site or when operating within the site. This includes obeying all New South Wales state road rules.
iii) ALL heavy vehicles must adhere to the designated heavy vehicle routes as far as practical;
iv) Comply with the directions of authorised personnel when operating within the site and obey any relevant signage installed along the internal roads.
v) Not use a mobile phone while operating any vehicle.
vi) Must always wear a seatbelt when operating any vehicle.

## 1.2 Vehicle Speeds

Drivers shall observe the posted speed limit along the designated transport route and adjust their vehicle speed as required to suit the road environment and prevailing weather conditions. Vehicle speeds must be appropriate to ensure the safe movements of the vehicle with consideration to the vehicle configuration.

Maximum speeds limits within the project site shall be as follows:

i) 40 km/hr along formed roads.
ii) 20 km/hr during foggy / dusty conditions. Headlights must be on.
iii) 10 km/hr when passing pedestrians or any plant equipment.

## 1.3 Driver Fatigue

Drivers shall not be permitted to operate a vehicle or plant equipment when impaired by fatigue. If you suspect that you or someone else is experiencing fatigue, please inform your supervisor.

Operators of heavy vehicles shall be aware of the requirements relating to fatigue as outlined in the Heavy Vehicle National Law. Drivers shall also be aware of their adopted fatigue management scheme (shown below) and ensure that they are operating within its requirements.

i) Standard Hours of Operation
ii) Basic Fatigue Management (BFM)
iii) Advanced Fatigue Management (AFM)



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Basic Fatigue Management (single driver)

| Time | Work | Rest |
|---|---|---|
| In any period of… | A driver must not work for more than a maximum of… | And must have the rest of that period off work with at least a minimum rest break of… |
| 6 ¼ hours | 6 hours work time | 15 continuous minutes rest time |
| 9 hours | 8 1/2 hours work time | 30 minutes rest time in blocks of 15 continuous minutes |
| 12 hours | 11 hours work time | 60 minutes rest time in blocks of 15 continuous minutes |
| 24 hours | 14 hours work time | 7 continuous hours stationary rest time* |
| 7 days | 36 hours long/night work time** | No limit has been set |
| 14 days | 144 hours work time | 24 continuous hours stationary rest time taken after no more than 84 hours work time and 24 continuous hours stationary rest time and 2 x night rest breaks# and 2 x night rest breaks taken on consecutive days. |

Advanced Fatigue management:

The seven principles are grouped into three categories:

Work-related rest breaks (such as short rest breaks):

1. Reduce the time spent continuously working in the work opportunity

2. The more frequent breaks from driving, the better

Recovery breaks (such as major rest breaks):

1. Ensure an adequate sleep opportunity in order to obtain sufficient sleep

2. Maximise adequate night sleep

3. Minimise shifts ending between 00:00-06:00

4. Minimise extended shifts

Reset breaks (such as long periods of rest or extended leave):

1. Prevent accumulation of fatigue with reset breaks of at least 30hrs (and include two night periods, 00:00 – 06:00) between work sequences

ALL details relating to fatigue management for delivery vehicles are covered by the National Heavy Vehicle Regulator

## 1.4 Operating Hours

*Construction*

Construction is to be in completed in accordance with the *Interim Construction Noise Guideline* (DECC 2009) which defined standard construction work hours as:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and Public holidays: No work

The following construction, upgrading and decommissioning activities may be undertaken outside these hours without the approval of the secretary:

- The delivery of materials as requested by the NSW Police Force or other authorities for safety reasons; or
- Emergency work to avoid loss of life, property and / or material harm to the environment.

Vehicle movements shall be undertaken during standard construction hours (or just before to allow workers to get to site). Oversize vehicles up to 26 metres long may require access to the site after hours however this would be subject to the requirements of Roads and Maritime, Dubbo Regional Council or NSW Police.

*Normal Operations*

Daily operations and maintenance by site staff would be undertaken during standard working hours:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and Public holidays: No work

During normal operations, all vehicle movements shall be undertaken during the standard operating hours (or just before to allow workers to get to site). There may be a requirement for vehicles to access the site after hours during an emergency however these would be infrequent.

Vehicles which arrive at the site prior to commencement of working hours shall have the engine turned off to minimise noise impacts on surrounding residences.

## 1.5 Transport Routes

All vehicles must travel to and from the project site via the route as shown below (Figure 1).



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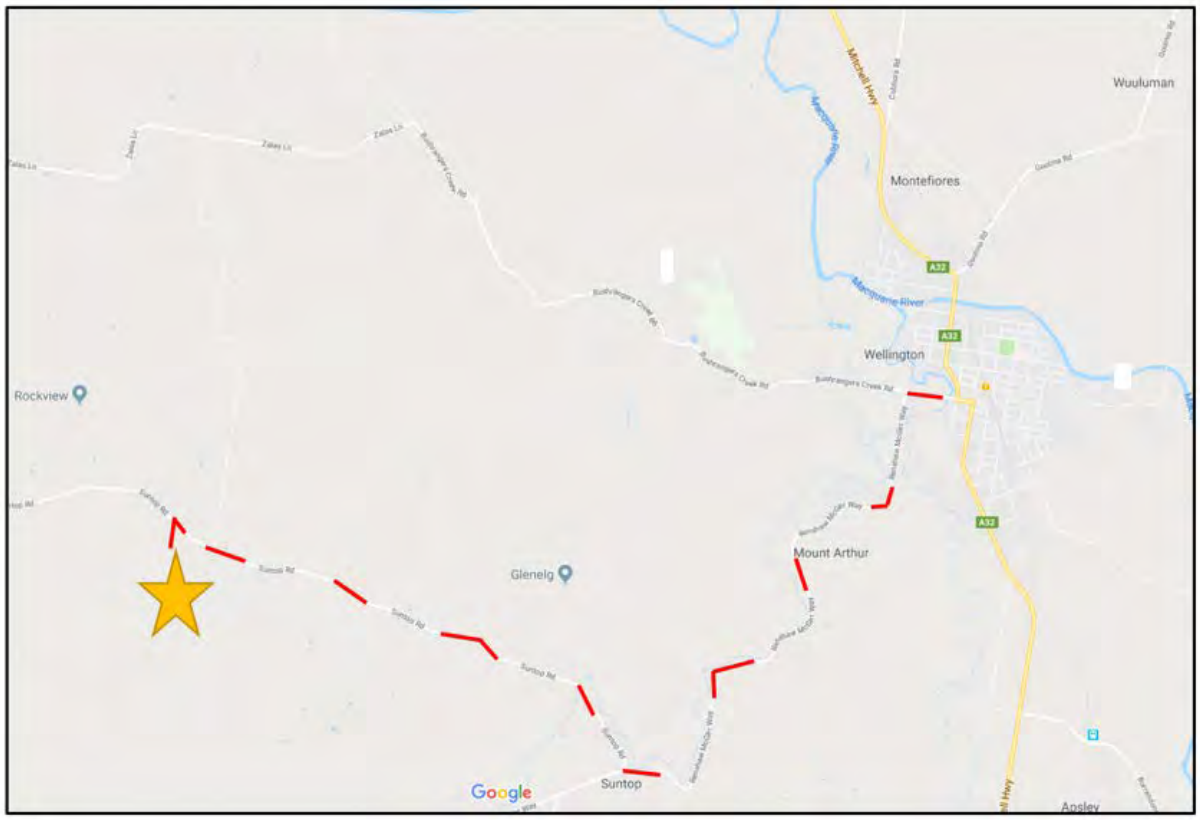



*Figure 1 - Transport route to/from the site for ALL*

## 1.6 Vehicle Departure and Arrival

Heavy vehicles departing the site shall have a minimum 5 minute separation to reduce the impacts upon the local road network.

Always maintain a minimum separation of at least 50 metres between vehicles when travelling within the site.

Drivers must contact the site supervisor upon arrival and await further instructions or direction before proceeding.

Drivers must also report to the site supervisor prior to departure.

All vehicles must enter and exit the site in a forward direction. Vehicles are to be washed down and in a clean condition upon exiting the site to prevent dirt being tracked onto the public road network.

## 1.7 Overtaking

Overtaking shall not be permitted within the site unless the intention to overtake has been communicated to the driver of the leading vehicle and consent to overtake granted.

## 1.8 Breakdowns and Incidents

*Heavy Vehicles*

In the case of a breakdown, the vehicle must be towed to the nearest breakdown point as soon as possible. All breakdowns must be reported to the RMS Transport Management Centre on 131 700 and the vehicle protected in accordance with the Heavy Vehicle Drivers Handbook. The relevant shift manager on site shall also be notified.

If a breakdown occurs on-site please remain inside your vehicle, notify the shift manager of your location and await further instruction.

If you are involved in an accident, please notify the shift manager immediately and contact emergency services if required.

*Light Vehicles*

In the case of a breakdown, ensure that the vehicle is secure, notify the shift manager of your location and await further instruction.

If you are involved in an accident, please notify the shift manager immediately and contact emergency services if required.

## 1.9 Penalties and Disciplinary Action

Any driver who fails to comply with the above requirements will have their details recorded and may be subject to disciplinary action.

## 1.10 Emergency Contact Numbers

| | | |
|---|---|---|
| i) | RMS Transport Management Centre | 131 700 |
| ii) | Dubbo Regional Council | (02) 6801 4000 |
| iii) | NSW Polic Service (Wellington) | (02) 6840 2099 |
| iv) | Site Office | _____ |
| v) | Shift Manager on Duty | _____ |



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## 1.11 Driver Declaration

I, the undersigned, hereby agree to abide by this Driver Code of Conduct for the transport of equipment or personnel to / from the Suntop Solar Farm, located off Suntop Road, Suntop, NSW. I have read and understand the requirements outlined in the attached document and will, to the best of my ability, comply and assist with their implementation, requirements or ongoing administration.

*The subject document to which this declaration relates is included as part of this overall document and signing of this declaration confirms that the signee has read and understood their requirements as outlined throughout.*

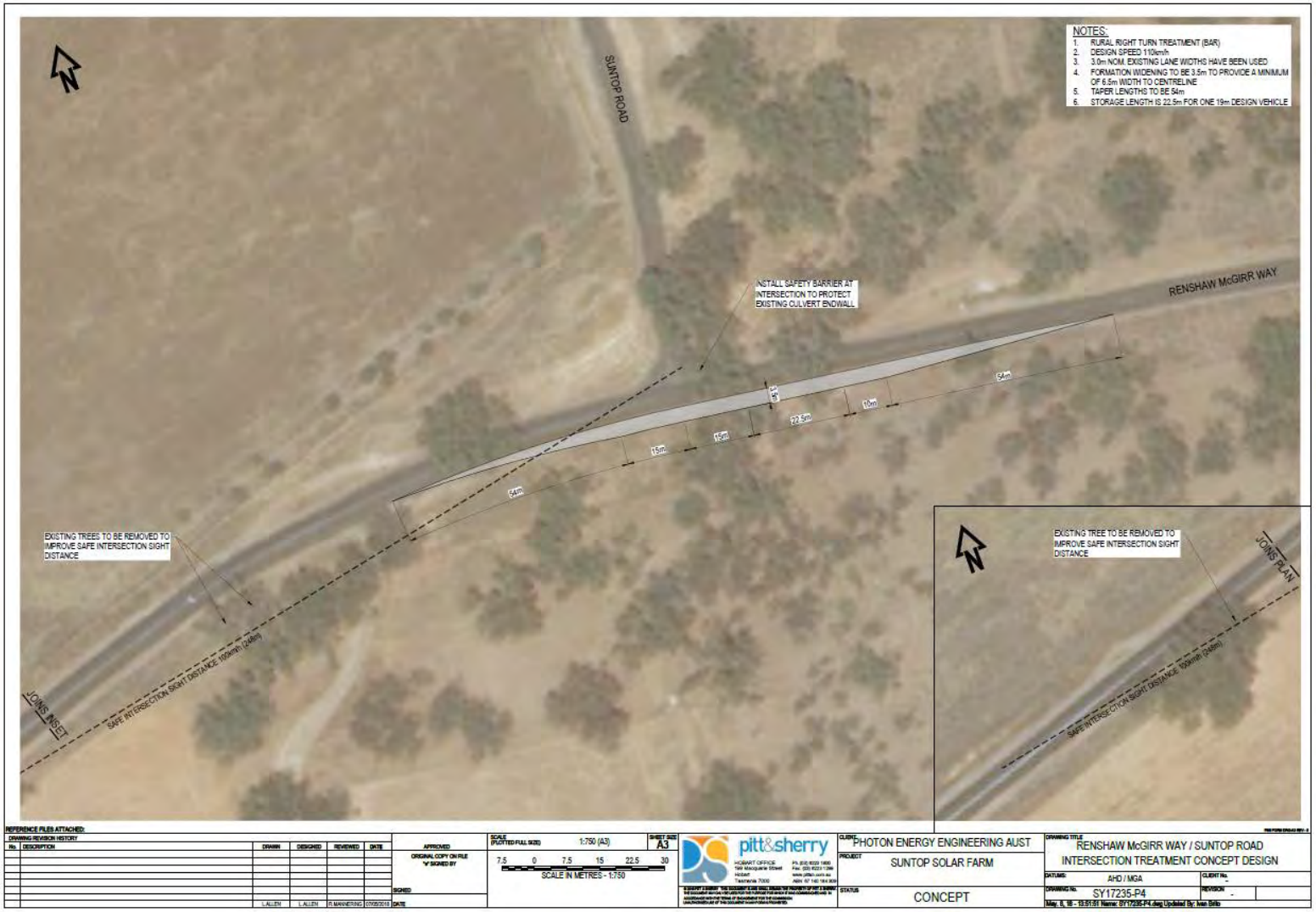
**Driver Details**

| | |
|---|---|
| Full Name | |
| Organisation | |
| Signature | |
| Date | |

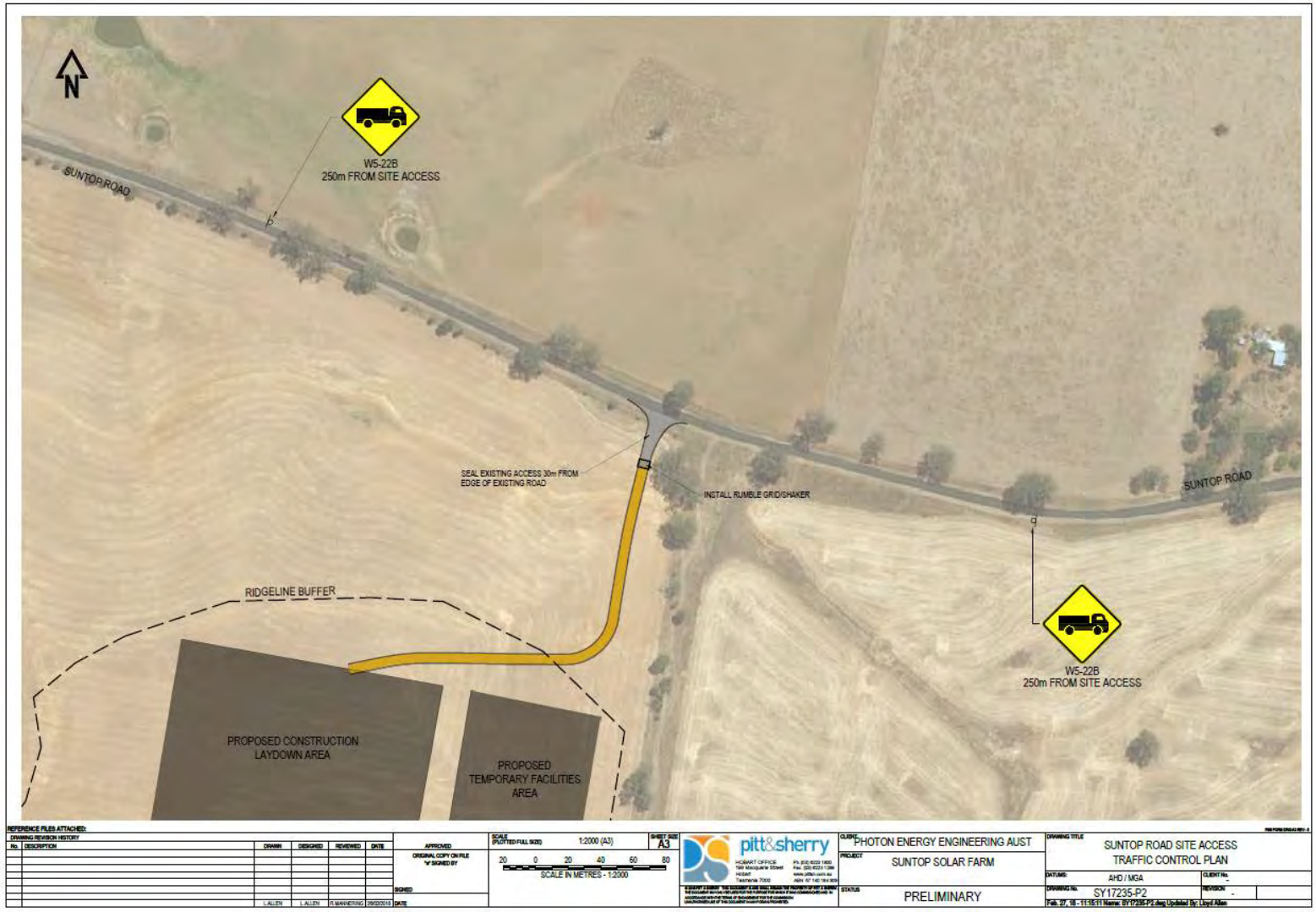
**Representative of:**

| | |
|---|---|
| Full Name | |
| Signature | |
| Date | |

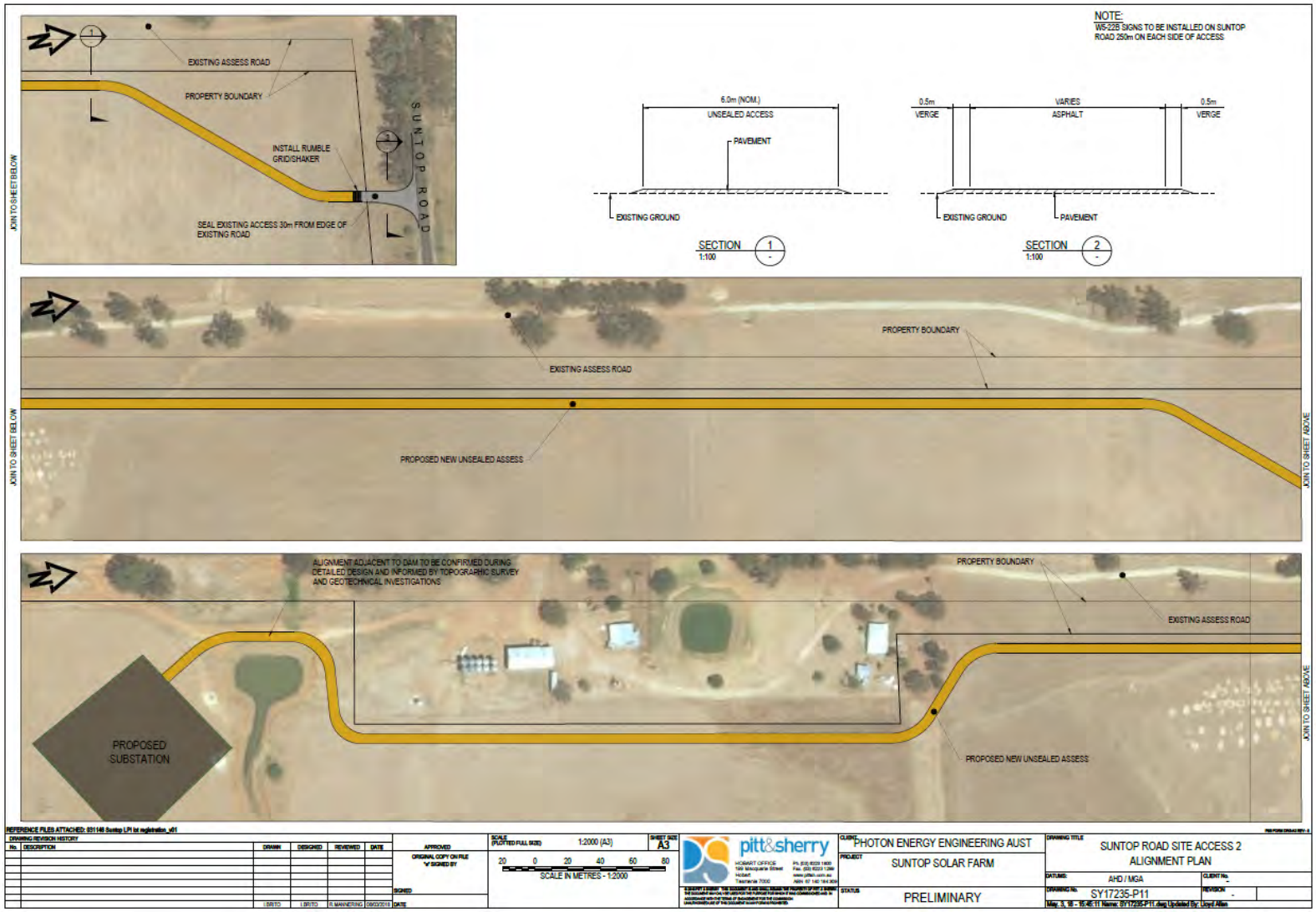
# Appendix C. Concept for upgrade of Intersection of Renshaw McGirr Way and Suntop Road



# Appendix D. Traffic Control Plan for Works at Site Access on Suntop Road



# Appendix E. Plan for Site Access upgrade works



# Noise Assessment

## Suntop Solar Farm, Wellington, NSW.

Prepared for: Pitt&Sherry Operations Pty Ltd

May 2018



# *Document Information*

## Noise Assessment

## Suntop Solar Farm, Wellington NSW.

**Prepared for:** pitt&sherry Operations Pty Ltd
Suite 902, Level 9, North Tower
1-5 Railway Street
Chatswood NSW 2067

**Prepared by:** Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

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CONTENTS


1 INTRODUCTION ..... 5

1.1 PURPOSE AND OBJECTIVES ..... 5

1.2 SCOPE OF THE ASSESSMENT ..... 5

2 PROJECT DESCRIPTION ..... 7

2.1 BACKGROUND ..... 7

2.2 DESCRIPTION OF PROPOSED CONSTRUCTION WORKS ..... 7

2.3 DESCRIPTION OF PROPOSED OPERATION ..... 8

3 NOISE POLICY AND GUIDELINES ..... 11

3.1 INTERIM CONSTRUCTION NOISE GUIDELINE ..... 12

3.1.1 CONSTRUCTION NOISE MANAGEMENT LEVELS ..... 13

3.1.2 CONSTRUCTION SLEEP DISTURBANCE ..... 13

3.2 NOISE POLICY FOR INDUSTRY ..... 14

3.2.1 PROJECT NOISE TRIGGER LEVELS ..... 16

3.2.2 PROJECT INTRUSIVENESS NOISE LEVEL ..... 16

3.2.3 PROJECT AMENITY NOISE LEVELS ..... 16

3.2.4 MAXIMUM NOISE LEVEL ASSESSMENT ..... 18

3.3 ROAD NOISE POLICY ..... 18

4 EXISTING ENVIRONMENT ..... 19

4.1 POTENTIALLY SENSITIVE RECEPTORS ..... 19

4.2 NOISE MONITORING METHODOLOGY ..... 20

4.3 NOISE MONITORING RESULTS ..... 20

5 ASSESSMENT CRITERIA ..... 21

5.1 CONSTRUCTION NOISE MANAGEMENT LEVELS ..... 21

5.2 OPERATIONAL NOISE CRITERIA ..... 21

5.2.1 PROJECT INTRUSIVENESS NOISE LEVELS ..... 21

5.2.2 PROJECT AMENITY NOISE LEVELS ..... 22

5.2.3 PROJECT NOISE TRIGGER LEVELS ..... 22

5.2.4 MAXIMUM NOISE LEVEL SCREENING CRITERION ..... 23
5.3 ROAD TRAFFIC NOISE CRITERIA ..... 23
5.3.1 RELATIVE INCREASE CRITERIA ..... 24
6 MODELLING METHODOLOGY ..... 25
6.1 CONSTRUCTION ASSESSMENT METHODOLOGY ..... 25
6.2 OPERATIONAL ASSESSMENT METHODOLOGY ..... 26
6.2.1 MODELLING SCENARIOS ..... 26
6.2.2 METEOROLOGICAL ANALYSIS ..... 27
6.3 ROAD TRAFFIC NOISE ..... 28
7 RESULTS ..... 29
7.1 CONSTRUCTION RESULTS ..... 29
7.2 OPERATIONAL NOISE RESULTS ..... 30
7.3 MAXIMUM NOISE LEVEL ASSESSMENT - OPERATIONS ..... 30
7.4 ROAD TRAFFIC NOISE ASSESSMENT ..... 31
8 RECOMMENDATIONS ..... 33
8.1 CONSTRUCTION NOISE RECOMMENDATIONS ..... 33
8.2 OPERATIONAL NOISE RECOMMENDATIONS ..... 34
9 CONCLUSION ..... 35
APPENDIX A – GLOSSARY OF TERMS ..... 37
APPENDIX B – NOISE MONITORING CHARTS ..... 41
APPENDIX C – NEWA ANALYSED METEOROLOGY ..... 43

# 1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been engaged by pitt&sherry Operations Pty Ltd on behalf of Photon Energy (Photon) to complete a Noise Assessment (NA) for the proposed Suntop Solar Farm near Wellington, NSW. This report presents the methodology and findings of the NA for the construction and operation of the project.

## 1.1 Purpose and Objectives

A NA report is required as part of the Environmental Impact Statement (EIS) for the project. The purpose of the NA is to quantify potential environmental noise levels associated with the construction and operation of the project.

Where impacts are identified, the assessment includes recommendations for potential noise mitigation and management measures.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A.**

## 1.2 Scope of the Assessment

The NA includes the following key tasks:

- review construction and operating activities to identify noise generating plant, equipment, machinery or activities proposed to be undertaken as part of the project;
- identify the closest and/or potentially most affected receptors situated within the area of influence to the project;
- quantify the existing noise environment by conducting unattended and operator attended noise measurements at locations representative of the closest and/or potentially most affected receptors;
- establish existing noise levels to determine project-specific construction Noise Management Levels (NMLs), and operational noise criteria;
- undertake 3D noise modelling to predict noise levels that may occur as a result of the construction and operation of the project at the closest and/or potentially most affected receptors;

- provide a comparison of predicted noise levels against relevant construction NMLs and operational noise criteria;
- assess the potential noise impacts associated with construction and operational aspects of the project; and
- provide feasible and reasonable noise mitigation and management measures, and monitoring options, where NMLs or operational noise criteria may be exceeded.

# 2 Project Description

## 2.1 Background

Photon propose to construct and operate a 200 Megawatt (MW) Photovoltaic Solar (PV) Farm at a 517 - hectare site at Suntop, NSW (the 'project'). The project would be located adjacent to Suntop Road, Suntop, NSW, contained within Lot 1-2-3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (the 'subject lands'). The project is located within the Dubbo Local Government Area (LGA) and is approximately 10km south-west from the Wellington town centre. The area was previously considered part of the Wellington LGA, which has recently amalgamated with Dubbo to form the Dubbo Regional Council. The Wellington Local Environmental Plan (LEP 2012) is still current and applies to the Site.

Total subject land is approximately 517 hectares in area and is currently used for agriculture including cropping (e.g. wheat and lucerne) and grazing. The solar farm would occupy 472 hectares (the "Site") out of the 517 hectares (equivalent to approximately 83%) with the remaining land retained as existing agricultural land.

## 2.2 Description of Proposed Construction Works

The project includes installation of groups of north facing PV modules (approximately 2m x 1m) on mounting structures approximately 3m in height. An estimated 900,000 PV panels will be installed tilted at a 25° north facing angle or using a single axis tracking system, tilted +/- 60° along the north-south axis. The PV mounting structure would comprise steel posts driven approximately 2.5m below ground using a small pile driver. Additional support structures would be attached to the piles, which would then support the PV panels.

Earthworks will primarily involve trenching which is required for cabling of each PV array/module to inverters and substation. Other minor earthworks would be completed for the preparation of the site and in most cases a concrete slab would be required to support the ancillary infrastructure. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

It is anticipated that the solar farm would be constructed in one-hectare stages, with up to 10 stages in construction at any one time over a nine to 12 month period during standard construction hours.

All vehicles would access the Site from Suntop Road, a sealed single-lane, two-way local road. Suntop Road joins Renshaw McGirr Way about 6.5km east of the Site. The Mitchell Highway (A32) joins Renshaw McGirr Way about 9km further east of the Site. A new access road would be constructed leading south into the Site from Suntop Road of the subject land.

During construction, traffic generated by the works would include employee and delivery vehicles. During the peak construction period, the traffic volume is expected to be 80 heavy vehicles (mostly semi-trailers) and 50 light commercial vehicles or mini buses for worker transport per day.

## 2.3 Description of Proposed Operation

PV infrastructure on site will comprise of groups of PV panels located 3m above ground with a 15m set back from the site boundaries. The PV infrastructure will be mounted on support structures attached to the driven galvanized steel posts. Electrical cabling would be attached beneath the modules and would connect the individual PV modules to each other. Inverters will be located centrally to groups of PV panels that will be connected to each other by underground cables. The PV modules will either be in a fixed position facing north or on a single axis tracker system which will follow the sun and move in an east to west direction.

The project will be contained solely within the site, including areas required for stockpiling and materials laydown during construction as shown in Figure 1.

The project would operate 24 hours a day, 7 days a week and would not involve the presence of staff on-site (aside from routine maintenance work) and would typically see minimal plant and equipment operating on site. During operation, the PV panels would generate electricity which would be fed into the power grid via the substation. Key noise emissions from the operation of the project are associated with the invertor and transformer components of the substation. It is noted that emissions from these sources are anticipated to be acoustically insignificant compared to ambient background noise levels at assessed receptors.

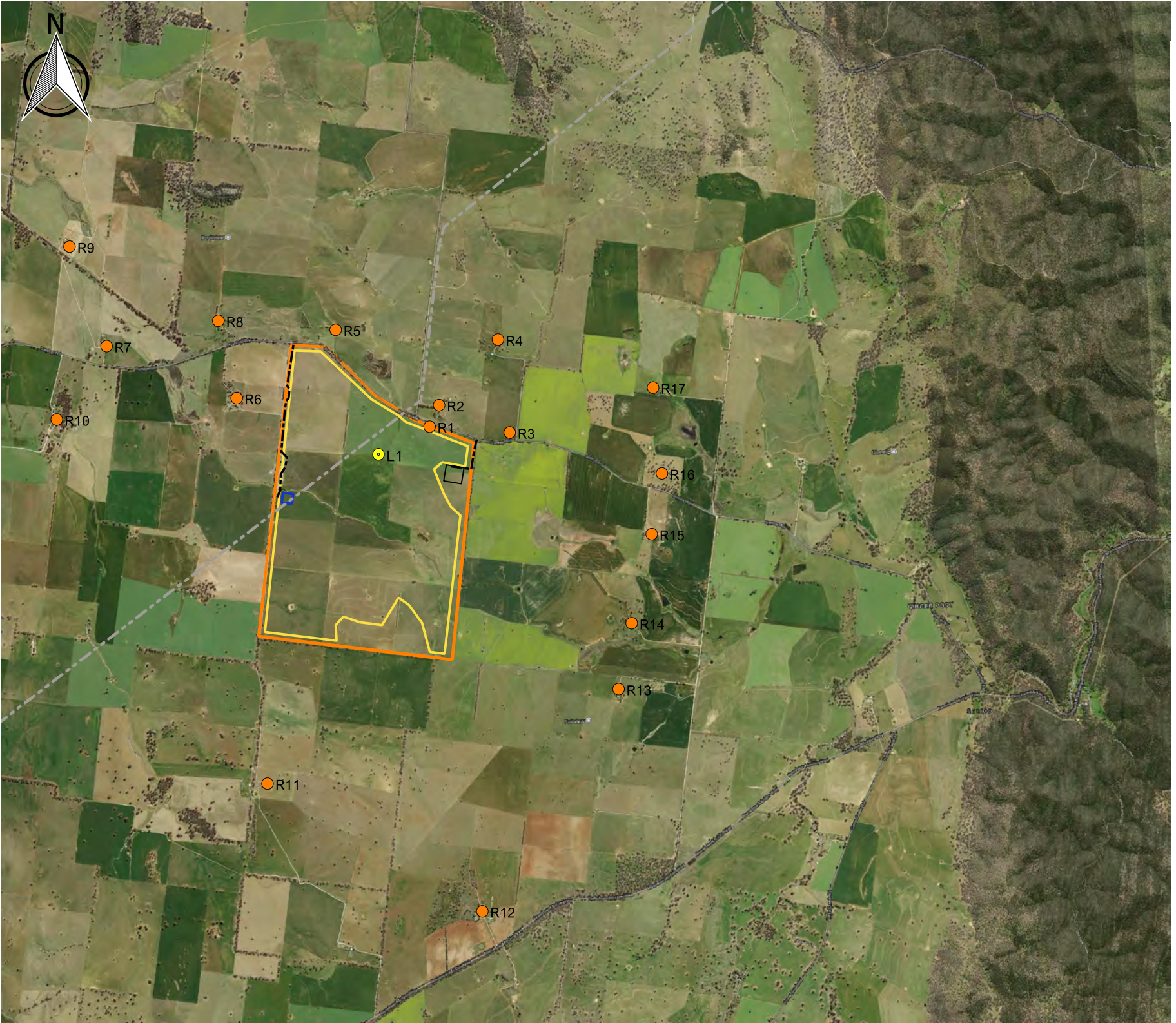
When required, maintenance activities will be undertaken during standard working hours (except for emergencies) and are expected to include:

- panel cleaning;
- repairs or replacement of infrastructure, as required; and
- land management including stock management or mowing to control vegetation as required.

Typical noise sources associated with maintenance activities would be associated with light vehicle movements on site and maintenance equipment.

# FIGURE 1

## PROJECT LAYOUT
## REF: MAC170550




### LEGEND

- Site Boundary
- Receivers
- Monitoring Location
- Access Road
- Construction Compound
- PV Panels
- Proposed Substation
- 132kV - Overhead

0 500 1000 1500 2000 m

MAC
Muller Acoustic Consulting

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# 3 Noise Policy and Guidelines

This Noise Assessment has been conducted in accordance with the following key policy and guidelines:

- NSW Department of Environment and Climate Change (DECC), NSW Interim Construction Noise Guideline (ICNG), 2009;
- Environment Protection Authority's (EPA's), Noise Policy for Industry (NPI), 2017; and
- NSW Department of Environment, Climate Change and Water (DECCW), NSW Road Noise Policy (RNP), 2011.

The assessment has also considered and applied the following additional policy, guidelines and standards where relevant:

- Standards Australia AS 2436–2010(2016) (AS2436) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance sites;
- Standards Australia AS1055–1997 (AS1055) – Description and Measurement of Environmental Noise;
- Standards Australia AS IEC 61672.1–2004 (AS61672) – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990™ (AS1259) – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device; and
- Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard – Electroacoustics – Sound Calibrators.

## 3.1 Interim Construction Noise Guideline

The assessment and management of noise from construction work is completed with reference to the Interim Construction Noise Guideline (ICNG). The ICNG is specifically aimed at managing noise from construction work regulated by the EPA, and is used to assist in setting statutory conditions in licences or other regulatory instruments. The types of construction regulated by the EPA under the POEO Act (1997), include construction, maintenance and renewal activities carried out by a public authority, such as road upgrades as described in Schedule 1 of the POEO Act.

The ICNG sets out procedures to identify and address the impact of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; or
- Qualitative, which is suited to short term infrastructure maintenance (for projects with a typical duration of less than three weeks).

The methodology for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the nearest relevant receptors. The qualitative assessment methodology is a more simplified approach that relies more on noise management strategies. This study has adopted a quantitative assessment approach.

The quantitative approach includes identification of potentially affected receptors, description of activities involved in the project, derivation of the construction noise management levels, quantification of potential noise impact at receptors and, provides management and mitigation recommendations. Error! Reference source not found. summarises the ICNG recommended standard hours for construction.

**Table 1 Recommended Standard Hours for Construction**

| Period | Preferred Construction Hours |
|---|---|
| Day (Standard construction hours) | Monday to Friday - 7am to 6pm<br>Saturdays - 8am to 1pm<br>Sundays or Public Holidays - No construction |

The recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. Work conducted outside of standard hours are considered out of hours work (OOH). OOH periods are divided into two categories representing evening and night periods and cover the hours listed below:

**Period 1** (evening/low risk period): Monday to Friday – 6pm to 10pm, Saturdays – 1pm to 6pm, Sundays 8am to 6pm.

**Period 2** (night/medium to high risk period): Monday to Friday – 10pm to 7am, Saturdays/Sundays – 6pm to 7am (8am on Sunday mornings).

There is no out of hours work proposed for this project.

### 3.1.1 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. Error! Reference source not found. provides the ICNG recommended $LA_{eq,15min}$ NMLs and how they are to be applied.

### 3.1.2 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights.

Given that construction activities are only expected to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

| Table 2 Noise Management Levels | | |
|---|---|---|
| Time of Day | Management Level $LA_{eq,15min}$[1] | How to Apply |
| Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays. | Noise affected RBL + 10 dB | The noise affected level represents the point above which there may be some community reaction to noise.<br>Where the predicted or measured $LA_{eq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly noise affected 75 dBA. | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>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 work near schools, or mid-morning or mid-afternoon for work near residences; and 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 strong justification would typically be required for work outside the recommended standard hours.<br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community.<br>For guidance on negotiating agreements see section 7.2.2. |

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

## 3.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997. The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, taking into account the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels, above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTLs, assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts, that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.
5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.
6. Monitor and report environmental noise levels from the development.

### 3.2.1 Project Noise Trigger Levels

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) value of the **Project Intrusiveness Noise Level (PINL)** and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

### 3.2.2 Project Intrusiveness Noise Level

The Project Intrusiveness Noise Level ($LA_{eq,15min}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels needs to be measured.

### 3.2.3 Project Amenity Noise Levels

Amenity noise levels are relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI) and are reproduced in **Error! Reference source not found.**. The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area.
- **Project Amenity Noise Levels (PANL)** – is the recommended levels for a receiver area, specifically focusing the project under investigation.

Additionally, Section 2.4 of the NPI states: "*to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise levels applies for each new source of industrial noise as follows*":

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

Notwithstanding, where the PANL is applicable and can be satisfied, the assessment of cumulative industrial noise is not required.

| Table 3 Amenity Criteria | | | |
|---|---|---|---|
| Receiver Type | Noise Amenity Area | Time of day | Recommended amenity noise level $LA_{eq}$, dBA |
| Residential | Rural | Day | 50 |
| | | Evening | 45 |
| | | Night | 40 |
| | Suburban | Day | 55 |
| | | Evening | 45 |
| | | Night | 40 |
| | Urban | Day | 60 |
| | | Evening | 50 |
| | | Night | 45 |
| Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks | See column 4 | See column 4 | 5dBA above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day |
| School classroom – internal | All | Noisiest 1-hour period when in use | 35 |
| Hospital ward<br>- internal<br>- external | All | <br>Noisiest 1 hour<br>Noisiest 1 hour | <br>35<br>50 |
| Place of worship – internal | All | When in use | 40 |
| Area specifically reserved for passive recreation (e.g. national park) | All | When in use | 50 |
| Active recreation area (e.g. school playground, golf course) | All | When in use | 55 |
| Commercial premises | All | When in use | 65 |
| Industrial premises | All | When in use | 70 |
| Industrial interface (applicable only to residential noise amenity areas) | All | All | Add 5dBA to recommended noise amenity area |

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7.

Time of day is defined as follows: (These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.)

• day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays;

• evening – the period from 6 pm to 10 pm;

• night – the remaining periods.

In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable LAeq noise level may be increased to 40dB LAeq(1hr).

### 3.2.4 Maximum Noise Level Assessment

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed:

- $L_{Aeq,15min}$ 40dBA or the prevailing RBL plus 5dB, whichever is the greater, and/or
- $L_{Amax}$ 52dBA or the prevailing RBL plus 15dB, whichever is the greater,

a detailed maximum noise level event assessment should be undertaken.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

## 3.3 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in Section 6.

# 4 Existing Environment

A key element in assessing environmental noise impacts is understanding the existing ambient and background noise levels at the closest and/or potentially most affected receptors to the project.

## 4.1 Potentially Sensitive Receptors

From observations on site, review of aerial photos and other project information, MAC has identified the following potentially sensitive receptors that may be affected by noise from operations, construction activities and related road traffic. **Table 4** presents a summary of receiver Identification, type, address and coordinates. These are reproduced graphically in **Figure 1.**

**Table 4 Noise Sensitive Receptors**

| ID | Type | Description Address | Coordinates (MGA 56) | |
|---|---|---|---|---|
| | | | Easting | Northing |
| R01 | | 675 Suntop Road | 108862 | 6388151 |
| R02 | | 14 Bennetts Road | 108960 | 6388371 |
| R03 | | 586 Suntop Road | 109684 | 6388090 |
| R04 | | 582 Suntop Road | 109563 | 6389044 |
| R05 | | 796 Suntop Road | 107898 | 6389143 |
| R06 | | 1834 Arthurville Road | 106884 | 6388444 |
| R07 | | Lot 17 1094 Suntop Road | 105549 | 6388976 |
| R08 | | 898 Suntop Road | 106696 | 6389236 |
| R09 | Rural Residential | Lot 86 1094 Suntop Road | 105168 | 6389997 |
| R10 | | 69 Frogleys Road | 105038 | 6388224 |
| R11 | | 1570 Renshaw McGirr Way | 107199 | 6384488 |
| R12 | | 1420 Renshaw McGirr Way | 109403 | 6383178 |
| R13 | | 193 Bestwicks Lane | 110800 | 6385458 |
| R14 | | 233 Bestwicks Lane | 110935 | 6386134 |
| R15 | | 433 Suntop Road | 111140 | 6387048 |
| R16 | | 440 Suntop Road | 111245 | 6387671 |
| R17 | | 18 Ringwood Road | 111154 | 6388552 |

## 4.2 Noise Monitoring Methodology

In accordance with NSW noise guidelines, background noise levels are measured in the absence of the site under assessment and are used to develop NMLs for residential receptors.

To quantify existing noise levels, long-term unattended noise measurements were performed on the subject land (Location L1) as it is representative of receptors located near the project (refer **Table 5**). Location L1 is situated on the subject land and is currently used for agriculture.

The unattended noise monitoring survey was conducted in general accordance with the procedures described in Australian Standard AS 1055-1997, "Acoustics - Description and Measurement of Environmental Noise" and the EPL. Noise measurements were carried out using a Svantek Type 1, 977 noise analyser from Wednesday 22 November 2017 to Thursday 30 November 2017. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2004- Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

**Table 5 Noise Monitoring Locations**

| ID | Unattended Noise Monitoring Location | Site Description | Co-ordinates MGA56 | |
|---|---|---|---|---|
| L1 | Project Site | Off Suntop Road | 672143m E | 6394263m S |

## 4.3 Noise Monitoring Results

From observations whilst on site, the noise environment at existing residential receptors is best described as 'rural' in accordance with the NPI. A rural area, as described in the NPI, is one that has an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. he results of the unattended noise measurements for the background monitoring location, including derived RBLs are summarised in **Table 6**. **Appendix B** presents the noise monitoring charts for the monitoring period.

**Table 6 Unattended Noise Monitoring Results**

| Unattended Noise Monitoring Location | Period[1] | Measured Background Level RBL $L_{A90}$, dBA | Measured Ambient Noise Level $L_{Aeq}$, dBA |
|---|---|---|---|
| L1 Project Site | Day | 26 | 66 |
| | Evening | 26 | 59 |
| | Night | 26 | 59 |

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

# 5 Assessment Criteria

## 5.1 Construction Noise Management Levels

Noise Management Levels (NMLs) for construction activities at all residential receivers are 45dB $L_{Aeq,15min}$ (RBL +10dB). Although construction activities are only planned for standard hours, the relevant NML standard construction hours and out of hours periods are summarised in **Table 7**.

**Table 7 Construction Noise Management Levels**

| Location | Assessment Period | RBL, dBA | NML dB $L_{Aeq,15min}$ |
|---|---|---|---|
| Residential Receptors | Day (Standard Hours) | 35 | 45 (RBL+10dBA) |
| | Evening (OOH Period 1) | 30 | 35 (RBL+5dBA) |
| | Night (OOH Period 2) | 30 | 35 (RBL+5dBA) |

## 5.2 Operational Noise Criteria

### 5.2.1 Project Intrusiveness Noise Levels

The PINLs for the project are presented in **Table 8** and have been determined based on the RBLs +5dBA.

**Table 8 Intrusiveness Noise Levels**

| Receiver | Period[1] | Measured RBL dB $LA_{90}$ | Adopted RBL[2] dB $LA_{90}$ | Intrusiveness Noise Level dB $LA_{eq,15min}$ |
|---|---|---|---|---|
| All Residential Receivers | Day | 26 | 35 | 40 |
| | Evening | 26 | 30 | 35 |
| | Night | 26 | 30 | 35 |

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

Note 2: Where the measured RBL is less than 35dBA for the day period, is set to 35dBA, and where the measured RBL is less than 30dBA for the evening and night, is set to 30dBA.

### 5.2.2 Project Amenity Noise Levels

The PANLs for residential receivers potentially affected by the project are presented in **Table 9.**

**Table 9 Amenity Noise Levels and Project Amenity Noise Levels**

| Receiver Type | Noise Amenity Area | Assessment Period[1] | Recommended ANL dB $L_{Aeq,period}$[2] | PANL dB $L_{Aeq,period}$[3] | PANL dB $L_{Aeq,15min}$[4] |
|---|---|---|---|---|---|
| Residential | Rural | Day | 50 | 50 | 53 |
| | | Evening | 45 | 45 | 48 |
| | | Night | 40 | 40 | 43 |

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

Note 2: Recommended amenity noise levels as per Table 2.2 of the NPI.

Note 3: Project Amenity Noise Level equals the amenity noise level as there is no other industry in the area.

Note 4: Includes a +3dB adjustment to the amenity period level to convert to a fifteen-minute assessment period as per Section 2.2 of the NPI.

### 5.2.3 Project Noise Trigger Levels

The PNTLs are the lower of either the PINL or the PANL. **Table 10** presents the derivation of the PNTL's in accordance with the methodologies outlined in the NPI. For this assessment, the night time PNTL of 35dB $L_{Aeq,15min}$ is the limiting criteria.

**Table 10 Project Noise Trigger Levels**

| Assessment Period[1] | Intrusiveness Noise Level dB $L_{Aeq,15min}$ | PANL dB $L_{Aeq,15min}$ | PNTL dB $L_{Aeq,15min}$ |
|---|---|---|---|
| Day | 40 | 53 | 40 |
| Evening | 35 | 48 | 35 |
| Night | 35 | 43 | 35 |

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

### 5.2.4 Maximum Noise Level Screening Criterion

The maximum noise level screening criterion shown in **Table 11** is based on night time RBLs and trigger values as per Section 2.5 of the NPI.

**Table 11 Maximum Noise Assessment Trigger Levels**

| Residential Receivers | | | |
|---|---|---|---|
| LAeq,15min | | LAmax | |
| 40dB $LA_{eq,15min}$ or RBL + 5dB | | 52dB $LA_{max}$ or RBL + 15dB | |
| Trigger | 40 | Trigger | 52 |
| RBL +5dB | 35 | RBL +5dB | 45 |
| **Highest** | **40** | **Highest** | **52** |

Note 1: As per Section 2.5 of the NPI, the highest of the two criteria are adopted as the screening criteria.

## 5.3 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the RNP. For this assessment, the 'local road' category, as specified in the RNP, has been adopted for Suntop Road, and 'sub arterial road' category for Renshaw McGirr Way. It is acknowledged that the functional classification of Renshaw McGirr Way is a 'Collector Road' in accordance with the Roads and Maritime Noise Criteria Guideline (April 2015). However, the Road Noise Policy does not provide separate noise criteria for Collector Roads but applies the sub-arterial category to all roads that are not classified as local roads.

Road noise criteria relevant to this assessment are presented in **Table 12** for residential receivers.

**Table 12 Road Traffic Noise Assessment Criteria for Residential Land Uses**

| Road category | Road Name | Type of Project/Development | Assessment Criteria - dBA | |
|---|---|---|---|---|
| | | | Day (7am to 10pm) | Night (10pm to 7am) |
| Freeway/arterial/sub-arterial road | Renshaw McGirr Way | Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments | 60dBA LAeq,15hr external | 55dBA LAeq,9hr external |
| Local Roads | Suntop Road | Existing residences affected by additional traffic on existing local roads generated by land use developments | 55dBA LAeq,1hr external | 50dBA LAeq,1hr external |

Note: For road noise assessments, the day period is from 7am to 10pm (ie there is no evening assessment period as there is with operational noise). Night is from 10pm to 7am.

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

### 5.3.1 Relative Increase Criteria

In addition to meeting the assessment criteria, any significant increase in total traffic noise at receivers must be considered. Receivers experiencing increases in total traffic noise levels above those presented in **Table 13** due to the addition of project vehicles on Renshaw McGirr Way should be considered for mitigation. Relative increase criteria is not applicable to local roads.

**Table 13 Increase Criteria for Residential Land Uses**

| Road Category | Type of Project/Development | Total Traffic Noise Level Increase, dBA | |
|---|---|---|---|
| | | Day (7am to 10pm) | Night (10pm to 7am) |
| Freeway/arterial/sub-arterial roads and transit ways | New road corridor/redevelopment or existing road/land use development with the potential to generate additional traffic on existing road. | Existing traffic LAeq,15hr +12dB (external) | Existing traffic LAeq9hr +12dB (external) |

Note 1: Relative increase criteria is not applicable to local roads.

# 6 Modelling Methodology

A computer model was developed to determine the impact of project noise emissions to neighbouring receivers for typical construction activities and operations. Brüel and Kjær Predictor Type 7810 (Version 11.10) noise modelling software was used to assess potential noise impacts associated with the project. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. Additionally, the model uses relevant noise source data (measured on site at the project), ground type, shielding such as barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Plant and equipment were modelled at various locations and heights, representative of realistic construction and operational conditions for assessed scenarios.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'.

## 6.1 Construction Assessment Methodology

Construction activities are proposed to be progressive (trenching, piling and assembly) and will occur at several locations simultaneously. Noise emissions were modelled for the following three scenarios:

- earthworks involving trenching for cabling;
- piling of panel supports; and
- assembly of the panels.

It is envisaged that all three scenarios have the potential to occur simultaneously at up to 10 locations across the site, together with substation construction, vehicle movements on the site and deliveries of material to site. Noise emission data and assumptions used in this assessment are summarised in Table 14. All significant noise generating construction activities will be limited to standard construction hours. Where low intensity construction activities are required to be undertaken outside standard construction hours, such as cabling, minor assembly, use of hand tools etc, they will be managed such that they are not audible at any residential receivers.

| Table 14 Construction Equipment Sound Power Levels, Lw dBA re $10^{-12}$ W | | | | |
|---|---|---|---|---|
| Noise Source/Item | Utilisation % | Quantity | Lw/Item | Total Lw |
| **Trenching & Earthworks (per work area)** | | | | |
| Backhoe | 100 | 1 | 104 | 104 |
| Light vehicle | 50 | 2 | 76 | 76 |
| **Total – Trenching & Earthworks** | | | | **104** |
| **Piling (per work area)** | | | | |
| Piling Rig (hydraulic) | 100 | 1 | 113 | 113 |
| Tele-handler | 80 | 1 | 106 | 105 |
| Light vehicle | 50 | 1 | 76 | 73 |
| **Total – Piling** | | | | **114** |
| **Assembly (per work area)** | | | | |
| Mobile Crane/HIAB | 100 | 1 | 104 | 104 |
| Tele-handler | 100 | 1 | 106 | 106 |
| Light vehicle | 50 | 2 | 76 | 76 |
| Hand tools/Power tools | 25 | 1 | 102 | 96 |
| Welder | 25 | 1 | 105 | 99 |
| **Total – Assembly** | | | | **109** |
| **Transport (on site)** | | | | |
| Heavy vehicle | 100 | 2 | 104 | 107 |
| Tele-handler | 100 | 1 | 106 | 106 |
| **Total – Transport** | | | | **110** |

## 6.2 Operational Assessment Methodology

### 6.2.1 Modelling Scenarios

For this assessment, operational noise predictions were modelled for a typical worst case operational scenario over a 15-minute assessment period based on the operational assumptions and sound power levels in **Table 15.** The exact design details regarding the number of transmission kiosk/inverter stations (40 x 4.92MW or 59 x 3.20MW) is yet to be confirmed, therefore the maximum potential number of sources has been adopted for the assessment. Plant noise emission data used in modelling for this assessment were obtained from manufacturer data or the MAC database.

Where relevant, modifying factors in accordance with Section 3.3 and Fact Sheet D of the NPI have been applied to calculations.

| Table 15 Operational Equipment Sound Power Levels dBA re $10^{-12}$ W | | | | |
|---|---|---|---|---|
| Noise Source/Item | Activity | Quantity | Lw/ Item | Total Lw |
| PV Panel Tracking Motor[1,2] | All tracking motors in operation<br>1 minute per 15-minute period | 12380 | 78 | 102 |
| **Transmission Kiosk/Inverter Stations** – each consisting of the following | | | | |
| Inverter | Constant | 69 | 75 | 99 |
| Transformer | Constant | 69 | 70 | 94 |
| Capacitor Battery | Constant | 69 | 75 | 99 |
| **Transmission Kiosk - Total**[2,3] | Constant | 69 | 79 | 102 |
| Substation | Constant | 1 | 90 | 90 |
| Light Vehicle | 2 vehicles arrive and depart<br>from site (5 minutes duration) | 2 | 76 | 79 |

Note 1: Tracking motor is situated underneath the PV panel, -5dB attenuation applied to account for shielding provided by the panel.

Note 2: Modifying factor penalty of +5dB added for low frequency and +5dB added for tonality.

Note 3: -5dB applied to account for power station/ kiosk vented enclosure.

### 6.2.2 Meteorological Analysis

Noise emissions from industry can be significantly influenced by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is at low velocities and travels from the direction of the noise source.

Meteorological conditions that enhance received noise levels include source to receiver winds and the presence of temperature inversions. To account for the potential for enhancements, the NPI specifies that the source to the receiver wind component speeds up to 3m/s for 30% or more of the time in any seasonal period (i.e. day, evening or night), is a significant meteorological feature and predictions must incorporate these conditions.

To determine the prevailing conditions for the project, weather data during the period January 2015 to November 2017 was obtained from the nearest Bureau of Meteorology's (BOM) weather station at Dubbo Airport located approximately 58km north west of the project site. The data was analysed using the EPA's Noise Enhancement Wind Analysis (NEWA) program to determine the frequency of occurrence of winds speeds up to 3m/s in each seasonal period.

Table 16 summarises the results of the wind analysis and includes the dominant wind direction and percentage occurrence during each season for each assessment period. The results of the detailed analysis of meteorological data is presented in Appendix C.

**Table 16 Seasonal Frequency of Occurrence Wind Speed Intervals**

| Season | Period | Wind Direction ±(45°) | % Wind Speeds (m/s) |
|---|---|---|---|
| | | | 0.5 to 3 m/s |
| Summer | Night | 292.5 | 15 |
| Autumn | Night | 292.5 | 22 |
| Winter | Night | 292.5 | 23 |
| Spring | Night | 292.5 | 21 |

Based on the results of this analysis, prevailing winds are not a feature of the area and default calm meteorological conditions have been adopted for noise modelling. The relevant meteorological conditions adopted in the noise modelling assessment are summarised in Table 17.

**Table 17 Modelled Site Specific Meteorological Parameters**

| Assessment Condition[1] | Temperature | Wind Speed / Direction | Relative Humidity | Stability Class |
|---|---|---|---|---|
| Day - Calm | 20°C | n/a | 60% | n/a |
| Evening - Calm | 10°C | n/a | 60% | n/a |
| Night - Calm | 10°C | n/a | 60% | n/a |

Note 1: Day 7am to 6pm, Evening 6pm to 10pm, Night 10pm to 7am.

## 6.3 Road Traffic Noise

The United States (US) Environmental Protection Agency's road traffic calculation method was used to predict the $LA_{eq}$ noise levels from construction vehicles travelling past receivers along public roads. This method is an internationally accepted theoretical traffic noise prediction model and is ideal for calculating road traffic noise where relatively small traffic flows are encountered.

Suntop Road is a local road managed by Dubbo Regional Council which runs along the northern border of the Site. The south, east and west boundaries of the project are adjoined by neighbouring agricultural lots with some sections of unnamed, unsealed rural roads and tree-lined fences.

# 7 Results

## 7.1 Construction Results

Noise levels were predicted to each assessed receptor assuming receiver heights of 1.5m above ground level for typical construction activities. **Table 18** summarises the maximum predicted noise level from each of the construction scenarios at identified residential receptors.

**Table 18 Predicted Construction Noise Levels**

| Receiver ID | Description | Highest Predicted Noise Level dB $LA_{eq,15min}$ | NML Standard Hours dB $LA_{eq,15min}$ | Compliance |
|---|---|---|---|---|
| R01 | 675 Suntop Road | **56** | 45 | No |
| R02 | 14 Bennetts Road | **51** | 45 | No |
| R03 | 586 Suntop Road | **46** | 45 | No |
| R04 | 582 Suntop Road | 42 | 45 | Yes |
| R05 | 796 Suntop Road | **51** | 45 | No |
| R06 | 1834 Arthurville Road | **48** | 45 | No |
| R07 | Lot 17 1094 Suntop Road | 37 | 45 | Yes |
| R08 | 898 Suntop Road | 43 | 45 | Yes |
| R09 | Lot 86 1094 Suntop Road | 29 | 45 | Yes |
| R10 | 69 Frogleys Road | 32 | 45 | Yes |
| R11 | 1570 Renshaw McGirr Way | 37 | 45 | Yes |
| R12 | 1420 Renshaw McGirr Way | 29 | 45 | Yes |
| R13 | 193 Bestwicks Lane | 34 | 45 | Yes |
| R14 | 233 Bestwicks Lane | 36 | 45 | Yes |
| R15 | 433 Suntop Road | 35 | 45 | Yes |
| R16 | 440 Suntop Road | 34 | 45 | Yes |
| R17 | 18 Ringwood Road | 32 | 45 | Yes |

The activities predicted to exceed the NMLs at receives along Suntop Road are (ranked order) are: piling, general assembly and trenching works. These levels would be experienced only when these construction activities occur simultaneously along the northern boundary. Scheduling of piling activities to minimise the number of work fronts along the northern boundary would reduce noise levels by approximately 3dB in most situations. The predicted maximum noise levels would be expected when construction work is occurring at the closest point to the receivers, although this is anticipated to be for a limited period.

## 7.2 Operational Noise Results

Noise levels were predicted at each assessed receptor assuming receiver heights of 1.5m above ground level. **Table 19** summarises the predicted operational noise levels which are demonstrated to comply with the PNTLs at all residential receptors.

**Table 19 Predicted Operational Noise Levels**

| Receiver ID | Description | Predicted Noise Level dB $LA_{eq,15min}$ | Limiting Night time PNTL dB $LA_{eq,15min}$ | Compliance |
|---|---|---|---|---|
| R01 | 675 Suntop Road | 32 | 35 | Yes |
| R02 | 14 Bennetts Road | 26 | 35 | Yes |
| R03 | 586 Suntop Road | 22 | 35 | Yes |
| R04 | 582 Suntop Road | 19 | 35 | Yes |
| R05 | 796 Suntop Road | 25 | 35 | Yes |
| R06 | 1834 Arthurville Road | 23 | 35 | Yes |
| R07 | Lot 17 1094 Suntop Road | 15 | 35 | Yes |
| R08 | 898 Suntop Road | 19 | 35 | Yes |
| R09 | Lot 86 1094 Suntop Road | <15 | 35 | Yes |
| R10 | 69 Frogleys Road | <15 | 35 | Yes |
| R11 | 1570 Renshaw McGirr Way | <15 | 35 | Yes |
| R12 | 1420 Renshaw McGirr Way | <15 | 35 | Yes |
| R13 | 193 Bestwicks Lane | <15 | 35 | Yes |
| R14 | 233 Bestwicks Lane | <15 | 35 | Yes |
| R15 | 433 Suntop Road | <15 | 35 | Yes |
| R16 | 440 Suntop Road | <15 | 35 | Yes |
| R17 | 18 Ringwood Road | <15 | 35 | Yes |

## 7.3 Maximum Noise Level Assessment - Operations

A detailed maximum noise level assessment is not required as predicted noise levels for night time operations do not exceed the maximum noise level screening criterion of 40dB $LA_{eq,15min}$ and/or 52dB $LA_{max}$.

## 7.4 Road Traffic Noise Assessment

As described in **Section 2.2**, the route via Suntop Road and Renshaw McGirr Way would be the major transport route for all vehicles. During construction, traffic generated by the project include employee/subcontractor and delivery vehicles. During construction, the traffic volume over a typical day for standard construction hours is expected to be 80 heavy vehicles (semi-trailers) and 50 light vehicles per day (including mini buses for employee transport). Road traffic noise calculations are based on the parameters adopted for average and peak flows presented in **Table 20**.

**Table 20 Predicted Construction Road Traffic Noise Levels**

| Vehicle Type | Vehicles / day[1] | Average / hour | Maximum / hour[2] | Movements / hour | Speed km/h |
|---|---|---|---|---|---|
| B-double or Semi-trailer | 80 | 7.2 | 14 | 28 | 80 |
| Mini bus | 5 | <1 | 5 | 10 | 80 |
| Light Vehicle | 45 | 4.1 | 20 | 40 | 100 |

Note 1: Standard construction hours 7am to 6pm

Note 2: Assumes that all mini buses and 50% of light vehicles travel to and from site during AM peak and PM peak.

Predicted $LA_{eq,1hr}$ noise levels from project related construction traffic at the closest receptor on both roads on the route has been completed using the United States (US) Environment Protection Agency's road traffic calculation method is presented in **Table 21**.

**Table 21 Predicted Construction Road Traffic Noise Levels**

| Road Name | Nearest Offset Distance to Receiver | Predicted Noise Level | RTN Criteria | Comply |
|---|---|---|---|---|
| Suntop Road site access[1] | 23m | 48dB $LA_{eq,1hr}$ | 55dB $LA_{eq,1hr}$ | Yes |
| Suntop Road | 65m | 49dB $LA_{eq,1hr}$ | 55dB $LA_{eq,1hr}$ | Yes |
| Renshaw McGirr Way | 30m | 54dB $LA_{eq,15hr}$ | 60dB $LA_{eq,15hr}$ | Yes |

Note 1: A pass by speed of 25km/h has been used for vehicles at this location

Results demonstrate that project construction traffic noise levels would comply with the relevant RNP criteria.

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# 8 Recommendations

## 8.1 Construction Noise Recommendations

It is noted that construction noise emissions are anticipated to satisfy relevant NMLs at most receivers. Noise levels are predicted to exceed the NMLs at those receivers along Suntop Road (R1, R2, R3, R5, R6), however, the project is committed to managing noise emissions within the community and will adopt the following procedures where feasible to minimise noise emissions. Recommendations for consideration during construction activities to reduce emissions to the surrounding community for this project may include:

- a construction noise management protocol to minimise noise emissions, manage out of hours (minor) works to be inaudible, and to respond to potential concerns from the community;
- limiting and scheduling the number of work areas along the northern boundary for piling, trenching and assembly activities to minimise noise levels at receptors along Suntop Road;
- where possible use localised mobile screens or construction hoarding around plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (eg unloading and laydown areas);
- operating plant in a conservative manner (no over-revving), be shutdown when not in use. and be parked/started at farthest point from relevant assessment locations;
- selection of the quietest suitable machinery available for each activity;
- avoidance of noisy plant/machinery working simultaneously where practicable;
- minimise impact noise wherever possible;
- utilise a broadband reverse alarm in lieu of the traditional hi frequency type reverse alarm;
- provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities;
- signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site; and
- utilise project related community consultation forums to notify residences within close proximity of the site with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure.

## 8.2 Operational Noise Recommendations

Operational noise predictions identify that relevant noise criteria would be satisfied at all receivers. Notwithstanding this, it is recommended that the proponent actively minimise potential noise emissions from the project. To assist in noise management for the project the following recommended:

- complete a one-off noise validation monitoring assessment to quantify emissions from site and to confirm emissions meet relevant criteria; and
- prepare an operational noise management protocol to minimise noise emissions and to respond to potential concerns from the community regarding project noise emissions.

# 9 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has been engaged by pitt&sherry Operations Pty Ltd on behalf of Photon Energy (Photon) to complete a Noise Assessment (NA)for the construction and operation of a Solar Farm at Suntop, near Wellington, NSW. The assessment has quantified potential noise emissions associated with the construction and operation of the project including road traffic noise associated with the construction phase.

The results of the NA demonstrate that construction noise levels satisfy relevant NMLs; at all assessed receivers, with the exception of those situated along Suntop Road when noise intensive works are nearest. Mitigation measures such as localised barriers, scheduling and respite would minimise noise emissions. Impacts would be of short duration and of a temporary nature.

Operational noise levels are predicted to satisfy the NPI PNTLs at all assessed receivers. However, recommendations to ensure noise levels are minimised and verified have been provided in this report.

Additionally, the NA demonstrates that the road noise criteria as specified in the RNP will be satisfied at all receivers on the proposed transport route.

Based on the NA results, there are no noise related issues which would prevent the approval of the project. The results of the assessment shows compliance with the relevant construction, operational and road noise criteria. Additionally, the results of the operational assessment demonstrate compliance with the relative EPA and DECCW policies, once ameliorative measures have been adopted.

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# Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in Table A1.

**Table A1 Glossary of Terms**

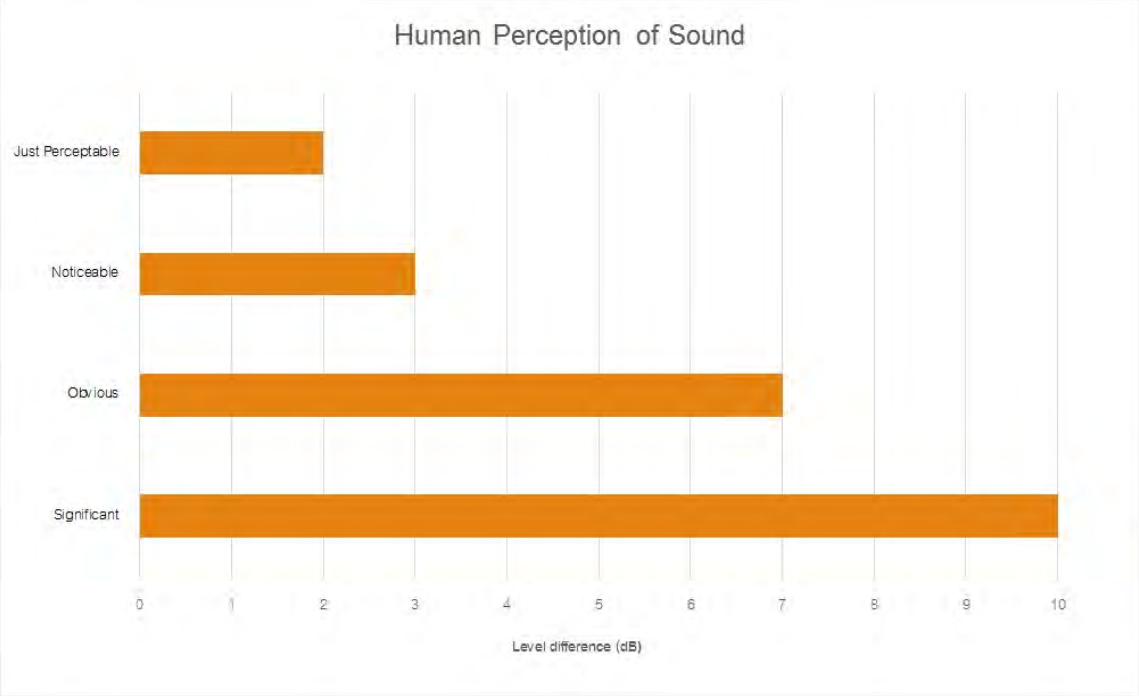
| Term | Description |
|---|---|
| 1/3 Octave | Single octave bands divided into three parts |
| Octave | A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit. |
| ABL | Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels. |
| Ambient Noise | The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant. |
| A Weighting | A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise. |
| dBA | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| dB(Z), dB(L) | Decibels Linear or decibels Z-weighted. |
| Hertz (Hz) | The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz. |
| LA10 | A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels. |
| LA90 | Commonly referred to as the background noise, this is the level exceeded 90 % of the time. |
| LAeq | The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period. |
| LAmax | The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval. |
| RBL | The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's. |
| Sound power level (LW) | This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by :<br>= 10.log10 (W/Wo)<br>Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts. |

**Table A2** provides a list of common noise sources and their typical sound level.

**Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA**

| Source | Typical Sound Level |
|---|---|
| Threshold of pain | 140 |
| Jet engine | 130 |
| Hydraulic hammer | 120 |
| Chainsaw | 110 |
| Industrial workshop | 100 |
| Lawn-mower (operator position) | 90 |
| Heavy traffic (footpath) | 80 |
| Elevated speech | 70 |
| Typical conversation | 60 |
| Ambient suburban environment | 40 |
| Ambient rural environment | 30 |
| Bedroom (night with windows closed) | 20 |
| Threshold of hearing | 0 |

**Figure A1** – Human Perception of Sound

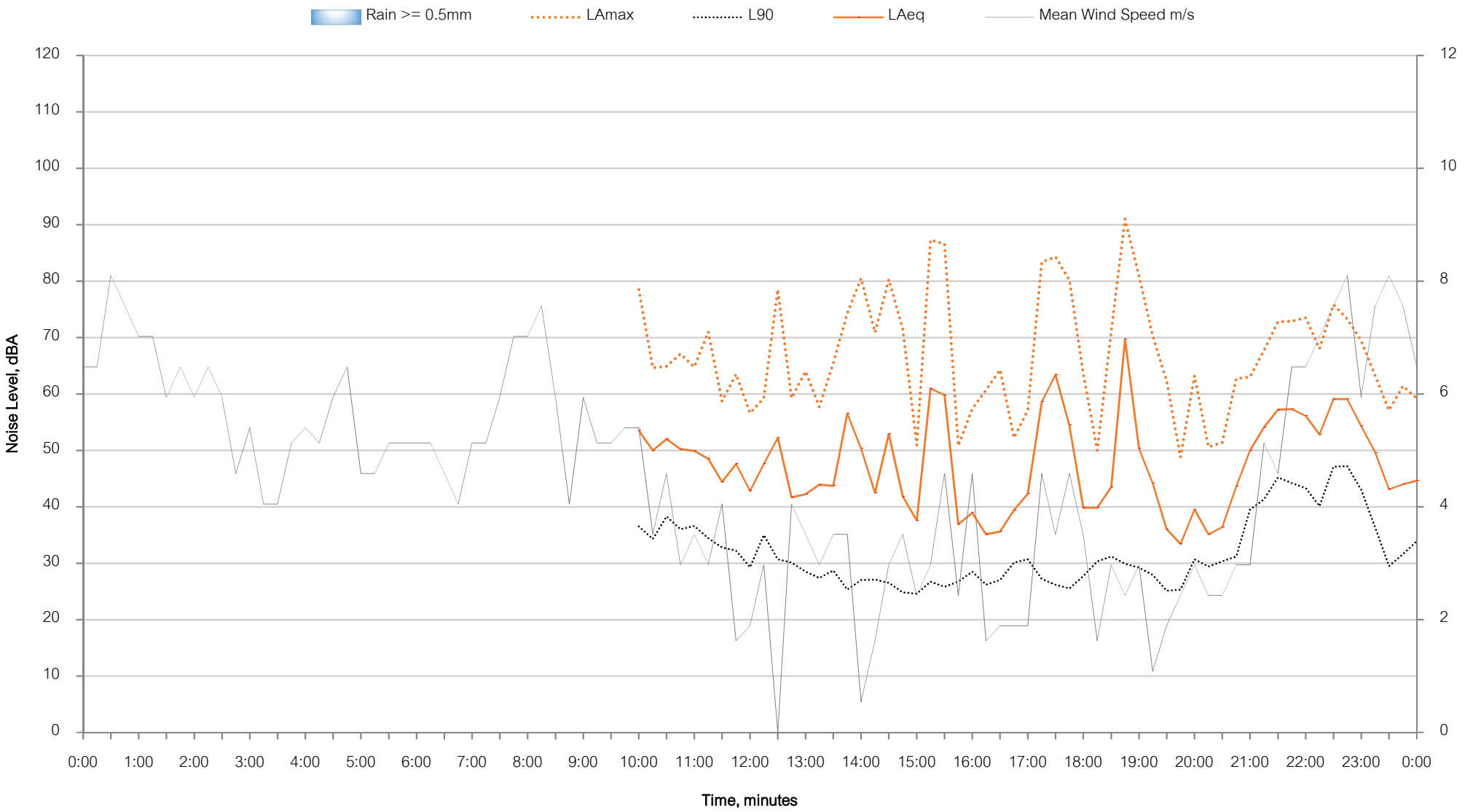


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# Appendix B – Noise Monitoring Charts

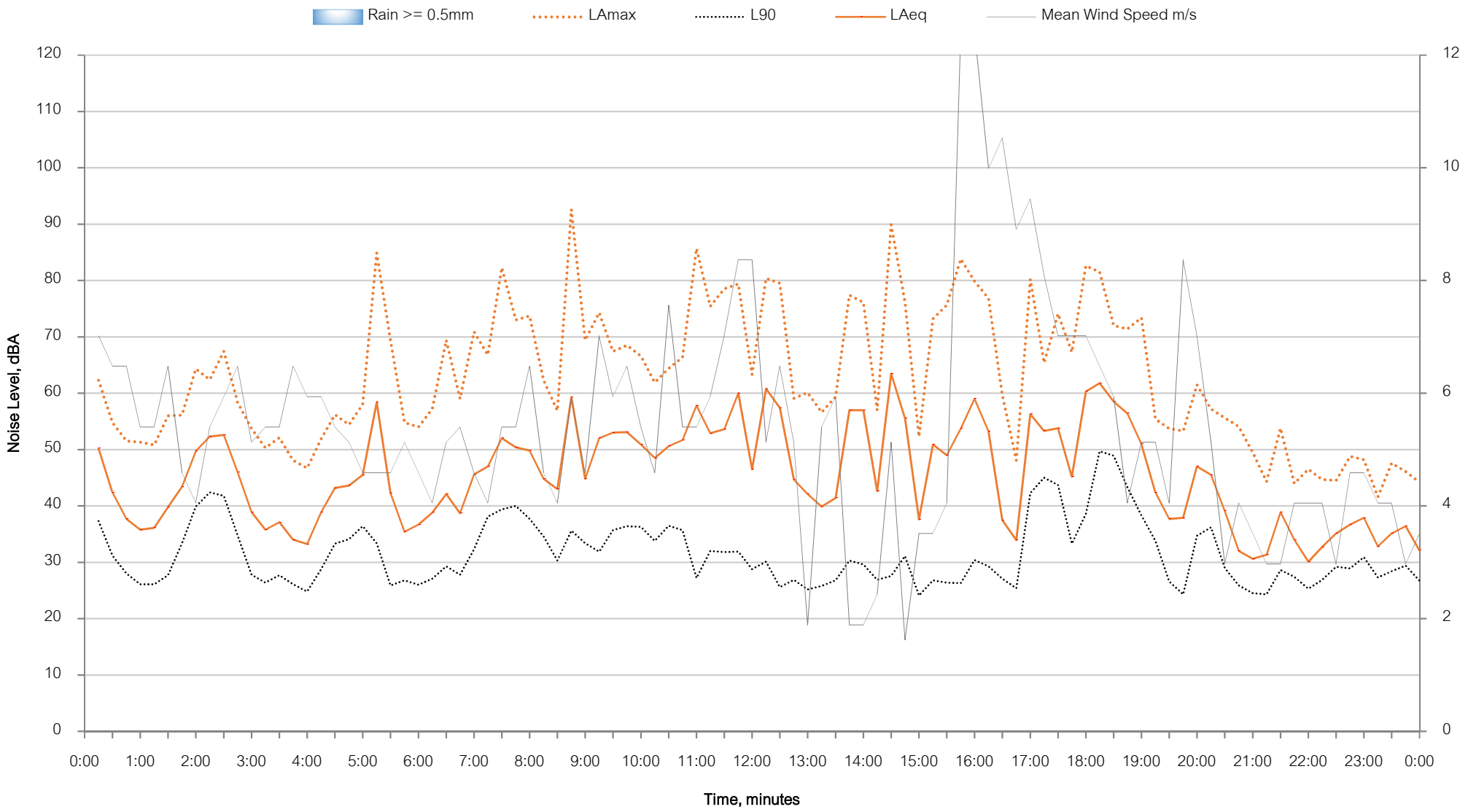
Background Noise Levels

Photon Suntop - Wednesday 22 November 2017



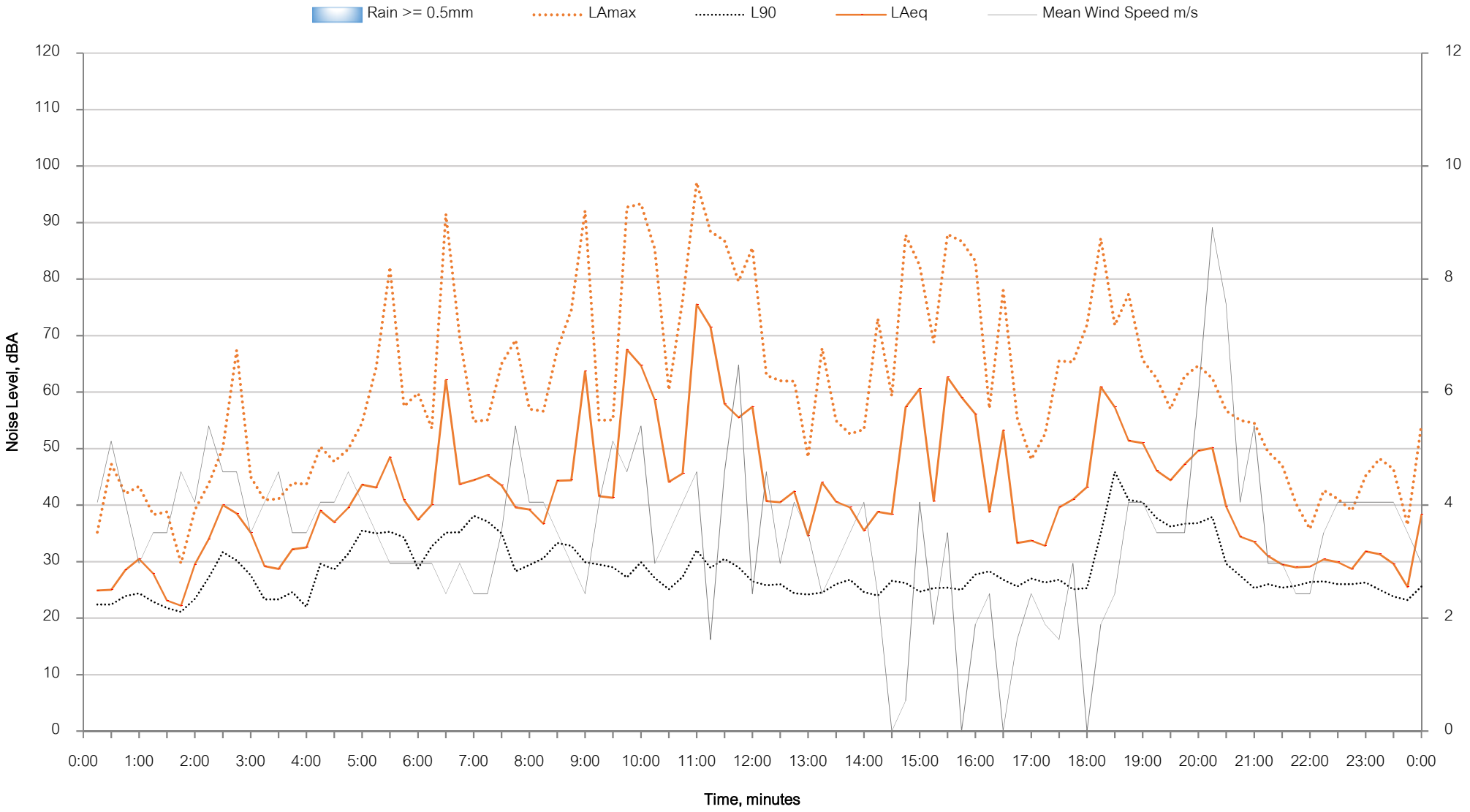
Background Noise Levels

Photon Suntop - Thursday 23 November 2017



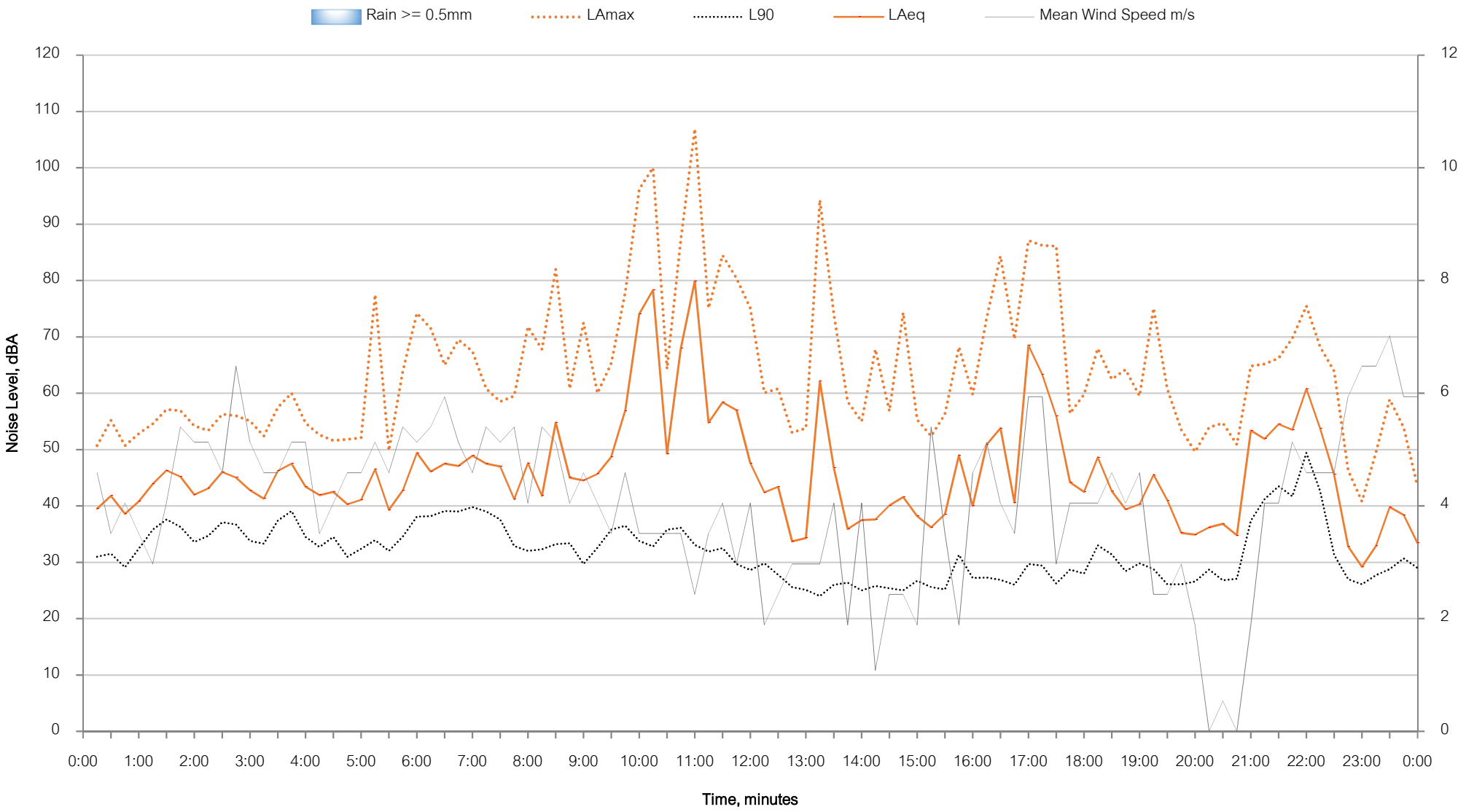
Background Noise Levels

Photon Suntop - Friday 24 November 2017



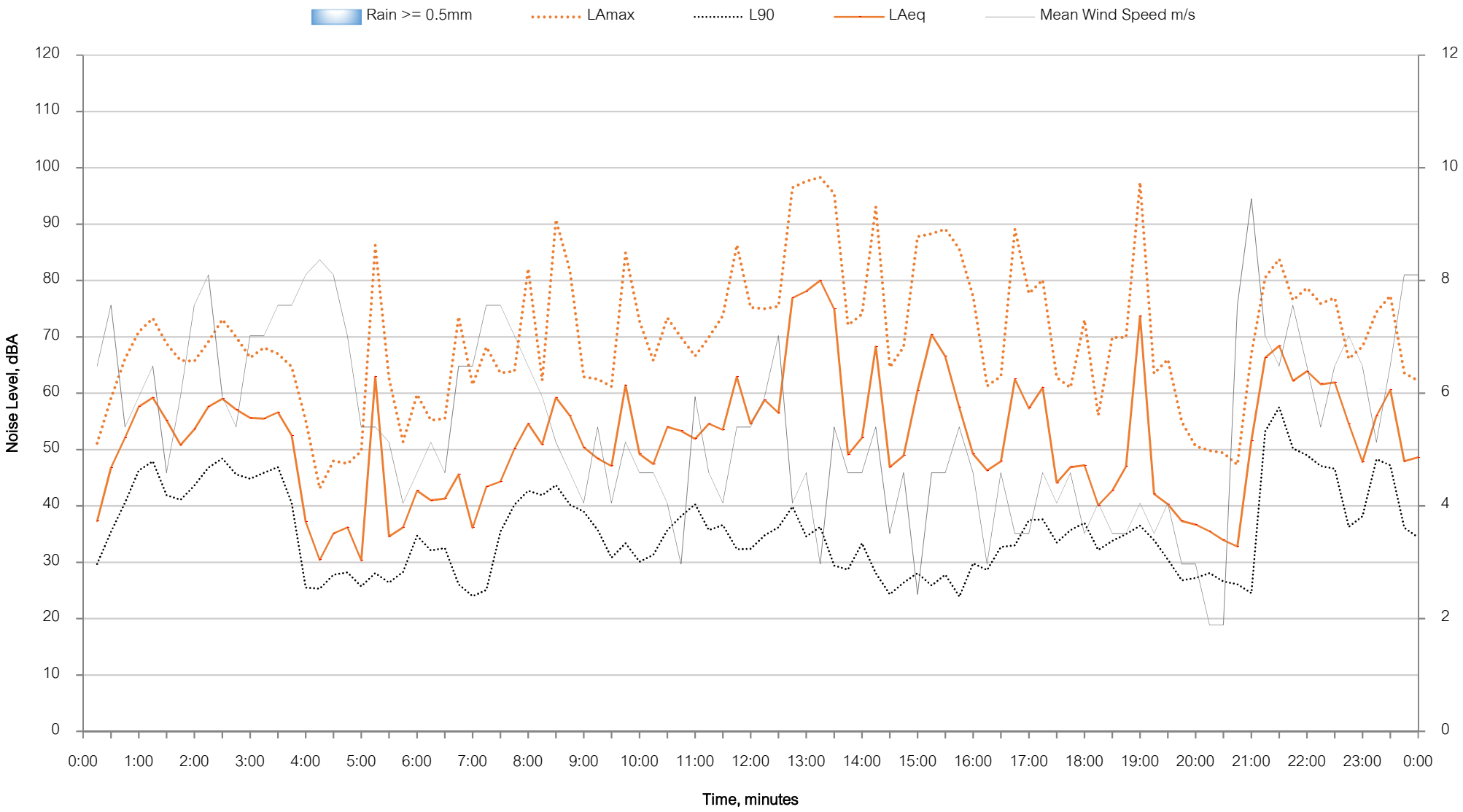
Background Noise Levels

Photon Suntop - Saturday 25 November 2017



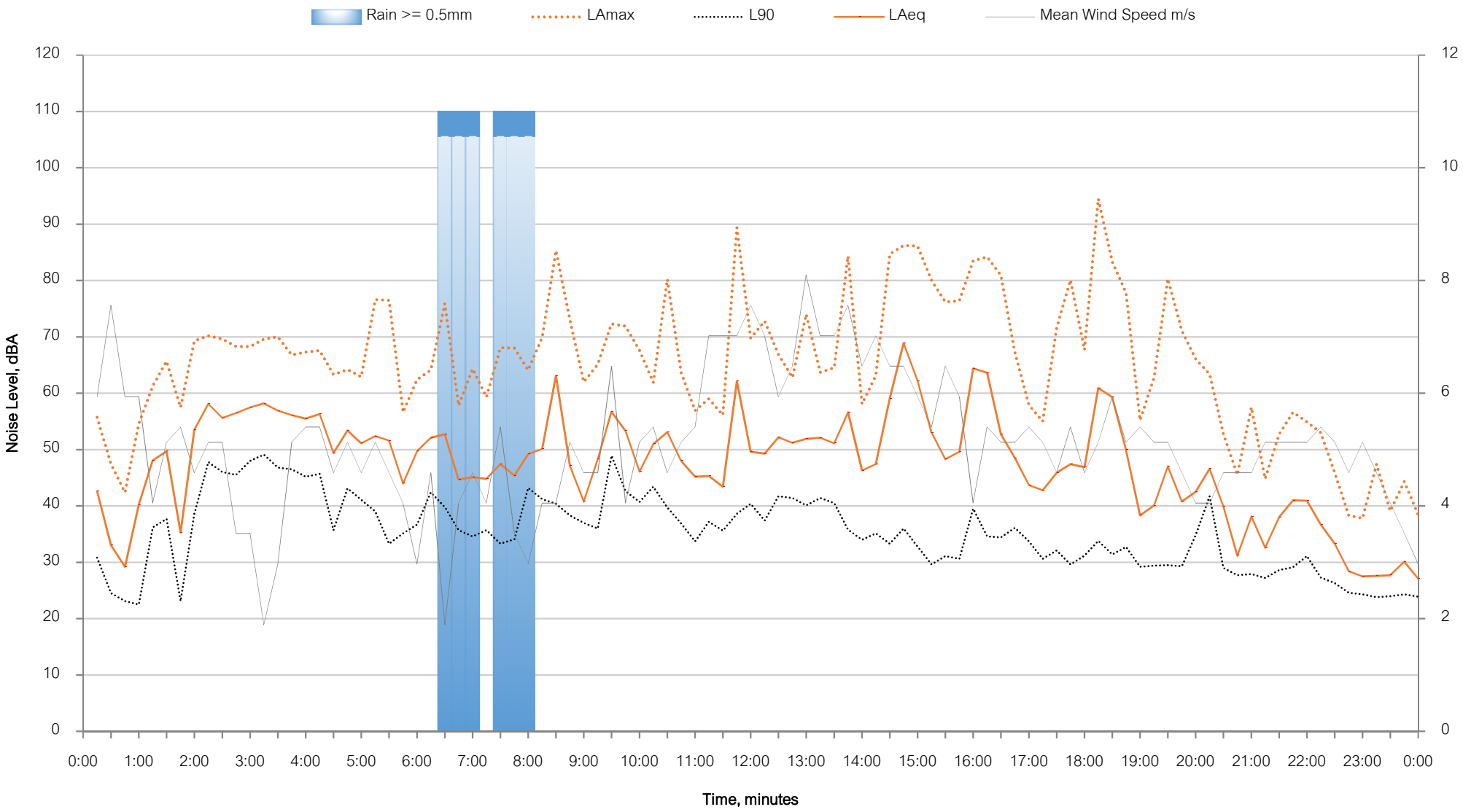
# Background Noise Levels

## Photon Suntop - Sunday 26 November 2017



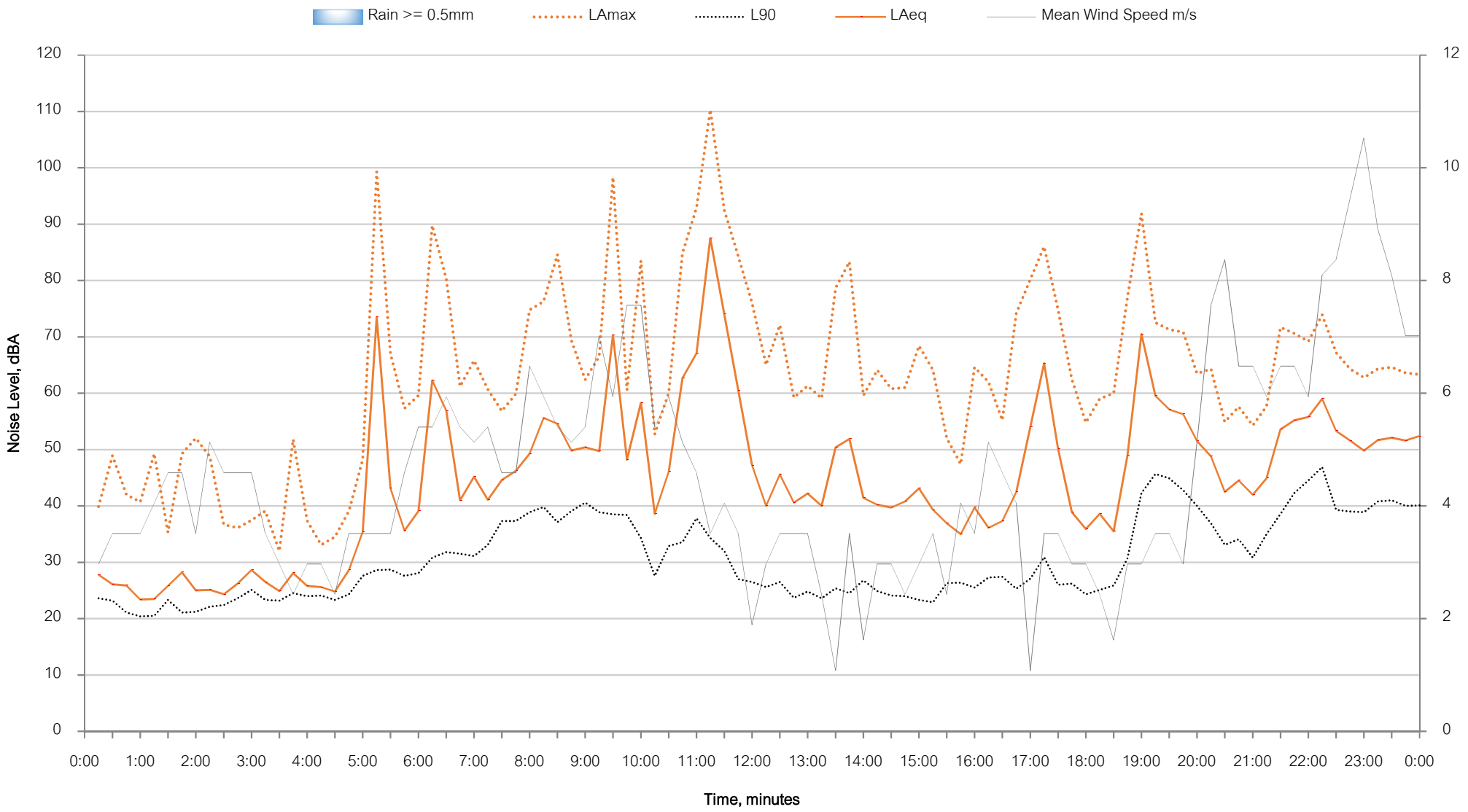
# Background Noise Levels

## Photon Suntop - Monday 27 November 2017



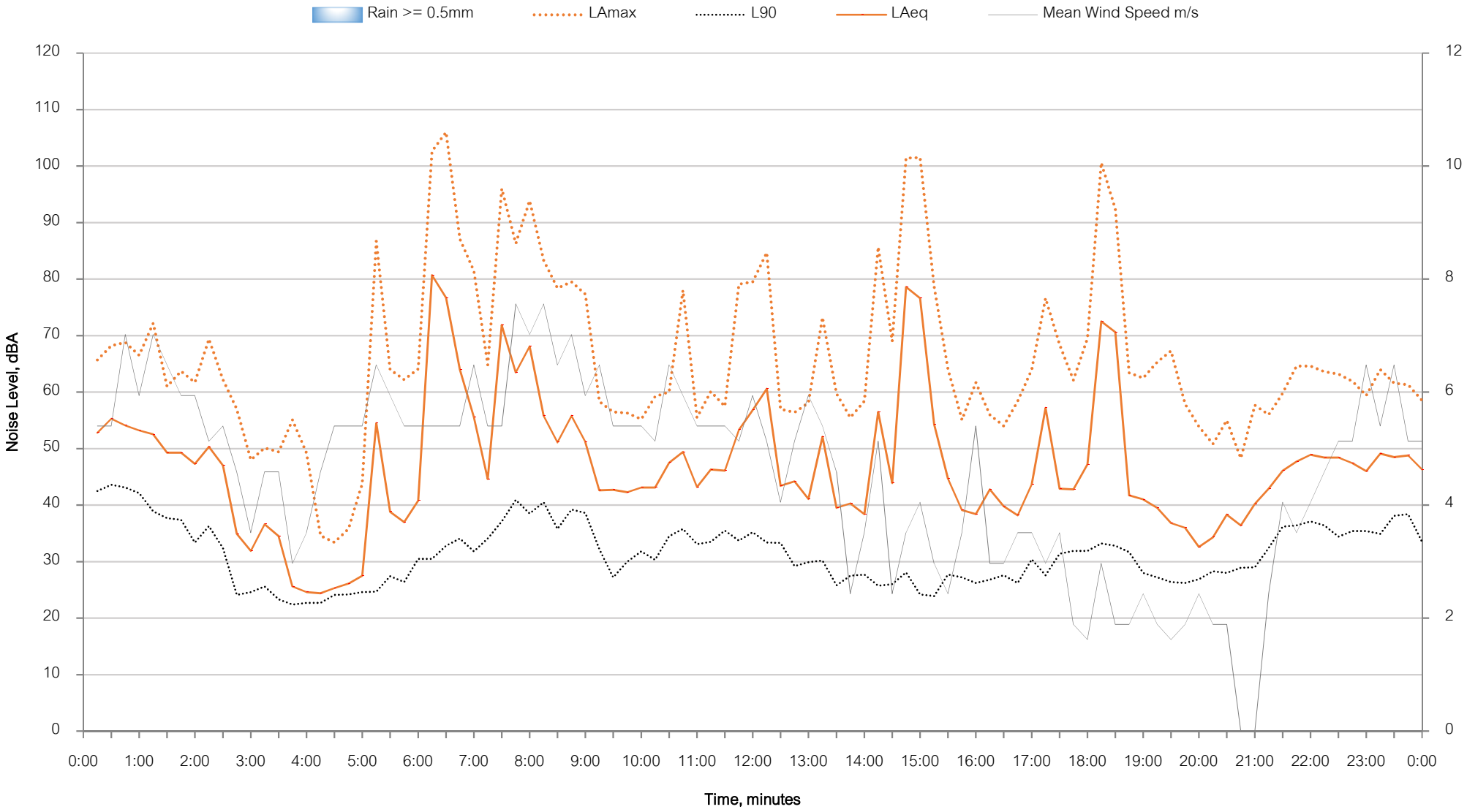
Background Noise Levels

Photon Suntop - Tuesday 28 November 2017



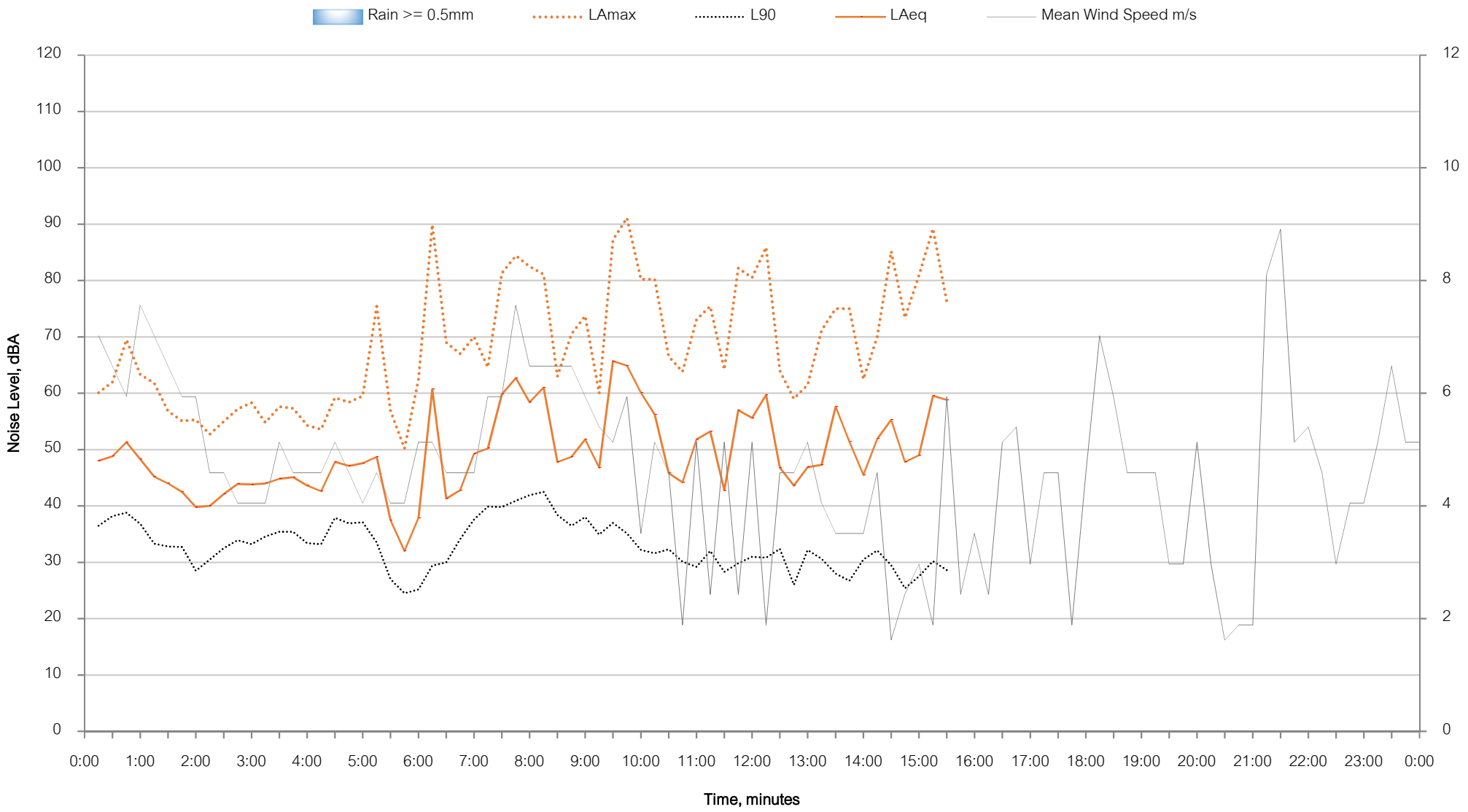
Background Noise Levels

Photon Suntop - Wednesday 29 November 2017



Background Noise Levels

Photon Suntop - Thursday 30 November 2017



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# Appendix C – NEWA Analysed Meteorology

| Table C1 NEWA Analysed Meteorological Conditions, Dubbo NSW | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Direction ± 45° | Season | Day | Evening | Night | Direction | Season | Day | Evening | Night |
| | | Percentage Occurrence % | | | | | Percentage Occurrence % | | |
| 0 | Summer | 5 | 8 | 7 | 180 | Summer | 7 | 9 | 5 |
| 0 | Autumn | 9 | 13 | 11 | 180 | Autumn | 7 | 6 | 4 |
| 0 | Winter | 10 | 16 | 13 | 180 | Winter | 7 | 10 | 6 |
| 0 | Spring | 6 | 14 | 10 | 180 | Spring | 7 | 11 | 6 |
| 22.5 | Summer | 5 | 8 | 6 | 202.5 | Summer | 8 | 12 | 8 |
| 22.5 | Autumn | 7 | 14 | 8 | 202.5 | Autumn | 7 | 8 | 6 |
| 22.5 | Winter | 9 | 17 | 10 | 202.5 | Winter | 7 | 11 | 8 |
| 22.5 | Spring | 5 | 14 | 8 | 202.5 | Spring | 8 | 13 | 8 |
| 45 | Summer | 5 | 6 | 4 | 225 | Summer | 9 | 14 | 13 |
| 45 | Autumn | 7 | 12 | 6 | 225 | Autumn | 9 | 13 | 11 |
| 45 | Winter | 9 | 17 | 9 | 225 | Winter | 8 | 15 | 12 |
| 45 | Spring | 6 | 13 | 6 | 225 | Spring | 9 | 17 | 14 |
| 67.5 | Summer | 4 | 5 | 3 | 247.5 | Summer | 8 | 11 | 14 |
| 67.5 | Autumn | 7 | 10 | 6 | 247.5 | Autumn | 10 | 14 | 15 |
| 67.5 | Winter | 9 | 16 | 10 | 247.5 | Winter | 9 | 15 | 14 |
| 67.5 | Spring | 6 | 11 | 7 | 247.5 | Spring | 9 | 15 | 16 |
| 90 | Summer | 4 | 4 | 3 | 270 | Summer | 7 | 10 | 14 |
| 90 | Autumn | 6 | 8 | 5 | 270 | Autumn | 11 | 14 | 18 |
| 90 | Winter | 9 | 11 | 9 | 270 | Winter | 11 | 15 | 19 |
| 90 | Spring | 6 | 8 | 7 | 270 | Spring | 9 | 13 | 19 |
| 112.5 | Summer | 5 | 4 | 2 | 292.5 | Summer | 8 | 10 | 15 |
| 112.5 | Autumn | 7 | 6 | 4 | 292.5 | Autumn | 13 | 14 | 22 |
| 112.5 | Winter | 10 | 9 | 9 | 292.5 | Winter | 14 | 15 | 23 |
| 112.5 | Spring | 7 | 6 | 6 | 292.5 | Spring | 9 | 13 | 21 |
| 135 | Summer | 6 | 5 | 2 | 315 | Summer | 7 | 9 | 13 |
| 135 | Autumn | 7 | 5 | 3 | 315 | Autumn | 13 | 15 | 20 |
| 135 | Winter | 10 | 8 | 7 | 315 | Winter | 14 | 14 | 20 |
| 135 | Spring | 7 | 4 | 5 | 315 | Spring | 8 | 12 | 19 |
| 157.5 | Summer | 7 | 10 | 4 | 337.5 | Summer | 4 | 5 | 7 |
| 157.5 | Autumn | 7 | 6 | 3 | 337.5 | Autumn | 8 | 10 | 14 |
| 157.5 | Winter | 9 | 9 | 6 | 337.5 | Winter | 10 | 10 | 15 |
| 157.5 | Spring | 8 | 8 | 5 | 337.5 | Spring | 5 | 9 | 13 |

# Construction Noise Management Plan

Suntop Solar Farm,
Wellington, NSW.

Prepared for: pitt&sherry Operations Pty Ltd
May 2018
MAC170550RP2

Muller Acoustic Consulting

# *Document Information*

## Construction Noise Management Plan

## Suntop Solar Farm, Wellington NSW

**Prepared for:** pitt&sherry Operations Pty Ltd
Suite 902, Level 9, North Tower
1-5 Railway Street
Chatswood NSW 2067

**Prepared by:** Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

| Document ID | Status | Date | Prepared By | Signed | Reviewed By | Signed |
|---|---|---|---|---|---|---|
| MAC170550RP2 | Draft | 10 May 2018 | Rod Linnett | | Oliver Muller | |

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CONTENTS

1 INTRODUCTION ..... 5

1.1 PURPOSE AND OBJECTIVES ..... 5

2 PROJECT DESCRIPTION ..... 7

2.1 DESCRIPTION OF PROPOSED CONSTRUCTION WORKS ..... 7

2.2 PROJECT DURATION ..... 7

2.3 RECEIVER REVIEW ..... 8

2.4 VIBRATION IMPACTS ..... 9

3 NOISE POLICY AND GUIDELINES ..... 11

3.1 CONSTRUCTION NOISE ..... 12

3.1.1 CONSTRUCTION NOISE MANAGEMENT LEVELS ..... 14

3.1.2 CONSTRUCTION SLEEP DISTURBANCE ..... 16

4 EXISTING ENVIRONMENT ..... 17

4.1 NOISE MONITORING METHODOLOGY ..... 17

4.2 NOISE MONITORING RESULTS ..... 17

5 ASSESSMENT CRITERIA ..... 19

5.1 CONSTRUCTION NOISE MANAGEMENT LEVELS ..... 19

6 NOISE MODELLING METHODOLOGY ..... 21

6.1 CONSTRUCTION ASSESSMENT METHODOLOGY ..... 21

7 RESULTS ..... 23

7.1 CONSTRUCTION RESULTS ..... 23

8 NOISE MITIGATION FOR CONSTRUCTION ACTIVITIES ..... 25

8.1 NOISE MANAGEMENT RECOMMENDATIONS ..... 25

8.1.1 COMPLAINTS HANDLING ..... 30

8.2 NOISE MONITORING ..... 31

8.2.1 DATA PRESENTATION AND REPORTING ..... 33

9 CONCLUSION ..... 35

APPENDIX A – GLOSSARY OF TERMS

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# 1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by pitt&sherry Operations Pty Ltd on behalf of Photon Energy (Photon) to prepare a Construction Noise Management Plan (CNMP) for the proposed Suntop Solar Farm near Wellington, NSW (the 'project').

## 1.1 Purpose and Objectives

The Noise Assessment (NA) completed for the project Environmental Impact Statement (EIS) identified potential noise impacts during its construction phases. This CNMP summarises the construction noise and vibration related findings of the NA completed for the Environmental Impact Statement and noise mitigation and management measures that may be implemented to effectively manage construction noise emissions at off-site receivers.

The objectives of the CNMP are as follows:

- identify the closest and/or potentially most affected receivers situated within the area of influence to the project;
- review construction and operating activities to identify noise generating plant, equipment, machinery or activities proposed to be undertaken that have the potential to exceed construction Noise Management Levels (NMLs) during standard construction hours and out of hours periods;
- utilise 3D noise modelling to predict noise levels that may occur as a result of the construction and operation of the project at the closest and/or potentially most affected receptors;
- provide a comparison of predicted noise levels against the project construction NMLs;
- assess the potential noise impacts associated with construction aspects of the project; and
- provide feasible and reasonable noise mitigation and management measures, and monitoring options, where NMLs may be exceeded.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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# 2 Project Description

Photon propose to construct and operate a 200 Megawatt (MW) Photovoltaic Solar (PV) Farm at a 517 hectare site at Suntop, NSW (the 'project'). The project would be located adjacent to Suntop Road, Suntop, NSW, contained within Lot 1-2-3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 (the 'subject lands'). The project is located within the Dubbo Local Government Area (LGA) and is approximately 10km south-west from the Wellington town centre. The area was previously considered part of the Wellington LGA, which has recently amalgamated with Dubbo to form the Dubbo Regional Council. The Wellington Local Environmental Plan (LEP 2012) is still current and applies to the site.

## 2.1 Description of Proposed Construction Works

The project includes the installation of approximately 550,000 PV modules in one hectare groups on mounting structures approximately 3m in height. The PV mounting structure would comprise of steel posts driven approximately 2.5m below ground using a small pile driver. Additional support structures would be attached to the piles, which would then support the PV panels.

Earthworks will primarily involve trenching which is required for cabling of each PV array/module to inverters and substation. Other minor earthworks would be completed for the preparation of the site and in most cases a concrete slab would be required to support the ancillary infrastructure. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

## 2.2 Project Duration

It is anticipated that the project would be constructed in one-hectare stages, with up to 10 stages in construction at any one time over a nine to twelve month period. Most construction work will be conducted during standard construction hours, however, there will be periods where works will be required after outside standard construction hours to undertake minor works or low intensity activities. This may be required to catch up on program schedule, to meet delivery deadlines or other unforeseeable program restrictions.

## 2.3 Receiver Review

From observations on site, review of aerial photos and other project information during the EIS, MAC has identified the following potentially sensitive receivers that may be affected by noise from construction activities and related road traffic. **Table 1** presents a summary of receiver Identification, type, address and coordinates. These are reproduced graphically in **Figure 1.**

**Table 1 Noise Sensitive Receivers**

| ID | Type | Description Address | Coordinates (MGA 56) | |
|---|---|---|---|---|
| | | | Easting | Northing |
| R01 | | 675 Suntop Road | 108862 | 6388151 |
| R02 | | 14 Bennetts Road | 108960 | 6388371 |
| R03 | | 586 Suntop Road | 109684 | 6388090 |
| R04 | | 582 Suntop Road | 109563 | 6389044 |
| R05 | | 796 Suntop Road | 107898 | 6389143 |
| R06 | | 1834 Arthurville Road | 106884 | 6388444 |
| R07 | | Lot 17 1094 Suntop Road | 105549 | 6388976 |
| R08 | | 898 Suntop Road | 106696 | 6389236 |
| R09 | Rural Residential | Lot 86 1094 Suntop Road | 105168 | 6389997 |
| R10 | | 69 Frogleys Road | 105038 | 6388224 |
| R11 | | 1570 Renshaw McGirr Way | 107199 | 6384488 |
| R12 | | 1420 Renshaw McGirr Way | 109403 | 6383178 |
| R13 | | 193 Bestwicks Lane | 110800 | 6385458 |
| R14 | | 233 Bestwicks Lane | 110935 | 6386134 |
| R15 | | 433 Suntop Road | 111140 | 6387048 |
| R16 | | 440 Suntop Road | 111245 | 6387671 |
| R17 | | 18 Ringwood Road | 111154 | 6388552 |

## 2.4 Vibration Impacts

A qualitative assessment of potential vibration impacts has been completed. Due to the nature of the works proposed and distances to receivers, vibration impacts from the project would be negligible.

The Construction Noise Strategy (Transport for NSW, 2012) sets out safe working distances to achieve the human response criteria for vibration. The key vibrating source proposed to be used on the project is a vibratory pile driver. For a small hydraulic hammer, similar to the type of vibration generated by pile driving works, the Construction Noise Strategy sets a safe working distance of 7m to achieve the residential human response criteria for continuous vibration. Therefore, as the nearest receivers to the project site are greater than 20m, human exposure to vibration is anticipated to be minimal. Furthermore, where the human response criteria are satisfied, the structural or cosmetic criteria for sensitive receivers will be achieved. Therefore, vibration impacts are not considered to be a significant issue to the project and has not been considered further in this assessment.

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# 3 Noise Policy and Guidelines

This CNMP has been prepared in consideration of the following relevant policies and standards, providing a framework for monitoring, communication, management, reporting and auditing.

- Environment Protection Authority (EPA) 2017, NSW Noise Policy for Industry (NPI);
- Department of Environment and Climate Change (DECC) 2009, Interim Construction Noise Guideline (ICNG);
- Australian Standard AS 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites;
- Australian Standard AS 1055.1:1997 - Acoustics - Description and measurement of environmental noise - General Procedures; and

The CNMP has also considered and applied the following additional policy, guidelines and standards where relevant:

- Australian Standard AS IEC 61672.1–2004 (AS61672) – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990 (AS1259) – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device; and
- Australian Standard AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard – Electroacoustics – Sound Calibrators.

## 3.1 Construction Noise

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- Qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The methodology for a quantitative assessment requires a more complex approach, involving noise predictions from construction activities to the nearest relevant assessment locations.

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This study has adopted a quantitative assessment approach. Steps of the quantitative approach are summarised in **Figure 1.**

The quantitative approach includes identification of potentially affected receivers, description of activities involved in the proposal, derivation of the construction noise management levels, quantification of potential noise impact at receivers and, provides management and mitigation recommendations.

Figure 1 Quantitative Assessment Processes for Assessing and Managing Construction Noise

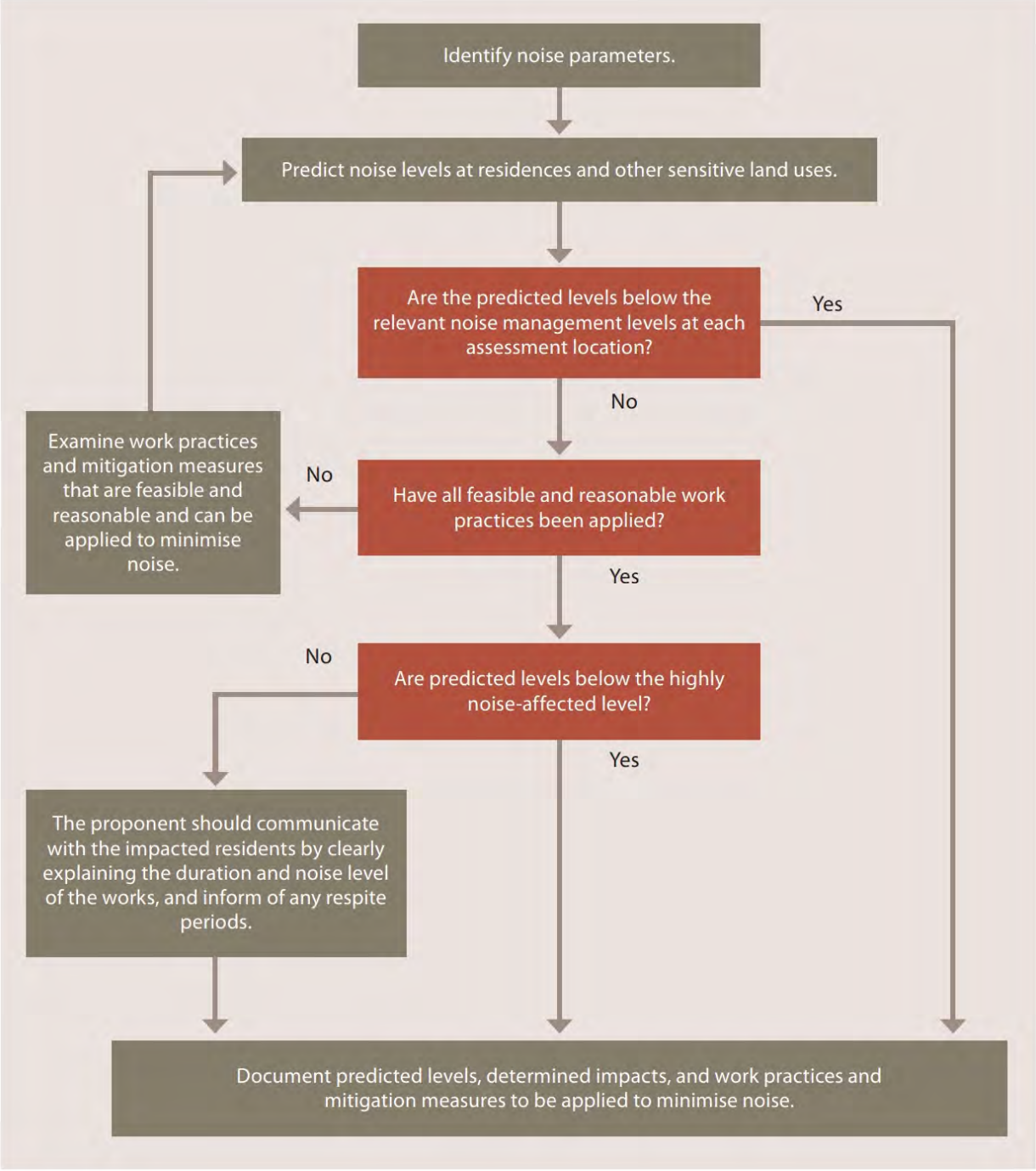


**Table 2** summaries the recommended standard and out of hours periods for construction. Note, although are not mandatory, strong justification is required to work outside of normal construction hours.

**Table 2 Recommended Hours for Construction**

| Period | Preferred Construction Hours |
|---|---|
| Normal construction | Monday to Friday - 7am to 6pm<br>Saturdays - 8am to 1pm<br>Sundays or Public Holidays - No construction |
| Out of Hours Period 1 | Monday to Friday - 6pm to 10pm<br>Saturdays - 7am to 8am and 1pm to 10pm<br>Sundays or Public Holidays - 8am to 6pm |
| Out of Hours Period 2 | Monday to Friday - 10pm to 7am<br>Saturdays - 10pm to 8am<br>Sundays or Public Holidays - 6pm to 7am |

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

Work conducted outside of standard hours are considered Out of Hours (OOH) work periods. OOH periods are divided into two categories representing evening and night periods and cover the hours listed below:

**Period 1** (evening/low risk period): Monday to Friday – 6pm to 10pm, Saturdays – 1pm to 6pm, Sundays 8am to 6pm.

**Period 2** (night/medium to high risk period): Monday to Friday – 10pm to 7am, Saturdays/Sundays – 6pm to 7am (8am on Sunday mornings).

### 3.1.1 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. **Table 3** provides the ICNG recommended $LA_{eq(15min)}$ NMLs and how they are to be applied.

| Table 3 Noise Management Levels | | |
|---|---|---|
| Time of Day | Management Level $LA_{eq(15min)}$[1] | How to Apply |
| Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays. | Noise affected RBL + 10 dB | The noise affected level represents the point above which there may be some community reaction to noise.<br>Where the predicted or measured $LA_{eq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly noise affected 75 dBA. | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>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 work near schools, or mid-morning or mid-afternoon for work near residences; and 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 strong justification would typically be required for work outside the recommended standard hours.<br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community.<br>For guidance on negotiating agreements see section 7.2.2. |

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

### 3.1.2 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights.

Given that construction activities are not expected to occur during Period 2, sleep disturbance has not been considered.

# 4 Existing Environment

## 4.1 Noise Monitoring Methodology

In accordance with NSW noise guidelines, background noise levels were measured for the EIS (MAC170550RP1) and are used to develop NMLs for residential receivers.

To quantify existing noise levels, long-term unattended noise measurements were performed on the project site (Location L1) as it is currently used for agriculture and representative of receivers located near the project (refer **Table 4**).

**Table 4 Noise Monitoring Locations**

| ID | Unattended Noise Monitoring Location | Site Description | Co-ordinates MGA56 | |
|---|---|---|---|---|
| L1 | Project Site | Off Suntop Road | 672143m E | 6394263m S |

## 4.2 Noise Monitoring Results

From observations whilst on site, the noise environment at existing residential receivers is best described as 'rural' in accordance with the NPI. A rural area, as described in the NPI, is one that has an acoustical environment that is dominated by natural sounds, having little or no road traffic noise and generally characterised by low background noise levels. The results of the unattended noise measurements for the background monitoring location, including derived RBLs are summarised in **Table 5**.

**Table 5 Unattended Noise Monitoring Results**

| Unattended Noise Monitoring Location | Period[1] | Measured Background Level RBL $L_{A90}$, dBA | Measured Ambient Noise Level $L_{Aeq}$, dBA |
|---|---|---|---|
| L1 Project Site | Day | 26 | 66 |
| | Evening | 26 | 59 |
| | Night | 26 | 59 |

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

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# 5 Assessment Criteria

## 5.1 Construction Noise Management Levels

Noise Management Levels (NMLs) for construction activities at all residential receivers are 45dB $L_{Aeq(15min)}$ (RBL +10dB). Although the majority of construction activities are planned for standard hours, the relevant NMLs for standard construction hours and out of hours periods are summarised in **Table 6**.

**Table 6 Construction Noise Management Levels**

| Location | Assessment Period | RBL, dBA | NML dB $L_{Aeq(15min)}$ |
|---|---|---|---|
| Residential Receivers | Day (Standard Hours) | 35 | 45 (RBL+10dBA) |
| | Evening (OOH Period 1) | 30 | 35 (RBL+5dBA) |
| | Night (OOH Period 2) | 30 | 35 (RBL+5dBA) |

Note 1: Monday to Saturday: Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.

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# 6 Noise Modelling Methodology

A computer model was developed to determine the impact of project noise emissions to neighbouring receivers for typical construction activities. Brüel and Kjær Predictor Type 7810 (Version 11.10) noise modelling software was used to assess potential noise impacts associated with the project. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. Additionally, the model uses relevant noise source data (measured on site at the project), ground type, shielding such as barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Plant and equipment were modelled at various locations and heights, representative of realistic construction and operational conditions for assessed scenarios.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'.

## 6.1 Construction Assessment Methodology

Construction activities are proposed to be progressive (trenching, piling and assembly) and will occur at several locations simultaneously. Noise emissions were modelled for the following three scenarios:

- earthworks involving trenching for cabling;
- piling of panel supports; and
- assembly of the panels.

It is envisaged that all three scenarios have the potential to occur simultaneously at up to 10 locations across the site, together with substation construction, vehicle movements on the site and deliveries of material to site. Noise emission data and assumptions used in this assessment are summarised in **Table 7**.

| Table 7 Construction Equipment Sound Power Levels, Lw dBA re $10^{-12}$ W | | | | |
|---|---|---|---|---|
| Noise Source/Item | Utilisation % | Quantity | Lw/Item | Total Lw |
| **Trenching & Earthworks (per work area)** | | | | |
| Backhoe | 100 | 1 | 104 | 104 |
| Light vehicle | 50 | 2 | 76 | 76 |
| **Total – Trenching & Earthworks** | | | | **104** |
| **Piling (per work area)** | | | | |
| Piling Rig (hydraulic) | 100 | 1 | 113 | 113 |
| Tele-handler | 80 | 1 | 106 | 105 |
| Light vehicle | 50 | 1 | 76 | 73 |
| **Total – Piling** | | | | **114** |
| **Assembly (per work area)** | | | | |
| Mobile Crane/HIAB | 100 | 1 | 104 | 104 |
| Tele-handler | 100 | 1 | 106 | 106 |
| Light vehicle | 50 | 2 | 76 | 76 |
| Hand tools/Power tools | 25 | 1 | 102 | 96 |
| Welder | 25 | 1 | 105 | 99 |
| **Total – Assembly** | | | | **109** |
| **Transport (on site)** | | | | |
| Heavy vehicle | 100 | 2 | 104 | 107 |
| Tele-handler | 100 | 1 | 106 | 106 |
| **Total – Transport** | | | | **110** |

# 7 Results

## 7.1 Construction Results

Noise levels were predicted to each assessed receptor assuming receiver heights of 1.5m above ground level for typical construction activities. **Table 8** summarises the maximum predicted noise level from the construction scenarios at assessed residential receivers for standard hours and OOH periods without additional noise mitigation or management measures.

**Table 8 Highest Predicted Construction Noise Levels (All Scenarios)**

| Receiver ID | Description | Highest Predicted Noise Level dB $L_{Aeq(15min)}$ | NML dB $L_{Aeq(15min)}$ | | Compliance | |
|---|---|---|---|---|---|---|
| | | | Standard Hours | Period 1 and Period 2 | Standard Hours | Period 1 and Period 2 |
| R01 | 675 Suntop Road | **56** | 45 | 35 | No | No |
| R02 | 14 Bennetts Road | **51** | 45 | 35 | No | No |
| R03 | 586 Suntop Road | **46** | 45 | 35 | No | No |
| R04 | 582 Suntop Road | 42 | 45 | 35 | Yes | No |
| R05 | 796 Suntop Road | **51** | 45 | 35 | No | No |
| R06 | 1834 Arthurville Road | **48** | 45 | 35 | No | No |
| R07 | Lot 17 1094 Suntop Road | 37 | 45 | 35 | Yes | No |
| R08 | 898 Suntop Road | 43 | 45 | 35 | Yes | No |
| R09 | Lot 86 1094 Suntop Road | 29 | 45 | 35 | Yes | Yes |
| R10 | 69 Frogleys Road | 32 | 45 | 35 | Yes | Yes |
| R11 | 1570 Renshaw McGirr Way | 37 | 45 | 35 | Yes | No |
| R12 | 1420 Renshaw McGirr Way | 29 | 45 | 35 | Yes | Yes |
| R13 | 193 Bestwicks Lane | 34 | 45 | 35 | Yes | Yes |
| R14 | 233 Bestwicks Lane | 36 | 45 | 35 | Yes | No |
| R15 | 433 Suntop Road | 35 | 45 | 35 | Yes | Yes |
| R16 | 440 Suntop Road | 34 | 45 | 35 | Yes | Yes |
| R17 | 18 Ringwood Road | 32 | 45 | 35 | Yes | Yes |

Note: Bold font identifies exceedances at receivers for standard hours of construction.

During standard hours, the activities predicted to exceed the NMLs at receivers along Suntop Road include piling, general assembly and trenching works. These levels would be experienced when activities occur simultaneously along the northern boundary or when a single activity is closest to the specific receiver.

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# 8 Noise Mitigation for Construction Activities

The results of the EIS NA indicate that noise levels during construction have potential to exceed the NMLs at several surrounding noise sensitive receivers. The noise levels are predicted to be between 3dB to 11dB above the NMLs for standard hours for receivers to the north of the project along Suntop Road. Construction noise levels are predicted to satisfy the highly noise affected criteria of 75dBA $LA_{eq(15min)}$ for all activities. Construction activities, in ranked order of received noise level at these receivers, are: piling, general assembly and trenching works.

The primary objective of the noise management plan is to minimise noise impacts on surrounding receivers. The project construction manager may adopt the following hierarchical strategy to achieve this objective:

- ensure that construction activities meet construction noise management levels within the allowable hours of operation as far as practicable;
- where noise levels are above relevant noise management levels, implement reasonable and feasible best practice noise controls to minimise noise emissions and/or exposure duration at affected receivers; and
- where the use of best practice noise controls does not adequately address exceedance of noise management levels, adopt alternative measures to minimise impacts on the community.

Australian Standard AS 2436-2010 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites"* sets out numerous practical recommendations to assist in mitigating construction noise emissions. These recommendations include operational strategies, source noise control strategies, noise barrier control strategies, and community consultation.

## 8.1 Noise Management Recommendations

To fully understand potential impacts, when and where they could occur, a more detailed assessment of each of the activities has been undertaken utilising 3D noise modelling to determine Noise Management Zones (NMZ) highlighting work areas that will require additional noise mitigation measures, allowing for effective noise management during the construction period.

Therefore, NMZ were developed by calculating the work areas, from which NMLs would be achieved across the project site for standard hours and OOH periods. The development of the NMZ are based on triggers used in construction noise management guidelines (consistent with those adopted by Roads and Maritime Services and/or TfNSW) where additional noise mitigation measures and strategies are implemented. Typically, these triggers are based on NML + 10dB for standard hours and NML + 5dB for OOH periods, are summarised in **Table 9**.

**Table 9 Construction Noise Management Levels**

| Location | Assessment Period | RBL, dBA | NML dB $LA_{eq(15min)}$ | NMZ dB $LA_{eq(15min)}$ |
|---|---|---|---|---|
| Residential Receivers | Day (Standard Hours) | 35 | 45 (RBL+10dBA) | 55 (NML+10dBA) |
| | Evening (OOH Period 1) | 30 | 35 (RBL+5dBA) | 40 (NML +5dBA) |
| | Night (OOH Period 2) | 30 | 35 (RBL+5dBA) | 40 (NML +5dBA) |

The NMZ are presented in **Figure 2** and **Figure 3**. Where works are to be undertaken within Zone 1, additional (Level 1) mitigation measures are required. Similarly, where works are to be undertaken within Zone 2, additional (Level 2) mitigation measures are required. Where works are to be undertaken in the remaining area (unshaded area) of the project site, standard mitigation measures are required.




FIGURE 2

REF: MAC170550RP2

Construction Noise Management Standard Hours

## Legend

- Noise Management Zone 1
- Noise Management Zone 2
- Receivers
- Construction Compound
- Suntop Site Boundary

0 200 400 600 800 m

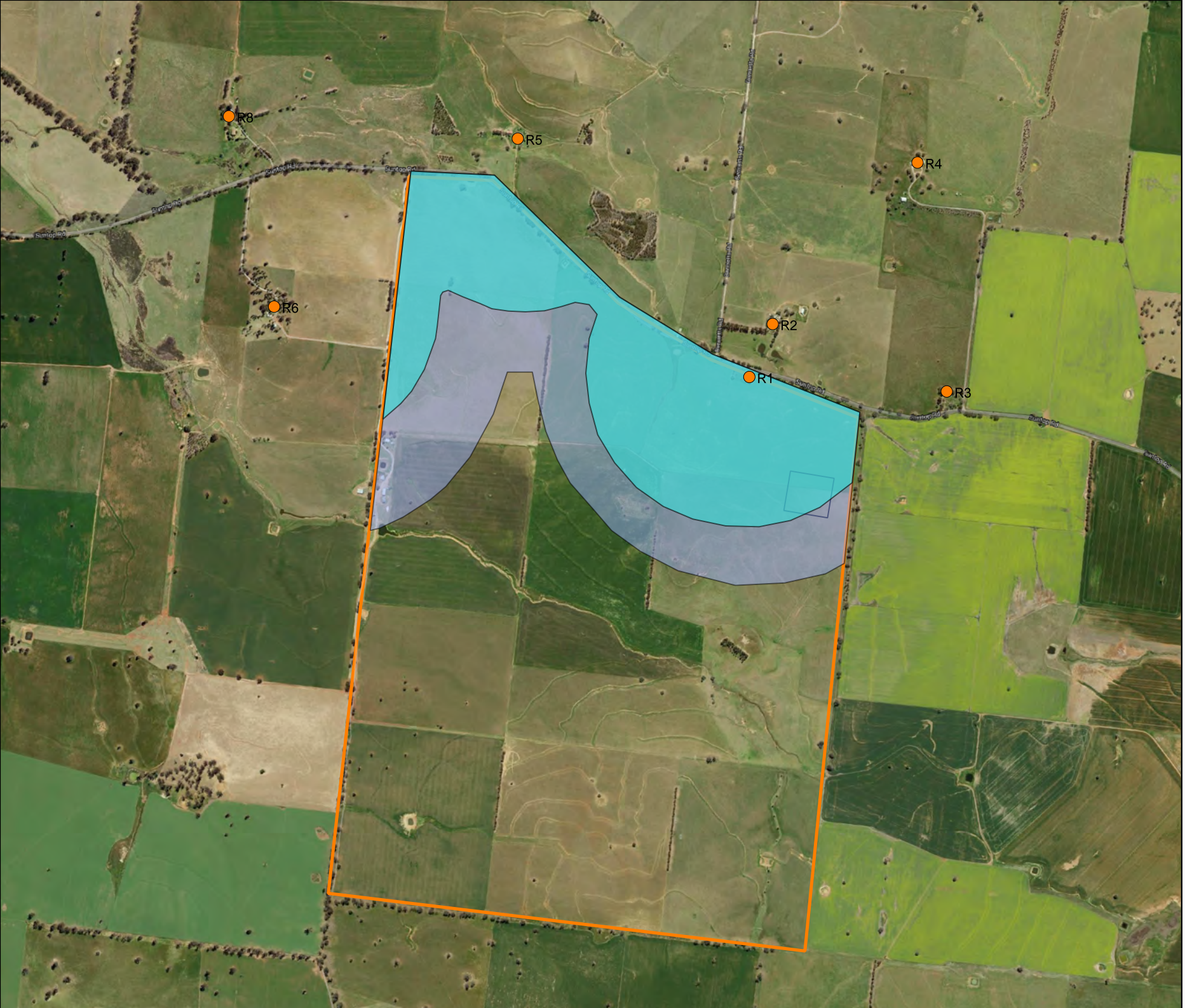



FIGURE 3

REF: MAC170550RP2

Construction Noise Management Out of Hours Period 1 & Period 2

## Legend

- Noise Management Zone 1
- Noise Management Zone 2
- Receivers
- Construction Compound
- Suntop Site Boundary

0 200 400 600 800 m

Standard, Level 1 and Level 2 mitigation measures are described in **Table 10**.

**Table 10 Construction Noise Mitigation Measures**

| Mitigation Level | Mitigation Measures |
|---|---|
| Standard Mitigation | ▪ Toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to surrounding receivers;<br>▪ Training (of employees to conduct quieter work practices);<br>▪ Equipment which is used intermittently is to be shut down when not in use;<br>▪ Where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers;<br>▪ Undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers;<br>▪ The quietest suitable machinery reasonably available will be selected for each work activity;<br>▪ Avoid queuing of vehicles adjacent to any receivers;<br>▪ Where practicable, ensure noisy plant/machinery are not working simultaneously in close proximity to receivers;<br>▪ Where possible, all plant are to utilise a broad band reverse alarm in lieu of the traditional hi-frequency type reverse alarm;<br>▪ Minimising the need for reversing or movement alarms. |
| Level 1 Mitigation (Including Standard Mitigation Level) | ▪ Scheduling of construction activities to minimise the number of work fronts and simultaneous activities occurring along the northern boundary to minimise noise levels;<br>▪ Wherever possible, subject to feasibility and reasonability, the quietest plant and equipment should be utilised in combination with management measures to minimise noise impacts;<br>▪ Where vehicle queuing is required, for example due to safety reasons, engines are to be switched off to reduce their overall noise impacts on receivers;<br>▪ Notification of OOH works;<br>▪ Conduct noise monitoring to validate noise emissions are within NMLs. |
| Level 2 Mitigation (Including Mitigation Level 1) | ▪ Use mobile noise screens (which can achieve noise reductions of up to 8dBA), optimise the positioning of plant and equipment to minimise line of site to receivers or substitute noisy equipment to reduce the noise level at nearby receivers for these activities;<br>▪ Conduct noise monitoring to validate noise emissions are within NMLs;<br>▪ Respite periods;<br>▪ Potential temporary alternative accommodation. |

Employing these strategies could potentially result in noise level reductions ranging:

- Standard Mitigation – up to 10dBA in instances where space requirements place limitations on the attenuation options available;
- Level 1 Mitigation – potentially up to 20dBA depending on mixture of measures and noise sources in operation, location and proximity to receivers;
- Level 2 Mitigation – potentially over 20 dBA where the use of enclosures, silencers, etc) can be combined with noise barriers and management techniques (eg avoidance of clustering).

Should compliance noise monitoring indicate exceedances of the noise criteria, a combination of comprehensive noise mitigation treatments (i.e. noise barriers, equipment enclosures, silencers, regular equipment maintenance, etc) and consultation with the local community will be considered on a case by case basis to manage exceedances. Further descriptions of management measures and mitigation options are provided for specific construction activities and work areas in the following sections.

### 8.1.1 Complaints Handling

- Provide a readily accessible contact point, for example, through a toll-free information and complaints line and give complaints a fair hearing.
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.
- Records of all community complaints will be maintained on an up-to-date complaints register. The records will include:
    - date and time of the complaint;
    - the means by which the complaint was made (telephone, mail or email);
    - any personal details of the complainant that were provided, or if no details are provided, a note to that effect;
    - the nature of the complaint;
    - any actions taken by the site supervisor/construction contractor in relation to the complaint, including any follow up contact with the complainant and the timing for implementing action; and
    - if no action was taken by site supervisor/construction contractor in relation to the complaint, the reason why no action was taken.

- Community complaints will be allocated to a responsible contractors representative immediately to facilitate the implementation of corrective actions. The details of the complaint will also be circulated to the applicable construction personnel for action, where required.

## 8.2 Noise Monitoring

A noise monitoring program may be considered by the proponent to guide, manage, quantify and control noise emissions from construction activities in the event of community concerns regarding noise emissions or receipt of a formal noise complaint. Where monitoring indicates exceedances, additional mitigation measures and controls may be considered to minimise impacts to nearby sensitive receivers.

The objectives of the noise monitoring program are as follows:

- assess construction noise levels against derived NMLs presented in this report, with consideration given to non-site related ambient and background noise at the time of measurements;
- identify potential noise sources and their relative contribution to noise impacts from construction;
- specify appropriate intervals for noise monitoring to evaluate, assess and report the noise contribution due to construction;
- outline the methodologies to be adopted for monitoring construction noise, including justification for monitoring intervals or triggers, weather conditions, monitoring location selection and timing; and
- incorporate noise management and mitigation strategies outlined in this plan.

The noise measurement procedures employed throughout the monitoring programme shall be guided by the requirements of AS 1055 1997 “Acoustics - Description and Measurement of Environmental Noise” and the EPA’s Noise Policy for Industry (NPI), 2017. Noise monitoring will be undertaken by a suitably qualified acoustic specialist or suitably qualified and trained environment officer.

Operator attended noise measurements and recordings shall be conducted to quantify the intrusive noise emissions from construction as well as the overall level of ambient noise.

The operator shall quantify and characterise the maximum ($L_{Amax}$) and the energy equivalent ($L_{Aeq}$) intrusive noise level from construction over a 15-minute measurement period. In addition, the operator shall quantify and characterise the overall levels of ambient noise over the 15-minute measurement interval. It is recommended that instrumentation used during the monitoring is to be equivalent to a Type 1 meter with 1/3 octave band analysis and have audio recording functionality for post processing source identification. It is noted that 1/3 octave band analysis is required to establish whether modification factors in accordance with the NPI are to be applied.

All acoustic instrumentation used as part of the attended monitoring program must been designed to comply with the requirements of AS IEC 61672.1-2004, "Electroacoustics - Sound level meters - Specifications" and shall have current NATA or manufacturer calibration certificates. All instrumentation shall be programmed to record continuously statistical noise level indices in 15 minute intervals which may include the $L_{Amax}$, $L_{A1}$, $L_{A5}$, $L_{A10}$, $L_{A90}$, $L_{A99}$, $L_{Amin}$ and the $L_{Aeq}$.

The statistical noise exceedance levels (LAn) are the levels exceeded for n% of the 15-minute interval. The $L_{A90}$ represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level. The $L_{Aeq}$ is the equivalent continuous sound pressure level and represents the steady sound level which is equal in energy to the fluctuating level over the interval period. The $L_{Amax}$ is the maximum noise level recorded over the interval.

Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA. The measurement position(s) should be selected taking into account:

- the weather, rain, wind, noise and insect noise;
- the location and direction of any noise source/s;
- the most sensitive position at the affected receiver; and
- the need to avoid reflecting surfaces (where possible).

### 8.2.1 Data Presentation and Reporting

The measured $LA_{eq(15min)}$ noise level contributions from construction operations as well as the overall ambient noise levels together with the weather and construction activities at the time of the measurement shall be reported on a regular basis.

In the event of an exceedance of the relevant NMLs, the Construction Manager shall be promptly informed of the location, the margin of exceedance and the source of emission. The noise level, meteorological conditions at the time of the survey and plant operating data shall be documented and forwarded to the Construction Manager so that an appropriate response can be made with respect to conformance.

Reporting of monitoring will include the following:

- monitoring location(s);
- list of operating plant and equipment;
- measured noise and/or vibration levels from construction;
- overall ambient noise levels;
- comparison of results with relevant NMLs;
- monitoring equipment details;
- weather conditions; and
- comments specific to each site.

Compliance reports, discussing compliance against the NMLs, will be prepared and submitted to the Construction Manager as required. Compliance reports will include a summary of the information listed in the preceding sections, specifically issues or non-compliances and the response or management of the issues and non-compliances.

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# 9 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has been engaged by pitt&sherry Operations Pty Ltd on behalf of Photon Energy (Photon) to complete a Construction Noise Management Plan for a proposed Solar Farm at Suntop, near Wellington, NSW. The CNMP has quantified potential noise emissions associated with the construction phase of the project and mitigation management measures.

The results of the CNMP demonstrate that construction noise levels for several activities have the potential to be above the relevant NMLs at several receivers in close proximity to the work. Therefore, construction noise mitigation measures as outlined in Section 8 should be considered. **Figure 2** and **Figure 3** provide a visual representation of the NMZ, and when activities occur within these areas, mitigation measures as per **Table 10** should be implemented.

Notwithstanding, the highly affected $LA_{eq(15min)}$ noise management level of 75dBA is expected to be satisfied at all receivers.

In summary, it is recommended that during construction, noise control and management measures provided in this report are adopted to minimise impacts to surrounding receivers, specifically during noise intensive works when they occur adjacent to the northern boundary.

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# Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in Table A1.

**Table A1 Glossary of Terms**

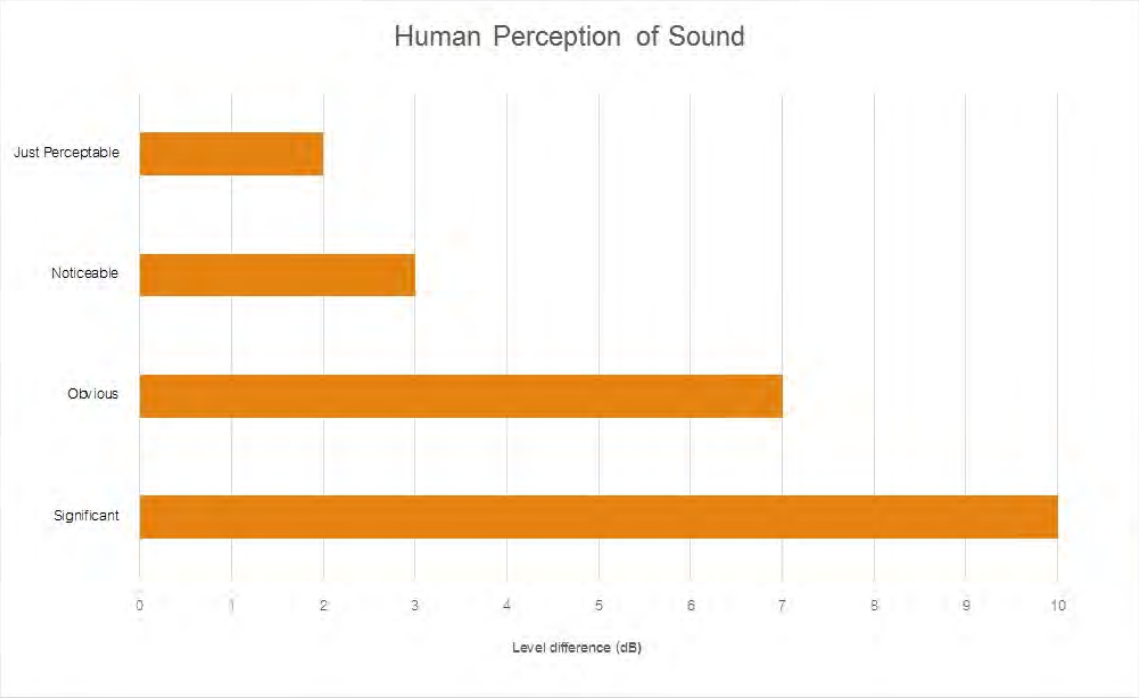
| Term | Description |
|---|---|
| 1/3 Octave | Single octave bands divided into three parts |
| Octave | A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit. |
| ABL | Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels. |
| Ambient Noise | The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant. |
| A Weighting | A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise. |
| dBA | Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear. |
| dB(Z), dB(L) | Decibels Linear or decibels Z-weighted. |
| Hertz (Hz) | The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz. |
| LA10 | A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels. |
| LA90 | Commonly referred to as the background noise, this is the level exceeded 90 % of the time. |
| LAeq | The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period. |
| LAmax | The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval. |
| RBL | The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's. |
| Sound power level (LW) | This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by :<br>= 10.log10 (W/Wo)<br>Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts. |

**Table A2** provides a list of common noise sources and their typical sound level.

**Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA**

| Source | Typical Sound Level |
|---|---|
| Threshold of pain | 140 |
| Jet engine | 130 |
| Hydraulic hammer | 120 |
| Chainsaw | 110 |
| Industrial workshop | 100 |
| Lawn-mower (operator position) | 90 |
| Heavy traffic (footpath) | 80 |
| Elevated speech | 70 |
| Typical conversation | 60 |
| Ambient suburban environment | 40 |
| Ambient rural environment | 30 |
| Bedroom (night with windows closed) | 20 |
| Threshold of hearing | 0 |

**Figure A1** – Human Perception of Sound



Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

MAC
Muller Acoustic Consulting

# Land Management Plan
# Suntop Solar Farm

transport | community | mining | industrial | food & beverage | energy







| | |
|---|---|
| **Prepared for:** | Photon Energy Australia Pty Ltd |
| **Client representative:** | Robert Ibrahim |
| **Date:** | May 2018<br>Rev00 |

pitt&sherry

## Table of Contents


1. Introduction ..... 1
   - 1.1 Purpose of the Report ..... 1
   - 1.2 Objectives ..... 1
   - 1.3 Post-Approval Implementation ..... 1
   - 1.4 Interactions with Other Documents ..... 1
2. The Proponent ..... 1
3. The Proposal ..... 2
   - 3.1 Overview ..... 2
   - 3.2 Construction Activities ..... 4
   - 3.3 Operational Activities ..... 5
   - 3.4 Existing Environment ..... 5
4. Land Management Activities ..... 7
   - 4.1 Grazing Activities ..... 7
   - 4.2 Cropping Activities ..... 7
5. Ownership ..... 7
   - 5.1 Structure and Responsibility ..... 7
6. Approvals and Licensing ..... 8
   - 6.1 Conditions of Approval ..... 8
7. Implementation ..... 8
   - 7.1 Risk Assessment ..... 8
   - 7.2 Management Activities and Controls ..... 9
8. Remediation Plan ..... 13
9. Audit and Quality Management ..... 14
   - 9.1 Review ..... 14
   - 9.2 Records ..... 14


Prepared by: ..... Date: 9 April 2018
Chris Dickson

Reviewed by: ..... Date: 9 May 2018
Jessica Berry

Authorised by: ..... Date: 10 May 2018
Jessica Berry

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# 1. Introduction

## 1.1 Purpose of the Report

The purpose of this Suntop Solar Farm Land Management Plan (LMP) is to develop a framework for the ongoing management of land, water and vegetation within the site (the "Subject Land") and describe the following components to ensure that land management is undertaken in the most appropriate manner throughout all phases of the Project:

- Provide a brief description of the Proposal and the existing environment (Section 3)
- Identify and document the existing operations, and conditions of the Site (Section 3 and 4)
- Identify critical stakeholders (Section 5)
- Outline the applicable approvals and licencing conditions (Section 6)
- Implement appropriate management measures to ensure the management of land within the Site is maintained (Section 7)
- Provide a methodology for the remediation of land following decommissioning of the Proposal (Section 8)
- Outline reporting procedures to gauge management measure effectiveness (Section 9).

## 1.2 Objectives

The objective of this LMP is to provide a documented system that will help ensure all land management requirements and commitments made during the approvals process are collated within this document and implemented when operating the Suntop Solar Farm.

## 1.3 Post-Approval Implementation

It is anticipated that following approval being given to the Proposal by the Department of Planning and Environment (DP&E), conditions of approval would likely relate to the requirement of this LMP to be updated, reviewed, approved and implemented either under, or within, the Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP).

As a result of this, this document would be amended post-approval to reflect the specific conditions or management measures outlined within any approval documents and requirements.

## 1.4 Interactions with Other Documents

This LMP is a supporting document to the Suntop Solar Farm Environmental Impact Statement (EIS), 2018 and should be read in conjunction with the EIS and specialist reports provided as part of the EIS.

Specific management measures relating to surface water, erosion and sediment controls etcetera would be incorporated into the overarching CEMP, OEMP and other specific management plans as required.

# 2. The Proponent

The proponent is Suntop Solar Farm (SSF) which is owned by three companies including Photon Energy, Canadian Solar and Polpo Investments.

# 3. The Proposal

This section outlines a broad explanation of the Suntop Solar Farm (the 'Proposal'), defines the projects boundaries and identifies existing operations and environmental conditions within the Subject Land.

## 3.1 Overview

SSF propose to construct and operate a 200-megawatt (MW) solar farm using photovoltaic (PV) technology, comprising a total of 472 hectares in Wellington, NSW. The Proposal would be located at 909 Suntop Road, Wellington, NSW 2820 and contained within Lot 1-2 and part Lot 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805.

The Proposal is located within the Dubbo Local Government Area (LGA) and is approximately 10km south-west from the Wellington town centre.

The solar farm and its ancillary components would occupy a total of 472 hectares out of the total land holdings of 517 hectares (equivalent to approximately 92% of the available land) and is hereafter referred to as the "Site". Figure 1: The Proposalprovides an overview of the Proposal.

Up to 550,000 PV panels would be installed on a single axis tracker system across the Site. The single axis tracker system option would consist of groups of east-west facing PV modules tilted at +/- 60$^{o}$ angle (each approximately 2m x 1m in area) on mounting structures approximately 2m in height and in rows approximately 11m apart. The mounting structure would be piled steel posts that would extend between 1.6m to 4m below ground depending on geological conditions. The maximum height of panels during tracking movement is up to 4m.

The major additional components of the Proposal required to support the construction and operation of the Proposal are outlined below.

- Construction of a new main access road for all access and egress to the Site and related facilities
- Installation of electrical infrastructure including:
  - A new 132kV Substation
  - Inverters to collect and convert DC to AC
  - Cabling and other electrical infrastructure (e.g. security systems)
- A maintenance compound and ancillary buildings
- Fencing, landscaping and environmental works.

Power generated by the facility will be initially transmitted from the new 132kV substation to the existing 132kV transmission lines via a 'tee-off' (an electrical connector that joins electrical cables into existing electrical lines), along an easement owned by TransGrid that traverses the Site, before extending through to the Wellington substation, located approximately 15 kilometres to the north.

The operational life of the Proposal is expected to be 30 years at which point the panels are either replaced and operations continue (pending subsequent extension approvals) or decommissioned, removed from Site and ultimately rehabilitated as required.

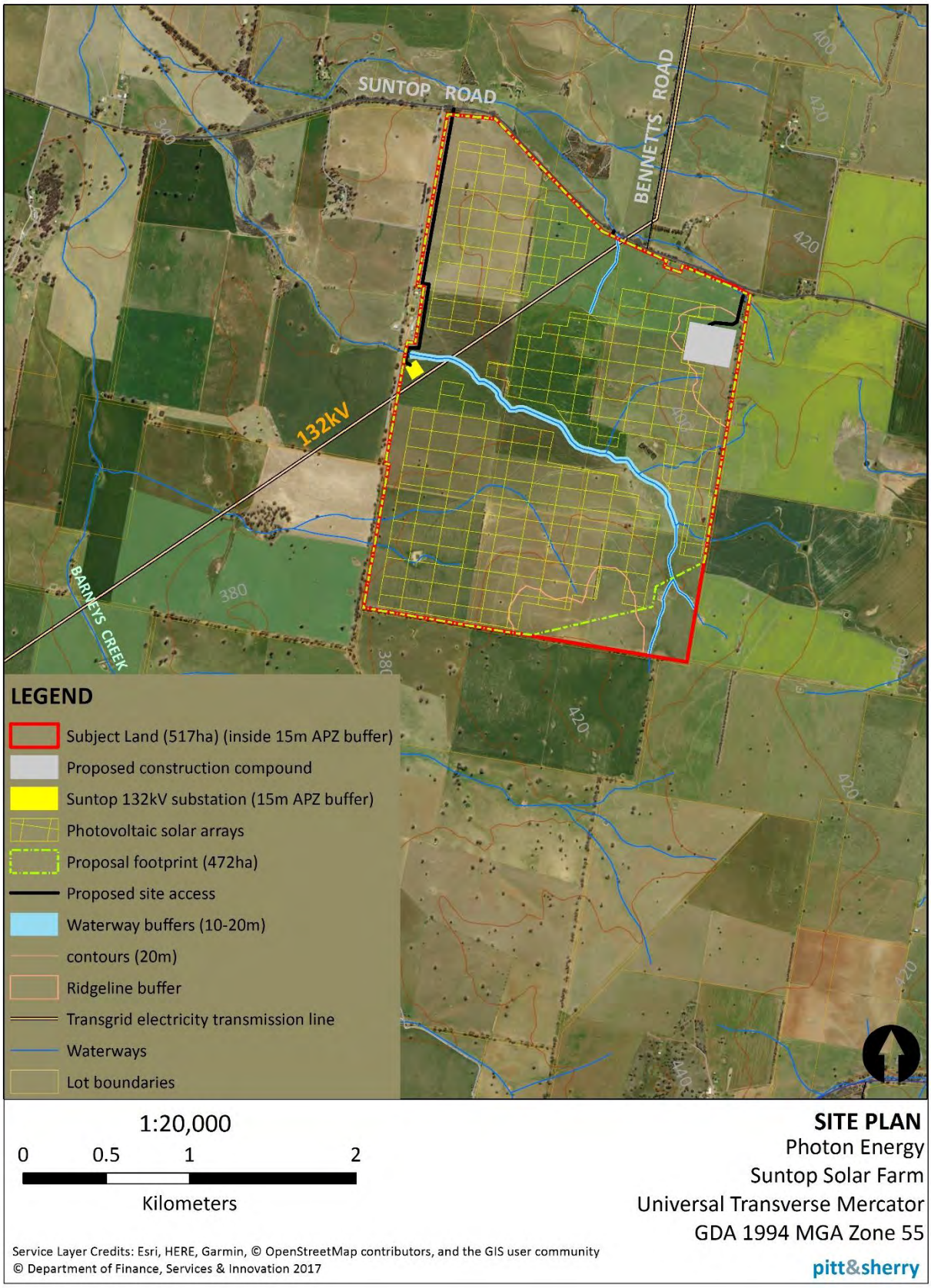



Figure 1: The Proposal

## 3.2 Construction Activities

The construction and commissioning phase is expected to last approximately 12 months. The main construction activities are outlined in Table 1.

Table 1: Main Construction Activities

| Stage | Main activities |
|---|---|
| Site Establishment | • Installation of new access road<br>• Installation of security measures including fencing<br>• Establishment of site compound, material layout and equipment wash down areas<br>• Ground preparation<br>• Installation of environmental controls in accordance with a detailed Construction Environmental Management Plan (CEMP)<br>• Minor vegetation clearing (grasses, shrubs and groundcover)<br>• Targeted clearance of low laying vegetation around trenching areas<br>• Pile driven installation of PV mounting structures to minimise disturbance to existing ground cover<br>• Establishment of tree and vegetation buffer protection measures as required<br>• Establishment of additional sedimentation and erosion controls as required. |
| Preliminary civil works | • Setting up foundations for the substation and inverter stations<br>• Drainage works (as required). |
| Install PV systems and cables | • Installation of steel post and rail foundation system for the solar panels<br>• Installation of PV panels and DC wiring beneath the panels<br>• Installation of electrical cabling including trenching for underground cabling and installation of inverter stations. |
| Construction of 132kV substation and new transmission line | • Site establishment and clearing (if required)<br>• Bulk earthworks<br>• Detailed civil works including earthing, foundations<br>• Erection of steelwork, equipment, demountable buildings and transformers<br>• Electrical connections<br>• Install new poles<br>• Transmission line stringing for new conductor and optical ground wire (OPGW) from substation to existing 132 kV transmission line. |
| Rehabilitation and Commissioning | • Testing of electrical infrastructure<br>• Removal of temporary construction facilities and rehabilitation of disturbed areas<br>• Undertake appropriate rehabilitation to be outlined in the CEMP. |

## 3.3 Operational Activities

Operational activities are to immediately follow the construction and installation stages. Once operational, activities would include daily operations and maintenance, including the following.

- Remote 24/7 on-line monitoring
- Scheduled visual inspections and general maintenance
- Repair and cleaning operations of the PV arrays (as required)
- Replacement of equipment and infrastructure, as required
- Land management monitoring and activities including:
  - Livestock and grazing management
  - Maintenance of vegetation (including groundcover and pasture improvement)
  - Weed and feral animal control
  - Soil monitoring and improvement (if required).

## 3.4 Existing Environment

The following subheadings outline the existing site operations that occur within the Site and existing environmental conditions.

### 3.4.1 Existing Operations

The Subject Land, as shown in Figure 2, comprises a series of large fenced paddocks containing cereal crops and grazing cattle livestock. The paddocks have been largely cleared for agricultural purposes with a series of constructed earthworks in the form of rollover banks being placed across the Site. The property also contains several built structures including agricultural sheds, one residential dwelling and grain silos.

Section 4 provides further details regarding specific land management activities undertaken within the Subject Land.

### 3.4.2 Existing Site Conditions

#### *Vegetation*

The majority of the Subject Land has been previously cleared for historical cropping (i.e. wheat, oats, canola and Lucerne) and grazing purposes (cattle and sheep) with limited native vegetation remaining. As such, the area contains minimal native vegetation with the local surface hydrology, landform and soils have been heavily modified by the paddock development. There are however, several small scattered rows and isolated clumps of vegetation across the Subject Land, including 28 native scattered paddock trees, comprised of the following:

- Fuzzy Box (*Eucalyptus conica*)
- White Box (*Eucalyptus albens*)
- Kurrajong (*Brachychiton populneus*)
- White Cypress Pine (*Callitris glaucophylla*).

A total of eight dams exist within the Subject Land, ranging from 0.2ha to 0.5ha.



Figure 2: Typical Existing Site Conditions

## *Soils*

The majority of soils on the land have been extensively disturbed by agricultural activities such as clearing for grazing and rotational cultivation. The soils are described as quite deep and relatively well drained with limited constraints. Generally, the soils do not present any major physical or chemical constraints that cannot be managed.

Chemical analysis of soil samples indicate that potential issues can be easily rectified with the application of an ameliorant such as lime for pH issues or targeted addition of nutrients for fertility. The soil tests also show that the existing soils can be prone to soil erodibility when left unvegetated due to K factors, although the overall erosion hazard is low due to climate and landform factors.

See Appendix K of the EIS for further details including soil sampling results and Section 6.8 for detailed soil management measures.

## *Weather*

To assist with any improvement of pasture works and management of the site generally, weather data has been reviewed to determine suitable pasture species.

Generally in Wellington, Summer temperatures extend to a maximum mean of of 31.2°C and down to a mean minimum of 3.4°C in winter. Median rainfall is Summer dominant with the highest totals in the Spring/Summer months and lowest throughout the winter months. The long term median annual average rainfall is 620 mm.

The varying temperature and rainfall conditions in the area can have a significant impact on summer growing species. It is therefore very important that any pasture established would have a mix of both Summer and Winter growing species.

# 4. Land Management Activities

## 4.1 Grazing Activities

Existing sheep grazing activities would continue to occur alongside the areas occupied by solar infrastructure. These grazing activities would ensure the ongoing management of pasture grasses within the Site.

The existing surface water infrastructure within the Site (i.e. existing dams and bore) would continue to be utilised for stock watering with no changes anticipated.

## 4.2 Cropping Activities

It is anticipated that any cropping activities within the Site would cease following the Proposal being approved due to potential proximity issues between solar farm infrastructure and any cropping machinery. The Site would essentially be allowed to return to pasture whilst solar operations are undertaken throughout the life of the Project.

Depending upon the decommissioning and remediation decisions following the proposed 30-year solar farm consent life, if it is determined that cropping would be recommenced, this would be undertaken in accordance with a closure plan and in consultation with the landowner/operator.

# 5. Ownership

## 5.1 Structure and Responsibility

The carriage and use of this plan would be the responsibility of SSF and the onsite management representative, whether it be a SSF employee or contractor.

### 5.1.1 Property Owner

SSF has a purchase agreement with the landholders for Lots 1, 2 and part Lot 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805. A reconfiguration of the above lots is proposed as part of the purchase agreement, such that a reconfiguration would allow the current Landowner to operate separately from the proposed solar farm.
It is proposed that the purchase arrangement will involve the joining of Lots 1, 2 and part Lot 3 DP 506925, Lot 122 DP 753238 and Lot 90 DP 657805 to create a new 513ha lot of which SSF will own. A 4ha section of Lot 3 DP 506925 will create the new subdivision that will be owned by the current landowner.
Electricity Infrastructure Owner.

TransGrid operates and manages a large portion of the major high voltage electricity transmission network in NSW and the ACT, connecting power generators, distributors and major end users. Their core role is to connect electricity consumers to a safe, secure and reliable network through efficient maintenance and effective operation and management of electricity supply assets.

The Suntop Solar Farm will connect into the existing TransGrid 132 kV network. The easement for this network runs from north to south through the Site.

### 5.1.2 Contractors

Details of the contractor will be included when they are available.

### 5.1.3 Government Agencies

Agency consultation as part of the LMP would be limited to that required by specific conditions or to clarify specific issues. In recognition of this, the LMP would likely be prepared in consultation with the following list of agencies as relevant.

- Dubbo Regional Council
- NSW DPE
- NSW OEH.

# 6. Approvals and Licensing

Compliance with all relevant approvals and licences would be addressed in the OEMP. Table 2 provides a list of the likely key legal instruments relevant to the requirements of the LMP.

Table 2: Legislation reference for requirements of the LMP

| Legal Instrument | Reference to LMP |
|---|---|
| *Environmental Planning and Assessment Act 1979* | Compliance with Conditions of Approval |
| *Protection of the Environment Operations Act 1997* | No pollution of waters<br>Reporting environmental harm |
| *Waste Avoidance and Resource Recovery Act 2001* | Appropriate disposal of waste to a lawful facility |
| *Noxious Weeds Act 1993* | Treatment of noxious weeds |
| *Rural Fires Act 1997* | Compliance with Rural Fire Service directives |

## 6.1 Conditions of Approval

Conditions of approval would be identified and addressed once specific conditions have been assigned to the Project.

# 7. Implementation

## 7.1 Risk Assessment

Potential impacts in relation to land management from the Suntop Solar Farm have been identified through consideration of the operations to be undertaken on site, along with issues identified in the EIS, specifically Chapter 6 Environmental Impact Assessment.

The potential impacts from these issues are treated as risks and need to be managed through environmental management activities, monitoring and controls which can be implemented to prevent or reduce the risks of the issues occurring.

Potential risks identified from the operation of the Suntop Solar Farm associated with land management practices, and addressed by this LMP, are outlined below:

- Loss of productive agricultural land. See Section 7.2.1
- Management of ongoing grazing activities. See Section 7.2.2
- Maintenance of adequate and suitable groundcover (e.g. pasture for grazing). See Section 7.2.3
- Weed and feral animal management. See Section 7.2.4

- Disturbances to soil and generation of dust. See Section 7.2.5
- Management of fuel loads and potential for bushfires. See Section 7.2.6.

Other operational risks identified in the EIS would be addressed in the CEMP, including incident response and management.

## 7.2 Management Activities and Controls

This section of the LMP details the environmental management activities, mitigation and control measures that would be used to prevent or minimise environmental risks and impacts associated with the management of the land.

Due to the similar nature of environmental controls to be implemented within the construction and operational phases of the Proposal in regard to land management, the following management activities and controls relate to both construction and operational phases.

Remediation of the Site is discussed within Section 8; however, it is expected that these management activities would be expanded upon within a separate Remediation Plan, a document that would be compiled and subsequently approved prior to any decommissioning activities towards the end of the Proposal's lifespan.

Specific management measures regarding erosion and sediment control, noise, etc. (i.e. non-land management related issues) are discussed within the EIS and would be managed in accordance with their own specific management plans (to be outlined within the Project's Conditions of Approval) and CEMP / OEMP. As a result of this, these specific measures are not discussed further in this document.

### 7.2.1 Agricultural Land Management

#### *Objective*

Ensure the potential loss of available agricultural land is minimised whilst ensuring that agricultural land is utilised for agricultural purposes within the Site where possible.

#### *Management Measures*

Managed grazing would continue within the Site by being used to maintain the height of ground cover during operation of the solar farm (see Section 7.2.2), in accordance with the permissible thresholds detailed within the vegetation and soil monitoring programs.

Following decommissioning activities and owing to the reversible nature of the Proposal, the land would be returned to its former agricultural use of grazing and cropping.

### 7.2.2 Grazing Management

#### *Objective*

Utilise stock grazing within the Site to continue the use the available land for agricultural purposes, whilst also minimising maintenance costs and reduce the requirement for slashing / herbicide use.

#### *Management Measures and Monitoring*

Grazing management and practicalities will be developed in consultation with the stock provider and updated as part of this LMP prior to commencement of operation. Strategic internal electric fencing and access to watering points would be discussed with the stock provider with management of grazing live stock.

This would include details of the grazing regime (i.e. when sheep arrived, head numbers and when they were taken off the site) or the date of mechanical slashing and the location of the activity carried out.

### 7.2.3 Vegetation Management

#### *Objective*

Establish and maintain groundcover suitable for grazing with minimal weed incursion over the Solar Farm footprint that does not create or increase a fuel hazard and minimises the potential for erosion and sediment laden runoff.

#### *Management Measures*

Due to the existing environment in which the majority of the Site has a base groundcover of vegetation, the following measures relate to pasture improvement in order to maintain or exceed the proposed 80% of groundcover across the Site that would be suitable for grazing activities. Management measures to maintain suitable groundcover for grazing purposes are outlined below.

- A baseline of site vegetation conditions would be recorded prior to construction operations.
- Prior to any construction or grazing activities, the Subject Land would require at least an 80% groundcover of vegetation, including grasses and legumes, and assisted by fertiliser activities if required. Suitable grass and legume species are identified in Table 3.

Table 3: Appropriate Groundcover Vegetation Species

| Grass | Legumes | | |
|---|---|---|---|
| • Phalaris (*Phalaris aquatica*) | • Lucerne (*Medicago sativa*) | • Sub clover (*Trifolium subterraneum*) | • Gland clover (*Trifolium glanduferum*) |
| • Cocksfoot *(Dactylis glomerata*) | • Snail medic (*Medicago scutellata*) | • Rose clover (*Trifolium hirtum*) | • Sulla (*Hedysarum coronarium*) |
| • Fescue (*Festuca arundinacea*) | • Barrel medic (*Medicago truncatula*) | • Serradella (*Ornithopus spp.*) | • Arrowleaf clover (*Trifolium vesiculosum*) |
| | • Biserrula (*Biserrula pelecinus*) | • Disc/Strand hybrid medic (*Medicago tornata/ littoralis*) | • Purple clover (*Trifolium purpureum*) |

- Revegetation activities would be undertaken upon land that has been disturbed as a direct result of construction activities (i.e. trenching)
- If any seasonal factors or overgrazing lead to a drop in vegetative cover stock grazing would be managed accordingly
- No grazing would occur until plants are initially higher than 15 cm.

#### *Monitoring*

To enable an effective groundcover being established and maintained over the life of the Proposal, a monitoring program would be implemented and involve visual analysis as outlined within Table 4 (pre-construction) and Table 5 (operational). Following the visual analysis, areas requiring improvement would be identified within a register, along with an accurate location plan, before measures are implemented to improve the health of the groundcover vegetation. Follow up monitoring would also occur to ensure the

ameliorative measures implemented are successful before any further grazing works occur within these areas.

The results of the vegetation groundcover monitoring program would be collected as part of the ongoing monitoring program and record keeping for the operation.

The location component of the monitoring program would consist of representative plots being identified following the completion of construction works. These locations would be recorded on a map, similar to Figure 1. Opportunistic monitoring at other locations would also be undertaken as required, if it was identified that vegetation parameters varied from any established baselines during the operational phase.

Table 4: Vegetation Monitoring Program – Pre-construction Stage

| Vegetation Parameter | On site Methodology | Location |
|---|---|---|
| Vegetation Type | Onsite – visual | |
| Groundcover Type | Onsite – visual | |
| 80% groundcover | Onsite – visual | |
| Weed species present | Onsite – visual | |
| Species composition | Onsite – visual | |

Table 5: Vegetation Monitoring Program – Operational Stage

| Vegetation Parameter | On site Methodology | Frequency | Location |
|---|---|---|---|
| Bare patches / scalds | Onsite – visual | Monthly | |
| Vegetation condition | Onsite – visual | Monthly | |
| 80% groundcover | Onsite – visual | Monthly | |
| Weed species present | Onsite – visual | Monthly | |
| Species composition | Onsite – visual | Annual | |

If it is identified from the monitoring program that vegetation is being affected by grazing, cattle/sheep would be removed from the identified areas of land until groundcover has re-established to appropriate levels (i.e. 80% groundcover and/or appropriate species compositions). A revised grazing plan would be implemented to ensure that grazing activities are undertaken whilst maintaining 80% of vegetation groundcover.

Weeds would be identified and treated in accordance with Section 7.2.4.

### 7.2.4 Weed and Feral Animal Management

#### *Objective*

The objective of weed and feral animal management is to:

- Prevent the spread of noxious weeds and feral animals
- Ensure the operation of the Suntop Solar farm complies with the *Noxious Weeds Act 1993*.

#### *Management Measures*

Any noxious weed or feral animals detected on-site will be managed using appropriate methods.

Where this requires the application of pesticides, the Proponent would ensure an appropriately accredited (ChemCert) local contractor is engaged and a copy of the contractor's application treatment will be retained and filed on-site.

This treatment record would detail the date, chemical applied and at what rates, weather conditions and the weed species sprayed.

Noxious weeds as identified by the *Noxious Weeds Act 1993* will be notified to the relevant authority as required in accordance with the Act. If weeds are becoming an issue, advice will be sought from DPI or local agronomists of the best strategies.

Regular monitoring would be required, as weeds are more easily controlled when they first germinate, as outlined in Section 7.2.3.

The perimeter security fencing would provide a barrier for medium to large feral animals to entire the Site. Any smaller feral animals would be managed in accordance with standard rural feral management procedures.

#### *Monitoring*

The results of any weed removal and treatment operations would be reported as part of the ongoing vegetation monitoring program and record keeping for the operation, including location, date and type of species identified/targeted, treatment undertaken, any follow up treatment and sign off.

### 7.2.5 Soil Management

#### *Objective*

The objective of soil management on the Site is to minimise potential for impacts upon soil health including erosion and soil degradation.

#### *Management Measures*

Soil management measures are outlined below, noting that erosion and sediment control management measures would be included within the Soil and Water Management Plan.

- Maintain existing pasture vegetation beneath and surrounding the panels (excluding foundation points and internal access tracks) to be suitable and utilised for grazing purposes, ensuring limited potential for soil erosion to occur
- Monitor soil health through visual and chemical testing to improve soil health if deemed required, as outlined below:
  - Utilise ameliorants such as lime or organic mulches to adjust pH levels dependent upon acidity or alkalinity levels
  - Targeted addition of nutrients (i.e. fertilisers) to improve soil fertility levels
- Temporarily excavated soil and other materials that exhibit significant dust lift off would be wet down, stabilised or covered to manage dust.

#### *Monitoring*

To enable an effective analysis of soil over the life of the Proposal, a monitoring program would be implemented and utilise the existing baseline soil results to gauge overall soil health and coverage. The proposed monitoring program is outlined within Table 6 and would occur in locations that appropriately capture the health of the soil across the entirety of the Subject Land.

The results of the soil monitoring program and any related treatment operations would be reported as part of the ongoing monitoring program and record keeping for the operation.

Table 6: Soil Monitoring Program

| Soil Parameter | On site / laboratory | Frequency |
|---|---|---|
| Bare patches / scalds | Onsite – visual | Monthly |
| Hard setting | Onsite – visual | Monthly |
| N, P, K, S | Laboratory | Annual |
| pH | Laboratory | Annual |
| ECe | Laboratory | Annual |

### 7.2.6 Bushfire Management

#### *Objective*

The objective is to manage the occurrence of any bushfires and ensure the Site is managed accordingly during a bushfire.

#### *Management Measures*

EIS Section 6.9 provides a holistic detailed bushfire management section with the following information relating to land management activities should a bush fire occur.

- Construct and utilise an Asset Protection Zone (APZ) around all Site infrastructure
- Install a water supply tank with a capacity of 50,000L outside of the APZ suitable for firefighting uses
- Maintain vegetation fuel levels within the Site utilising grazing, slashing or mowing activities
- Develop an Emergency Response Plan (ERP) in consultation with NSW RFS District Control Centre prior to construction.

#### *Monitoring*

Bushfire monitoring activities such as fuel loads etc. will be collected within the vegetation monitoring program outlined in Table 4. External monitoring of known bush fires would be checked by the "fires near me" app for Wellington.

## 8. Remediation Plan

As has been documented in the Suntop Solar Farm EIS, the Solar Farm has a projected life span of 30 years. At this time, the infrastructure will be assessed and a decision will be made as to whether the Site will be refurbished to allow ongoing operation or to close and decommission the Site.

If the decision is made to decommission the Solar Farm, the Proponent has made a commitment to remove all above and below ground infrastructure and remediate the Site to allow it to be returned it to its original use and condition as agricultural land. At this time a specific Site Remediation Plan would be compiled to ensure the removal of material from the Site is done in a structured and appropriate manner in accordance with relevant approvals and permits, and in conjunction with all necessary works and processes to return the Site to its pre- development condition.

The specifics of the Remediation Plan would be established prior to decommissioning and in consultation with relevant stakeholders including Council. The following aspects would be address in the plan:

- Remediation goals
- Discussion of the extent of remediation
- Discussion of possible remedial options and risk reduction
- Rationale for the selection of recommended remedial actions
- Proposed testing to validate the site after remediation
- Contingency plan if the selected remedial strategy fails
- Interim site management plan (before remediation), including
  - Fencing
  - erection of warning signs
  - stormwater diversion
- Site management plan (decommissioning phase) including:
  - Site stormwater management
  - Soil management
  - Noise control
  - Dust control
  - Vegetation management
  - Waste and Contaminated material management
  - Occupational health and safety plan
- Remediation schedule
- Hours of operation
- Contingency plans to respond to site incidents, to minimise potential impacts on the surrounding environment and community
- Identification of regulatory compliance requirements such as licences and approvals
- Names and phone numbers of appropriate personnel to contact during remediation
- Community Consultation
- Staged progress reporting, where appropriate
- Long-term site management plan.

# 9. Audit and Quality Management

## 9.1 Review

This management plan is to be reviewed at an agreed appropriate interval in conjunction with other relevant plans that are subject to review.

The review will include an assessment of the effectiveness of the established controls and their performance against the LMP's objectives. In addition, progressive amendments / updates will be made to this LMP as / if required.

## 9.2 Records

All records associated with this LMP are to be retained by the Proponent.

transport | community | mining | industrial | food & beverage | energy







**Brisbane**
Level 10
241 Adelaide Street
PO Box 5243
Brisbane City QLD 4000
T: (07) 3058 7499

**Devonport**
Level 1
35 Oldaker Street
PO Box 836
Devonport TAS 7310
T: (03) 6451 5599

**Hobart**
Level 1, Surrey House
199 Macquarie Street
GPO Box 94
Hobart TAS 7001
T: (03) 6210 1400
F: (03) 6223 1299

**Launceston**
Level 4
113 Cimitiere Street
PO Box 1409
Launceston TAS 7250
T: (03) 6323 1900
F: (03) 6334 4651

**Melbourne**
Level 1, HWT Tower
40 City Road
Southbank VIC 3006
PO Box 259
South Melbourne VIC 3205
T: (03) 9682 5290
F: (03) 9682 5292

**Newcastle**
Level 1
81 Hunter Street
Newcastle NSW 2300
T: (02) 4910 3600

**Sydney**
Suite 902, Level 9,
North Tower
1-5 Railway Street
Chatswood NSW 2067
PO Box 5487
West Chatswood NSW 1515
T: (02) 9468 9300

**E:** info@pittsh.com.au
**W:** www.pittsh.com.au

incorporated as
Pitt & Sherry (Operations) Pty Ltd
ABN 67 140 184 309



INTERNATIONAL CERTIFICATIONS
ISO 9001
ISO 14001
AS/NZS 4801
www.intlcert.com


pitt&sherry

## Soil Profile Log

| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Suntop Solar Farm - EIS | | | **Borehole No:** | |
| **Project No:** | SY17235 | **Date:** | **22/11/2017** | **GPS Coord:** | |
| **Location:** | Pit 1 | **Logged by:** | **DP** | **Zone:** | |
| **Maximum Depth:** | 500mm | **Method:** | Test Pit | **Angle:** | 90 degrees |

| DEPTH (m) | DESCRIPTION (Horizon, Field Texture, Structure, Colour, Mottling, Coarse frags) | GRAIN SIZE | PLASTICITY | DENSITY | CONSISTENCY | MOISTURE | GROUNDWATER | SAMPLES | COLOUR | FORMATION / COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | Sandy Loam | | | | | SM | N/A | TP1/1<br>TP1/2 | Grey-Brown | Roots present<br><5% Coarse fragments<br>Weakly pedal |
| 0.1 | Sandy Loam | | | | | D | N/A | | Yellowish-Brown | Roots present<br>10% Coarse Fragment<br>Weak structure |
| 0.2 | | | | | | | | | | |
| 0.3 | | | | | | | | | | |
| 0.4 | Sandy Loam Clay Loam | | M | | | D | N/A | | Light yellowish-brown | No Roots present<br>0% coarse fragments<br>Weak Structure |
| 0.5 | Test pit terminated at 0.5m, layer continues | | | | | | | | | |
| 0.6 | | | | | | | | | | |
| 0.7 | | | | | | | | | | |
| 0.8 | | | | | | | | | | |
| 0.9 | | | | | | | | | | |
| 1 | | | | | | | | | | |

**FIELD TEXTURE**

| | |
|---|---|
| S | Sand |
| LS | Loamy sand |
| CS | Clayey sand |
| SL | Sandy loam |
| L | Loam |
| SCL | Sandy clay loam |
| CL | Clay loam |
| LC | Light clay |
| MC | Medium clay |
| HC | Heavy clay |

**PLASTICITY**

| | |
|---|---|
| L | Low |
| M | Medium |
| H | High |

**DENSITY**

| | |
|---|---|
| VL | Very Loose |
| L | Loose |
| MD | Moderately Dense |
| D | Dense |
| VD | Very Dense |

**GRAIN SIZE**

| | |
|---|---|
| F | Fine |
| M | Medium |
| C | Coarse |

**CONSISTENCY**

| | |
|---|---|
| VS | Very Soft |
| S | Soft |
| F | Firm |
| St | Stiff |
| VSt | Very Stiff |
| H | Hard |

**MOISTURE**

| | |
|---|---|
| D | Dry |
| SM | Slightly moist |
| M | Moist |
| W | Wet |

**GROUNDWATER**

**PID**

Measurements in (ppm)

## Soil Profile Log

| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Suntop Solar Farm - EIS | | | **Borehole No:** | |
| **Project No:** | SY17235 | **Date:** | **22/11/2017** | **GPS Coord:** | |
| **Location:** | Pit 2 | **Logged by:** | **DP** | **Zone:** | |
| **Maximum Depth:** | 500mm | **Method:** | Test Pit | **Angle:** | 90 degrees |

| DEPTH (m) | DESCRIPTION (Horizon, Field Texture, Structure, Colour, Mottling, Coarse frags) | GRAIN SIZE | PLASTICITY | DENSITY | CONSISTENCY | MOISTURE | GROUNDWATER | SAMPLES | COLOUR | FORMATION / COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | Sandy Loam | | | | | SM | N/A | TP2/1<br>TP2/2 | Dark Reddish Brown | Roots present<br>0% Coarse fragments<br>Structure: Massive<br>Location: Edge of wheat Paddock |
| 0.1 | | | | | | | | | | |
| 0.2 | Sandy Loam | | | | | D | N/A | | Reddish brown | Roots present<br>0% Coarse Fragment<br>Weak structure |
| 0.3 | | | | | | | | | | |
| 0.4 | | | | | | | | | | Roots present<br>0% coarse fragments<br>Weak Structure |
| 0.5 | Sandy Clay Loam | | | | | D | N/A | | Reddish Brown | |
| | Test pit terminated at 0.5m, layer continues | | | | | | | | | |
| 0.6 | | | | | | | | | | |
| 0.7 | | | | | | | | | | |
| 0.8 | | | | | | | | | | |
| 0.9 | | | | | | | | | | |
| 1 | | | | | | | | | | |

**FIELD TEXTURE**

| | |
|---|---|
| S | Sand |
| LS | Loamy sand |
| CS | Clayey sand |
| SL | Sandy loam |
| L | Loam |
| SCL | Sandy clay loam |
| CL | Clay loam |
| LC | Light clay |
| MC | Medium clay |
| HC | Heavy clay |

**PLASTICITY**

| | |
|---|---|
| L | Low |
| M | Medium |
| H | High |

**DENSITY**

| | |
|---|---|
| VL | Very Loose |
| L | Loose |
| MD | Moderately Dense |
| D | Dense |
| VD | Very Dense |

**GRAIN SIZE**

| | |
|---|---|
| F | Fine |
| M | Medium |
| C | Coarse |

**CONSISTENCY**

| | |
|---|---|
| VS | Very Soft |
| S | Soft |
| F | Firm |
| St | Stiff |
| VSt | Very Stiff |
| H | Hard |

**MOISTURE**

| | |
|---|---|
| D | Dry |
| SM | Slightly moist |
| M | Moist |
| W | Wet |

**GROUNDWATER**

**PID**

Measurements in (ppm)

## Soil Profile Log

| | | | |
|---|---|---|---|
| **Project Name:** | Suntop Solar Farm - EIS | | **Borehole No:** |
| **Project No:** | SY17235 | **Date:** 22/11/2017 | **GPS Coord:** |
| **Location:** | Pit 3 | **Logged by:** DP | **Zone:** |

| | | |
|---|---|---|
| **Maximum Depth:** 500mm | **Method:** Test Pit | **Angle:** 90 degrees |

| DEPTH (m) | DESCRIPTION (Horizon, Field Texture, Structure, Colour, Mottling, Coarse frags) | GRAIN SIZE | PLASTICITY | DENSITY | CONSISTENCY | MOISTURE | GROUNDWATER | SAMPLES | COLOUR | FORMATION / COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | Sandy Loam | | | | | SM | N/A | TP3/1<br>TP3/2 | Reddish Brown | Roots present<br>0% Coarse fragments<br>Structure: weak<br>Location: Mid slope, undulating, sown paddock with grazed lucerne |
| 0.2 | Light Sandy Loam | | | | | D | N/A | | Reddish brown | Roots present<br>0% Coarse Fragment<br>Structure: Massive |
| 0.5 | Test pit terminated at 0.5m, layer continues | | | | | | | | | |
| 1 | | | | | | | | | | |

**FIELD TEXTURE**

| | |
|---|---|
| S | Sand |
| LS | Loamy sand |
| CS | Clayey sand |
| SL | Sandy loam |
| L | Loam |
| SCL | Sandy clay loam |
| CL | Clay loam |
| LC | Light clay |
| MC | Medium clay |
| HC | Heavy clay |

**PLASTICITY**

| | |
|---|---|
| L | Low |
| M | Medium |
| H | High |

**DENSITY**

| | |
|---|---|
| VL | Very Loose |
| L | Loose |
| MD | Moderately Dense |
| D | Dense |
| VD | Very Dense |

**GRAIN SIZE**

| | |
|---|---|
| F | Fine |
| M | Medium |
| C | Coarse |

**CONSISTENCY**

| | |
|---|---|
| VS | Very Soft |
| S | Soft |
| F | Firm |
| St | Stiff |
| VSt | Very Stiff |
| H | Hard |

**MOISTURE**

| | |
|---|---|
| D | Dry |
| SM | Slightly moist |
| M | Moist |
| W | Wet |

**GROUNDWATER**

**PID**

Measurements in (ppm)

## Soil Profile Log

| | | | |
|---|---|---|---|
| **Project Name:** | Suntop Solar Farm - EIS | | **Borehole No:** |
| **Project No:** | SY17235 | **Date:** 22/11/2017 | **GPS Coord:** |
| **Location:** | Pit 4 | **Logged by:** DP | **Zone:** |

| | | |
|---|---|---|
| **Maximum Depth:** 500mm | **Method:** Test Pit | **Angle:** 90 degrees |

| DEPTH (m) | DESCRIPTION (Horizon, Field Texture, Structure, Colour, Mottling, Coarse frags) | GRAIN SIZE | PLASTICITY | DENSITY | CONSISTENCY | MOISTURE | GROUNDWATER | SAMPLES | COLOUR | FORMATION / COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | Sandy Loam | | | | | SM | N/A | TP4/1<br>TP4/2 | Reddish Brown | Roots present<br><5% Coarse fragments<br>Structure: massive<br>Location: western aspect, edge of flow line & low slope |
| 0.2 | Sandy Loam | | | | | D | N/A | | Light Reddish brown | Roots present<br>10% Coarse Fragment<br>Structure: Massive |
| 0.5 | Test pit terminated at 0.5m, layer continues | | | | | | | | | |
| 1 | | | | | | | | | | |

**FIELD TEXTURE**

| | |
|---|---|
| S | Sand |
| LS | Loamy sand |
| CS | Clayey sand |
| SL | Sandy loam |
| L | Loam |
| SCL | Sandy clay loam |
| CL | Clay loam |
| LC | Light clay |
| MC | Medium clay |
| HC | Heavy clay |

**PLASTICITY**

| | |
|---|---|
| L | Low |
| M | Medium |
| H | High |

**DENSITY**

| | |
|---|---|
| VL | Very Loose |
| L | Loose |
| MD | Moderately Dense |
| D | Dense |
| VD | Very Dense |

**GRAIN SIZE**

| | |
|---|---|
| F | Fine |
| M | Medium |
| C | Coarse |

**CONSISTENCY**

| | |
|---|---|
| VS | Very Soft |
| S | Soft |
| F | Firm |
| St | Stiff |
| VSt | Very Stiff |
| H | Hard |

**MOISTURE**

| | |
|---|---|
| D | Dry |
| SM | Slightly moist |
| M | Moist |
| W | Wet |

**GROUNDWATER**

**PID**

Measurements in (ppm)

## Soil Profile Log

| | | | |
|---|---|---|---|
| **Project Name:** | Suntop Solar Farm - EIS | | **Borehole No:** |
| **Project No:** | SY17235 | **Date:** 22/11/2017 | **GPS Coord:** |
| **Location:** | Pit 5 | **Logged by:** DP | **Zone:** |

| | | |
|---|---|---|
| **Maximum Depth:** 500mm | **Method:** Test Pit | **Angle:** 90 degrees |

| DEPTH (m) | DESCRIPTION (Horizon, Field Texture, Structure, Colour, Mottling, Coarse frags) | GRAIN SIZE | PLASTICITY | DENSITY | CONSISTENCY | MOISTURE | GROUNDWATER | SAMPLES | COLOUR | FORMATION / COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | Sandy Loam | | | | | D | N/A | TP5/1<br>TP5/2 | Light brown | Roots present<br>10% Coarse fragments<br>Structure: weakly pedal |
| 0.1 | Medium Clay | | | | | SM | N/A | | Light brown | Roots present<br>Gritty<br>Structure: weakly pedal |
| 0.2 | | | | | | | | | | Location: Geology change - igneous |
| 0.3 | | | | | | | | | | |
| 0.4 | | | | | | | | | | |
| 0.5 | Test pit terminated at 0.5m, layer continues | | | | | | | | | |
| 0.6 | | | | | | | | | | |
| 0.7 | | | | | | | | | | |
| 0.8 | | | | | | | | | | |
| 0.9 | | | | | | | | | | |
| 1 | | | | | | | | | | |

**FIELD TEXTURE**

| | |
|---|---|
| S | Sand |
| LS | Loamy sand |
| CS | Clayey sand |
| SL | Sandy loam |
| L | Loam |
| SCL | Sandy clay loam |
| CL | Clay loam |
| LC | Light clay |
| MC | Medium clay |
| HC | Heavy clay |

**PLASTICITY**

| | |
|---|---|
| L | Low |
| M | Medium |
| H | High |

**DENSITY**

| | |
|---|---|
| VL | Very Loose |
| L | Loose |
| MD | Moderately Dense |
| D | Dense |
| VD | Very Dense |

**GRAIN SIZE**

| | |
|---|---|
| F | Fine |
| M | Medium |
| C | Coarse |

**CONSISTENCY**

| | |
|---|---|
| VS | Very Soft |
| S | Soft |
| F | Firm |
| St | Stiff |
| VSt | Very Stiff |
| H | Hard |

**MOISTURE**

| | |
|---|---|
| D | Dry |
| SM | Slightly moist |
| M | Moist |
| W | Wet |

**GROUNDWATER**

**PID**

Measurements in (ppm)

## Soil Profile Log

| | | | |
|---|---|---|---|
| **Project Name:** | Suntop Solar Farm - EIS | | **Borehole No:** |
| **Project No:** | SY17235 | **Date:** 22/11/2017 | **GPS Coord:** |
| **Location:** | Pit 6 | **Logged by:** DP | **Zone:** |

| | | |
|---|---|---|
| **Maximum Depth:** 500mm | **Method:** Test Pit | **Angle:** 90 degrees |

| DEPTH (m) | DESCRIPTION (Horizon, Field Texture, Structure, Colour, Mottling, Coarse frags) | GRAIN SIZE | PLASTICITY | DENSITY | CONSISTENCY | MOISTURE | GROUNDWATER | SAMPLES | COLOUR | FORMATION / COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | Sandy Loam | | | | | D | N/A | TP6/1<br>TP6/2 | Light brown | Roots present<br>10% Coarse fragments<br>Structure: weakley pedal |
| 0.1 | Medium Clay Loam | | | | | SM | N/A | | Light brown | Roots present<br>Gritty (quartz crystals)<br>Structure: weakley pedal |
| 0.2 | | | | | | | | | | Location: Crest on cultivated paddock |
| 0.3 | | | | | | | | | | |
| 0.4 | | | | | | | | | | |
| 0.5 | Test pit terminated at 0.5m, layer continues | | | | | | | | | |
| 0.6 | | | | | | | | | | |
| 0.7 | | | | | | | | | | |
| 0.8 | | | | | | | | | | |
| 0.9 | | | | | | | | | | |
| 1 | | | | | | | | | | |

**FIELD TEXTURE**

| | |
|---|---|
| S | Sand |
| LS | Loamy sand |
| CS | Clayey sand |
| SL | Sandy loam |
| L | Loam |
| SCL | Sandy clay loam |
| CL | Clay loam |
| LC | Light clay |
| MC | Medium clay |
| HC | Heavy clay |

**PLASTICITY**

| | |
|---|---|
| L | Low |
| M | Medium |
| H | High |

**DENSITY**

| | |
|---|---|
| VL | Very Loose |
| L | Loose |
| MD | Moderately Dense |
| D | Dense |
| VD | Very Dense |

**GRAIN SIZE**

| | |
|---|---|
| F | Fine |
| M | Medium |
| C | Coarse |

**CONSISTENCY**

| | |
|---|---|
| VS | Very Soft |
| S | Soft |
| F | Firm |
| St | Stiff |
| VSt | Very Stiff |
| H | Hard |

**MOISTURE**

| | |
|---|---|
| D | Dry |
| SM | Slightly moist |
| M | Moist |
| W | Wet |

**GROUNDWATER**

**PID**

Measurements in (ppm)

Department of Primary Industries

**Biosecurity Laboratory Operations**
**Environmental Laboratory**
**1243 Bruxner Highway, WOLLONGBAR NSW 2477**
Phone: 02 6626 1103 Email: wollongbar.csu@dpi.nsw.gov.au

Report No. **WN180439**

Adam Bishop
Pitt & Sherry
PO Box 5487
WEST CHATSWOOD NSW 1515

## Soil Analysis Report

12 Sample(s) received on 7/12/17 . Tested as per the following methods.

| Method | Method Description |
|---|---|
| S201 | Soil pH in 1:5 water or 1:5 $CaCl_2$ suspension |
| S202 | Soil Electrical Conductivity |
| S266 | Available Sulfur by $KCl_{40}$ extraction |
| S260 | Bray's Extractable Phosphorus by FIA |
| S236 | Organic Carbon by Walkley & Black |
| M630 | Total Carbon and/or Total Nitrogen by Dumas Combustion |
| S273 | Gillman & Sumpter Exchangeable Cations |

**Notes:** Site: Suntop

**Results relate only to the items tested.**

*- When required, samples air dried at 40ºC as per Soil Chemical Methods - Australasia (Rayment and Lyons 2011).*
*- Results are expressed on an air-dry weight basis unless otherwise stated.*
*- This report should not be reproduced except in full.*
*- Samples will be retained for one calendar month from the date of the final report. Samples will then be discarded.*
*- Clients wishing to recover their samples must contact the laboratory within this period. This laboratory will return residual samples at client expense.*

Date of issue 15/12/17

NATA ACCREDITED FOR TECHNICAL COMPETENCE
Accredited for compliance with ISO/IEC 17025 – Testing
Accreditation No. 14173

ASPAC

Approved for Release by: Craig Hunt
Craig Hunt
Technical Officer

| Laboratory No.<br>Client's ID | Units | Limit of Reporting | 1<br>TP1/1 | 2<br>TP1/2 | 3<br>TP2/1 | 4<br>TP2/2 | 5<br>TP3/1 |
|---|---|---|---|---|---|---|---|
| **Cropping Analysis** | | | | | | | |
| pH (Water) | pH units | 0.04 | 5.3 | 5.6 | 5.4 | 6.0 | 5.6 |
| pH ($CaCl_2$) | pH units | 0.04 | 4.5 | 4.7 | 4.4 | - | - |
| Electrical Conductivity | dS/m | 0.0010 | 0.20 | 0.026 | 0.059 | 0.042 | 0.082 |
| Sulfur ($KCl_{40}$) | mg/kg | 2.0 | 7.0 | <2 | 2.4 | - | - |
| Bray Phosphorus | mg/kg | 0.060 | 40 | 1.1 | 6.4 | - | - |
| Organic Carbon | % | 0.050 | 1.0 | 0.28 | 1.0 | - | - |
| Total Nitrogen | % | 0.020 | 0.11 | 0.040 | 0.13 | - | - |
| **Exchangeable Cations** | | | | | | | |
| Aluminium | cmol(+)/kg | 0.10 | 0.32 | <0.1 | 0.32 | - | - |
| Calcium | cmol(+)/kg | 0.030 | 4.3 | 3.2 | 3.5 | - | - |
| Potassium | cmol(+)/kg | 0.010 | 1.8 | 0.39 | 1.0 | - | - |
| Magnesium | cmol(+)/kg | 0.0070 | 0.58 | 0.40 | 0.50 | - | - |
| Sodium | cmol(+)/kg | 0.030 | <0.03 | <0.03 | <0.03 | - | - |
| CEC (effective) | cmol(+)/kg | 0.20 | 7.0 | 4.0 | 5.3 | - | - |
| Calcium/ Magnesium | | | 7.4 | 8.0 | 6.9 | - | - |
| Percent Aluminium Saturation | % of ECEC | | 5 | N/A | 6.0 | - | - |
| Exchangeable Calcium | % of ECEC | | 62 | 80 | 65 | - | - |
| Exchangeable Potassium | % of ECEC | | 25 | 9.8 | 19 | - | - |
| Exchangeable Magnesium | % of ECEC | | 8.4 | 10 | 9.4 | - | - |
| Exchangeable Sodium Percentage | % of ECEC | | N/A | N/A | N/A | - | - |

| Laboratory No.<br>Client's ID | Units | Limit of Reporting | 6<br>TP3/2 | 7<br>TP4/1 | 8<br>TP4/2 | 9<br>TP5/1 | 10<br>TP5/2 |
|---|---|---|---|---|---|---|---|
| **Cropping Analysis** | | | | | | | |
| pH (Water) | pH units | 0.04 | 5.8 | 5.5 | 6.2 | 6.8 | 6.1 |
| pH ($CaCl_2$) | pH units | 0.04 | - | 4.7 | - | 6.0 | 5.3 |
| Electrical Conductivity | dS/m | 0.0010 | 0.021 | 0.054 | 0.028 | 0.068 | 0.064 |
| Sulfur ($KCl_{40}$) | mg/kg | 2.0 | - | 2.5 | - | 11 | 3.8 |
| Bray Phosphorus | mg/kg | 0.060 | - | 12 | - | 4.5 | 140 |
| Organic Carbon | % | 0.050 | - | 1.1 | - | 0.43 | 1.1 |
| Total Nitrogen | % | 0.020 | - | 0.13 | - | 0.047 | 0.14 |
| **Exchangeable Cations** | | | | | | | |
| Aluminium | cmol(+)/kg | 0.10 | - | 0.14 | - | <0.1 | <0.1 |
| Calcium | cmol(+)/kg | 0.030 | - | 5.6 | - | 17 | 7.3 |
| Potassium | cmol(+)/kg | 0.010 | - | 0.67 | - | 0.80 | 1.0 |
| Magnesium | cmol(+)/kg | 0.0070 | - | 0.46 | - | 4.1 | 0.68 |
| Sodium | cmol(+)/kg | 0.030 | - | 0.038 | - | 0.070 | <0.03 |
| CEC (effective) | cmol(+)/kg | 0.20 | - | 6.9 | - | 22 | 9.0 |
| Calcium/ Magnesium | | | - | 12 | - | 4.0 | 11 |
| Percent Aluminium Saturation | % of ECEC | | - | 2 | - | N/A | N/A |
| Exchangeable Calcium | % of ECEC | | - | 81 | - | 77 | 81 |
| Exchangeable Potassium | % of ECEC | | - | 9.7 | - | 3.7 | 12 |
| Exchangeable Magnesium | % of ECEC | | - | 6.7 | - | 19 | 7.6 |
| Exchangeable Sodium Percentage | % of ECEC | | - | 0.54 | - | 0.32 | N/A |

| Laboratory No.<br>Client's ID | Units | Limit of Reporting | 11<br>TP6/1 | 12<br>TP6/2 |
|---|---|---|---|---|
| **Cropping Analysis** | | | | |
| pH (Water) | pH units | 0.04 | 5.4 | 6.5 |
| Electrical Conductivity | dS/m | 0.0010 | 0.11 | 0.041 |
| **Exchangeable Cations** | | | | |