STUBBO SOLAR FARM
ENVIRONMENTAL IMPACT STATEMENT

December 2020

Bright ideas. Sustainable change.

CERTIFICATION

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

EIS prepared by

Ramboll Australia Pty Ltd

Applicant

UPC Renewables Australia Pty Ltd

Proposed Development

The Stubbo Solar Farm project includes the construction, operation and decommissioning of a grid-connected photovoltaic solar farm of up to 400 megawatts and associated infrastructure in the New South Wales Central West Orana region.

Land to be developed

The Stubbo Solar Farm proposal site would be located on Lot 14 DP 217391, Lot 22 DP 217391, Lot 55 DP 750765, Lot 86 DP 750765, Lot 5 DP 113406, Lot 2 DP 525593, Lot 9 DP 217381, Lot 69 DP 750761, Lot 120 DP 840082, Lot 4 DP 113406, Lot 20 DP 217391, Lot 19 DP 217391, Lot 8 DP 217382, Lot 4 DP 502956, Lot 10 DP 217381, Lot 60 DP 750765, Lot 80 DP 750765, Lot 11 DP 217391, Lot 1 DP 525593, Lot 67 DP 750765, Lot 24 DP 750761, Lot 68 DP 750765, Lot 1 DP 1018333, Lot 24 DP 502960, Lot 146 DP 750765, Lot 5 DP 502956, Lot 78 DP 750765, Lot 59 DP 750765, Lot 69 DP 750765 and Lot 22 DP 750761.

Certification

I certify that I have prepared the contents of this Environmental Impact Statement in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulations 2000.* To the best of my knowledge, this assessment contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure, and that information in the EIS is neither false nor misleading.

Name: Jon Williamson, *Project Director*

Signature:

Date: 11 December 2020

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EXECUTIVE SUMMARY

Overview

UPC Renewables Australia Pty Ltd, operating as UPC\AC Renewables Australia (UPC\AC) proposes to develop the Stubbo Solar Farm and Battery Project, a grid-connected photovoltaic solar farm of up to 400 megawatts, with battery storage of up to 200 megawatt hours in the New South Wales (NSW) Central West Orana region (the project). The project is located between Blue Springs Road and Barneys Reef Road, approximately 10 kilometres north of Gulgong in the locality known as Stubbo. The project is within the Mid-Western Regional Council Local Government Area and is located within the Central-West Orana (CWO) Renewable Energy Zone (REZ), recently legislated by the NSW Government to help meet its objective to achieve net zero emissions by 2050.

Key infrastructure for the project would include:

- photovoltaic modules (solar panels) installed in a series of rows across the development footprint
- power conversion units designed to convert the direct current electricity generated by the photovoltaic modules into alternating current compatible with the electricity network
- onsite substation containing transformers and associated switchgear
- transmission infrastructure including up to 33 kilovolt overhead and/or underground electrical reticulation; and connection from the substation to the existing 330 kilovolt transmission line, Line 79, operated by TransGrid
- a centralised or decentralised battery energy storage system
- operational and maintenance ancillary infrastructure including control room, staff office and amenities, car parking, spare parts storage and maintenance facilities; and supervisory control and data acquisition (SCADA) facilities
- access roads, both to the project and internal access roads
- security fencing around the entire site with asset protection zones for bushfire risk mitigation
- temporary facilities required during the construction and decommissioning phases, such as construction compounds and laydown areas, site office and amenities, access tracks, gates and fencing.

The project is expected to require up to 400 full-time equivalent employees during peak construction and up to approximately 10 full-time equivalent employees would be required during operation and ongoing maintenance of the solar farm.

The capital value of the project would be in excess of $30 million and accordingly the project is a State Significant Development under the *State Environmental Planning Policy (State and Regional Development) 2011*. This environmental impact statement (EIS) has been prepared in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* to support a development application to be lodged with the NSW Department of Planning, Infrastructure and Environment.

Site selection and justification

The NSW Government's submission to the Australian Energy Market Operator's draft Integrated System Plan consultation in 2018 and its release of its Transmission Infrastructure Strategy in late 2018 both highlighted the suitability of the Central West region for large scale wind and solar development.

UPC\AC commenced its investigations and initial discussions with landholders in the district in late 2018, with the aim of identifying a suitable site for a grid-connected solar farm project. The site selection process identified the Stubbo area as being:

- close to the existing 330 kilovolt transmission line operated by TransGrid, with enough available capacity for a project of the required size to justify the connection costs
- on gently undulating land, suitable for photovoltaic power generation
- away from the existing coal mines to the East and the nearby National Parks
- not close to residential areas, avoiding as much nuisance to the broader community as possible and avoiding visual impact to the nearby historic town of Gulgong.

In November 2019, after UPC\AC had progressed its discussions with landholders and commenced engaging with near neighbours in the Stubbo area, the NSW Government released its Electricity Strategy and announced that the CWO REZ would be the first "pilot REZ" in the State, further supporting UPC\AC's decision to progress with the project.

The *Electricity Infrastructure Investment Bill 2020*, passed by the NSW parliament in early December, legislates the Central West Orana REZ as a priority area in NSW for large scale solar farm development and is key to the Government's strategy for transitioning the electricity sector.

Project Refinement

In response to community feedback and throughout the EIS preparation, UPC\AC has undertaken several project refinements to reduce and manage potential environmental and social impacts.

Since the scoping report was issued in April 2020, additional lots have been incorporated into the development footprint on the northern most part of the study area. This addition of a further 287 hectares of land provides UPC\AC with more flexibility to minimise environmental impacts across the broader development footprint, while still enabling the target capacity of 400 megawatts and the viability of the project.

With this additional flexibility, UPC\AC has been able to expand the environmental exclusion zone in the centre of the development footprint and also incorporate additional environmental exclusion zones around the perimeter of the site to protect other environmentally sensitive areas. These environmental exclusion zones now total 528.7 hectares (30 per cent of the study area) and help to avoid most of the potential impacts on biodiversity values and cultural heritage.

Changes to the proposed site entrance have also been refined following environmental and technical considerations, as well as receiving community feedback regarding the potential use of Barneys Reef Road for site access. Blue Springs Road is now proposed for all traffic entering and exiting the site for construction and operations, except in the case of emergency.

Consultation

UPC\AC has developed a community and stakeholder engagement plan that outlines the consultation objectives and implementation throughout the different phases of the project. This plan will continue to be implemented following submission of the EIS and, if the project is approved, through construction and operations to decommissioning of the project.

Key consultation and engagement with landowners, near neighbours and the wider community, government agencies; and other relevant stakeholders during the preparation of this EIS has included:

- establishment and operation of a dedicated project website, Facebook page, project email address and phone line
- phone calls, emails and face-to-face meetings including numerous meetings with Council
- distribution of fact sheets, flyers and letters to community
- a community information drop-in session on 28 October 2020
- consultation with registered Aboriginal parties during preparation of the Aboriginal Cultural Heritage Assessment Report.

Overall, there has been a generally positive or neutral response from stakeholders and community members and it is evident that there is a high level of awareness in the community about the pace of renewables development in the Central West region. Some near neighbours who initially raised concerns about the project became more comfortable as a result of consultation efforts and specifically the drop-in session. Community members have identified the potential employment and economic benefits of the project to the local community.

Issues of concern that were raised during consultation largely related to potential visual and amenity impacts, changes to the existing agricultural land use, proposed traffic and transport routes; and the potential for social impacts such as workforce and accommodation management within the town of Gulgong during construction. Some of these concerns were mainly driven by issues relating to other projects that had been proposed closer to Gulgong town. Issues raised during consultation have been considered in the design of the project and in this EIS.

UPC\AC would continue to engage with the community throughout construction, operation and decommissioning of the project. Additionally, UPC\AC has committed to developing a community benefit sharing program with the local community aimed to help build and support local projects and initiatives.

Environmental Assessment

Biodiversity

As a result of the site selection and refinement process, over 99 per cent of the proposed development site footprint is located on land with little to no biodiversity value. Potential impacts would most likely occur during the construction stage when vegetation clearance and ground disturbance works would be undertaken.

Two Plant Community Types (PCTs) were recorded in the development footprint totalling 5.53 hectares that would be impacted. This includes:

- PCT 281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion (5.29 hectares)
- PCT 1770 - Narrow-leaved Ironbark - Red Stringybark - Black Pine woodlands on sandstone substrates of the Brigalow Belt South (0.24 hectares).

Additionally, a direct impact to 4.4 hectares of potential habitat for the Barking Owl (*Ninox connivens*) is expected to occur as a result of the project, based on conservative assumptions.

Disturbance to waterways is required for the construction of two waterway crossings. However, the disturbance areas would be limited and would avoid permanent obstruction of fish passage or dredging/reclamation works. No significant impacts to aquatic ecological values are expected to occur as result of the project.

The residual impact of the project requires offset of a total of 87 ecosystem credits and 66 species credits.

Aboriginal heritage

A field assessment of the study area was undertaken on 10–14 August and 17–19 August 2020 with representatives from nine registered Aboriginal parties. The survey resulted in 23 previously unidentified Aboriginal sites being recorded, and two previously recorded AHIMS sites being located. These include:

- nine isolated finds
- three isolated finds with potential archaeological deposits
- two artefact scatters
- nine artefact scatters with potential archaeological deposits
- one potential archaeological deposit
- one modified tree, which was previously recorded in 2009.

Of the 25 Aboriginal sites, all would be avoided by the project through the implementation of the environmental exclusion zones, except one isolated find (Rosevale IF-01). This site would be salvaged in consultation with local aboriginal groups prior to it being impacted by construction.

Historic heritage

A field assessment of the study area was on 10–14 August and 17–19 August 2020. Overall, there was limited potential for historic heritage to be present inside the site due to the current land use of the study area being grazing and limited cropping. No historic sites were identified within the site and, as such, there would be no impact to any historic sites as a result of the proposal.

Geology, soils and land capability

The study area is identified as having a land capability class 5 (moderate to low capability land), which has limited potential for high impact land management uses such as cropping and is more suited to grazing with some limitations for pasture establishment. This is consistent with the current land use practices on the site and therefore the project would not be expected to impact on any high capability land or associated land management practices.

Construction of the project would involve the disturbance of soil and may lead to increased levels of soil erosion if not managed effectively. These activities would include site preparation, installation of piles and mounting systems for the solar panels; and establishment of permanent and temporary infrastructure including the substation hardstand area, access areas and carparking areas.

Erosion and sediment control measures would be implemented to minimise the potential for erosion and sedimentation during construction. Once construction has been completed, the ground cover vegetation would be progressively re-established and therefore significant impacts to soils are not expected.

No reported contaminated sites have been identified within the study area. Disturbance of soils has the potential for disturbance and exposure of contaminants such as pesticides, which may be present due to historical agricultural practices. Appropriate management measures would be implemented to minimise potential soil contamination impacts during construction such as accidental spills or leaks of chemicals.

Land use

The study area and the immediately surrounding land is zoned as Primary Production (RU1) under the *Mid-Western Regional Local Environmental Plan 2012*. The project would result in a change of the land use in the development footprint from its existing agricultural use, to electricity generation. Notwithstanding this, UPC\AC and the host landholders have plans to trial the co-location of sheep grazing within the solar farm during operation, which would maintain some ongoing agricultural use.

Whilst considered unlikely, in the worst case scenario, if no ongoing sheep grazing occurs, the project would reduce the total area available for agricultural use within the Mid-Western Regional Council local government area and Central Tablelands region by 0.20 percent. Once the project has reached the end of its operational life, all project infrastructure would be decommissioned and removed and the study area would be made suitable for its pre-existing land use, namely grazing of sheep and/or cattle grazing, as agreed by the project owner and the landholder at that time.

There have been refinements to the development footprint and layout of infrastructure made, relative to the original study area, in order to minimise impacts to existing agricultural operations of host landholders and neighbouring landholders. It is anticipated that landholders would continue to use their remaining properties not involved in the project for agricultural activities during operation of the project, as well as trialling the grazing of sheep within the solar farm site.

A Land Use Conflict Risk Assessment was undertaken for the project in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide.* The assessment focused on how to implement performance targets to address eight potential land use conflict issues. These primarily related to the temporary removal of agricultural land, amenity changes and safety risks.

Landscape character and visual

The study area has been extensively cleared and is predominately characterised by grazing and modified pasture with some small pockets of dryland cropping. The project is likely to require the removal of a some scattered vegetation, which in the broader landscape context would have a negligible visual impact to the landscape character.

It is noted that there is a significant amount of electrical infrastructure already in the vicinity of site, including major 330 kilovolt and 132 kilovolt transmission lines which form part of the existing landscape character. During construction, the landscape within the array areas would undergo physical changes through installation of project infrastructure, which would add new features to the visual landscape. However, due to the relatively low height of the panels, topography of the study area, existing infrastructure and the limited opportunities to view the project from public land, visual impacts associated with the project are generally considered low or negligible.

There is an assessed low or no potential for visual impacts during construction and operation from seven dwellings within two kilometres of the site. The proposed development footprint is already screened by either topography, vegetation or both from all these dwellings.

Once decommissioned, the visual landscape has the capacity to return to its current state. The proposed development could be undertaken whilst maintaining the core landscape character of the area and have a minimal visual impact on the surrounding visual landscape.

Noise and vibration

The study area and land immediately surrounding it is sparsely populated with a limited number of sensitive receivers. Ambient noise monitoring undertaken at two locations from 17 to 24 August 2020 confirmed a rural noise environment with the primary noise sources being wildlife, farming practices and occasional road noise.

Construction would be undertaken during standard construction hours in accordance with the *Interim Construction Noise Guideline* which is Monday to Friday 7am to 6pm; Saturday 8am to 1pm; and no work on Sunday or public holidays. While not expected, certain works may need to occur outside standard hours: out of hours work and extended construction hours may be required on limited occasions such as for special deliveries to minimise disruption or in the case of emergencies.

The site preparation works and pile driving and foundations for the substation and battery energy storage system(s) have the most potential for noise impacts given the number of plant to be used, their cumulative emission levels, duration and locations of other construction activities.

Noise modelling undertaken based on a worst-case scenario approach, indicates that all construction noise management levels are expected to be complied with during standard hours. The only out of hours work exceedance predicted is at residence 'R2', which is a host landholder's residence.

Traffic and transport

Traffic surveys were undertaken during peak traffic periods on 8 September 2020 at key intersections and a quantitative assessment was undertaken to determine the potential impacts of additional light and heavy vehicles on the local road network. A qualitative assessment was undertaken to assess potential impacts during operation and decommissioning.

Two potential access points were considered in the traffic and transport assessment, one being from Blue Springs Road to the east of the development footprint and the other being from Barneys Reef Road to the west.

Subsequent to the traffic and transport assessment and in response to community consultation, it was determined that the western access off Barneys Reef Road may be constructed, but it would only be used for emergency site access, such as in the event of bushfire for local fire crew access or for evacuation. This decision mitigates potential impacts to the local road network and the nearby residences located along Barneys Reef Road.

The *Austroads Guide to Road Design Part 3 Geometric Design* specifies road width design standards for low volume (generally rural) roads based on daily traffic volumes. As a result of the proposed site access, the traffic is forecast to increase on Blue Springs Road during the construction period. It is noted that, even though the current daily traffic volume on Blue Springs Road is greater than 150 vehicles per day, the sealed road width varies between four metres and six metres, which is less than the 7.2 metres sealed width recommended in the Austroads guidance.

Consultation with Mid-Western Regional Council was undertaken on 29 October 2020 with additional information provided at Mid-Western Regional Council's request on 4 and 10 November 2020. Subsequently Mid-Western Regional Council advised that a formal response to matters discussed would be provided during the submissions phase of the approval pathway. In the meantime, UPC\AC will continue to consult with Mid-Western Regional Council to determine the appropriate treatment for the safe use of Blue Springs Road during construction.

The proposed construction and operations access via Blue Springs Road would require a new basic rural intersection, suitable for all heavy and light vehicles to access and leave the site at one of two potential site entrance locations:

- Option 1 - via the existing TransGrid 330 kilovolt easement
- Option 2 – via a new entrance to the south of the easement.

The preferred option is via the existing TransGrid easement and consultation is currently underway to determine the suitability of this access in accordance with the *TransGrid Easement Guidelines* and the *TransGrid Fencing Guidelines*.

Parking for staff would be provided onsite, close to the Blue Springs Road main site entrance for all phases of the project.

The two-year construction phase of the solar farm is expected to generate the following peak daily construction traffic demand for the project:

- 60 heavy vehicles per day
- 230 light vehicles per day to transport staff from Gulgong or Mudgee
- 20 over dimensional vehicles.

The vehicle movements would peak during twelve months of the approximately two-year construction phase, when the majority of the photovoltaic modules are being delivered to site and the peak workforce numbers are reached. On either side of this time period, the vehicle movements would be fewer than at the peak, as the level of activity onsite and the number of deliveries would be ramping up or down.

During the daily AM and PM peak hours, it is anticipated that six heavy vehicles would enter and six heavy vehicles would leave the site in each peak hour; with 230 cars entering the site in the AM peak hour and 230 cars leaving the site in the PM peak hour. This is a conservative assumption which assumes that no mini vans or shuttle buses would be used.

Most of the heavy vehicles would come from the Port of Newcastle, whilst light vehicles would come from Mudgee (90 per cent) and Gulgong (10 per cent). The assessment determined that the additional construction traffic would not trigger the requirement for any road or intersection treatments beyond the basic rural intersection required at the site access point on Blue Springs Road.

Once in operation, the project is forecast to generate about 10 vehicles to / from the project in each peak period, which is forecast to have minimal impact on the road network. The decommissioning phase would see lower traffic generation in relation to expected mechanical decommissioning processes and a reduced labour force compared to the construction phase.

Water

There is greatest potential for surface water quality impacts during construction, with limited potential for impacts during the operation stage. Construction of the project would disturb soils which has the potential to lead to sediments or pollutants mobilising in runoff and entering local waterways including Stubbo Creek, Pine Creek, Merotherie Creek and Gum Creek, which discharge to Slapdash Creek. However, with implementation of the appropriate management measures the project is not anticipated to have negative water quality impacts.

Flood modelling concluded that the study area is mostly characterised as: H1: 'Generally safe for vehicles, people and buildings'. The exception would be waterways and confined drainage lines (which are mostly within the environmental exclusion zones), during both 5 per cent annual exceedance probability and 1 per cent annual exceedance probability events. No adverse effect to beneficial inundation of the floodplain environment on, adjacent to, or downstream of the study area is anticipated.

The project is not anticipated to have material groundwater interaction and no changes to groundwater infiltration or extraction are proposed. The deepest infrastructure to be installed would be the steel piles, to a depth of between 1.5 metres to 2.4 metres below ground level.

Hazards and risks

The *Large-Scale Solar Energy Guideline for State Significant Development* (NSW Government 2018) identifies battery storage (and associated chemicals) as a key element of a solar farm to be considered as a potential hazard. Subsequently, a Preliminary Hazard Analysis was prepared for the project. The Preliminary Hazard Analysis also considered risks associated with storage of dangerous goods, electromagnetic fields, and bushfires.

The main hazardous materials to be stored onsite include liquid petroleum, gas, refrigerant, gasoline, transformer oil, pesticides and/or herbicides and batteries. The highest risk level associated with the project is medium. Medium level risks can be managed with the measures inherent to the project.

The project includes several potential electromagnetic field sources such as cabling, substations, transformers, transmission lines and the battery energy storage system(s). These impacts are considered to be negligible, particularly in the context of the existing electrical infrastructure, and would be addressed through design and construction in accordance with Australian and international standards.

No land within the study area is mapped as bushfire prone. However, the land surrounding the project contains vegetation consistent with grassland and woodland which is considered to form a bush fire threat. Bushfire measures, including introducing Asset Protection Zones, would be implemented to minimise bushfire risks.

Socio-economic

A qualitative socio-economic assessment was undertaken to identify, predict, evaluate and develop responses to potential social impacts as a result of the project. The social area of influence, or social locality, was defined as the Mid-Western Regional Council Local Government Area as it is expected that the primary area of influence of the project is likely to be Mudgee and Gulgong and to a lesser extent the remainder of the Mid-Western Regional Council LGA including nearby villages such as Ulan to the east.

The majority of potential social impacts are expected during the construction phase of the project which would result in the need for up to 400 full time equivalent personnel. Given the assessed availability of both skilled and non-skilled local workers within the social locality, it is expected that approximately 50 per cent of the workforce would be non-local hires. As such there are expected to be some pressures on local accommodation and other service providers to meet demand whilst minimising impact to other key industries such as tourism. It is noted that as a result of travel restrictions on NSW residences during the COVID-19 pandemic that tourist numbers in the region are unusually high and hence accommodation availability is particularly low at present, but is likely to return to more normal levels ahead of construction commencing (anticipated in early 2022).

Aside from the strong role of the mining industry and the agricultural sector in the region, the social locality has an identity and economic profile based around a tourism culture of food, wine, arts and crafts and historical value. There is potential for impacts to the community values and social cohesion should the workforce impacts be managed poorly. As such an Accommodation and Employment Strategy would be developed and implemented for the project in consultation with Mid-Western Regional Council to address the accommodation and employment workforce management measures.

Waste and resources

The project would produce various waste streams during the construction and decommissioning phases. Minor quantities of waste would also continue to be generated by the operation of the project. Most waste generated by the project would be classified as non-putrescible general solid waste. Ancillary facilities in the site compound would also produce sanitary wastes classified as putrescible general solid waste. The majority of the project components are able to be reused or recycled in accordance with resource management hierarchy principles.

Strategies for waste management would be considered by the contractor as part of its construction environment management plan in consultation with regional waste management facilities.

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities. Underground cables buried at 1,000 millimetres deep and greater would likely remain in situ. Any items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to licensed facilities.

While the use of non-renewable resources can increase material scarcity, the materials required for the project are not currently limited or restricted. In the volumes required, the project is unlikely to place significant pressure on the availability of local or regional resources.

Cumulative impacts

Potential cumulative impacts that were considered relate to changes to land use, traffic volumes and movements, noise and vibration emissions, air emissions including dust and vehicle emissions, changes to the landscape character and visual amenity, social impacts including workforce accommodation and availability and resource use and availability including construction materials and labour force availability.

There may be cumulative impacts from the concurrent construction of the project and the Wollar Solar Farm and Dunedoo Solar Farm developments, if those projects proceed to construction, due to the size of the construction workforce and subsequent demand for short-term accommodation, local infrastructure and services and associated vehicle movements on the regional road network.

These impacts would be dependent on the final timing and duration of construction activities associated with the two proposed developments and the project. Cumulative impacts relating to visual amenity and traffic are not anticipated to occur as a result of the project due to the distance between the operations and the project.

Justification and conclusion

The environmental assessment undertaken for the project has determined that the project would not result in significant impacts to environmental, cultural, social and economic values and residual impacts can be managed with the implementation of proposed mitigation measures. Furthermore, the project is consistent with the principles of Ecologically Sustainable Development, and the objectives of the NSW *Environmental Planning and Assessment Act 1979*.

The project forms an important part of Australia's transition to renewable energy generation and would positively contribute towards meeting Commonwealth and NSW government targets. The project would enhance the reliability and security of electricity supply by contributing towards bridging the anticipated supply gaps that would result following the closure of over 7000 megawatts of major coal-fired power generators within NSW in the coming ten to fifteen years.

There are numerous State, Federal and international agreements and strategic documents that provide the context and justification for why the development of the project is justified, including:

- The 2015 UNFCCC "Paris Agreement"
- The Federal Government's Renewable Energy Target scheme
- The AEMO *2020 Integrated System Plan*
- *NSW Net Zero Plan Stage 1: 2020-2030*
- *NSW Renewable Energy Action Plan 2013* and *NSW Renewable Energy Action Plan Completion Report 2018*
- *NSW Electricity Strategy 2019*
- *NSW Electricity Infrastructure Roadmap 2020* and associated NSW legislation.

The proposed development is also supported by and consistent with strategic planning policies and agreements at a local level. Furthermore, given the location of the study area within the CWO REZ it is clear that the proposed development is highly consistent with the NSW Government's plans for development in the wider region and already consistent with the emerging land use for renewable energy generation.

Should the project not proceed, the potential project benefits described within this EIS would not be realised. In addition, it would be more difficult in the short-term for the Commonwealth and NSW Governments to achieve their respective renewable energy and greenhouse gas emission reduction targets, while the future security of electricity supply in NSW would be weakened.

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GLOSSARY

Term	Definition
Access tracks	Vehicle access tracks for use during operation
Alternating current	The type of current that reverses its direction many times a second at regular intervals
Array	A collection of connected solar panels that work together
Associated residences	Property owners within or near the study area which UPC\AC has entered into access licence and option agreements with (landholder agreements) allowing it to lease the land for the construction, operation and decommissioning of the solar farm
Battery energy storage system	A technology developed for storing electric charge by using specially developed batteries
Centralised battery energy storage system	A battery energy storage system that is located adjacent to the grid substation (one of two locations A or B will be chosen)
Connection point	Point at which the project connects with the National Energy Market. This is where the proposed substation connects with the TransGrid 330 kilovolt line as indicated in **Figure 2-1**
Construction access tracks	Vehicle access tracks for construction and delivery of plant and equipment on private property
Decentralised battery energy storage system	Small battery energy storage system units connected to some or all of the power conversion units distributed throughout the site
Development footprint	The maximum extent of ground disturbing work associated with construction and operation of the project as indicated on **Figure** 2-1
Direct current	An electric current that flows in one direction only
Environmental exclusion zones	The areas of higher environmental value excluded from the development footprint as indicated in **Figure 2-1**
Inverter	Converts direct current to alternating current
Non-associated residences	Residences near the study area that have not been the subject of an access licence and option agreement (landholder agreement)
Photovoltaic	Materials contained within the solar panels that generate electric current when exposed to light
Photovoltaic array	A group of multiple solar panels connected together
Power conversion unit	The power conversion units comprise three main components, inverters, transformers and a ring main unit, and convert the direct current electricity generated by the photovoltaic modules into alternating current form and increase the voltage of the electricity
Project	The proposed Stubbo Solar Farm consisting of photovoltaic arrays, inverters, a substation and ancillary infrastructure and a battery energy storage system within the development footprint
Proponent	UPC Renewables Australia Pty Ltd (abbreviated to 'UPC\AC')

Term	Definition
Solar panel	A unit consisting of solar photovoltaic materials, which turn sunlight into electricity
Study area	The area assessed as part of this environmental impact statement as indicated in **Figure 2-1**
Substation	The location where the lower-voltage electricity from the solar farm is converted to higher-voltage electricity for distribution in the consumer energy network
Voltage	The pressure from an electrical circuit's power source that pushes charged electrons (current)

ACRONYMNS

Abbreviation	Definition
2020 ISP	The 2020 Integrated System Plan
ABL	Assessment Background Level
ABS	Australia Bureau of Statistics
AC	Alternating current
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACHMP	Aboriginal Cultural Heritage Management Plan
ADGC	Australian Dangerous Goods Code
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
APZ	Asset Protection Zone
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ARR2019	*Australian Rainfall and Runoff: A Guide to Flood Estimation*
ARTC	Australian Rail Track Corporation
AS	Australian Standard
AUTH	Authorisation
BAL	Bushfire Attack Level
BAM	Biodiversity Assessment Methodology
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Regulation	NSW *Biodiversity Conservation Regulation 2017*
BCD	NSW Biodiversity and Conservation Division of the Department of Planning, Industry and Environment
BDAR	Biodiversity Development Assessment Report
BESS	Battery and Energy Storage System
BoM	Bureau of Meteorology
BPAD	Bushfire Planning and Design
BS 6472–1992	*British Standard BS7385.2 - 1993 Evaluation and Measurement for Vibration in Buildings, Part 2 - Guide to damage levels from ground borne vibration 1993*
BSA Act	*NSW Biosecurity Act 2015*
BSAL	Biophysical Strategic Agricultural Land
CAC	Corroboree Aboriginal Corporation

Abbreviation	Definition
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CIC	Critical Industry Clusters
CIV	Capital Investment Value
CL Act	*NSW Crown Land Management Act 2016*
CLM Act	*NSW Contaminated Land Management Act 1997*
CNVS	Transport for NSW *Construction Noise and Vibration Strategy*
Code of Practice	*Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010)
Conveyancing Act	*NSW Conveyancing Act 1919*
CSEP	Community and Stakeholder Engagement Plan
CWO REZ	Central-West Orana Renewable Energy Zone
DA	Development application
DAWE	Commonwealth Department of Agriculture, Water and the Environment
dB(A)	Decibels, a measure of A-weighted (c.f.) sound levels
DC	Direct Current
DCP	Development Control Plan
DECCW	Department of Environment, Climate Change and Water
DG	Dangerous Goods
DIN 4150	*German Standard DIN 4150: Part 3-1999 Structural vibration – Effects of vibration on structures 1999*
DoI	NSW Department of Industry
DP	Deposited Plan
DPI	Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
DPI-Water	NSW Department of Primary Industry – Water
DTM	Digital Terrain Model
ECRTN	*Environment Criteria for Road Traffic Noise*
EEC	Endangered Ecological Community
EIS	Environmental impact statement
ELA	EcoLogical Australia
ELA	Eco Logical Australia
EMF	Electro-magnetic fields

Abbreviation	Definition
EMP	Environmental Management Plan
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW *Environmental Planning and Assessment Regulation 2000*
EPA	NSW Environmental Protection Authority
EPBC Act	*Commonwealth Environment Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Planning Instrument
EPL	Environmental Protection Licence
ESD	Ecologically Sustainable Development
FCAS	Frequency Control Ancillary Services
FDI	Fire Danger Index
FM Act	NSW *Fisheries Management Act 1994*
FPAA	Fire Protection Association of Australia
GAC	Gallanggabang Aboriginal Corporation
GCHAC	Gunjeewong Cultural Heritage Aboriginal Corporation
GW	Gigawatt/s
ha	Hectares
Heritage Act	NSW *Heritage Act 1977*
HHIMS	Historic Heritage Information Management System
HIPAP	*Hazard Industry Planning Advisory Paper No.6 – Guidelines for Hazard Analysis*
hr	Hour
HV	High voltage
HVAC	Heating Ventilation Air Conditioning
Hz	Hertz
IBRA	NSW South Western Slopes Interim Biogeographic Regionalisation for Australia
ICNG	*Interim Construction Noise Guideline*
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IPP	Independent Power Producer
KFH	Key Fish Habitat
kL	Kilolitres
km	Kilometre/s
kV	Kilo volt/s

Abbreviation	Definition
LALC	Local Aboriginal Land Council
LEMC	Mid-Western Local Emergency Management Committee
LEP	Local Environmental Plan
LGA	Local Government Area
LGCs	Large-scale generation certificates
LLS	Central Tablelands Local Land Services
LLS Act	*NSW Local Land Services Act 2013*
LPG	Liquefied Petroleum Gas
LRET	Large-scale Renewable Energy Target
LSC	Land and soil capability
LSPS	Local Strategic Planning Statement
LUCRA	Land Use Conflict Risk Assessment
LV	Low voltage
m	Metre/s
MEG	NSW Department of Regional NSW – Mining, Exploration and Geoscience
Mining Act	*NSW Mining Act 1992*
ML	Mining Lease
MLALC	Mudgee Local Aboriginal Land Council
MNES	Matter of National Environmental Significance
MV	Medium voltage
MW	Megawatt/s
MWh	Megawatt hours
Native Title Act	NSW *Native Title Act 1993*
NEL	National Electricity Law
NEM	National Energy Market
NES	NSW Electricity Strategy
NML	Noise Management Level
NNTT	National Native Title Tribunal
NP&W Act	NSW *National Parks and Wildlife Act 1974*
NPfI	*Noise Policy for Industry*
NRAR	Natural Resources Access Regulator
NSW	New South Wales
NTSCORP	Native Title Service Corporation

Abbreviation	Definition
OCPs	Organochlorine pesticides
OEH	NSW Office of Environment and Heritage
OEMP	Operational environmental Management Plan
OIPC	Office of the Independent Planning Commission of NSW
OzArk	OzArk Environment & Heritage
PAD	Potential Archaeological Deposit
PCTs	Plant Community Types
PCU	Power Conversion Unit
PEL	Petroleum Exploration Licence
PHA	Preliminary Hazard Analysis
PHA	Preliminary Hazard Assessment
PMF	Probable Maximum Flood
PMST	Protected Matters Search Tool
POEO Act	*NSW Protection of Environment Operations Act 1997*
PPV	Peak Particle Velocity
PV	Photovoltaic
PVP	Property vegetation plans
RAP	Registered Aboriginal Party
RBL	Rating Background Level
REP	Regional Environmental Plan
RET	Renewable Energy Target
REZ	Renewable Energy Zone
RF Act	NSW *Rural Fires Act 1997*
RNP	NSW *Road Noise Policy*
Roads Act	NSW *Roads Act 1993*
RtS	Response to Submissions
SALIS	NSW Soil and Land Information System
SAT	Spot Assessment Technique
SCADA	Supervisory Control and Data Acquisition
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEPP 33	*State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*
SEPP 55	*State Environmental Planning Policy No 55 – Remediation of Land*

Abbreviation	Definition
SEPP Infrastructure	*State Environmental Planning Policy (Infrastructure) 2007*
SEPP Koala Habitat	*State Environmental Planning Policy (Koala Habitat Protection) 2019*
SEPP Mining	*State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries 2007)*
SEPP PP&RD	*State Environmental Planning Policy (Primary Production and Rural Development)* 2019
SEPP S&RD	*State Environmental Planning Policy (State and Regional Development) 2011*
SHR	State Heritage Register
SISD	Safe Intersection Sight Distance
SRES	Small-scale Renewable Energy Scheme
SSD	State Significant Development
STCs	Small-scale technology certificates
TECs	Threatened ecological communities
UPC\AC	UPC\AC Renewables Australia Pty Ltd operating as UPC\AC Renewables Australia
VDV	Vibration dose value
WAL	Water Access Licence
WARR Act	*NSW Waste Avoidance and Resource Recovery Act 2001*
Waste Regulation	*Protection of the Environment Operations (Waste) Regulation 2014*
WM Act	*NSW Water Management Act 2000*
WVWAC	Wellington Valley Wiradjuri Aboriginal Corporation

1. INTRODUCTION

1.1 Project overview

UPC Renewables Australia Pty Ltd, operating as UPC\AC Renewables Australia (UPC\AC), the Proponent, proposes to develop the Stubbo Solar Farm, a grid-connected photovoltaic solar farm of up to 400 megawatts in the New South Wales (NSW) Central West Orana region (the project). The project would be located approximately 90 kilometres east of Dubbo, in the Mid-Western Regional Council Local Government Area (LGA). The project is located within the proposed Central-West Orana Renewable Energy Zone, recently identified by the NSW Government to help meet its objective to achieve net zero emissions by 2050. The regional context of the project is presented in **Figure 1-1**.

The project would include the construction, operation and decommissioning of a 400 megawatt solar farm that would supply electricity to the National Electricity Market (NEM). Key infrastructure for the project would include:

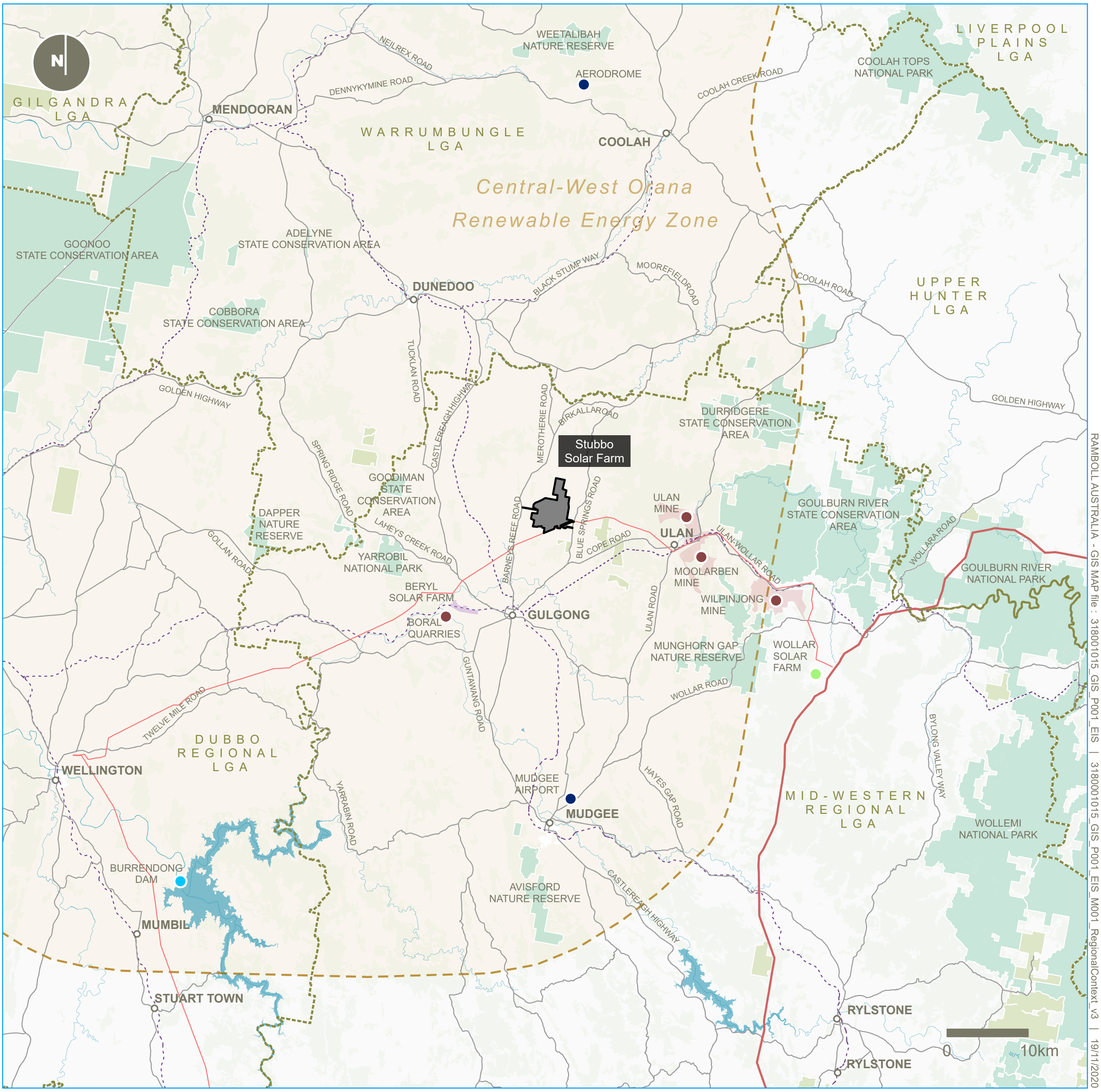
- photovoltaic modules (solar panels) installed in a series of rows across the development footprint
- power conversion units (PCUs) designed to convert the direct current (DC) electricity generated by the photovoltaic modules into alternating current (AC) form, compatible with the electricity network
- onsite substation containing two main transformers and associated switchgear
- transmission infrastructure including up to 33 kilovolt overhead and/or underground electrical reticulation; and connection from the substation to the existing 330 kilovolt transmission line (Line 79) operated by TransGrid
- a centralised or decentralised battery energy storage system (BESS)
- operational and maintenance ancillary infrastructure including staff office and amenities, car parking, spare parts storage and maintenance facilities; and supervisory control and data acquisition (SCADA) facilities
- access roads, both to the project and internal access roads
- temporary facilities required during the construction and decommissioning phases, such as construction compounds and laydown areas, site office and amenities; and access tracks and associated infrastructure, including gates and fencing.

The permanent and temporary components associated with construction and operation would be located within the development footprint.

Designated environmental exclusion zones have been included within the development footprint, intended to minimise impacts of the development in the areas of highest environmental value. A detailed project description is provided in **Chapter 2** and an indicative project layout is provided in **Figure 2-1**.

The project is expected to require up to 400 full-time employees during peak construction and approximately 10 full-time employees would be required during operation and ongoing maintenance of the solar farm.

The capital value of the project would be in excess of $30 million. Accordingly, the project is a State Significant Development (SSD) under the *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP SR&D) and Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).



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Key

- Study area
- Indicative Central-West Orana Renewable Energy Zone
- Beryl Solar Farm
- Proposed solar farm
- Power station
- Airport
- Mine / quarry
- LGA boundaries
- Reserves
- State Forest
- Existing 500kV transmission line
- Existing 330kV transmission line
- Road
- Rail

Figure 1-1 | Regional context

1.2 Project location and regional context

The project is located between Blue Springs Road and Barneys Reef Road, approximately 10 kilometres north of Gulgong in the locality known as Stubbo. The small rural locality is characterised by gently undulating open land with only a small number of scattered residences. The project location is shown in **Figure 1-2**.

The project is located within the proposed Central-West Orana REZ, recently identified by the NSW Government to help meet its objective to achieve net zero emissions by 2050. The project is proximate to the existing Wellington to Wollar 330 kilovolt transmission line owned by TransGrid, providing a connection opportunity to the NEM.

The study area is predominantly cleared agricultural land primarily used for livestock grazing and intermittent cropping. Native vegetation remains in the form of scattered trees, vegetation along riparian corridors and isolated areas of remnant vegetation. Several non-perennial watercourses and their tributaries run throughout the study area, including Merotherie Creek, Pine Creek, Stubbo Creek and Gum Creek.

UPC\AC has incorporated the area of higher environmental value associated with the watercourses and riparian vegetation as identified and assessed in this document into an approximate 461.5 hectare environmental exclusion zone that bisects the project. Four additional areas of higher environmental value have been identified within the study area and are also included as environmental exclusion zones. These additional areas total approximately 67.2 hectares. The total area for all the environmental exclusion zones is 528.7 hectares. The environmental exclusion zones are shown on **Figure 2-1**. UPC\AC does not intend to propose any development within these areas except that required for the provision of access and electrical reticulation between the northern portion and the southern portion of the development footprint.

There are approximately 10 sensitive receivers, including rural residences located within two kilometres of the project, three of which are associated with the project. The Ulan and Wilpinjong coal mines are located east of the study area approximately 10 and 20 kilometres away, respectively.

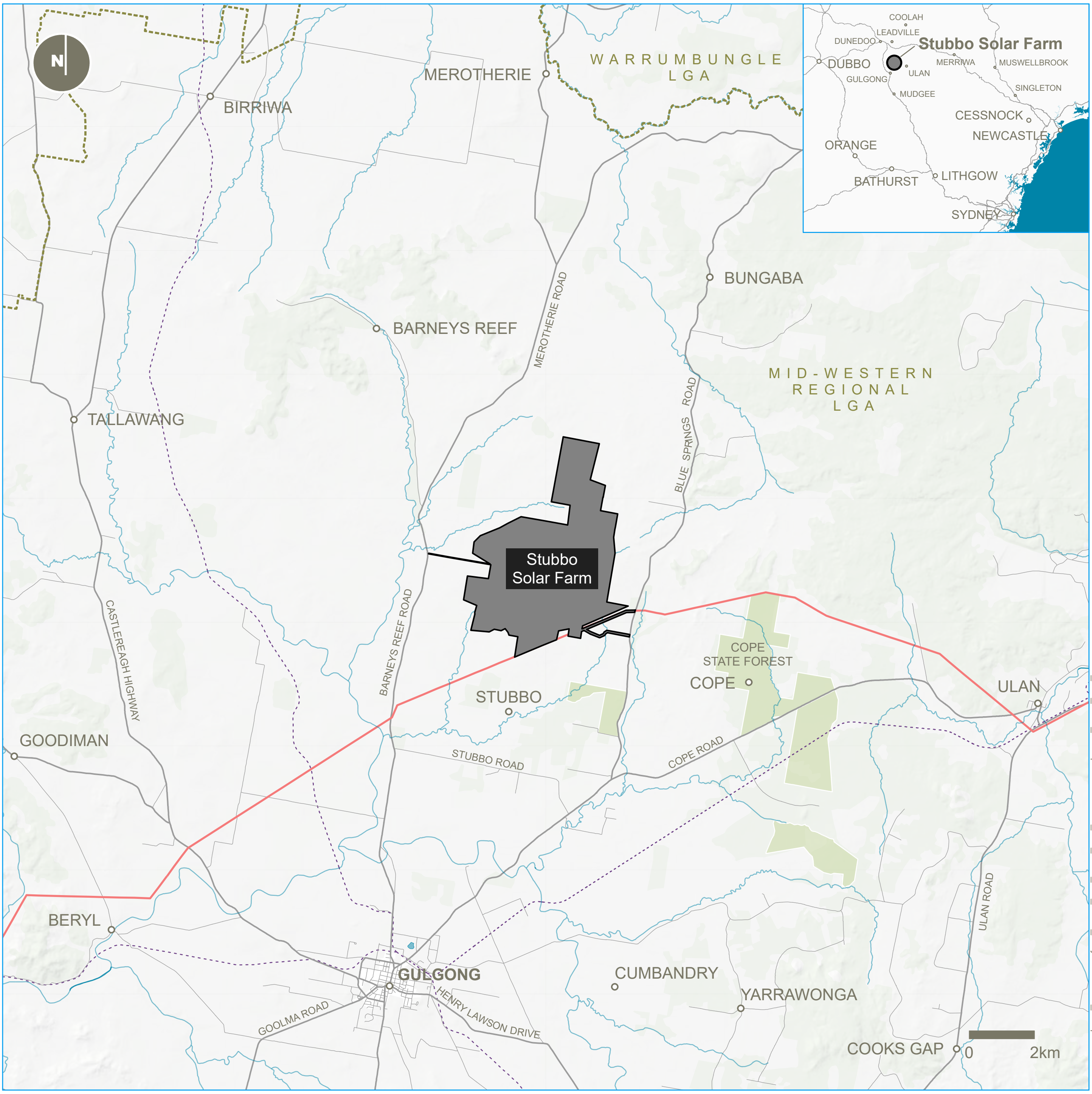
1.3 The proponent

The Proponent for the Project is UPC Renewables Australia Pty Ltd, operating as UPC\AC Renewables Australia (UPC\AC). UPC\AC is a 50-50 joint venture between UPC\AC (through UPC\AC Solar Asia Pacific Limited) and AC Energy (through AC Renewables International Pte. Ltd.).

UPC\AC is a leading renewable energy developer in the Asia Pacific region with offices in Australia, China, Hong Kong SAR, India, Indonesia, Philippines, South Korea, Taiwan, and Vietnam. UPC\AC Renewables was established in 1995 and has been active in Asia since 2006. To date, UPC\AC companies have developed more than 4,500 megawatts of operating wind and solar projects with an estimated investment value of over $6 billion.

AC Energy is the energy platform of Ayala, one of the largest business groups in the Philippines. AC Energy is one of the fastest growing energy companies with over $1 billion of invested and committed equity in renewable and thermal energy in the Philippines and around the region.

UPC\AC is focused on supplying renewable energy at the lowest possible price in a socially responsible way and independently develops, builds, owns and operates its solar and wind energy generating assets as an independent power producer.



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Key

Study area	Existing 330kV transmission line
LGA boundaries	Road
State Forest	Rail
	Creek

Figure 1-2 | Locality plan

UPC\AC has a large pipeline of renewable energy projects in development across Australia, including:

- New England Solar Farm in New South Wales
- Axedale Solar Farm in Victoria
- Jim's Plain and Robbins Island Renewable Energy Parks in Tasmania
- Valley of the Winds Wind Farm in New South Wales
- Baroota Pumped Hydro in South Australia

More information about UPC\AC and its project are available at: https://upc-ac.com/.

1.4 Project objectives

Objectives of the project are to:

- develop an economically viable grid-connected solar farm that contributes to the delivery of affordable, sustainable and reliable electricity within NSW
- enhance energy security by contributing to diversification of the State's energy mix in preparation for the retirement of large coal-fired power stations
- produce clean and renewable energy that contributes to meeting State and National climate change mitigation targets and reduces greenhouse gas emissions
- provide local and regional employment opportunities and provide economic benefits to the local community
- avoid and/or minimise environmental impacts wherever practicable, through careful design and implementation of best practice environmental management and mitigation.

1.5 Purpose of this environmental impact statement

This environmental impact statement (EIS) has been prepared in accordance with Part 4 of the EP&A Act by Ramboll Australia Pty Ltd on behalf of UPC\AC. The EIS supports the development application (DA) for the project to be lodged with the NSW Department of Planning, Industry and Environment (DPIE) for Development Consent; and fulfils the requirements of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and Section 4.15 of the EP&A Act.

Under Section 4.12(8) of the EP&A Act, a DA for SSD must be accompanied by an EIS. This EIS identifies and assesses the potential environmental, economic and social impacts associated with the construction, operation and decommissioning of the project. The EIS is intended to help the community, government agencies and the consent authority to make informed submissions or decisions on the merits of the project.

The structure and content of the EIS addresses the Secretary's Environmental Assessment Requirements (SEARs), provided by DPIE on 5 May 2020. A list of the SEARs and where they have been addressed in this EIS is provided in **Table 1-1**.

Table 1-1: SEARs and where each requirement has been addressed in this EIS

Requirement	Where addressed
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* (the Regulation). In particular, the EIS must include:	**Section 21.3**
• a stand-alone executive summary;	Refer to the beginning of this EIS
• a full description of the development, including: – details of construction, operation and decommissioning; – a site plan showing all infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process); – a detailed constraints map identifying the key environmental and other land use constraints that have informed the final design of the development;	**Chapter 2** and **Figure 3-3**:
• a strategic justification of the development focusing onsite selection and the suitability of the proposed site with respect to potential land use conflicts with existing and future surrounding land uses (including other proposed or approved solar farms, rural residential development and subdivision potential);	**Chapter 21**
• an assessment of the likely impacts of the development on the environment, focusing on the specific issues identified below, including: – a description of the existing environment likely to be affected by the development; – an assessment of the likely impacts of all stages of the development, (which – is commensurate with the level of impact), including any cumulative impacts of the site and existing or proposed developments in the region (including the approved Beryl and Wollar Solar Farms and the proposed Dunedoo Solar Farm), taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; – a description of the measures that would be implemented to avoid, mitigate and/or offset the impacts of the development (including draft management plans for specific issues as identified below); and – a description of the measures that would be implemented to monitor and report on the environmental performance of the development;	**Chapter 6** to **Chapter 19**
• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; and	**Chapter 20**
• the reasons why the development should be approved having regard to: – relevant matters for consideration under the Environmental Planning and Assessment Act 1979, including the objects of the Act and how the principles of ecologically sustainable development have been	**Chapter 21**

Requirement	Where addressed
– incorporated in the design, construction and ongoing operations of the development; – the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; and – feasible alternatives to the development (and its key components), including the consequences of not carrying out the development.	
• a detailed consideration of the capability of the project to contribute to the security and reliability of the electricity system in the National Electricity Market, having regard to local system conditions and the Department's guidance on the matter; and	**Section 3.1.2**
• a detailed evaluation of the merits of the project as a whole.	**Chapter 21**
The EIS must also be accompanied by a report from a suitably qualified person providing: • a detailed calculation of the capital investment value (CIV) (as defined in clause 3 of the Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived; and • certification that the information provided is accurate at the date of preparation.	Provided to DPIE separate to this EIS
The development application must be accompanied by the consent in writing of the owner/s of the land (as required in clause 49(1)(b) of the Regulation).	Provided to DPIE separate to this EIS
Key issues	
The EIS must address the following specific matters:	N/A
• Biodiversity – including: – an assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless BCD (formerly OEH) and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values; and – the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; – an assessment of the likely impacts of the project on aquatic ecology, including aquatic and riparian biodiversity and key fish habitats;	**Chapter 6** and **Appendix B**
• Heritage – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, including consultation with the local Aboriginal community in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents*;	**Chapters 7** and **8** and **Appendix C** and **D**
• Land – including: – an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:	**Chapters 9** and **10** and **Appendix E**

Requirement	Where addressed
◦ a consideration of agricultural land, flood prone land, Crown lands (including Crown reserve 750765), mining, quarries, mineral or petroleum rights (including mineral licence ML1466, petroleum exploration licence PEL456 and coal authorisation AUTH 286); ◦ consideration of any Aboriginal Land Claim, including but not limited to NC2018/002; ◦ a soil survey to determine the soil characteristics and consider the potential for erosion to occur and agricultural land capability of the site; and ◦ a cumulative impact assessment of nearby developments; – an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including: ◦ consideration of the zoning provisions applying to the land, including subdivision, and; ◦ completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide*.	
• 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, Siding Spring Observatory in accordance with the *Dark Sky Planning Guideline*, air traffic and road corridors in the public domain, including a draft landscaping plan for onsite perimeter planting, with evidence it has been developed in consultation with affected landowners;	**Chapter 11** and **Appendix F**
• Noise – including an assessment of the construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG), operational noise impacts in accordance with the *NSW Noise Policy for Industry* (2017), cumulative noise impacts (considering other developments in the area), and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria;	**Chapter 12** and **Appendix G**
• Transport – including: – an assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation; – an assessment of the likely transport impacts to the site access route (including, but not limited to, Castlereagh Highway, Cope Road, Barneys Reef Road, Blue Springs Road and Merotherie Road), site access point, any Crown land, particularly in relation to the capacity and condition of the roads; – a cumulative impact assessment of traffic from nearby developments (including cumulative impacts from Wollar Solar Farms and the proposed Dunedoo Solar Farm); – a description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required); and – a description of the measures that would be implemented to mitigate any transport impacts during construction;	**Chapter 13** and **Appendix H**

Requirement	Where addressed
• Water – including: – an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including Merotherie, Pine, Stubbo and Gum creeks traversing the site and surrounding water courses), drainage channels, wetlands, riparian land, farm dams, groundwater dependent ecosystems and acid sulfate soils, related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; – details of water requirements and supply arrangements for construction and operation; and – a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004);	**Chapter 14** and **Appendix I**
• Hazards and Risks – including: – Battery Storage – include a Preliminary Hazard Analysis (PHA) prepared in accordance with Hazard Industry Planning Advisory Paper No.6 – Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011), demonstrating that the battery energy storage system is suitably located and minimises risks to neighbouring land uses and onsite substation(s); and – an assessment of potential hazards and risks including but not limited to bushfires, spontaneous ignition, electromagnetic fields or the proposed grid connection infrastructure against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields.	**Chapter 15** and **Appendix J**
• Socio-Economic – including an assessment of the likely impacts on the local community, demands on Council infrastructure and a consideration of the construction workforce accommodation; and	**Chapter 16**
• Waste – identify, quantify and classify the likely waste stream to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste, taking into consideration capacity and availability of local landfills.	**Chapter 17**
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 and any exploration licence and/or mineral title holders. In particular, you must undertake detailed consultation with affected landowners surrounding the development and Mid-Western Regional Council. The EIS must describe the consultation process and the issues raised and identify where the design of the development has been amended in response to these issues. Where amendments have not been made to address an issue, a short explanation should be provided.	**Chapter 4**

1.6 Structure of this environmental impact statement

This EIS is structured as follows:

- **Section 1. Introduction** – introduces the project, including an overview of the project location and regional context, the proponent, the project objectives, and the purpose and structure of this EIS
- **Section 2. Project description** – provides a detailed description of the project including key project elements and construction, operation and decommissioning activities
- **Section 3. Project justification and alternatives** – outlines the strategic context for the project and provides a summary of the alternatives and options considered during the design phase
- **Section 4. Statutory planning and approval process** – discusses the approvals process and relevant statutory planning documents that relate to the project
- **Section 5. Consultation** – provides a summary of the consultation undertaken to date and an overview of proposed future consultation activities
- **Section 6 to Section 17. Key issues** – provides an assessment of the key environmental, economic and social issues for the project, their potential impact and proposed management and mitigation measures. The key issues identified for the project are:
    - Biodiversity
    - Aboriginal heritage
    - Historic heritage
    - Geology, soils and land capability
    - Land use
    - Landscape and visual
    - Noise and vibration
    - Traffic and transport
    - Water
    - Hazards and risks
    - Socio-economic
    - Waste and resources
- **Section 18. Other issues** – an assessment of the non-key environmental issues for the project, their potential impact and proposed management and mitigation measures. Other issues include air quality and climate change and greenhouse gas.
- **Section 19**. **Cumulative** – an assessment of the cumulative impacts of the project for both existing and proposed developments within the locality.
- **Section 20. Environmental management and mitigation measures** – provides a summary of the environmental management and mitigation measures to be implemented for the project
- **Section 21. Project justification and conclusion** – presents the overall impacts and benefits of the project, considering the principals of ecologically sustainable development (ESD)
- **Section 22. References**
- **Appendices** – the appendices to the EIS which support the main document, including copies of all technical assessments. Appendices include:
    - **Appendix A**: Secretary's Environmental Assessment Requirements and Agency Comments
    - **Appendix B**: Community and Stakeholder Engagement Plan
    - **Appendix C**: Biodiversity Development Assessment Report
    - **Appendix D**: Aboriginal and Cultural Heritage and Historic Heritage Assessment Report
    - **Appendix E**: Land Use Conflict Risk Assessment

- **Appendix F**: Landscape Character and Visual Assessment Report
- **Appendix G**: Noise and Vibration Assessment Report
- **Appendix H**: Traffic and Transport Assessment Report
- **Appendix I**: Hydrological Assessment Report
- **Appendix J**: Preliminary Hazard Assessment

2. PROJECT DESCRIPTION

2.1 Overview of the project

The project would include the construction, operation and decommissioning of a 400 megawatt solar farm, including a BESS that would supply electricity to the NEM. The project is expected to require up to 400 full-time equivalent employees during peak construction, and approximately 10 full-time equivalents would be required during operation and ongoing maintenance of the solar farm.

Key infrastructure for the project would include:

- Up to approximately 800,000 single axis tracking photovoltaic modules (solar panels) across the development footprint
- approximately 70 PCUs which include inverters for converting DC power to AC
- onsite substation containing two main transformers and associated switchgear
- transmission infrastructure, including:
  - up to 33 kilovolt overhead and/or underground electrical reticulation connecting the power generating infrastructure to the onsite substation
  - onsite connection from the substation to the existing 330 kilovolt transmission line (Line 79) operated by TransGrid
- BESS, either DC-coupled or AC-coupled
- operational and maintenance ancillary infrastructure including:
  - staff office, operations room, meeting facilities and amenities
  - car parking
  - a temperature-controlled spare parts storage facility
  - SCADA facilities
  - a workshop and associated infrastructure
  - permanent security fencing
- access roads, both to the project and internal access roads
- temporary facilities required during the construction and decommissioning phases, such as:
  - construction compounds and laydown areas suitable for plant and equipment
  - site office and amenities
  - parking areas
  - containers for storage
  - access tracks and associated infrastructure, including gates and fencing.

Indicative heights of the various infrastructure components are summarised in **Table 2-1**.

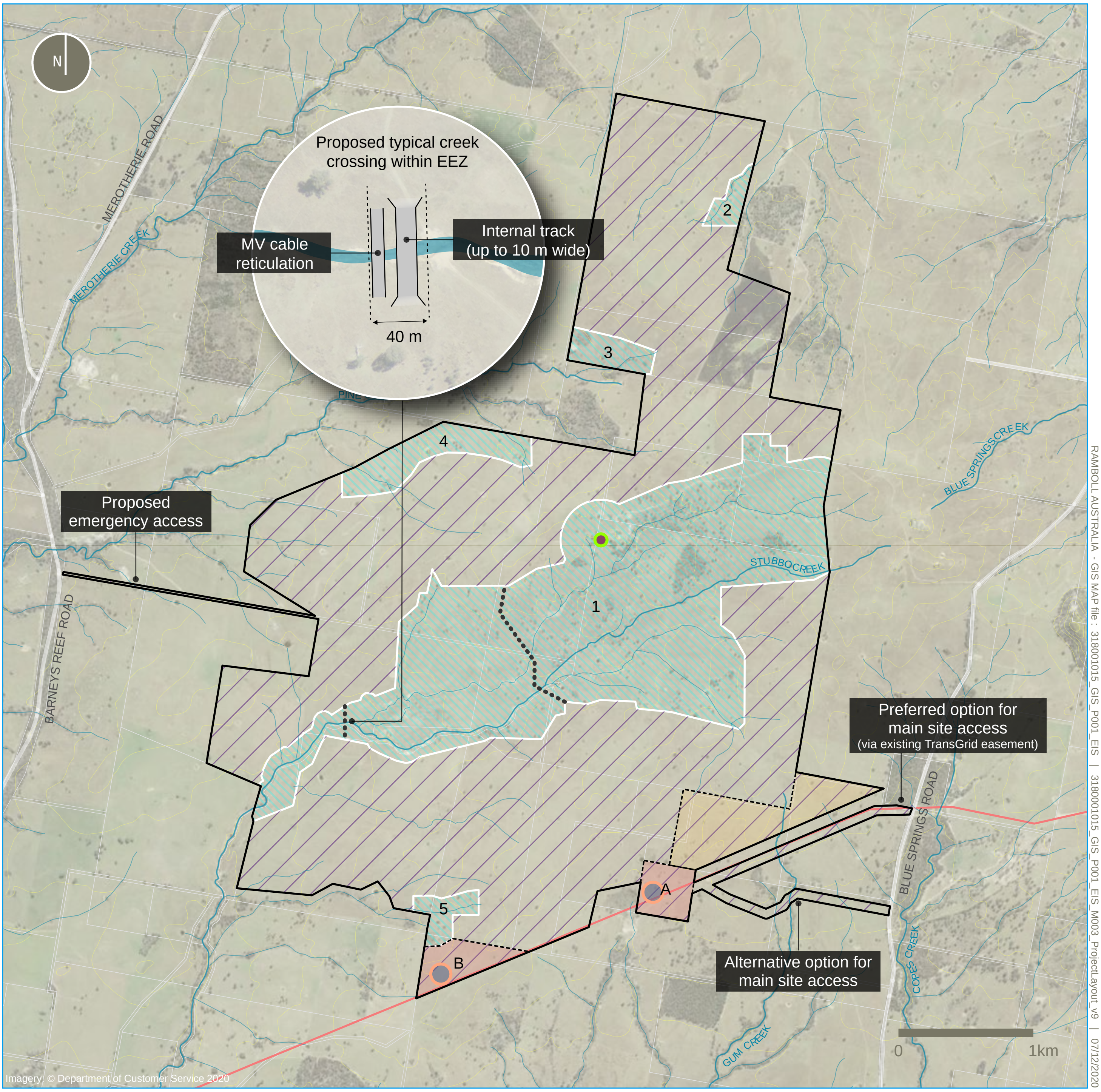
Table 2-1: Indicative infrastructure heights

Infrastructure	Indicative height
Photovoltaic modules	4.3 m at full tilt
Substation	3.5 m with ancillary components not greater than 10 m
BESS	3.5 m with ancillary components not greater than 10 m
Operation and maintenance infrastructure	3.5 m with ancillary components not greater than 10 m

The permanent and temporary components associated with construction and operation would be located within the development footprint for the project, which would cover an area of approximately 1,243.2 hectares.

Designated environmental exclusion zones would be included within the development footprint, intended to minimise impacts of the development in the areas of highest environmental value (refer to **Figure 2-1**). Within the development footprint, there will be, indicatively, between five to twelve metres of space between the rows of solar photovoltaic panels, measured from post to post, which therefore accounts for a significant area of land not covered with infrastructure (the ground coverage ratio will depend on the final designs, but for a single axis tracking photovoltaic plant is typically up to 40 per cent).

A detailed project description is provided in the following sections, and an indicative project layout is provided in **Figure 2-1**.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS (option A or B)
- Indicative connection point to the NEM (option A or B)
- Proposed development footprint
- Environmental exclusion zones
- Access and MV cable reticulation
- Landholder associated with the project
- Existing 330kV transmission line
- Road
- Creek

Figure 2-1 | Project layout

2.2 Project study area

The study area is approximately 1,772 hectares in area and comprises (wholly or partly) 30 cadastral lots, which are listed in **Table 2-2**. UPC\AC has entered into access licence and option agreements with associated property owners (landholder agreements) allowing it to lease the land for the construction, operation and decommissioning of the solar farm.

Table 2-2: Cadastral lots intersecting with the study area

Lot	Deposited Plan	Lot	Deposited Plan
14	217391	60	750765
22	217391	80	750765
55	750765	11	217391
86	750765	1	525593
5	113406	67	750765
2	525593	24	750761
9	217381	68	750765
69	750761	1	1018333
120	840082	24	502960
4	113406	146	750765
20	217391	5	502956
19	217391	78	750765
8	217382	59	750765
4	502956	69	750765
10	217381	22	750761

Also located within the study area is 13.99 hectares of crown land and easements.

The study area contains an approximately 1,243 hectares development footprint that would contain all the permanent and temporary project components associated with construction and operation of the project. This development footprint comprises a northern portion and a southern portion, separated by an environmental exclusion zone of approximately 461.5 hectares intended to minimise impacts of the development in the areas of highest environmental value associated with watercourses and riparian vegetation.

Four additional areas of higher environmental value have been identified within the study area and are also included as environmental exclusion zones, bringing the total area within the study area excluded from development to 528.7 hectares. The environmental exclusion zones are discussed further in **Section 3.4.2** and shown on **Figure 2-1**. **Table 2-3** provides a summary of the project component areas.

Table 2-3: Project component areas

Project component	Area*(ha)
Study area	1771.89
Proposed Development Footprint	1243.18
Indicative Ancillary Facilities	48.75
Indicative Substation Areas – A	15.30
Indicative Substation Areas – B	17.65
Environmental Exclusion Zone – 1	461.46
Environmental Exclusion Zone – 2	8.02
Environmental Exclusion Zone – 3	14.36
Environmental Exclusion Zone – 4	33.52
Environmental Exclusion Zone – 5	11.34

**these areas have been calculated using ArcGIS and are indicative for the purposes of undertaking this environmental assessment.*

No development would be undertaken within the environmental exclusion zones, with the exception of access provisions between the two portions of the development footprint during construction and operation, and electrical reticulation required to connect the two portions and carry electricity generated in the northern portion to the substation in the southern portion. Access tracks and reticulation will use adjacent corridors within the same area of up to 40 metres wide in total to minimise environmental impacts. These access provisions are shown as indicative locations in **Figure 2-1** and will be ground-truthed prior to construction such that the alignment avoids vegetation clearance and impacts on other areas of high environmental and cultural value such as Aboriginal heritage sites.

The extent of the development footprint and the environmental exclusion zones is a result of UPC's commitment to avoiding areas of ecological and heritage significance which is discussed further in **Chapter 3**.

2.3 Project components

2.3.1 Photovoltaic modules

The number of photovoltaic modules (solar panels) is subject to detailed design, available technology and final capacity available in the 330 kilovolt network at the time of finalising the connection agreement with TransGrid, however, based on a 400 megawatt (AC) facility and the assumption of 30 per cent oversizing (DC to AC ratio) and up to 500 watt panels (technology expected to be commonly used at the time of detailed design), it is anticipated that there will be up to approximately 800,000 photovoltaic panels installed across the development footprint. The proposed development involves the use of single axis tracking. An example of the type of photovoltaic modules, mounted on a single axis tracking system, that may be used is provided in **Photo 2-1** and **Photo 2-2**.

The photovoltaic modules would be installed on racking frames fixed onto a horizontal tracker tube, with this mounted on top of vertical piles driven or screwed into the ground, where geotechnical conditions allow; and installed in rows spaced between five and twelve metres apart. The rows of photovoltaic modules will be aligned in a north-south direction, allowing the panels to rotate from east to west during the day, tracking the sun's movement.

The photovoltaic modules have a surface area of approximately two square metres (or higher depending on technology available at the time of final design) per panel and are constructed of solar glass, which may include an anti-reflective surface treatment to maximise light absorption. When fully titled (typically up to 60 degrees), the top edge of the panels would be up to 4.3 metres high for a 2P configuration (vertical two panel configuration) (**Photo 2-1**) or up to approximately 2.5 metres high for a 1P configuration (vertical one panel configuration) (**Photo 2-2**). The leading (lower) edge of each photovoltaic module would be up to 1.2 metres from the ground (when in horizontal position) and no less than 0.3 metres (maximum tilt), allowing for sheep grazing around and underneath the photovoltaic modules.

DC cables would be strung underneath the panels, housed in cable trays, or be passed through the tracker tubes before being connected to the PCUs.

Source: *Nextracker*

Photo 2-1: Example of a photovoltaic module (2P Configuration)

Source: *Nextracker*

Photo 2-2: Example of a photovoltaic module (1P Configuration)

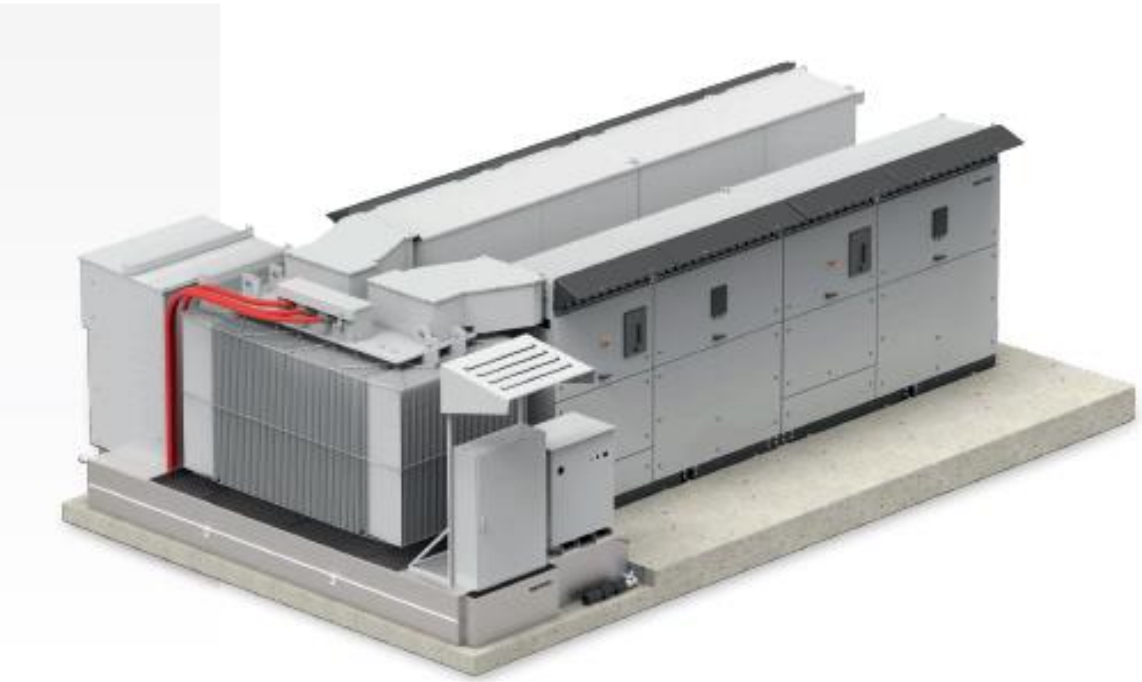
2.3.2 Power conversion units

The PCUs comprise three main components, being inverters, transformers and a ring main unit; and are designed to convert the DC electricity generated by the photovoltaic modules into AC form that is compatible with the NEM. The PCUs would also increase the voltage of the electricity from 11 kilovolt generated by the photovoltaic modules, to 33 kilovolts for transmission to the substation.

The quantity and exact dimensions of the PCUs will be determined during detailed design, however, based on a 400 megawatt (AC) facility it is anticipated that approximately 70 to 100 PCUs would be required, depending on the final design and procurement decisions made at the time of construction commencing. Assuming an outdoor solution for the PCUs as shown below, each PCU will be approximately 8 metres in length by 2.6 meters wide by 2.7 meters high.

The outdoor solution involves the PCU components being assembled on a concrete pad or footings with the inverter cabinets, transformer and switchgear being outside rather than in an enclosure. Alternative solutions for the PCUs include a containerized solution (the inverters, transformers and switchgear are housed inside a modified 20-foot or 40-foot shipping container) or a skid-mounted solution (the components are assembled on a steel platform called a skid).

An example of the type of PCU that may be used, assuming an outdoor solution is selected, is provided in **Photo 2-3**.



***Source**: Ingeteam*

Photo 2-3: Example of a power conversion unit

2.3.3 Electrical reticulation cable network

Medium voltage cables would be installed to interconnect the electricity generating infrastructure, being the PCUs, and to transport the electricity to the substation where it is injected into the grid. The medium voltage reticulation network may be installed overhead or buried underground and would have a maximum capacity of 33 kilovolt.

Because the proposed development is split into two portions (northern and southern) there is a need to gather the individual 33 kilovolt cables and then pass them (overhead or underground) through the portion in the south and into the connection point at the substation. The corridor containing the 33 kilovolt transmission lines from the northern portion would cross the main environmental exclusion zone and connect to the onsite BESS and substation.

Underground cabling would be installed with the relevant Australian Standards: *AS/NZS 3000:2018, Electrical installations* and would be at a depth of at least 600 millimetres below ground.

2.3.4 Substation

Electricity from the medium voltage electrical reticulation cable network would be increased to high voltage electricity at the substation, to match the voltage of the network at the connection point. The substation is proposed at one of two possible locations shown in **Figure 2-1**. The total area required for the substation, BESS and ancillary infrastructure would be approximately 17 hectares.

The substation would consist of an indoor switch room to house the medium voltage switchboard and circuit breakers, and an outdoor switch yard to house the transformer(s), gantries and associated infrastructure. A security fence would be installed around the substation to maintain site security and public safety.

From the substation, electricity generated by the solar farm would be injected into the NEM via the existing Wellington to Wollar 330 kilovolt transmission line owned by TransGrid, which crosses the southern boundary of the proposed site. The 330 kilovolt transmission line is shown in **Figure** 2-1.

2.3.5 Battery energy storage system

The BESS will be either a centralised 'AC Coupled' BESS adjacent to grid substation (one of two locations A or B will be chosen) or a decentralised 'DC Coupled' BESS with small BESS units connected to some or all of the PCUs distributed throughout the site.

If an AC Coupled solution is selected as the preferred option, the centralised BESS would be housed in a secure compound adjacent to the electrical substation at either location A or B as shown in **Figure 2-1**. The decentralised system would involve small enclosures/cabinets similar in size to the inverter cabinets. If an AC Coupled solution is adopted, one option is for a large building to house the inverters that would use materials similar in appearance and construction to agricultural sheds prevalent across the study area. An alternative is cabinets or shipping container style housing of the batteries as shown in the figure below.

The major components of the BESS would comprise:

- **Batteries** – most likely a lithium-ion technology type
- **Inverters** – convert the DC electricity generated by the photovoltaic modules into AC. The decentralised DC Coupled arrangement will utilise battery DC to DC converters connected to the solar inverters rather than additional battery inverters. DC to DC converters are a simplified version of an inverter missing components such as the AC to DC transformation equipment
- **Transformers** – there would be two types of transformers within the centralised AC Coupled BESS if this option is chosen: a low-voltage to medium-voltage transformer and a medium-voltage to high-voltage transformer if a separate grid connection for the BESS is required. The decentralised BESS option does not require any additional transformers
- **Heating ventilation air conditioning** (HVAC) – the HVAC would maintain the batteries at a temperature to optimise their lifetime and performance. This would include small package units and large chillers or a liquid cooling system
- **Fire protection** - active gas-based fire protection systems would be installed within the BESS enclosure. Thermal sensors and smoke/gas detectors would be installed and connected to a fire control panel.

Unless the "large shed" style option is selected for housing the AC Coupled system, the compound housing the BESS would likely comprise a modified shipping container, prefabricated switch room structures or smaller outdoor-rated cabinets. The modified shipping containers and prefabricated switch rooms would likely be mounted on concrete footings, while the cabinets would be mounted on concrete slabs. This infrastructure component would likely be in the order of 3.5 metres high. An example of what a typical centralised BESS may look like is provided in **Photo 2-4**.

Photo 2-4: Example of a centralised battery energy storage system

2.3.6 Permanent onsite ancillary infrastructure

In addition to the infrastructure described above, the project will also require:

- staff office, operations and control room, meeting facilities, amenities and carparking
- a temperature-controlled spare parts storage facility
- SCADA facilities
- a workshop and associated infrastructure.

An indicative footprint for the above infrastructure is shown in **Figure 2-1**. The specific locations for the permanent onsite ancillary infrastructure would be confirmed during detailed design of the project and would be located within the development footprint.

2.3.7 Access road network and security fencing

The project would be accessed via Blue Springs Road from the East, with two possible options for the dedicated site access point that have been assessed in this EIS. These access options are shown in **Figure 2-1**. The preferred option would be the northernmost option that utilises the existing TransGrid transmission line easement and therefore minimises vegetation clearance and property impacts. Upgrades to Blue Springs Road are not proposed for the project as assessed in the traffic and transport assessment in **Chapter 13**.

Option 1: Use of existing TransGrid easement for access from Blue Springs Road

UPC\AC has commenced consultation with TransGrid around the use of the easement for the access road and this will continue through detailed design. The EIS assesses the maximum potential impact associated with use of the easement to gain access from the public road network to the substation location "Option A", which is a distance of approximately 1.47 kilometres. If this option is selected, the existing access track through the easement would be upgraded to be suitable for construction and operations traffic and the design would be agreed in consultation with TransGrid.

Option 2: Establishment of a new access route from Blue Springs Road

The second option utilises a corridor through adjacent land to the south of the TransGrid easement and follows a route that has been developed in consultation with the landowner. The distance of this route is approximately 1.58 kilometres. Should the preferred northern option not be viable or agreed through consultation with TransGrid, or a design not being able to meet the requirements of safe access and asset protection, this southern option would be developed further through ongoing consultation with the landowner. As with Option 1, an access road suitable for construction and operations traffic would be designed and constructed in this corridor should this option be chosen.

For the purpose of the EIS a 70-metre wide corridor has been applied and assessed for both options.

In addition to the eastern access from Blue Springs Road, UPC\AC had considered the provision of a supplementary light vehicle and/or occasional access from Barneys Reef Road to the West. A crown road extends from Barneys Reef Road to the site and could in theory be used for access. After assessment of the potential risks associated with this western access road in the traffic report and during consultation with the community, UPC\AC decided that it would not use the western access route except in the event of emergencies (e.g. to gain access to the site for the purposes of fighting bushfire, for evacuation purposes etc). Importantly, this means that all construction traffic including both heavy and light vehicles will be directed to travel to site via Blue Springs Road.

Further discussion on access provisions and how they have been refined through project development is provided in **Chapter 3** and the traffic and transport assessment in **Chapter 13**.

The northern and southern portions of the development footprint would be connected via internal access roads. As discussed in **Section 2.3**, these access provisions are shown as indicative locations in **Figure 2-1** and will be ground-truthed prior to construction such that the alignment minimises vegetation clearance and impacts to other areas of high environmental and cultural value. If the chosen location for the substation is Option B, an internal access road would be required in continuity with the proposed external access track and would be constructed in accordance with the TransGrid requirements for access to operational substations. The additional distance between substation options A and B is approximately 1.07 kilometres.

Security fencing would be installed around the project boundary to restrict public access to the development footprint. The exact alignment of the security fencing would be determined in consultation with the construction contractors and landholders but will be entirely contained within the proposed development footprint. The fencing would be comprised of chain-link (or mesh) and would be up to 2.4 metres high. Where possible, fencing will be positioned to minimise disruption to ongoing agricultural operations on land adjacent to the development footprint.

2.4 Construction

2.4.1 Site preparation

Prior to commencement of construction activities, the following works would be undertaken:

- construction of access tracks for accessing site from the local road network
- installation of temporary construction fencing around work areas
- safety marking of the overhead line
- site survey to confirm infrastructure positioning and placement
- establishment of temporary construction compounds and site facilities
- establishment of laydown areas for construction materials and equipment
- construction of internal access roads and car parking
- ongoing geotechnical investigations to confirm the ground conditions
- preliminary earthworks and installation of environmental controls including erosion and sediment management structures
- identification and establishment of no-go zones around trees and vegetation to be retained.

Earthworks would be limited to the locations requiring resurfacing activities for temporary construction facilities (including laydown areas, construction compounds and carparking areas) and permanent operational infrastructure such as the substation, BESS and ancillary infrastructure. A small level pad area may need to be prepared for the PCUs depending on which specific solution is chosen in detailed design.

Minor earthworks would also be required to prepare the site for the installation of the rows of photovoltaic modules including some grading or levelling where required. The need for heavy earthworks such as grading/levelling and compaction will be minimised as much as practicable.

The extent of excavations and volume of fill required for the project would depend on the geotechnical conditions and the final locations for infrastructure. These details would be determined during detailed design of the project.

All site preparatory work would be undertaken within the development footprint, except for internal crossings and access easements.

2.4.2 Construction activities

Following site preparation, construction of the project would commence which would include:

- installation of steel piles and mounting system for the tracking system and solar panels
- securing photovoltaic modules to the mounting system
- installation of DC cabling
- installation of PCUs on concrete pads or footings
- construction of permanent site office, operations and control room, meeting facilities and amenities, spare parts storage facility, SCADA facilities and workshop
- construction of the onsite substation, TransGrid cut-in on the existing 330 kilovolt line and associated switchyard and other grid connection related infrastructure (could include an up to 30-metre high lightning protection mast)
- establishment of the BESS compound if an AC Coupled solution is adopted
- testing and commissioning of infrastructure
- removal of temporary construction facilities
- revegetation of disturbed areas.

It is expected that some of these construction tasks would occur concurrently.

2.4.3 Temporary construction ancillary facilities

Several temporary construction ancillary facilities would be required during construction. These would typically include site compounds – inclusive of site offices, car parking and amenities, and laydown areas – suitable for plant and equipment.

These temporary facilities would be located within the development footprint and would be revegetated or have photovoltaic infrastructure installed on the area once decommissioned. Whilst the temporary construction ancillary facilities could be located anywhere within the development footprint, an indicative location is provided in **Figure 2-1**.

2.4.4 Plant and equipment

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

- earthmoving machinery and equipment for site preparation
- cable trenching and laying equipment
- pile-driving equipment
- assisted material handling equipment (forklifts and cranes)
- machinery and equipment for connection infrastructure establishment and installation of the BESS
- water trucks for dust suppression.

Typical quantities of machinery and equipment required for construction of solar farms of this scale are listed in **Table 2-4**.

Table 2-4: Anticipated construction machinery and equipment

Plant	Plant
Cranes	Grader
Drum rollers	Compactor
Dump truck	Small pile driving rig
Road truck	Water truck
Concrete truck	Cable trenching and laying equipment
Excavators	Generator
Forklifts	Light vehicles

2.4.5 Transport routes and traffic movements

It is anticipated that construction materials and infrastructure would be largely transported to the study area via road from the Port of Newcastle or from the Port of Sydney. Assuming the origin is Newcastle, trucks would use the following route: Bourke Street → Hannel Street → Industrial Drive → Maitland Road → New England Highway → John Renshaw Drive → Hunter Expressway → New England Highway → Golden Highway → Ulan Road → Cope Road → Blue Springs Road.

Deliveries may also come from Sydney or the North Coast (subject to resource supplier selection and port capabilities and fees etc). Deliveries coming from Sydney are expected to use the M1 Motorway to the Hunter Expressway and then use the same route as deliveries coming from Newcastle. Deliveries from the North Coast would use the Pacific Highway to Maitland Road then use the same route as deliveries coming from Newcastle.

Heavy vehicles up to 25 metres in length would be used for transporting materials and components to site. The estimated maximum vehicle movements per day for each vehicle type during construction are shown in **Table 2-5**.

The number of light vehicle movement is based on the conservative assumption that no mini vans or shuttle buses would be used. As part of the construction traffic management plan (CTMP), the contractor may consider providing minivans for moving non-local workers to site from the more populated townships, thus reducing the number of light vehicle movements.

Table 2-5: Estimated peak vehicle movements during construction

Vehicle type	Peak movements per day
Light vehicles	230
Heavy vehicles	60
Over dimensional	20
Water trucks	10
Total	**320**

An assessment on the traffic and transport routes proposed for the project is in **Chapter 13**.

2.4.6 Construction staging, duration and hours

Construction activities would be undertaken during standard daytime construction hours consistent with the *Interim Construction Noise Guideline* (Department of Environment and Climate Change 2009) (ICNG) as follows:

- 7am to 6pm Monday to Friday
- 8am to 1pm on Saturdays
- No works on Sunday or public holidays.

Exceptions to these hours may occur on limited occasions for the delivery of large components, staff arrival/departure, or in the case of emergencies. The Secretary, Mid-Western Regional Council and surrounding landholders would be notified of any foreseeable exceptions.

The construction phase is expected to be undertaken over approximately 24 to 26 months from the commencement of site establishment works, including completion of the substation and 330 kilovolt grid connection works.

2.4.7 Construction workforce

Based on recent equivalent developments undertaken by UPC\AC, it is expected that up to 400 full-time equivalent personnel would be required during construction.

2.5 Operation and maintenance

The operational lifespan of the project would be around 30 years, unless the facility is re-powered at the end of the photovoltaic modules' operational life. Based on recent equivalent developments undertaken by UPC\AC, it is expected that approximately 10 full-time equivalent personnel would be required during operations. Activities to be undertaken during operations include:

- regular washing of the photovoltaic panels
- infrastructure and equipment maintenance and replacement as required
- site maintenance including vegetation management, weed and pest management, fence and access road maintenance and remediation of drainage channels if required
- general security and housekeeping.

Regular light vehicle access will be required throughout operations. Heavy vehicles would be required occasionally for replacing larger components of project infrastructure including inverters, transformers or components of the BESS.

UPC\AC is currently investigating with landholders the opportunity to allow sheep grazing within the array areas during operations. Should this occur, a detailed protocol would be developed to confirm biosecurity is maintained and that grazing does not impact on the safe and efficient operation of the project or result in injury to farm workers, stock or staff.

2.6 Decommissioning

Following completion of project operations, all project infrastructure would be decommissioned, and the development footprint would be returned to its pre-existing land use suitable for grazing, or another land use as agreed by the project owner and the landholder at that time.

UPC\AC or its contractors will attempt to recycle all dismantled and decommissioned infrastructure and equipment, where possible. Structures and equipment that cannot be recycled would be disposed of at an approved waste management facility. Any underground cabling below 1000 millimetres is proposed to remain in-situ following project decommissioning as this would not interfere with safe farming practices and would reduce the impact on soils during decommissioning.

Decommissioning personnel requirements are expected to be equal to or less than the construction stage of the project.

2.7 Service and utility supply arrangements

2.7.1 Water supply

Water required for construction would be preferentially sourced from:

1. commercial suppliers of treated wastewater in the nearby region
2. opportunistically sourced from farm dams located within the study area
3. sourced from town water.

Water sources would be determined in consultation with suppliers and landholders and be subject to availability. During drought conditions, it is likely that most of the water will be sourced from commercial suppliers or treated wastewater.

Water would primarily be used for dust suppression during construction and decommissioning activities and would likely be in the order of 200 kilolitres per day (the volume of approximately 10 water trucks with a capacity of 20,000 litres).

During operations, approximately five megalitres of non-potable water would be required for ongoing maintenance activities such as cleaning the photovoltaic modules (indicatively once a year) and vegetation management and for amenities and potable purposes by operational staff.

Water for maintenance activities would be sourced from water trucks, opportunistically from farm dams located in the study area, from treated wastewater if available in the nearby region; or would be sourced using town water where appropriate and available. Water used for staff amenities would be sourced from treated wastewater where available or from the town water supply.

2.7.2 Electricity

Access to electricity during construction activities would be via the local distribution network where available and via diesel generation where access to the grid is unavailable.

Electricity requirements during operation would include lighting, staff computers, domestic appliances and onsite security systems during operations. Electricity generated by the solar farm would be used for most activities during operations, except for maintaining the inverters during the night which will involve a small amount of auxiliary load being supplied from the grid.

2.7.3 Telecommunications

Telecommunication utilities are not available within the study area. As such, the cellular network would be used during construction. During operations connection to telecommunications would be via optical fibre with cellular backup.

2.7.4 Sewer

There is no sewer access at the site. Therefore, amenity facilities would be pumped out via tanker and delivered to the Gulgong sewage treatment facility, or as agreed with Mid-Western Regional Council during construction. UPC\AC or its contractors would consult with Mid-Western Regional Council prior to commencement of construction to reach an agreement.

It is likely that a septic system would be installed for the operational amenities. This would be constructed and managed in accordance with the relevant Mid-Western Regional Council requirements.

2.8 Environmental management

Chapter 20 provides a description of the proposed environmental management framework that will be implemented for the project and includes a consolidated summary of the management measures identified within this EIS. Some of these management measures will be detailed further prior to commencement of construction and/or operation.

3. STRATEGIC CONTEXT AND ALTERNATIVES

3.1 Strategic context

There are numerous State, Federal and international agreements and strategic documents that provide the context and justification for why the development of the project is justified, including:

- The 2015 UNFCCC "Paris Agreement"
- The Federal Government's Renewable Energy Target scheme
- The AEMO *2020 Integrated System Plan*
- *NSW Net Zero Plan Stage 1: 2020-2030*
- *NSW Renewable Energy Action Plan 2013* and *NSW Renewable Energy Action Plan Completion Report 2018*
- *NSW Electricity Strategy 2019*
- *NSW Electricity Infrastructure Roadmap 2020*

The proposed development is also supported by and consistent with strategic planning policies and agreements at a local level.

The context and justification for the project's need are discussed in the following sections.

3.1.1 National and international context

Paris Agreement

The Paris Agreement of 2015 came into force on 4 November 2016 and was established under the United Nations Framework Convention on Climate Change, to combat climate change and move towards a sustainable low carbon future. The key aim of the agreement is to ensure global temperature rise this century remains well below two degrees Celsius and to attempt to limit temperature increase to 1.5 degrees Celsius.

As a signatory to the Agreement, the Australian Government committed to reduce emissions to 26–28 per cent on 2005 levels by 2030. Consequently, in 2017 the Australian Government reviewed its climate change policies considering Australia's 2030 target and Paris Agreement commitments.

To contribute to achieving its revised commitments under the Paris Agreement, the Commonwealth Government proposed to double Australia's renewable energy capacity by the end of 2020, equating to over 23 per cent (33,000 gigawatt hours) of Australia's electricity supply, through the Renewable Energy Target (RET).

As a generator of renewable sourced electricity, the Stubbo Solar Farm and battery project would help contribute towards meeting Australia's commitment made under the Paris Agreement to reduce emissions by 26 to 28 per cent on 2005 levels by 2030.

Given the Paris Agreement's aim is to limit global mean temperature rise to 2 degrees Celsius above 1990 levels, more action will be required from Australia's power sector to reduce emissions. Considering several sectors of the economy (e.g. agriculture) have limited alternative technology options to reduce emissions, it is widely viewed by energy and climate change academics and independent research institutions that the electricity sector will have to completely transition to renewable energy to meet the required emissions reductions. The current Renewable Energy Target (RET) scheme only requires 23.5 per cent of Australia's electricity to be generated by renewable sources from 2020 to 2030 (Climate Change Council, 2016).

Once the project is operational, it would contribute up to 600,000 tonnes per annum in annual greenhouse gas emissions reductions and towards wider international emissions reduction goals (UPC, 2020).

Renewable Energy Target scheme

The RET is an Australian Government policy aiming to ensure that at least 33,000 gigawatt hours of Australia's electricity comes from renewable sources by 2020 (Clean Energy Council, 2018).

The RET operates in two parts:

1. the Large-scale Renewable Energy Target (LRET)
2. the Small-scale Renewable Energy Scheme (SRES).

The RET encourages the uptake of renewables through the LRET via the creation of a financial incentive for the establishment or expansion of renewable energy power stations, such as solar farms, and is therefore the part of the RET most relevant to the project. This is done by legislating demand for large-scale generation certificates (LGCs), whereby one LGC is created for each megawatt per hour of eligible renewable electricity produced by an accredited power station.

Electricity retailers and some high energy users are required under the LRET to acquire a fixed proportion of their electricity from renewable sources. Liable parties can purchase the LGCs from eligible power stations and surrender them to the Clean Energy Regulator to demonstrate compliance with the annual targets of the RET scheme (Australian Government Department of Industry, 2020) (Clean Energy Council, 2018). Revenue earned by the power station generated by the sale of LGCs to these high energy users is in addition to revenue generated by the sale of the electricity (Australian Government Department of Industry, 2020).

There have been several reviews and updates of the RET and associated legislation, including a reduction from the previously legislated 41,000-gigawatt hours to the current 33,000-gigawatt hours. As of September 2019, the Clean Energy Regulator announced that Australia had met the LRET more than a year ahead of schedule, however, the scheme will continue to require electricity retailers and high energy users to meet obligations under the policy until 2030 (Clean Energy Council, 2018).

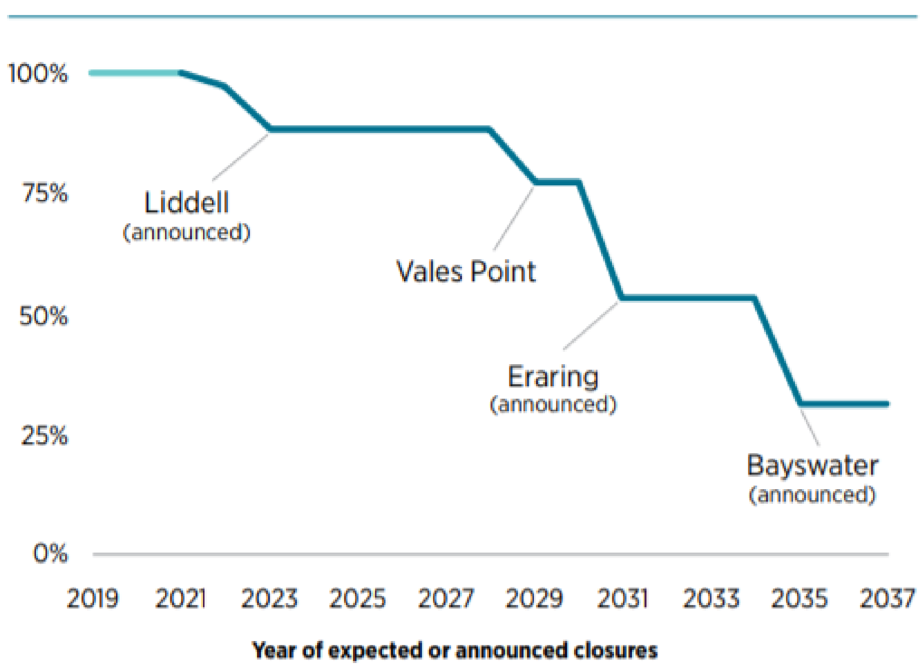
Corporates such as Woolworths, Coles, Aldi, Telstra, Amazon, Mars, Carlton United and others are also choosing to voluntarily procure renewable energy and LGCs to cover their entire electricity needs, irrespective of the RET obligation. Hence, there is a growing demand for green energy and the associated LGCs for these corporate "offtakes" or power purchasing agreements ("PPAs").

The project would generate approximately 400 megawatts of electricity annually, which would contribute to assisting the RET through the generation of approximately 1 LGC for every megawatt hour (MWh) of electricity generated by the project via the LRET scheme. Indicatively, a 400MW solar farm would generate around 1 million LGCs per annum.

3.1.2 Energy market considerations

Closure of coal-fired generators

Several major energy generators in NSW will reach the end of their lifespan and are scheduled to be retired in the coming decades. As shown in **Figure 3-1**, four out of the five operating coal-fired generators in the State are scheduled for retirement by 2035, beginning with Liddell Power Station in 2022 to 2023 (DPIE, 2019a). By 2043, all five coal-fired generators operating are expected to retire (DPIE, 2019b)



Source*: DPIE (2019), NSW Electricity Strategy, available at:*
https://energy.nsw.gov.au/media/1926/download

Figure 3-1: Schedule of coal-fired power generator closure

It is noted that modelling undertaken by the Australian Energy Market Operation (AEMO) in 2018 and presented in the *2018 Electricity Statement of Opportunities* report, indicates that additional investment will be required to replace retiring capacity in Australia, and that targeted actions will be required to provide additional capacity during the peak summer periods to reduce risks of supply interruptions (AEMO, 2018).

The modelling undertaken by AEMO as part of the *2019 Electricity Statement of Opportunities* report, reaffirms the message of the 2018 report that additional investment will be required ahead of time to replace the retiring generators (AEMO, 2019). Underlying energy consumption is expected continue to increase as the population and economy increases, in part due to the electrification of transport which is expected to further increase consumption when electric vehicles are likely to become cost-competitive with other transport alternatives (AEMO, 2018). The 2019 report notes that the electrification of transport is expected to result in a material increase in electricity consumption from 2028-2029, with an associated rise in unserved energy from this period.

Updated modelling undertaken by AEMO in 2019 predicts risks to the energy supply in the short term (2019-2020) in Victoria, with the unplanned outages of two of its major power stations posing a risk of insufficient supply that may lead to involuntary load shedding in peak summer periods (AEMO, 2019). However, in NSW following the gradual closure of Liddell Power Station, high summer demand combined with unplanned generator outages will lead to a risk of significant supply gaps and involuntary load shedding if no actions are taken. This includes the risk that between 135,000 and 770,000 households in the State may be without power for three hours during an extreme heat event (that is, a one in 10-year peak demand event). AEMO noted that the operation of Snowy 2.0 will improve the reliability outlook provided the necessary transmission is constructed to distribute the energy to Sydney and Melbourne (AEMO, 2019).

As a result of the capacity differences of relative technologies, approximately 2-3 megawatts of wind and solar generation is required for every megawatt of coal-fired electricity generation, indicating the need for more wind and solar plants to replace coal-fired generators. AEMO notes that the emerging reliability gap in the near term could be closed by a number of resources including utility-scale renewable generation (AEMO, 2018).

In the *2019 Electricity Statement of Opportunities* report, AEMO identifies several actions needed to avoid consumer exposure to the risk of involuntary risk of load shedding during the peak summer periods. One of these actions involves the provision of new dispatchable supply of approximately 215 megawatts to ensure NSW only has a one in 10-year risk of significant involuntary load shed in the 2023-2024 summer period following the closure of Liddell Power Station. The combination of solar photovoltaic and a battery facility such as proposed for the project is one such dispatchable technology (assuming a 400 megawatt hour BESS it would provide 100 megawatts of dispatchable electricity supply for 4 hours).

2020 Integrated System Plan

The *2020 Integrated System Plan* (2020 ISP) (published 30 July 2020) is the second ISP prepared by the Australian Energy Market Operator (AEMO). Its preparation commenced after the first ISP was released in 2018. The first ISP has guided governments, industry and consumers on the investments that are needed to achieve an affordable, secure and reliable energy future, while still meeting required emissions trajectories. The process for actionable ISP projects were triggered by the first ISP, while the 2020 ISP responds to the latest technology and developments policy, system and economy (AEMO, 2020).

The 2020 ISP provides a roadmap for the power system of eastern Australia to optimise consumer benefits while it transitions through a period of uncertainty, and aims to:

> *"minimise costs and the risk of events that can adversely impact future power costs and consumer prices, while also maintaining the reliability and security of the power system"* (AEMO, 2020).

The ISP has a 20-year planning horizon, which means the current ISP aims to guide the National Electricity Market (NEM) through the energy transition. As the market operator, AEMO is the key government entity responsible for ensuring the efficient, affordable and reliable supply of electricity for households and businesses into the future.

The modelling undertaken for the 2020 ISP confirms that the least cost and least regret transition of the NEM is from a system dominated by coal-fired generation, to a diverse mix of behind the meter and grid scale renewable energy supported by firming resources and enhanced grid and service capabilities to ensure security of the power system (AEMO, 2020).

To achieve the transition, the ISP modelled several scenarios to transition by 2040, demonstrating that over 26 gigawatts of new grid scale renewables is needed in all but the 'Slow Change' scenario, to replace approximately 63 per cent (equating to approximately 15 gigawatts) of Australia's coal fired generation that will reach the end of its operational life by 2040 and is expected to retire. Much of these 26 gigawatts will be built in REZs.

The *Integrated System Plan Consultation 2017* defines REZs as areas where clusters of large-scale renewable energy can be developed to promote economies of scale in higher-resource available areas and capture a diversity of technological and geographical renewable resources (AEMO, 2017).

The 2020 ISP states that by 2040 the transmission grid will need to be augmented to balance resources and unlock new REZs, and that strategically placed interconnectors and REZs (combined with energy storage) will be the most cost-effective way to supply capacity and balance resources across the NEM. The 2020 ISP prioritises REZ developments in three overlapping phases, with the first phase being development to help meet regional renewable energy targets and other policies, or areas where there is already good access to existing network capacity with good system strength. Variable renewable energy development in Central-West Orana REZ (CWO REZ), where the project would be located, has been identified as part of this first-priority phase.

The 2020 ISP also identifies several actionable ISP projects, with one being the Central-West Orana REZ Transmission Link, involving network augmentation to support the development of the CWO REZ. This link would transfer capacity between the CWO REZ and major load centres in NSW and is due to be completed in 2024-2025 (AEMO, 2020). Given that the Stubbo solar farm and battery project is right in the CWO REZ, which is chosen by AEMO as an actionable project, this highlights the appropriate choice of location and alignment with the market operator's thinking of where new generation capacity is likely to be located.

REZs proposed in NSW, including the CWO REZ are discussed further in **Section 3.1.3**.

National Electricity Market system security and reliability

Security of supply

The project would contribute to security of the NEM through the generation of additional electricity before it is needed to meet demand, thereby helping to avoid a shortfall that is currently expected in NSW following the closure of the existing coal-fired generators. Due to the long lead times in the development of a project, investment in energy is needed several years before retirement of existing energy generators.

After the retirement of the Liddell Power Station (currently generating 450 megawatts) in 2023 the remaining four coal-fired generators in NSW expected to retire by 2043 include:

- Vales Point Power Station (generating 1,320 megawatts) in 2029
- Eraring Power Station (generating 2,880 megawatts) in 2031
- Bayswater Power Station (2,640 megawatts) in 2035
- Mount Piper Power Station (1,400 megawatts) in 2043.

As noted above, modelling undertaken by AEMO in 2019 predicts that there will be reliability risks in NSW following the gradual closure of Liddell Power Station if no actions are taken. This includes the risk that between 135,000 and 770,000 households in the State may be without power for three hours during an extreme heat event (that is, a 1 in 10 year peak demand event) (AEMO, 2019). If approved in the first half of 2021, the project would be expected to commence construction in the second half of 2021 and come online approx. two years later in late 2023.

The project would connect directly to the existing Wellington to Wollar 330 kilovolt transmission line (line 79) via a substation which would be constructed as part of the project. The transmission line is owned and operated by TransGrid and connects to the existing Wollar Substation, that connects to the 500 kilovolt transmission network forming the backbone of the NSW system and allows for the project's output to be transported to meet loads across the NEM. The project would therefore contribute to the security and reliability of the electricity system in the NEM.

System security and reliability through storage

The project may incorporate a BESS of up to 200 megawatts (AC) of energy storage capacity. Three capacity options would be considered during the detailed design including:

- 50 megawatts and four megawatt-hours of usable energy capacity
- 100 megawatts and two megawatt-hours of usable energy capacity
- 200 megawatts and one megawatt-hour of usable energy capacity.

While the final size of the BESS for the project would be dependent on a range of commercial and design-related considerations, even a relatively small-scale BESS can contribute to system security and reliability, for example through the provision of frequency control ancillary services (FCAS), reactive power support or by firming the active power output of the project.

The introduction of grid connected battery systems in South Australia has shown that utility scale BESS projects can lower the cost of provision of these services to consumers. In the longer term, there is the potential for a BESS to provide fast frequency response and/or synthetic inertia services if a market for these services emerges in the NEM. UPC\AC is considering the use of grid-forming inverters as part of the BESS which enables the BESS to operate as a virtual synchronous generator, supporting system strength, unlike standard wind and solar farm generators which use grid-following inverters.

If constructed, a BESS would hence contribute to the demonstration of how the reliability of utility-scale renewable energy generation and its role in supporting a stable energy system can be enhanced with storage.

In October 2020, AEMO requested submissions for non-network options to support the optimum solution for the augmentation of the existing 330 kilovolt network across the CWO REZ. UPC\AC provided a submission and indicated that the project was ideally placed within the REZ and its development timing was well aligned with the REZ transmission timing.

UPC\AC noted that the proposed BESS, while it would help alleviate congestion and system strength issues on the 132 and 330 kilovolt network in the CWO region, is not seen as a substitute for the significant transmission upgrades envisaged by the NSW Government and the ISP. Rather, UPC\AC sees the role of the proposed BESS as being complementary to the new transmission investment needed in order to unlock several gigawatts of new renewable energy generation in the region.

Generator performance standards

Any major generator proposed to connect to the NEM must submit a connection application with the relevant network service provider under chapter 5 of the National Electricity Law (NEL), which is assessed by AEMO and TransGrid in the case of the proposed development. Part of the requirements of the NEL are that the generator must satisfy a range of safety, reliability and security standards, the generator performance standards, which include the following:

- the reactive power capability of a generating system at its connection point, which assists in the maintenance of a suitable power system voltage profile
- the quality of the electricity generated by a generating system at its connection point that can have a detrimental effect on other network users
- the response of the generator to frequency disturbances at the connection point and the conditions for which the generator will/will not remain connected
- the response of the generator to voltage disturbances at the connection point and the conditions for which the generator will/will not remain connected

- the response of the generating system to all disturbances, including network faults, and credible contingency events
- the quality of supply with respect to voltage fluctuations, harmonic voltage distortion and voltage unbalance at the connection point for which a generating system is required to remain connected
- the performance of protection systems and frequency control systems
- the impact of the generating system on inter-regional, and intra-regional transfer capability
- the performance of the voltage control system, and the ability of the generating system to increase or decrease its reactive power output in response to a power system incident
- the ability of a generating system to increase or decrease its active power transfer in response to a dispatch instruction from AEMO.

UPC\AC confirms that it has assessed the performance of the proposed project against all the relevant GPS as part of its application to connect to the network. The project would only obtain an offer to connect if it can be demonstrated that it is able to satisfy the requirements of the NEL with respect to the GPS.

In addition, there is a need to demonstrate that the project would not adversely impact on system strength, which involves the completion of an impact assessment. The final sign off of the GPS and system strength assessment will be undertaken by TransGrid and AEMO as the relevant authorities responsible for matters of system reliability, safety and security.

Compliance with the NEL and TransGrid and AEMO's requirements would ensure the project would meet the relevant requirements for safe, reliable and secure connection to the electricity system.

3.1.3 NSW context

NSW Net Zero Plan Stage 1:2020-2030

The NSW Government has an objective to achieve net zero emissions by 2050. The NSW *Net Zero Plan Stage 1: 2020-2030* outlines the actions the NSW Government will take over the next decade to contribute to meeting this objective. The plan focuses on the period of 2020 to 2030 due to rapid changes in technology causing difficulties in identifying the lowest cost path to net zero. As a result, the second and third decades of the net zero path will be developed in the lead up to those decades (DPIE, 2020).

The plan identifies that there is an increasing and maturing global demand for low emissions products, and that as this demand grows, low emissions technologies continue to come down in cost. An example of this is the cost of solar generation which has fallen by more than 73 per cent since 2010. The plan states that these reducing costs present opportunities for economic growth, jobs, globally competitive businesses and exports. These are presented in two forms:

1. job opportunities associated with the deployment of the technologies (e.g. solar panels), as manufacturing and deployment of these technologies can now be undertaken at significantly lower costs than traditional electricity generators. The plan states that NSW needs to take advantage of these opportunities to avoid renewables being constructed in other states at the expense of regional communities in NSW.
2. economic opportunities for businesses that make use of these technologies, for example businesses that have already reduced costs by installing rooftop solar. In addition, renewables are lowering wholesale electricity costs in the middle of the day, creating opportunities for businesses that can shift their demand to times of lower prices.

The plan sets out four priority areas for development over the next decade. One of these priority areas involves driving the uptake of proven emissions reduction technologies that grow the economy, create new jobs or reduce the cost of living.

The NSW Government's priority for this area is to provide a pathway to deploy these technologies at scale over the next decade. The plan notes that the national electricity system is undergoing a period of change with the retirement of existing power stations and introduction of new forms of generation, and that the NSW Government is committed to ensuring the provision of reliable and affordable electricity during this time, while also protecting the environment.

To achieve this, the NSW and Commonwealth Government are fast-tracking the delivery of the first NSW REZ, with the CWO REZ being the first priority as the "pilot REZ". The three REZs (also including the New England REZ and the South-West REZ) will play a critical role in replacing retiring generators in NSW and generating up to 17,700 megawatts of cheaper and renewable power to the NEM. The REZs are also expected to drive up to $23 billion of private sector investment and create approximately 2000 construction jobs per year in regional NSW (DPIE, 2020).

NSW Renewable Energy Action Plan 2013 and Completion Report 2018

The *NSW Renewable Energy Action Plan 2013* outlines a vision of increasing generation, storage and use of renewable energy in NSW. The plan includes 24 actions under three core goals to encourage private sector investment in new technologies and secure a reliable, affordable and clean energy future in NSW (NSW Government, 2018). These core goals comprise:

1. attract renewable energy investment
2. build community support for renewable energy
3. attract and grow expertise in renewable energy.

The *NSW Renewable Energy Action Plan Completion Report* identified that all 24 actions have now been completed. However, the report states that the NSW Government continues to promote the renewables boom. A total of 14 new wind and solar farms have been built in NSW with a capacity of more than 1,100 megawatts, supporting about $2.8 billion of investment in NSW and jobs in regional communities.

NSW Electricity Strategy 2019

In November 2019, the NSW Government released the NSW Electricity Strategy (NES), which aims to address key challenges in providing:

"a reliable, affordable and sustainable electricity future that supports a growing economy".

The strategy will support approximately $8 billion of private investment in the NSW electricity system over a 10-year period (including $5.6 billion in regional NSW), and is expected to generate 1,200 jobs, mostly in regional NSW. To achieve this, the NES proposes several measures to improve the efficiency and competitiveness of the NSW electricity market, including the delivery of three REZs in NSW as discussed previously. The NES aligns closely with the *NSW Net Zero Plan Stage 1:2020-2030*.

The NES discusses the *NSW Transmission Infrastructure Strategy*, which is the NSW Government's plan to unlock private sector investment in priority energy projects. The strategy has three aims, with one of those being to increase NSW's energy capacity through prioritising REZs in the Central-West, South West and New England areas of NSW, which will bring diversity to the State's energy mix and expand its transmission capabilities (DPIE, 2019b).

The NES sets out 10 actions to secure the State's electricity future, with a preference for the market to deliver investment required to ensure reliable and affordable energy. The action most relevant to the project is 'Action 4: Rolling out NSW Renewable Energy Zones'.

As part of this action, the NSW Government has committed to supporting transmission upgrades for a 3,000 megawatts pilot REZ in the Central-West (i.e. the CWO REZ), with a view to use the delivery model to inform the development of other REZs (DPIE, 2019a).

Together, the NSW Government and the Federal Government entered into a Memorandum of understanding in November 2019 and agreed on the provision of joint funding for the delivery of the CWO REZ as NSW's first renewable energy zone, with this expected to commence in 2022. The NSW Government alone has committed over $40m to the development of the CWO REZ.

The NES also identified that developing the three REZs is expected to reduce average annual electricity bills in NSW by approximately $40 and support $23 bn of investment in regional areas.

The project would be located within the CWO REZ, supplying approximately 400 megawatts (0.4 gigawatts) to the NEM and contributing towards the targeted 3,000 megawatts for the CWO REZ as identified in the NES.

NSW Electricity Infrastructure Roadmap 2020

On 9 November 2020 the NSW Government announced its Electricity Infrastructure Roadmap which outlined a number of new policy measures to drive the transition of the state's electricity sector to a system underpinned by wind and solar power, backed up by pumped hydro, batteries and gas peaking. At the time of writing, the Electricity Infrastructure Investment Bill 2020 had passed the Legislative Assembly and was being discussed in the Legislative Council. If passed into law, the Bill will implement in NSW legislation a number of measures which further encourage investment in renewable energy generation projects in NSW, in particular renewables combined with storage and specifically located in renewable energy zones including in the CWO REZ. This includes:

1. A wholesale power price underwriting mechanism called the Infrastructure Safeguard Scheme. This would ensure that projects located in designated REZs such as Stubbo would be able to sell power into the wholesale market at a minimum price guaranteed by the NSW Government.
2. An availability payment for long duration (8 hours) storage projects located in designated REZs (this is specifically suited to pumped hydro projects in particular).
3. A contract for "firming" of renewable energy output provided by batteries, under Long Term Energy Services Agreements. These contracts would be entered into by the State if modelling suggests reliability standards under the Energy Security Target will be breached (e.g. as a result of coal plant retirements). The contracts are to be tendered for via a competitive process by the Consumer Trustee, an entity to be established by the State.
4. Measures to deliver the REZ transmission infrastructure, including making declarations under the Act that a proposed line is a "declared REZ transmission line" and triggering the Independent Regulator to assess the level of cost recovery from consumers to fund the line. Access arrangements will also be developed for secure rights to connect to and evacuate power through the REZ transmission infrastructure.

The NSW Government is anticipated to release information on the proposed transmission infrastructure for the CWO REZ before the end of 2020, highlighting the strong focus on renewables development in the region and the ideal location of Stubbo solar farm and battery project in this respect.

3.1.4 Local and regional context

Central West and Orana Regional Plan 2036

The Central West and Orana region's population is expected to increase to more than 300,000 people by 2036. Most of that population growth will be centred in the regional cities such as such as Dubbo, Mudgee and Orange, with these cities providing new opportunities for surrounding networks of communities (NSW Government, 2017).

The Central West and Orana Regional Plan will guide NSW Government's land use planning priorities and decisions for the region until 2036 and provides an overarching framework to guide more detailed land uses plans, development proposals and infrastructure funding decisions. An accompanying Implementation Plan outlines priority actions and medium-term and longer-term actions to align with population and economic change in the region (NSW Government, 2017).

The plan notes that the two areas of Central West and Orana function in different ways however create a resilient and dynamic and resilient region when brought together. The Orana region, where the project is located, includes some of the most productive agricultural areas in NSW. The plan identifies that infrastructure improvements will strengthen the supply chain with markets both across Australia and internationally.

The plan's vision is for the Central West and Orana region to be:

"the most diverse regional economy in NSW with a vibrant network of centres leveraging the opportunities of being at the heart of NSW" (NSW Government, 2017).

The plan outlines four goals to contribute to this vision, each with several directions:

1. The most diverse regional economy in NSW
2. A stronger, healthier environment and diverse heritage
3. Quality freight, transport and infrastructure works
4. Dynamic, vibrant and healthy communities.

The first goal, to be the most diverse regional economy in NSW is most relevant, with the project aligning with Direction 9: Increase renewable generation.

The plan notes that growth in renewable energy in the region (particularly wind, solar and bioenergy) will promote local jobs in smaller communities and development opportunities for associated industries. The plan identifies the Orana region (where the project is located) as being most suited to solar generation due to the access that can be provided by its large open plains.

Our Place 2040 - Mid-Western Regional Local Strategic Planning Statement

The *Mid-Western Regional Local Strategic Planning Statement* (LSPS) lays out the vision for land use planning in the Mid-Western Regional Council local government area over the next 20 years. It does this through land use planning priorities and short, medium and long term actions, along with the means for monitoring and reporting on the delivery of the actions (Mid-Western Regional Council, 2020). The LSPS aligns with the *Central West and Orana Regional Plan 2036*, in implementing those actions identified in the plan at a local level.

Mid-Western Regional Council has identified 12 planning priorities to guide the future strategic planning work in the region. Planning Priority 7, to '*support the attraction and retention of a diverse range of businesses and industries*' includes a land use action of considering renewable energy development in appropriate areas that avoids impacts of scenic rural landscapes and preserves valuable agricultural land.

The project aligns with this priority as it involves renewable energy development in a 'primary production' land use zone. **Chapter 10** provides an assessment of the project's compatibility with the existing land use, whilst **Chapter 11** considers the existing landscape character and visual amenity impacts of the project. The project could be undertaken whilst maintaining the core landscape character of the area and would have a minimal visual impact on the surrounding visual landscape.

Mid-Western Regional Development Control Plan 2013

The *Mid-Western Regional Development Control Plan 2013* (the DCP) compliments the *Mid-Western Regional Local Environmental Plan 2012* (the LEP) and provides detailed requirements to guide development in the Mid-Western Regional Council LGA. The DCP was adopted by Mid-Western Regional Council on 6 February 2013 and commenced operation on 11 February 2013. Amendment 4 to the plan was adopted on the 19 June 2019 and commenced operation on 21 June 2019.

Section 6.5 of the DCP applies specially to solar farms. The objectives for solar energy farms stated in this section are as follows:

- *To minimise potential land use conflicts;*
- *To ensure that there is no unreasonable interference with the comfort or response of adjoining land users;*
- *To ensure that impacts on agricultural land, businesses and tourism are appropriately considered;*
- *To ensure road access, visual impacts, noise, health, waste, construction management and environmental constraints are identified and sufficient information is included with each development application to enable proper assessment; and*
- *To ensure that adequate provisions are made to restore developed land at the end of the life of the development*.

A Land Use Conflict Risk Assessment (LUCRA) has been undertaken for the project in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide* and is included in **Appendix E***.* Eight high risks were identified following the application of risk reduction controls. These primarily related to the temporary removal of agricultural land, amenity changes and safety risks. Performance targets have been proposed to address these potential land use conflicts.

Impacts to agricultural land have been considered in **Chapter 10**. There have been numerous refinements to the study area, development footprint, and layout of infrastructure, in order to minimise impacts to identified environmental constraints, disturbance to existing agricultural operations and impacts to neighbouring residences, and in response to stakeholder engagement, particularly with local landholders. Once the project has reached the end of its operational life, all project infrastructure would be decommissioned and removed, and the study area would be returned to its pre-existing land use, suitable for grazing of sheep and/or cattle, or another land use as agreed by the project owner and the landholder at that time.

Other environmental constraints including transport, visual, noise, health (hazards and risks), and waste have been assessed for the project in **Chapter 6** to **Chapter 19**.

3.2 Project options and alternatives considered

3.2.1 'Do nothing'

The 'do nothing' option represents the option of not developing a solar farm and battery project, and not investing in other renewable projects. This option would avoid all the impacts of the project as described in this EIS, however, would also not deliver the potential benefits of the project. The benefits that would not be delivered include:

- a renewable energy development that would align with NSW and Federal strategic direction on emissions reduction including emissions reduction targets
- development within the first REZ in NSW, supplying approximately 400 megawatts (0.4 GW) to the NEM, and contributing to the targeted 3,000 megawatts for the CWO REZ as identified in the NES
- providing additional electricity generation that is required to replace retiring coal plant capacity in the NEM to reduce risks of supply interruptions, with the expected closure of all five coal-fired electricity generators operating in NSW by 2043
- direct and indirect economic benefits to local communities in regional NSW, through employment opportunities, increased spending in local communities as a result of the project workers during construction and operation, community benefit programs and lease payments to landholders
- broader community benefits as a result of the project making funding available during its operational life – e.g. for supporting local education and training programs and public infrastructure upgrades.

This option would not achieve the above benefits or contribute to the project objectives outlined in **Section 1.4** so was not progressed.

3.2.2 Invest in other renewable projects

This option would involve investing in other renewable projects elsewhere in NSW or Australia, instead of investing in the proposed project at Stubbo.

Depending on the alternative locations, this option would deliver some of the project benefits discussed above as it may still allow for a renewable development that aligns with NSW and Federal strategic direction on emissions reduction and shoring up electricity supply.

The main reason for selecting the location at Stubbo is firstly, that its location in the first REZ in NSW is highly aligned with the State's strategic policy direction for the electricity sector. The alternatives, such as in the far West of NSW or the Riverina for example do not have adequate grid capacity for a project of the required size. Other locations further afield in the NEM, for example Queensland or North West Victoria, are also experiencing significant network issues.

As articulated through feedback from several local community members at the drop in session held in Gulgong prior to lodgement of the EIS, the proposed site is relatively uncontroversial from a community perspective because of its very limited visibility from surrounding roads and residences when compared with other recent solar farm developments proposed near Gulgong.

Going elsewhere to find an alternative site would not allow for the associated economic or social benefits to be reaped by the local communities around the Central West including the towns of Gulgong, Dunedoo, Birriwa, Mudgee and surrounds, most notably the job opportunities and direct funding for community-led initiatives.

3.2.3 Alternative technology

This option would involve the development of an alternative technology either within the same location as the project, or an alternate site.

The *NSW Renewable Energy Action Plan* states that the State has an abundance of renewable energy sources. While hydroelectricity (from the Snowy Mountains hydroelectricity scheme) comprises the largest portion of renewable energy generation, renewable energy from other sources (e.g. small-scale hydro, solar, bioenergy and wind) increased by 43 per cent between 2010 and 2011 and by another eight per cent between 2011 and 2012 (NSW Government, 2013). The Completion Report also identified around 40,000 megawatts of proposed solar, wind and hydro projects looking to connect to the grid as of 2018 (NSW Government, 2018).

However, while Australia has an abundance of renewable energy sources, alternative power generation options are economically limited from a private investment standpoint, with solar power generation, along with wind, becoming the cheapest forms of new build electricity in Australia, and private investment in the renewables sector is strong (NSW Government, 2018).

When the *NSW Renewable Energy Action Plan* was released in 2013 there were no operational large-scale solar farms in NSW, however there have been several waves of solar development since then, with the market currently driving a third wave of solar farms without grant funding, and solar is a low-cost option for new electricity generation (NSW Government, 2018).

Since the site is not suited for a wind farm, given the limited wind resource and relative proximity to Gulgong (wind turbines would be visible from residences in Gulgong due to their height), a solar farm development was therefore determined to be the preferred technology, so the option of an alternative technology was not progressed.

3.2.4 Alternative locations and components

This option would involve developing a solar farm in an alternative location, but assuming that the Central West of NSW is a suitable location for the various reasons discussed above.

As part of the site identification process, UPC\AC considered several alternative locations, including investigating sites further away from the transmission network at Wollar. While there is plenty of flat, cleared land to the North West e.g. towards Coonamble, with relatively few residences, the transmission network is very weak and does not allow for a sizeable project at all. A single Essential Energy 66 kilovolt line connects Coonamble to Dubbo; the line connecting Coonabarabran to Beryl substation West of Gulgong is also an Essential Energy 66 kilovolt line. Neither of these lines would be able to accommodate anything other than a small project and it is questionable whether the State's CWO REZ plan will include developments that far afield. Put simply, if the several 1000s of megawatt of coal plants are to be replaced in the coming decade, this will require large scale renewable energy projects such as Stubbo Solar Farm; it will not be achievable with fringe-of-grid smaller projects.

The proposed site was hence selected largely due to the following reasons:

- proximity to existing electricity transmission infrastructure (330 kilovolt line) with capacity to evacuate the energy generated by the solar farm into the grid
- available and suitable land for a project of a big enough size to justify the connection costs (roughly speaking, a 400 megawatt project is appropriate for the 330 kilovolt connection)
- relatively few environmental constraints at the site when compared to alternatives
- existing rural land uses surrounding the site and low density of surrounding dwellings
- willingness of landholders to be involved.

As discussed in **Section 3.1.4**, the *Central West and Orana Regional Plan* identifies region as being most suited to solar generation due to the access that can be provided by its large open plains. (NSW Government, 2017). Further justification behind site selection for the project is presented in **Section 3.3**.

3.3 Site selection and justification

The site selection process identified the Stubbo area because it is:

- close to the existing transmission network
- relatively flat/not too undulating
- away from the existing coal mines to the East and the nearby National Parks
- not too close to townships such as Gulgong.

The existing rural nature of the area is favourable as it results in a low density of dwellings, which minimises the number of surrounding dwellings that may be impacted by the project. In addition, the nearest town centre, of Gulgong, is approximately 10 kilometres south of the study area. Residents of Gulgong and surrounding areas can therefore benefit economically as a result of the project without the associated impacts on the township.

Furthermore, given the location of the study area within the CWO REZ it is clear that the proposed development is highly consistent with the NSW Government's plans for development in the wider region and already consistent with the emerging land use for renewable energy generation.

Other existing and planned solar developments in the area include the Beryl Solar Farm (located approximately 10 kilometres from the study area in Gulgong and operational since June 2019), Wollar Solar Farm (located approximately 33 kilometres south-east of the study area and approved February 2020), and Dunedoo Solar Farm (located approximately 28 kilometres from the study area, not yet approved). There are additional solar developments near Wellington. However, while there are numerous renewable developments either in planning or having been recently approved, there is only one solar development within 20 kilometres of the study area, indicating the capacity of the local area to accommodate further solar generation.

It was important to select a site location that was close to existing electrical infrastructure with enough capacity to avoid the need to provide transmission infrastructure to transport the generated solar energy to the NEM. The study area was chosen largely as a result of the willingness of the involved landholders to become part of the project.

The selected site also facilitates connection to the existing electricity network via a cut-in on the existing TransGrid Wellington to Wollar 330 kilovolt line which passes through the study area, and eventually connects to the existing Wollar Substation, with enough capacity to accommodate the energy proposed to be generated by the project.

As discussed in **Section 3.2.4**, a number of alternative locations were considered by UPC\AC for the project, however, many of these locations were either too far from suitable transmission infrastructure or limited due to the topography, protected vegetation, existing land uses or suitable from a construction point of view without the need for extensive earthworks.

The topography of the study area, whilst not perfectly flat, is suited for solar photovoltaic power generation, comprising a generally gently undulating area. As discussed in **Section 3.1.4**, the Central West and Orana Regional Plan identifies the region as being most suited to solar generation due to the access that can be provided by its large open plains (NSW Government, 2017).

The study area primarily consists of cleared agricultural land used for livestock grazing and intermittent cropping. As a result, the area has limited remnant native vegetation in the form of scattered trees, vegetation along riparian corridors and isolated areas of remnant vegetation. The environmental exclusion zones within the development footprint avoid many of the higher value patches of remnant vegetation.

3.4 Project refinement

Since the scoping report was issued to DPIE in April 2020, there have been numerous refinements to the study area, development footprint, and layout of infrastructure. These project refinements have been undertaken following ongoing consultation with landowners, in response to the findings of ongoing environmental assessments for the EIS; and in response to community feedback during the preparation of the EIS. Refinements have sought to:

- minimise vegetation clearance, particularly isolated areas of intact vegetation along waterways or other patches of vegetation of higher environmental value
- minimise disturbance of several minor waterways that traverse the site
- minimise the extent of ground disturbance required for temporary and permanent infrastructure
- avoid areas containing identified Aboriginal heritage items and minimise disturbance of areas that have the potential to contain further unidentified items or sensitive landscapes
- include an additional land parcel on the northern side of the footprint, which provides increased flexibility within the development footprint to avoid/exclude areas of environmental significance, whilst maximising the electricity generation potential of the infrastructure of the available development footprint
- minimise impacts to neighbouring residences
- minimise disturbance to agricultural operations
- minimise potential traffic impacts to local roads during construction.

A summary of refinements to the study area and development footprint is presented in **Table 3-1** and shown in **Figure 3-2**:.

Table 3-1: Stages of project refinement

Refinements since Scoping Report	Change	Key reasons for refinement
Increase in study area through inclusion of additional lots to the north	Increase from 1,485 ha to 1772 ha	Additional northern land parcel provides flexibility to minimise impacts across the development footprint. In particular, it allows for the increased area of the environmental exclusion zones while maintaining the targeted generation capacity of 400 MW
Increase in size of environmental exclusion zones	Total of 528.7 ha of environmental exclusion zones have been included	• Avoid or minimise impacts of the development in the areas of highest environmental value associated with watercourses and riparian vegetation • Protection of individual and isolated patches of vegetation close to the boundary of the study area in various locations • Avoid identified aboriginal heritage sites located in and around riparian corridors

Refinements since Scoping Report	Change	Key reasons for refinement
Changes to proposed site access routes	Previously proposed access from Barneys Reef Road changed to emergency access only, with construction and operational traffic to access site via the eastern access point off Blue Springs Road	• Avoids all heavy vehicle construction traffic movements from passing close to Gulgong town • Limit potential traffic impacts resulting from heavy vehicles on the local road network, by using a clearly defined access route during construction • Respond to community concern regarding traffic generation and location of proposed access point on Barneys Reef Road
Changes to proposed site entrance options	Identification of an additional option for site access from Blue Springs Road (TransGrid easement)	• Use of the existing TransGrid easement would avoid the need for further tree clearing for the main site access point
Changes to internal road crossings	Realignment to proposed route for internal crossing between north and south portion of site	• Avoids identified environmental and land use conflicts • Addresses landholder preferences
Inclusion of a temporary site compound and laydown area	Laydown area and site compound location added in south-east corner of proposed development footprint	• Site compound and laydown area required during construction for safe and efficient movement of deliveries in and out of site and to provide facilities for onsite construction workforce

As discussed in **Section 3.3**, UPC\AC has sought to avoid environmental constraints and impacts on surrounding land uses and sensitive receivers through the development of the project, including before and after lodgement of the Scoping Report. This has resulted in refinement of the development footprint and project layout, and a number of changes being made, including in particular the development of several environmental exclusion zones. The key environmental constraints within the study area are shown on **Figure 3-3**:.

This process of refinement has been undertaken through consultation with regulatory stakeholders, landholders, neighbouring residents, and the local community, involving:

- desktop studies, site inspections, and surveys to determine existing sensitive receivers within and surrounding the study area
- identifying existing constraints following the results of these desktop assessments and site inspections
- identifying ways to refine the project to avoid or minimise impacts to identified constraints where possible
- engaging with the broader community via phone, letter, email, and through a community information drop-in session held during the preparation of the EIS.

During the preparation of the scoping report and EIS, technical assessments have been undertaken to determine the potential impacts to sensitive receivers. The findings of these assessments have further informed the development footprint, the environmental exclusion zones, and layout of infrastructure within the development footprint.

Community feedback has informed a number of refinements made, in particular the decision not to use the Barneys Reef Road entrance as a major site access option during construction.

3.4.1 Increase in study area and development footprint

Since the scoping report was issued to DPIE in April 2020, additional lots have been incorporated into the development footprint to the north of the study area.

The addition of a further 287 hectares of land on the northern side of the site provides UPC\AC with more flexibility to minimise environmental impacts across the broader development footprint. As a result of this, the previously identified environmental exclusion zone in the centre of the footprint is able to be expanded and additional environmental exclusion zones around the perimeter of the site were added as is outlined below, while still maintaining the target capacity of 400 megawatts.

The additional area means that electricity generating infrastructure can be realigned as required to avoid areas of highest environmental value associated with watercourses and riparian vegetation. It also allows for the avoidance of identified aboriginal heritage through the environmental exclusion zone in the centre of the development footprint.

In consultation with DPIE, UPC\AC directly engaged with the closest neighbours to discuss the increase in study area, provided a project update by mail, email, on the project website and Facebook page. No specific comments were raised following this targeted consultation action.

3.4.2 Introduction of environmental exclusion zones

Since the scoping report was issued to DPIE in April 2020, four additional areas of higher environmental value have been identified within the study area and are also included as environmental exclusion zones.

The environmental exclusion zones are shown in **Figure 2-1** and are intended to avoid and/or minimise impacts of the development in the areas of highest environmental value associated with watercourses and riparian vegetation; and also avoid individual and isolated patches of vegetation in various locations and some isolated Aboriginal heritage artefacts that would otherwise be affected by the development footprint.

No development would be undertaken within the environmental exclusion zones, with the exception of access provisions between the two portions of the development footprint on the north and south of the central environmental exclusion zone. Access will be needed during construction and operation, as well as a corridor for medium voltage electrical reticulation required to connect the northern portion to the substation.

3.4.3 Changes to proposed access options

UPC\AC initially considered two broad options for access to the project. One access was nominated from Blue Springs Road to the east and another from Barneys Reef Road to the West, via either Stubbo Road or Black Lead Lane. These options are shown in **Figure 3-2**:.

Both access options were considered by the Traffic and Transport Assessment conducted by SCT and assessed for potential impacts to the local road network. Following consideration of the potential impacts on the local road network (particularly Black Lead Lane close to the town of Gulgong and Stubbo Road) and in response to feedback from the community during the preparation of the EIS, UPC\AC has decided not to use the western access option from Barneys Reef Road as a main construction access road.

Instead, the project site would be accessed via Blue Springs Road, including for all heavy vehicle movements, and the previously nominated access from Barneys Reef Road is now only considered to be an emergency access, such as in the event of bushfire for local fire crew access or for evacuation.

3.4.4 Changes to proposed site entrance from Blue Springs Road

The Scoping Report nominated a single option for the main site entrance from Blue Springs Road, directly aligned with entrance from the Road to access the substation (closest to substation location option A). The EIS identifies a second potential site entrance from Blue Springs Road, namely entering site and allowing vehicles to travel to the substation following the existing TransGrid 330 kilovolt easement. This would also align better with the proposed laydown area.

3.4.5 Changes to the proposed internal road crossings through the exclusion zone

The Scoping Report proposed a single internal crossing over the central environmental exclusion zone allowing vehicles to move between the north and south portions of site. The EIS has realigned the proposed crossings and added a second minor crossing in the south west corner. The main reasons for the realignment of the primary crossing across the environmental exclusion zone are:

- Firstly, to minimise impacts on environmental values, specifically avoiding riparian and vegetation constraints within the large central environmental exclusion zone to the extent possible, while still utilising an alignment that works from a topographical perspective
- Secondly, the internal crossing route was realigned to address landholder concerns about conflicting land use – the proposed route reduces the proximity of the internal road to an existing dwelling to the north
- Thirdly, the minor crossing added in the south west of the site is primarily for greater flexibility during construction operations, given the size of the site, as this would allow vehicles to move between the north and south portions more freely without creating bottlenecks at the main crossing.

3.4.6 Inclusion of a temporary site compound and laydown area

The Scoping Report did not propose a location for the temporary construction site compound and laydown area, mainly because the primary site access point had not been chosen yet. Given that UPC\AC has decided to use one of the two Blue Springs Road access points for site entry, and not to use Barneys Reef Road except for light/occasional vehicular access, the temporary laydown area and site compound is proposed near the eastern boundary of the site in the EIS. This will allow for trucks with deliveries to efficiently come onto site, unload, and then exist site.

The site compound is ideally located close to Blue Springs Road and the proposed substation locations (in particular Option A), providing ease of access for staff, visitors, and contractors. This is also the proposed location of car parking facilities for workers traveling to and from site in their own vehicles.

Once the construction phase is being completed, the temporary laydown and site compound area will be decommissioned and may be used for solar panels.

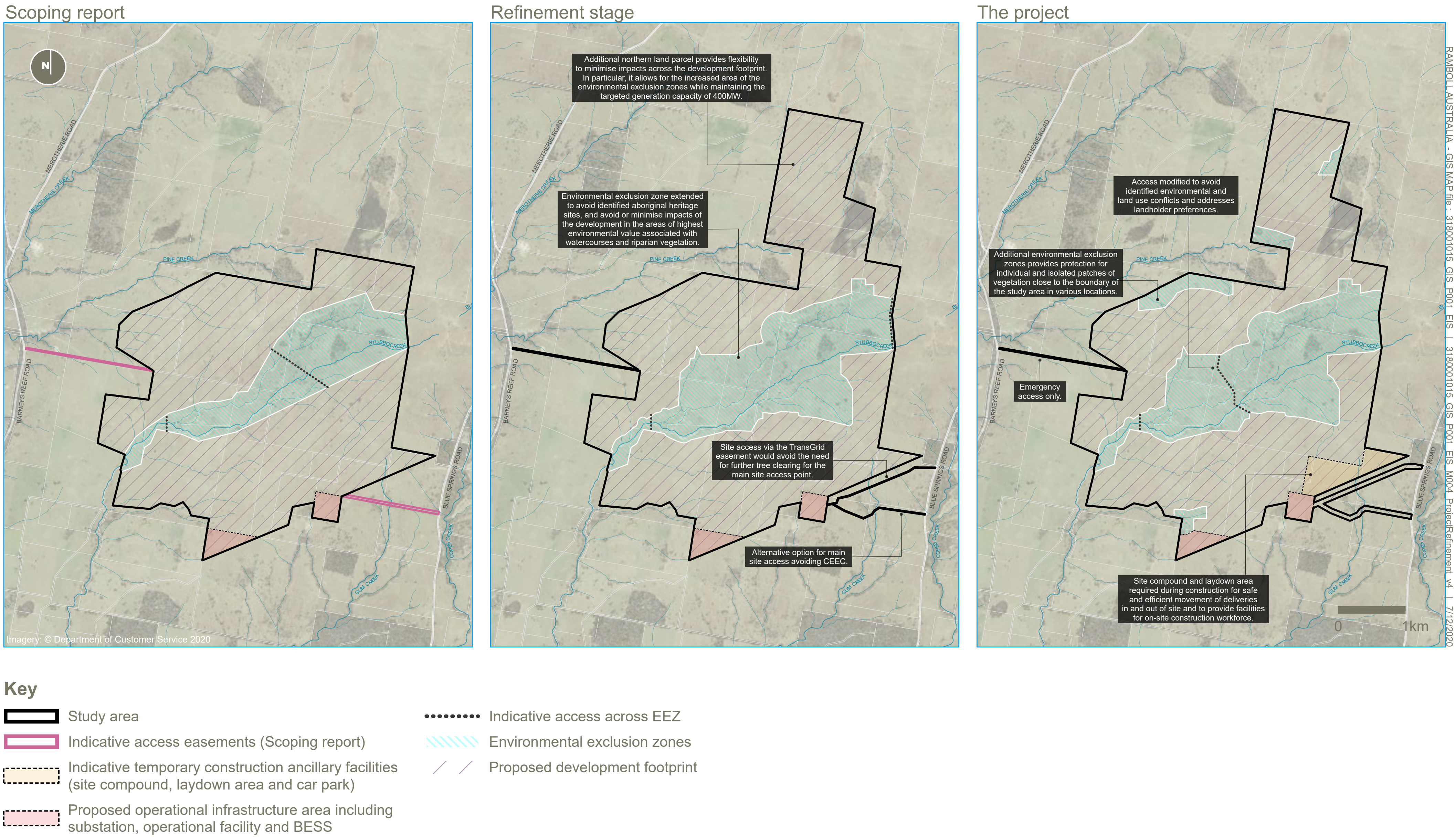
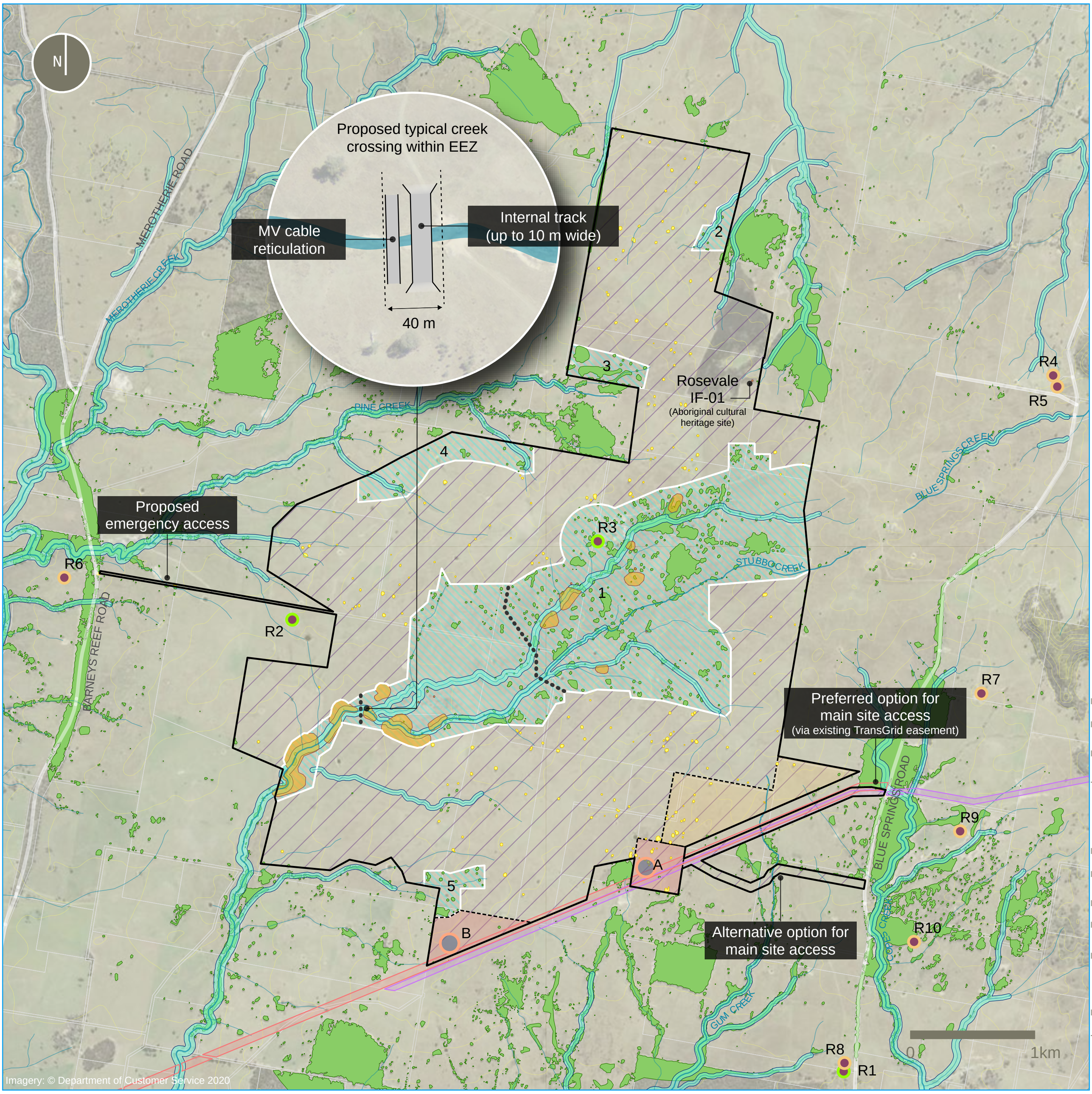


Figure 3-2 | Stages of project refinement



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Indicative connection point to the NEM (option A or B)
- Proposed development footprint
- Environmental exclusion zones
- Indicative access across EEZ
- 330kV transmission line easement
- 66kV transmission line easement
- Road
- Creek
- Sensitive receivers: Associated
- Sensitive receivers: Non-associated
- Vegetation to be removed
- Native vegetation to be retained
- Riparian buffer
- Aboriginal cultural heritage sites including buffer

Note:
Native title claim NC2018/002 - Warrabinga-Wiradjuri #7 covers the entire study area

Figure 3-3 | Key environmental and other land use constraints

4. STATUTORY PLANNING AND APPROVAL PROCESS

4.1 Environmental planning framework

4.1.1 Environmental Planning and Assessment Act 1979

4.1.1.1 Permissibility

The EP&A Act and EP&A Regulation provide the framework for environmental planning and assessment in NSW.

Environmental planning instruments (EPIs) are established under the EP&A Act to regulate land use and development. EPIs determine the relevant part of the EP&A Act under which a development project must be assessed and therefore determine the need or otherwise for development consent. EPIs consist of SEPPs, regional environmental plans (REPs), and local environmental plans (LEPs).

The project is declared to be SSD by the provisions of the SEPP S&RD (refer to discussion in **Section 4.1.2**). Development consent is required under Part 4 of the Act for any project that is considered to be SSD by a SEPP. The project is therefore subject to assessment under Part 4, Division 4.1 of the EP&A Act.

4.1.1.2 Development application process

The planning approval process for SSD under Division 4.1 of Part 4 of the EP&A Act is provided in **Figure 4-1**.

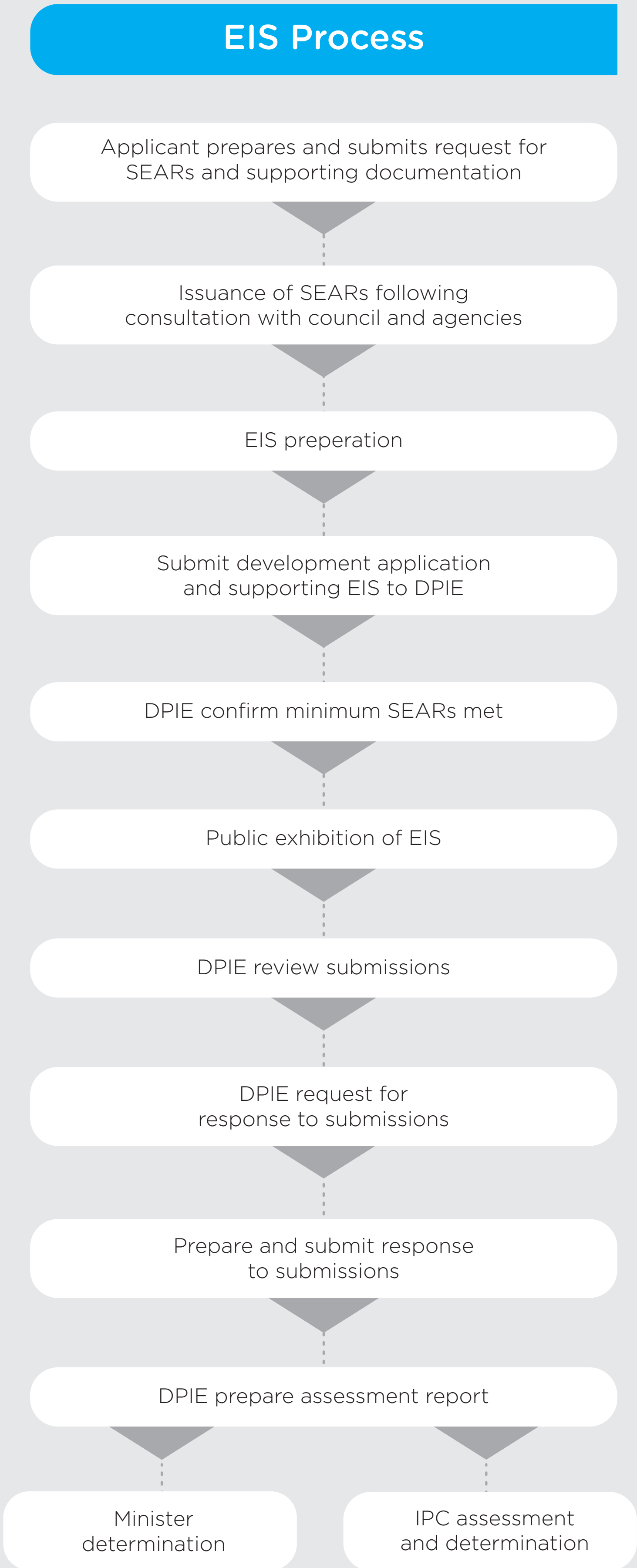
Section 4.12(8) of the EP&A Act requires an SSD DA to be accompanied by an EIS prepared in accordance with the EP&A Regulation. Prior to preparation of an EIS, an applicant must make a written application to the SEARs which specify what must be addressed in an EIS for a project. The proponent made a request for SEARs application on 9 April 2020 accompanied by a Scoping Report as required by Clause 3 of Schedule 2 of the EP&A Regulation. The SEARs for the project were issued on 5 May 2020 and are provided in **Appendix A.**

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

Following receipt of the response to submissions report, DPIE will prepare its assessment report considering this EIS, all submissions received during the exhibition process, and the responses provided by UPC\AC. DPIE's assessment report is forwarded to the consent authority for consideration before determining the DA.

Part 4 Division 4.1 of the EP&A Act

State significant development planning process



Bright ideas. Sustainable change.

4.1.1.3 Evaluation

Under Section 4.38 of the EP&A Act, the NSW Minister for Planning is the consent authority for SSD. However, pursuant to Section 2.4 of the EP&A Act, the Minister may delegate the consent authority function to the Office of the Independent Planning Commission (OIPC), the Secretary or to any other public authority. Additionally, in accordance with the NSW *Large-Scale Solar Energy Guideline for State Significant Development* (December 2018) the OIPC is the consent authority for SSD in the following circumstances:

- 50 or more people have objected to the application
- the local council has objected to the application and has not rescinded that objection following exhibition; and/or
- the applicant has disclosed a reportable political donation.

When assessing a DA for SSD, the consent authority is required to take into consideration the matters outlined in Section 4.15 of the EP&A Act. **Table 4-1** lists the requirements under Section 4.15 and where each has been addressed in this EIS.

Table 4-1: Matters for consideration under Section 4.15 of the EP&A Act

Provision	Where addressed
the provisions of–	N/A
(i) any environmental planning instrument, and	**Section 4.1.4** and **Section 4.2.15**
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	N/A
(iii) any development control plan, and	**Section 3.1.4**
(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and	N/A
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),	**Section 21.3**
(v) (Repealed)	N/A
that apply to the land to which the development application relates,	N/A
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,	**Chapter 6** to **Chapter 19**
(c) the suitability of the site for the development,	**Section 3.3**
(d) any submissions made in accordance with this Act or the regulations,	To be confirmed following public exhibition
(e) the public interest.	**Chapter 16** and **Chapter 5**

4.1.1.4 Determination and appeals

Pursuant to Division 4.16 of the EP&A Act, a consent authority is to determine a DA by either:

(a) granting consent to the application, either unconditionally or subject to conditions, or
(b) refusing consent to the application.

As provided by Clause 113 of the EP&A Regulation, the consent authority has 90 days to determine a DA for SSD. If the DA is refused, an applicant may appeal to the Land and Environment Court against the determination pursuant to Division 8.7 of the EP&A Act.

4.1.1.5 Exempt approvals for SSD

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

(a) (repealed);
(b) a permit under Section 201, 205 or 219 of the NSW Fisheries Management Act 1994;
(c) an approval under Part 4, or an excavation permit under Section 139, of the NSW Heritage Act 1977;
(d) an Aboriginal heritage impact permit under Section 90 of the NSW National Parks and Wildlife Act 1974;
(e) (repealed);
(f) a bush fire safety authority under Section 100B of the NSW Rural Fires Act 1997; and
(g) a water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the NSW Water Management Act 2000.

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

SEPP S&RD identifies development and infrastructure that is regionally and state significant. Schedule 1 identifies general criteria to be met for a project to be considered SSD. Clause 20 of Schedule 1 outlines the criteria for electricity generating works and heat or co-generation (including solar):

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

(a) has a capital investment value of more than $30 million, or
(b) has a capital investment value of more than $10 million and is located in an environmentally sensitive area of State significance.

The project is a development for the purpose of electricity generation using a solar energy source and would have a capital investment value of more than $30 million and is therefore considered SSD for the purposes of the EP&A Act.

4.1.3 State Environmental Planning Policy (Infrastructure) 2007

The *State Environmental Planning Policy (Infrastructure) 2007* (SEPP Infrastructure) provides development controls for infrastructure projects and services in NSW. Clause 34(7) of the SEPP provides provisions for development that are permitted with consent. It states:

(7) Solar energy systems

Except as provided by subclause (8), development for the purpose of a solar energy system may be carried out by any person with consent on any land.

Clause 34(7) of the SEPP Infrastructure provides that development for the purpose of a solar energy system may be carried out by any person with consent on any land providing it is not within a prescribed residential zone. The project is located within land zoned RU1 Primary Production (refer to discussion in **Section 4.1.4**). RU1 Primary Production is not a prescribed residential zone and the project is therefore permissible with consent.

4.1.4 Mid-Western Regional Council Local Environmental Plan

4.1.4.1 Land use zones and objectives

The project is located entirely within the Mid-Western Regional Council LGA and is subject to the *Mid-Western Regional Local Environmental Plan 2012* (LEP). The study area is zoned as 'Primary Production (RU1)' under the LEP. Land zoning of the study area is shown on **Figure 4-2**.

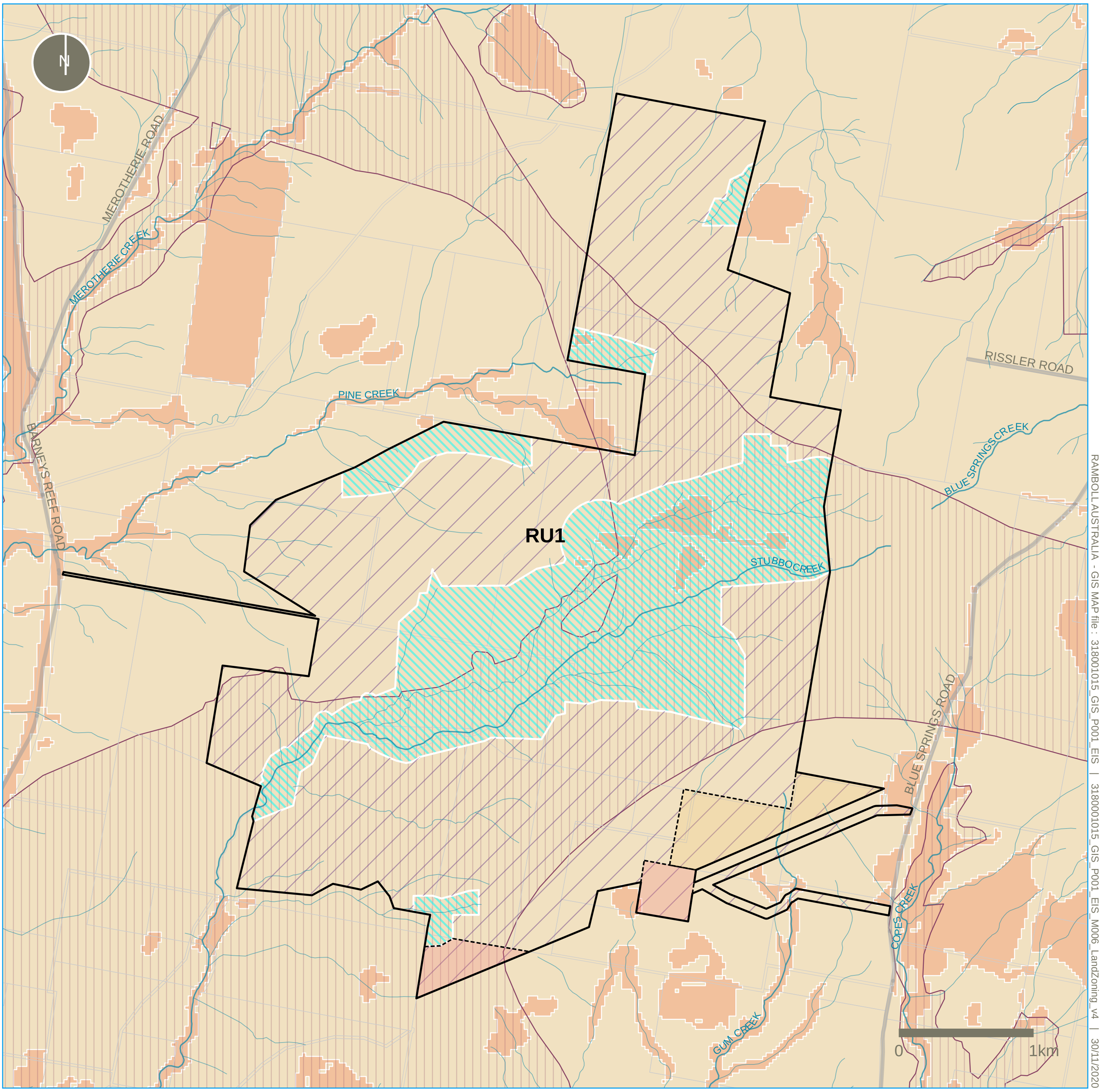
Electricity generation is prohibited within the Primary Production (RU1) zone under the LEP. However, the provisions of SEPP Infrastructure override the LEP in accordance with Clause 4.38(2) of the EP&A Act which states "*Development consent may be granted if the development is wholly prohibited by an environmental planning instrument*.".

The objectives of the Primary Production (RU1) zone are:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- To encourage diversity in primary industry enterprises and systems appropriate for the area
- To minimise the fragmentation and alienation of resource lands
- To minimise conflict between land uses within this zone and land uses within adjoining zones
- To maintain the visual amenity and landscape quality of Mid-Western Regional by preserving the area's open rural landscapes and environmental and cultural heritage values
- To promote the unique rural character of Mid-Western Regional and facilitate a variety of tourist land uses.

The project would harness a natural resource (solar energy) for the life of the solar farm and would diversify the current land use. While activities associated with the solar farm would impact on land available for primary production, the reversibility of the project and limited ground disturbance would allow the land to be available for primary production or other rural land uses at the end of the project life.

Chapter 10 provides an assessment of the project against the existing land use.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek

Mid Western Regional LEP 2012

- RU1 Primary Production
- Areas of high biodiversity sensitivity
- Groundwater vulnerable

Figure 4-2 | Land zoning

4.1.4.2 Groundwater

Areas of the study area are mapped as being groundwater vulnerable under the LEP. Clause 6.4(3) of the LEP states that before determining a development application the consent authority must consider:

(a) The likelihood of groundwater contamination from the development (including from any onsite storage or disposal of solid or liquid waste and chemicals),
(b) any adverse impacts the development may have on groundwater dependent ecosystems,
(c) the cumulative impact the development may have on groundwater (including impacts on nearby groundwater extraction for a potable water supply or stock water supply),
(d) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

Groundwater impacts associated with the project are discussed in **Chapter 14**. The project is not anticipated to have material groundwater interaction, and no changes to groundwater infiltration or extraction are proposed.

4.1.4.3 Flooding

Clause 6.2(3) of the LEP applies to land identified as a "flood planning area" on the Flood Planning Map. The study area is not identified as a flood planning area under the LEP. However, a Flood Study has been completed for the project which considers the potential for flooding implications to the construction and operation of the solar farm (refer to **Appendix I**).

Flooding impacts associated with the project are discussed in **Chapter 14**. No adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site is anticipated.

4.1.4.4 Salinity

Clause 6.1(2) of the LEP states that before determining a development application for proposed development to be carried out on land affected by groundwater salinity the consent authority must consider:

(a) whether the development is likely to have any adverse impact on salinity processes on the land,
(b) whether salinity is likely to have an impact on the development,
(c) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

The project is not anticipated to have any groundwater interaction with no changes to groundwater infiltration or extraction proposed. The study area is identified as land and soil capability class 5. Salinity can be a severe hazard in class 5 land, along with acidification.

4.1.4.5 Terrestrial biodiversity

There is are some small areas of mapped sensitive terrestrial biodiversity from the Mid-Western Regional Council LEP within the study area. These areas are largely within the environmental exclusion zones with the exception of a minor overlap with the study area boundary near a minor tributary of Pine Creek.

Clause 6.5(3) of the LEP states that before determining a development application the consent authority must consider:

(a) whether the development is likely to have—

(i) any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and

(ii) (ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and

(iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and

(iv) any adverse impact on the habitat elements providing connectivity on the land, and

(b) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

Impacts to terrestrial biodiversity associated with the project are discussed in **Chapter 6**. The minor area of mapped sensitive terrestrial biodiversity overlapping the study area near the Pine Creek tributary was determined in the biodiversity assessment to be Category 1 Land with little to no biodiversity value.

4.1.4.6 Subdivision

The development footprint is located within zone 'AD' for subdivision. Section 4.1 of the LEP states that the size of any lot resulting from a subdivision of land in zone AD is not to be less than 100 hectares. Clause 4.1E applies to subdivision of land in zone RU1 for non-agricultural land uses. Sub-clause 2 states that "*Land in Zone RU1 Primary Production may be subdivided to create a lot of a size that is less than the minimum size shown on the Lot Size Map in relation to that land if the consent authority is satisfied that the use of the land after the subdivision will be the same use permitted under the existing development consent for the land (other than for the purpose of a dwelling house or dual occupancy).".*

The land on which the substation is constructed is likely to require subdivision, resulting in lots that are less than the minimum 100 hectares. However, the proposed subdivision would be permissible under Section 4.38 of the EP&A Act subject to the approval of the Minister for Planning. Further discussion on the subdivision relating to land use is in **Chapter 10**.

4.2 Other NSW legislation

4.2.1 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) is the principal NSW environmental protection legislation and is administered by the NSW Environment Protection Authority (EPA). Section 48 of the POEO Act requires an environment protection licence (EPL) to undertake scheduled activities at a premise.

Scheduled activities are defined in Schedule 1 of the POEO Act and include the following premise-based activities that apply to the project:

17 Electricity generation

(1)…general electricity works, meaning the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power.

(2) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.

The project involves the generation of electricity from solar energy and is not referred to in Column 1 of the Table to Schedule 1, clause 17. Therefore, the project is not a scheduled activity and an EPL would not be required.

4.2.2 Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act) establishes the regulatory framework for assessing and offsetting biodiversity impacts for proposed developments. The BC Act is also supported by the *Biodiversity Conservation Regulation 2017* (BC Regulation) and the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*, which outline the methods to be used in applying the Biodiversity Assessment Methodology (BAM).

Detailed ecological assessments of the study area have been undertaken by Eco Logical Australia (ELA) in accordance with the BAM and is included in **Appendix C**. The project has been located to avoid and minimises impacts to biodiversity values. The main impact of the project on biodiversity values would result from the removal of vegetation and subsequent loss of habitat and associated indirect impacts. These impacts require offsetting. A total of 87 ecosystem credits and 66 species credits are required to offset the above impacts of the project. A biodiversity credit report is provided in appendix C of **Appendix C**.

Further discussion of the potential impacts of the project on native vegetation and threatened species listed under the BC Act is provided in **Chapter 6** and **Appendix C**.

4.2.3 Biosecurity Act 2015

The objective of the *Biosecurity Act 2015* (BSA Act) is to provide a framework for the prevention, elimination and minimisation of biosecurity risks within NSW. The BSA Act outlines priority weeds that pose a risk to reducing the diversity of native plant and animal species. Under Schedule 1 of the Act all private landowners, occupiers, public authorities and Councils are required to control weeds on their land. Mid-Western Regional Council is the Local Control Authority responsible for administering the BSA Act in the region that applies to the study area.

A weed assessment of the study area was undertaken by ELA and is included in **Appendix 6**. The assessment identified that some weeds are present within the study area however, with the appropriate mitigation measures in place, the risk of spreading of these weeds is considered low.

UPC\AC is currently in discussions with a number of the landholders to enable sheep grazing to resume on portions of the areas following the completion of the construction of the project. A detailed protocol will be developed to confirm biosecurity is maintained and that grazing does not impact on the safe and efficient operation of the project or result in injury to farm workers or operational and maintenance staff.

4.2.4 Local Land Services Act 2013

The NSW *Local Land Services Act 2013* (LLS Act) provides framework for the management of local land services and includes the requirement to obtain approval under Part 5A of the LLS Act to remove native vegetation in a regulated rural area.

Pursuant to Section 60O of the LLS Act, clearing of native vegetation in a regulated rural area is authorised under Part 4 of the EP&A Act and an authorisation for clearing of native vegetation is not required for the project under the LLS Act.

Stubbo Creek is mapped as 'Category 2 – vulnerable regulated land' under the LLS Act, which is land designated as steep or highly erodible lands, protected riparian land or special category land.

Stubbo Creek is within the environmental exclusion zone and therefore no clearing or ground disturbance would occur in this area as a result of the project.

4.2.5 National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act 1974* (NP&W Act) governs the management of national parks, historic sites, nature reserves, reserves, Aboriginal areas and state game reserves in NSW. The NP&W Act also provides for the protection of native flora and fauna.

The study area is not located within 10 kilometres of any nature reserve or forest protected under the NP&W Act. The closest nature reserve is Munghorn Gap Nature Reserve located more than 20 kilometres south east of the development footprint. The Goodiman Community Conservation Area (CCA) Zone 3 State Conservation Area and Yarrobil CCA Zone 1 National Park are located over 15 kilometres west of the development footprint. The Goulburn River National Park and Durridgere CCA Zone 3 State Conservation Area are located over 15 kilometres east of the development footprint. No impact to these areas is expected as a result of the project.

Under Section 90 of the Act, a person must not harm or desecrate an Aboriginal object or place without an Aboriginal heritage impact permit. However, a Section 90 permit is not required for SSD approvals by virtue of Section 4.41 of the EP&A Act (refer to discussion on exempt approvals for SSD in **Section 4.1.1.5**). Additionally, under Section 89A of the Act, it is a requirement to notify the Secretary of the Department of Premier and Cabinet of the location of an Aboriginal object. Identified Aboriginal items and sites are registered on Aboriginal Heritage Information Management System (AHIMS) that is administered by Heritage NSW.

An Aboriginal Cultural Heritage Assessment Report was undertaken by OzArk for the study area and is included in **Appendix D**. The assessment found one isolated artefact site (Rosevale IF-01) will be directly impacted by the project, and an additional 24 sites within the study area that will not be directly impacted by the project as they are located within the environmental exclusion zone. The site within the development footprint for the project (Rosevale IF-01) will be salvaged via surface collection and registered on AHIMS. Further discussion of the potential impacts to Aboriginal heritage sites resulting from the project are detailed in **Chapter 7** and **Appendix D**.

Part 8A of the NP&W Act provides for the protection of threatened flora and fauna. Section 118A (1)(a) states that a person must not harm any animal that is, or is part of, a threatened species, an endangered population or an endangered ecological community (EEC). Detailed ecological assessments of the study area have been undertaken by ELA and is included in **Appendix C**. Further discussion of the potential impacts of the project on native vegetation and threatened species listed under the BC Act is provided in **Chapter 6** and **Appendix C**.

4.2.6 Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) aims to protect and conserve the natural and cultural history of NSW, including scheduled heritage items, sites and relics. The Act defines 'environmental heritage' as those places, buildings, works, relics, moveable objects and precincts listed in the Local or State Heritage Significance register. A property is a heritage item if it is listed in the heritage schedule of the local Council's LEP or listed on the State Heritage Register (SHR), a register of places and items of particular importance to the people of NSW.

Aboriginal cultural and historic heritage assessments were undertaken by OzArk for the study area and are included in **Appendix D**. The assessments found one isolated artefact site (Rosevale IF-01) would be directly impacted by the project and no direct impacts to historic heritage would result from the project.

Approvals under Part 4 or an excavation permit under section 139 of the Heritage Act are not required for SSD by virtue of Section 4.41 of the EP&A Act (refer to discussion on exempt approvals for SSD in **Section 4.1.1.5**).

Further discussion of the potential impacts to heritage sites resulting from the project are detailed in **Chapter 7** and **Chapter 8**.

4.2.7 Water Management Act 2000

The NSW *Water Management Act 2000* (WM Act) regulates the use and interference of surface and groundwater in NSW where a water sharing plan has been implemented. The WM Act is progressively being implemented throughout NSW to manage water resources, superseding the *Water Act 1912.*

Two water sharing plans apply to the development footprint:

- *Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012* (Cooyal Wialdra Creek Water Source)
- *NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011* (Lachlan Fold Belt Murray Darling Basin Groundwater Source).

The following approvals are generally required under the WM Act:

- a water use approval under section 89 to authorise the use of water for a particular purpose at a particular location
- a water management work approval under section 90 for the construction and use of a water supply work, drainage work or flood work
- a Water Access Licence (WAL) under section 60A to allow water to be taken from a water source
- a controlled activity approval under section 91 for certain activities which are carried out on waterfront land
- an aquifer interference activity approval under section 91.

A water use approval under Section 89 of the WM Act is not required for the project by virtue of Section 4.41 of the EP&A Act (refer to discussion on exempt approvals for SSD in **Section 4.1.1.5**).

Water demands for the project during construction, operation and decommissioning would be sourced from suppliers in the region and brought to site via water trucks, opportunistically from farm dams located on the site or from treated wastewater or town water if available in the nearby region (refer to discussion in **Section 2.7.1**). Therefore, approvals are unlikely to be required under the WM Act for the project.

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

4.2.8 Fisheries Management Act 1994

The NSW *Fisheries Management Act 1994* (FM Act) governs the management of fish and their habitat within NSW and is administered by the Department of Primary Industries (DPI). The FM Act aims to conserve 'key fish habitats' (KFH) which includes aquatic habitats that are important to the maintenance of fish populations, the survival and recovery of threatened aquatic species and the sustainability of the recreational and commercial fishing industries.

A permit under sections 201, 205 or 219 of the FM Act is not required for SSD under the provisions of Section 4.41 of the EP&A Act (refer to discussion on exempt approvals for SSD in **Section 4.1.1.5**).

Stubbo Creek, located within the environmental exclusion zone, is listed as KFH. A Biodiversity Impact Assessment was undertaken by ELA for the study area and is included in **Appendix C** and summarised in **Chapter 6**. The study area contains mapped KFH at the location of the western cable crossing of Stubbo Creek, however no other areas of KFH were identified within the development footprint (refer to discussion in **Section 6.2.3**).

4.2.9 Rural Fires Act 1997

The NSW *Rural Fires Act 1997* (RF Act) aims to prevent, mitigate, and suppress bush and other fires. Section 63(2) of the RF Act requires the owners of land to prevent the ignition and spread of bushfires on their land. Under Section 4.41 of the EP&A Act, a bush fire safety authority under Section 100B of the RF Act is not required for SSD that is authorised by a development consent (refer to discussion on exempt approvals for SSD in **Section 4.1.1.5**).

No land within the study area is mapped bushfire prone.

4.2.10 Roads Act 1993

The NSW *Roads Act 1993* (Roads Act) is administered by Transport for NSW (previously Roads and Maritime Services (RMS)), local government or the Minister as delegated under the NSW *Crown Land Management Act 2016* (CL Act). Transport for NSW has jurisdiction over major roads, local government over minor roads and the Minister over Crown roads. The Roads Act sets out the rights of the public in regard to access to public roads.

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

- *(a) erect a structure or carry out a work in, on or over a public road*
- *(b) dig up or disturb the surface of a public road*
- *(c) remove or interfere with a structure, work or tree on a public road*
- *(d) pump water into a public road from any land adjoining the road*
- (e) *connect a road (whether public or private) to a classified road.*

The development footprint would be accessed via up to two private access roads to be constructed and/or upgraded, as required.

A Traffic and Transport Impact Assessment was undertaken by SCT Consulting for the study area and is included in **Appendix H** and summarised in **Chapter 13**. The assessment found the additional construction traffic generated by the project does not trigger the need for any road upgrades.

Pursuant to Section 4.42 of the EP&A Act, a consent under section 138 of the Roads Act cannot be refused for SSD that is authorised by a development consent (refer to discussion on exempt approvals for SSD in **Section 4.1.1.5**).

4.2.11 Crowns Land Management Act 2016

The CL Act sets out how Crown land is to be managed. In particular, specific use of Crown land generally needs to be authorised by a lease, licence or permit. Under Part 3 of the Act, the Minister for Lands must be satisfied that the land has been assessed in accordance with the principles of Crown land management by (amongst other matters) including an assessment of the capabilities of Crown land and the identification of suitable land uses.

The study area contains minor corridors of Crown land including a Crown road (Barneys Reef Road) and a Crown Waterway (Stubbo Creek Creek).

4.2.12 Conveyancing Act 1919

The development footprint extends over many adjoining properties, each of which require a separate lease from the owners of the affected land. Lease of a solar farm site is treated as a lease of premises, regardless of whether the lease will be for more or less than 25 years. The plan defining 'premises' (being the development footprint) will not constitute a 'current plan' within the meaning of Section 7A *Conveyancing Act 1919* (Conveyancing Act) and therefore will not require subdivision consent under Section 23G Conveyancing Act.

Section 23G of the Conveyancing Act may also apply if the relevant Authorised Network Operator for this project (likely to be TransGrid) requires subdivision for the purpose of construction, operation and maintenance of the substation.

4.2.13 Mining Act 1992

The main objective of the *Mining Act 1992* (Mining Act) is to encourage and facilitate the discovery and development of mineral resources in NSW, having regard to the need to encourage ecologically sustainable development.

The study area is subject of the following authorities under the Mining Act:

- Mining Lease (ML) 1466 held by Sibelco Australia Ltd for the mining of metallic minerals
- Authorisation (AUTH) 0286 held by the Secretary of Regional NSW for the exploration of coal and oil shale
- Petroleum Exploration Licence (PEL) 0456 held by Hunter Gas Pty Ltd and Santos QNT Pty Ltd.

Discussions with Hunter Gas Pty Ltd and Santos QNT Pty Ltd was undertaken for the project regarding the project location and potential implications for PEL 0456. A summary of consultation outcomes is included in **Section 5.7.4**.

No activities authorised by the mining lease or the exploration licenses have been carried out on land within the study area. There would be no ongoing restrictions on the mining or exploration of natural resources following end of the project’s life.

4.2.14 Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. Waste impacts from the project have been considered in **Chapter 17**, including details of the types of waste, expected volumes (where known) and how the waste would be transported and disposed.

The project's resource management options would be considered against a hierarchy of the following order:

- avoidance of unnecessary resource consumption
- resource recovery (including reuse, reprocessing, recycling and energy recovery)
- disposal.

4.2.15 Other State Environmental Planning Policies

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

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) requires that a preliminary hazard assessment (PHA) be prepared in accordance with the current circulars or guidelines for potentially hazardous or offensive development. The SEPP defines 'potentially hazardous industry' as:

> *"…development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:*
> *(a) to human health, life or property, or*
> *(b) to the biophysical environment,*
> *and includes a hazardous industry and a hazardous storage establishment.*

The guideline *Applying SEPP 33* (DoP 2011) includes a checklist and a risk screening procedure to determine whether a development is potentially hazardous or offensive. The *Applying SEPP 33* guideline lists industries that may fall within SEPP 33 as hazardous or offensive development. The lists do not include solar farms and energy storage facilities.

A PHA was undertaken for the project in accordance with *Hazard Industry Planning Advisory Paper No.6 – Guidelines for Hazard Analysis* (DoP, 2011) and *Multi-Level Risk Assessment* (DoP, 2011) and is included in **Appendix J**. The assessment concluded that the highest risk level associated with the project is medium. Medium level risks can be managed with the measures inherent to the project. Further discussion of the potential hazards and risk associated with the project is provided in **Chapter 15**.

4.2.15.2 State Environmental Planning Policy No 55 – Remediation of Land

The *State Environmental Planning Policy No 55 – Remediation of Land* (SEPP 55) provides a State-wide planning approach to the remediation of contaminated land and aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human and environmental health. Clause 7 of SEPP 55 requires that a consent authority take into consideration whether the land is contaminated prior to issuing development consent.

The contaminated land planning guidelines *Managing Land Contamination Planning Guidelines: SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning 1998) identifies 'agricultural/horticultural activities' as an activity which potentially causes contamination. Agricultural activities have occurred on and in the vicinity of the development footprint.

A limited phase 1 contamination assessment was undertaken for the project to identify known contaminated sites. No reported contaminated sites are associated with the study area. Further discussion on the contamination risks associated with the project is in **Chapter 9**.

4.2.15.3 State Environmental Planning Policy (Primary Production and Rural Development) 2019

The *State Environmental Planning Policy (Primary Production and Rural Development)* 2019 (SEPP PP&RD) aims to facilitate the orderly and economic use and development of rural lands for primary production related purposes and reduce land use conflict and sterilisation of rural lands. As the study area is zoned as RU1 Primary Production, the SEPP PP&RD has been considered.

The objectives of the SEPP PP&RD are as follows:

(a) to facilitate the orderly economic use and development of lands for primary production,
(b) to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources,
(c) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,
(d) to simplify the regulatory process for smaller-scale low risk artificial waterbodies, and routine maintenance of artificial water supply or drainage, in irrigation areas and districts, and for routine and emergency work in irrigation areas and districts,
(e) to encourage sustainable agriculture, including sustainable aquaculture,
(f) to require consideration of the effects of all proposed development in the State on oyster aquaculture,
(g) to identify aquaculture that is to be treated as designated development using a well-defined and concise development assessment regime based on environment risks associated with site and operational factors.

The development footprint is classified class 5 under the land and soil capability assessment scheme. The project has been sited and designed having regard for these objectives.

A LUCRA has been undertaken for the project in accordance with the Department of Industry's *Land Use Conflict Risk Assessment Guide* and is included in **Appendix E**. Eight high risks were identified following the application of risk reduction controls. These primarily related to the temporary removal of agricultural land, amenity changes and safety risks. Performance targets have been proposed to address these potential land use conflicts.

Part 2 of SEPP PP&RD identifies land that is considered State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land if it is listed in Schedule 1. Schedule 1 does not currently identify any land. Further discussion of the potential impacts to rural and agricultural lands associated with the project is provided in **Chapter 10**.

4.2.15.4 State Environmental Planning Policy (Koala Habitat Protection) 2019

The *State Environmental Planning Policy (Koala Habitat Protection) 2019* (SEPP Koala Habitat) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas. It applies to land to which an approved koala plan of management applies or land identified on the Koala Development Application Map and with an area of greater than 1 ha (including adjoining land within the same ownership), and in LGAs listed in Schedule 1 of SEPP Koala Habitat. The development footprint is in the Mid-Western Regional Council LGA which is listed in Schedule 1. SEPP Koala Habitat only applies to developments where Council is the determining authority.

Koala habitat was considered in the biodiversity impact assessment undertaken by ELA which is provided in **Appendix C** and summarised in **Chapter 6**. No evidence of koalas was recorded during the assessment.

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

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (SEPP Mining) is designed to provide for the proper management and development of mineral, petroleum and extractive material resources and establish appropriate planning controls to encourage ecologically sustainable development through environmental assessment and management.

Relevant to the project, the SEPP outlines land that has been classed as Biophysical Strategic Agricultural Land (BSAL) and Critical Industry Clusters (CIC). No land within the study area is mapped as BSAL or CIC land.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the core piece of legislation protecting Matters of National Environmental Significance (MNES) and Commonwealth land. There are nine MNES identified under the EPBC Act:

- World Heritage Properties
- National Heritage Places
- Wetlands of international importance
- Listed threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions
- A water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, a referral is required to be submitted to the Department of Agriculture, Water and the Environment (DAWE) for any 'action' that is considered likely to have a significant impact on any MNES. If DAWE determines the action to be a 'controlled activity' approval is required from the Minister of the Environment.

A search of protected matters under the EPBC Act for the project was undertaken on 12 August 2020 using the EPBC Act Protected Matters Search Tool (PMST) with a 10 kilometre radius. The report is provided in **Appendix C**. A summary of the search result is provided in **Table 4-2**.

Assessments concluded that no significant impacts are likely to occur and a Referral under the EPBC Act is not required.

Table 4-2: Summary of EPBC Protected Matters Search Tool results

Aspect	Result	Relevance to project
World Heritage Properties	None	N/A
National Heritage Places	None	N/A
Wetlands of National Importance (Ramsar)	4	No Wetlands of National Importance are present within or in proximity to the study area. The nearest Ramsar wetland is located approximately 200 – 300 km upstream. The Ramsar wetlands include: • The Macquarie Marshes (200 – 300 km upstream) • Banrock station wetland complex (800 – 900 km upstream) • Riverland (800 – 900 km upstream) • The Coorong, and lakes Alexandrina and Albert wetland (900 – 1000 km upstream)
Great Barrier Reef Marine Park	None	N/A
Commonwealth Marine Area	None	N/A
Listed Threatened Ecological Communities	2	One TEC is present within the study area: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered
Listed Threatened Species	31	No threatened species listed as MNES were recorded. Three species were considered to have potential to occur: • Regent Honeyeater • Swift Parrot • White-throated Needletail.
Listed Migratory Species	11	Two migratory species were considered to have potential to occur: • White-throated Needletail • Fork-tailed Swift.
Other Matters Protected by the EPBC Act		
Commonwealth Land	1	The Commonwealth land is not located in the study area
Commonwealth Heritage Places None	None	N/A
Listed Marine Species	18	The project is located inland and there are no marine environments within the vicinity of the study area
Whales and Other Cetaceans	None	N/A
Critical Habitats	None	N/A
Commonwealth Reserves Terrestrial	None	N/A

Aspect	Result	Relevance to project
Australian Marine Parks	None	N/A
Extra Information		
State and Territory Reserves	None	N/A
Regional Forest Agreements	None	N/A
Invasive Species	32	Invasive species are unlikely to become established above that already in existence
Nationally Important Wetlands	None	N/A
Key Ecological Features (Marine)	None	N/A

4.3.2 Native Title Act 1993

The *Native Title Act 1993* (Native Title Act) was enacted to formally recognise and protect native title rights in Australia. The Native Title Act establishes processes to determine where native title exists, how future activity affecting upon native title may be undertaken, and to provide compensation where native title is impaired or extinguished. Where a native title claimant application is made with the National Native Title Tribunal (NNTT), the Federal Court or High Court of Australia make a determination of whether native title does or does not exist in relation to the claim.

A search of the NNTT identifies that the study area is within a native title claim area (Tribunal file no. NC2018/002). As the claim has not yet been determined the claim applicants were invited to participate in the Aboriginal community consultation undertaken for the EIS. A summary on the consultation undertaken for the project is in **Chapter 5**.

4.4 Summary of licences, approvals and permits

Table 4-3 contains a summary of the licences, approvals and permits that are likely to be required for the project.

Table 4-3: Summary of licences, approvals and permits required for the project

Legal instrument	Licence or approval requirement	Consent or approval authority
EP&A Act	Approval from the NSW Minister of Planning or the IPC under Part 4 of the Act for SSD	Minister for Planning or delegate
Roads Act	Section 138 permits for works involving a public road (permit cannot be refused for SSD that is authorised by a development consent)	Mid-Western Regional Council

5. CONSULTATION

5.1 Overview

Consultation and engagement with affected parties, stakeholders, and the broader community has been an integral part of the development of the project as well as informing the scoping of investigations for this EIS. Important to note at the outset is that UPC\AC engaged with a very wide range of landholders in and around the proposed site going back as far as the second half of 2018, with phone calls, letters and face to face meetings held with more than just the involved landholders whose properties make up the refined project development footprint in the EIS.

As part of the project refinement process, consultation has been undertaken with a range of stakeholders including Government agencies, the local community, and other industry or special interest groups.

In June 2017, the NSW Department of Environment (now DPIE) released the *Draft Environmental Impact Assessment Guidelines Series: Community and Stakeholder Engagement* guideline (Department of Environment, 2017) to guide community and stakeholder engagement for State significant projects. In accordance with the guide, this chapter provides information on the following:

- the issues raised, and detail on how these have been addressed through project changes (refer to **Section 5.7**)
- justification for where issues raised have not been addressed through project changes– (refer to **Section 5.7**)
- overview of how the required outcomes from participation have been achieved including evaluation and measures of success (refer to **Section 5.7**)
- a list of the community and other stakeholder groups and how they participated (refer to **Section 5.2**)
- the planned approach to engaging the community and other stakeholders through construction and operation, if the proposed project is approved (refer to **Section 5.8**).

The *Large-scale Solar Energy Guidelines for State Significant Development* (Department of Planning, Industry and Environment, 2018) also provides guidance on stakeholder engagement and has informed the stakeholder engagement activities for the project.

5.1 Consultation objectives

The main objectives of consultation for the project have been to confirm identified stakeholders have adequate understanding of:

- the project and UPC\AC
- how the project may affect them and how the project is likely to benefit the community and the region
- how they can seek information on the project and register for ongoing project updates
- how engagement contributes to the overall development of the project
- how they can participate in the development of the project.

Community and stakeholder consultation has assisted the development of the project and preparation of this EIS by:

- collecting information and insights for scoping the EIS and technical assessments
- helping to maximise the diversity and representativeness of project stakeholders
- helping to understand the interests and values that stakeholders have in the project and the local area, and how potential impacts are perceived
- considering the views of stakeholders in a meaningful way and using these insights to refine the project and inform management measures where required.

5.2 Stakeholder identification

UPC\AC has developed an extensive and comprehensive stakeholder list of organisations and individuals, with stakeholders categorised into sub-groups based on organisation or individual type. Key stakeholders have been identified and grouped based on organisation type, individual interest or interaction with the project. The key stakeholder groups include the following:

- **Government** – Government and regulatory departments and consent authorities
- **Community** – near neighbours within and surrounding the study area, either directly or indirectly affected by the project, community service providers, special interest groups and Aboriginal community members
- **Mineral title holders** – including any exploration or mining licences held over the study area
- **Network service providers** – including grid connection, telecommunications, water and sewer.

An overview of key stakeholders and their relevant interests in the project is provided in **Table 5-1**.

Table 5-1: Known and potential stakeholder interests in the project

Stakeholder subgroup	Stakeholder name	Interests relevant to the project
Government		
Local	Mid-Western Regional Council	• construction and operational traffic impacts and potential road upgrades • employment and workforce opportunities • broader benefits and stimulation of the regional economy • construction workforce accommodation strategy • materials to be use in construction • construction and operational noise and visual amenity impacts • waste quantities and disposal • agriculture and land use • community consultation
State	DPIE	• project details, assessment pathway and timing • approach to community and stakeholder engagement • adequate assessment of environmental impacts and ongoing environmental management • role of the project in the context of the Central West Orana REZ and the Government’s electricity infrastructure roadmap
	DPIE - BCD	• biodiversity offsets • Aboriginal and historic heritage • water and soils • flooding
	DPI – Agriculture	• sediment and erosion controls • closure strategy • land capability • land use • biosecurity • amenity impacts from traffic • travelling stock reserves and livestock • community consultation

Stakeholder subgroup	Stakeholder name	Interests relevant to the project
	DPI – Fisheries	• aquatic ecology • waterway crossings • riparian vegetation
	DPI – Water and NRAR	• watercourses • water supply arrangements • surface water and groundwater impacts • flooding • erosion and sediment control
	EPA	• dust emissions • storage of chemicals, fuels and batteries • noise and vibration • waste management • surface water protection
	Heritage Council of NSW	• historic heritage
	NSW Department of Regional NSW – Mining, Exploration and Geoscience (MEG)	• impacts to exploration and mining of significant resources
	Transport for NSW	• traffic impacts
	Fire and Rescue NSW	• bushfire hazards and emergency planning
	NSW Rural Fire Service	• bushfire hazards and emergency planning • impacts to asset protection zones
	Central Tablelands Local Land Services (LLS)	• impacts to Aboriginal cultural heritage
	Office of The Registrar: Aboriginal Land Rights Act (ALRA)	• impacts to Aboriginal cultural heritage
	Service NSW Crown Lands Office	• development on crown lands

Stakeholder subgroup	Stakeholder name	Interests relevant to the project
Commonwealth	DAWE	• impacts to MNES under the EPBC Act
	NNTT	• impacts to Aboriginal cultural heritage
	AEMO	• connection to the national electricity transmission network
Community		
Directly involved landowners	Associated landholders	• general project information • land acquisition, leasing and access • mitigation and management of potential impacts
Residences located within 2 km radius of study area	Neighbours/non-associated landholders	• general and detailed project information • amenity impacts • conflict with adjacent land use • mitigation and management of potential impacts
Residences located greater than 2 km radius from study area and up to 10 km	Local community	• general project information • amenity impacts • mitigation and management of potential impacts • explore potential for involvement in the project
Broader community located outside the locality (i.e. greater than 10 km)	Broader community	• general project information • mitigation and management of potential impacts
Aboriginal community and stakeholder groups	Registered Aboriginal Parties (refer to **Section 5.7.2**) Mudgee Local Aboriginal Land Council (LALC) Native Title Service Corporation (NTSCORP)	• general project information • Aboriginal heritage • adequacy of consultation • mitigation and management of potential impacts to items of heritage significance
Local businesses and community service providers	Various	• general project information • project benefits and opportunities • impacts on the local community, infrastructure and services • mitigation and management of potential impacts

Stakeholder subgroup	Stakeholder name	Interests relevant to the project
Neighbouring mines	Ulan Mine	• cumulative impacts
	Wilpinjong Mine	• cumulative impacts
	Moolarben Mine	• cumulative impacts
Nearby solar projects	Beryl Solar Power Plant	• cumulative impacts
	Wollar Solar Farm	• cumulative impacts
	Dunedoo Solar Farm	• cumulative impacts
	Wellington Solar Farm	• cumulative impacts
Local media	Mudgee Guardian	• general project information • project benefits and opportunities • impacts on the local community, infrastructure and services
	Dunedoo District Diary	• general project information • project benefits and opportunities • impacts on the local community, infrastructure and services
	Gulgong community group Facebook Page	• general project information • project benefits and opportunities • impacts on the local community, infrastructure and services
Special interest groups	Gulgong Concerned Residences	• general project information • cumulative impacts • mitigation and management of potential impacts
	Gulgong Community Action Group	• general project information • project benefits and opportunities • impacts on the local community, infrastructure and services • amenity impacts • mitigation and management of potential impacts

Stakeholder subgroup	Stakeholder name	Interests relevant to the project
	Gulgong Community Group (Facebook page)	• general project information • project benefits and opportunities • impacts on the local community, infrastructure and services • amenity impacts • mitigation and management of potential impacts
	Gulgong Residents for Responsible Renewables	• general project information • project benefits and opportunities • impacts on the local community, infrastructure and services • mitigation and management of potential impacts
	Gulgong Aero Park	• general project information • mitigation and management of potential impacts
Mineral title holders		
Metallic minerals	Sibelco Australia Ltd (owner ML 1466)	• land use and potential impacts to mineral reserves
Coal and oil shale	Secretary of Regional NSW (owner AUTH 0286)	• land use and potential impacts to mineral reserves
Petroleum	Santos QNT Pty Ltd (part owner PEL 0456)	• land use and potential impacts to mineral reserves
	Hunter Gas Pty Ltd (part owner PEL 0456)	• land use and potential impacts to mineral reserves
Network Service providers		
Electricity grid	TransGrid	• connection to transmission infrastructure for evacuation of the electricity generated by the project
Distribution network	Essential Energy	• connection to the distribution network for auxiliary supply

5.3 Community and stakeholder consultation tools

An outline of the community and stakeholder consultation tools that have been used to date and that will continue to be utilised for the project is provided in **Table 5-2**.

As previously stated, the proposed development has been under investigation since late 2018 and a number of surrounding landholders were sent letters and/or were informed via phone or face to face meeting of the opportunity to be involved in a solar farm development at Stubbo at the same time as the now-involved landholders. UPC\AC took the approach of discussing the development with a wide radius of landholders right from this early stage and then refined the proposed development footprint in consultation with the interested parties and as a result of desktop and onsite assessment of the environmental constraints over the course of 2019 - 2020. The dedicated community engagement activities relating to the actual project site selected have been underway since around the time the Scoping Report was being prepared the first quarter of 2020.

At the time of preparing this EIS, the COVID-19 pandemic has had some impact in restricting the consultation and engagement strategies available. Effort has been made by UPC\AC to use alternative consultation methods where face-to-face engagement activities could not be undertaken due to Government restrictions. However, the peak of restrictions (March-May 2020) coincided with initial activities of community and stakeholder consultation such as establishment of the project website and Facebook page, mail-out of newsletters and fact sheets (by hard copy and email), and phone calls. Face-to-face engagement was undertaken when restrictions allowed these activities in a safely manner (for a brief period in June/July and from early-October 2020).

Table 5-2: Community and stakeholder consultation tools

Tool	Objectives	Stakeholders	Timing
Project website	Provides regular updates on the project, links to key project documents, and details opportunities for participation. The project website can be accessed via the following link: https://stubbosolarfarm.com.au/	• Community • Media • Local and regional businesses • regulatory authorities and agencies • industry and other stakeholders	Ongoing
Project Facebook page	Provides regular updates on the project, links to key project documents, and details opportunities for participation. The project Facebook can be accessed via the following link: https://www.facebook.com/StubboSolarFarm	• community • media • other stakeholders	Ongoing
Newsletters, notifications and fact sheets	Provide key information on the project and upcoming activities. Newsletters, notifications and fact sheets were delivered via letter box drop to the local community and published on the project website.	• community • industry and other stakeholders	Ongoing

Tool	Objectives	Stakeholders	Timing
Presentations and briefings	Used to keep identified stakeholders updated on specific events and activities tailored to the stakeholder group being consulted. They involved a group of stakeholders with similar interests or one-on-one meetings with individuals or with representatives of a group.	• community • regulatory authorities and agencies • industry and other stakeholders	During project development EIS preparation and (planned) during EIS exhibition
Community information sessions	A drop-in session where community members and stakeholders can ask questions and/or provide verbal or written feedback to members of the project team.	• Community • Local and regional businesses	During EIS preparation and EIS exhibition
Community information line	Provides an avenue for the community to enquire about the project or provide feedback. Email: stubbo@upc-ac.com Community Information Line: **1800 571 185**	• community	Ongoing
Project email mailing list	An avenue for community members to subscribe to receive regular project updates. Registration link: https://stubbosolarfarm.com.au/community/	• community • industry and other stakeholders	Ongoing
Media	Traditional media including print and online journalism & paid advertisements, television and radio.	• community • industry and other stakeholders	Ongoing

5.4 Community and stakeholder engagement plan

The community and stakeholder engagement Plan (CSEP) outlines how the consultation objectives for the project are implemented at the different phases of project development from scoping and early design, through to construction and operation. The CESP is included as **Appendix B**.

UPC\AC has developed a consultation methodology for each phase of the project in the CSEP. A summary of the consultation methodology is included in **Table 5-3**.

Table 5-3 Consultation methodology

Phase	Objectives	Action/ tools	Stakeholders	Status
Project scoping and site selection stage	• Inform potential host landholders of the project concept • Gauge the level of interest from local landholders with suitable land • Get a feel for the general community attitude towards renewable energy and solar farms	• Letters • Phone calls • Face to face meetings	• Landowners (potential and now involved)	Completed
EIS development and pre-lodgement	• incorporate stakeholder considerations into project design • focused assessment on the issues and impacts relevant to the community and other stakeholders • communicate the rationale or reason for the project and the project's strategic context • report on consultation outcomes and how matters have been considered • seek community and stakeholder comment on the project and EIS	• Meetings • Presentations • Drop in session • Media release and liaison • Project email address • Website • Letterbox drop • Feedback collation and mitigation options	• Community • Neighbours • Landowners • Registered Aboriginal Parties (RAPs) • Council • Government depts • Media	Completed
EIS public exhibition and determination	• respond to community and stakeholder feedback via a response to submissions report • identify any project changes required following receipt of submissions • inform the community and stakeholders about the determination decision for the project • clarify any conditions of consent for the project	• UPC\AC will be available to answer questions or concerns from the community, but will avoid interfering with the Department's Public Exhibition activities • UPC\AC will respond to all public and agency submissions made in a 'Response to Submission' report to be submitted to DPIE • Ongoing consultation with Council and TransGrid has been identified in regard to roads and access to site	• Community • Neighbours • Government authorities including Council, TfNSW and other agencies • TransGrid • Landowners	To be completed

Phase	Objectives	Action/ tools	Stakeholders	Status
Pre-Construction	• keep the community informed on project activities and timeframes to construction start • community benefit sharing models • early works (if relevant) • introductions to local workers, contractors and businesses interested in commercial and employment opportunities	• Letters • Letterbox drop status update • Support to landowner team • Presentations or information sessions	• Community • Neighbours • Landowners • Council • Local workers • Local businesses	To be completed
Construction and commissioning	• keep the community informed on construction activities • facilitate ongoing consultation and engagement throughout construction and operation including complaints handling procedures • regularly report on the environmental management outcomes	• Local consultation with landowners and neighbours • Local liaison officer (UPC\AC or contractor) • Council engagement and briefings • Establish a complaints register, including reporting and investigating procedures and timelines, and liaison with Council • Create a public hotline for rapid notification of complaints • FAQs • Drop in session • Letters • Letterbox drop status update • Support to landowner team	• Community • Neighbours • Landowners • Council	To be completed

5.5 Scoping phase consultation and stakeholder engagement

Engagement activities with key stakeholders commenced in late 2018 during the project scoping phase that took place prior to the site being defined. The purpose of early consultation activities was to provide a general introduction to the project concept, develop an understanding of the key stakeholder values and concerns, and to inform the content of the scoping report. During this consultation, UPC\AC has focussed on four areas of stakeholder consultation:

- starting in late 2018, engagement with local and state stakeholders to inform, advocate and gain feedback about the initial project concept and draft plans
- starting in late 2018, local landowner consultation to gain interest in and secure an interest in agricultural land suitable for the solar farm and battery development
- starting in early 2019, targeted consultation with nearby landowners to understand the concerns and potential impacts of the solar farm on near neighbours
- starting in early 2020, wider community engagement to communicate potential community benefits resulting from the project, understand community concerns, and inform the community about the potential impacts and benefits of the project and listen to their feedback, as well as gauge public sentiment more broadly towards the project.

Prominent members of the local community who had previously expressed concerns about other solar farms or infrastructure projects in the area were directly approached by UPC\AC before the project was publicly announced. UPC\AC provided detailed information in a transparent manner with the intention of understanding whether they had specific concerns about the project or about solar farms more broadly. These stakeholders were also encouraged to provide this information to like-minded members of the community and were encouraged to contact UPC\AC directly with any concerns.

A summary of the consultation and stakeholder engagement undertaken at the scoping phase, and the outcomes are provided in **Table 5-4**.

Table 5-4: Summary of early engagement activities

Stakeholder	Engagement activities	Consultation outcomes
Mid-Western Regional Council	• meeting on 4 February 2020 to provide a general update on the project and discuss project timelines • Regular phone and email conversations to discuss project updates, key issues and community consultation strategy (especially in light of Covid-19 restrictions)	• General project update before Scoping Report preparation.
DPIE	• meeting on 13 February 2020 to discuss the project prior to Scoping Report finalisation and lodgement • Regular phone and email conversations to discuss project updates, key issues and community consultation strategy (especially in light of Covid-19 restrictions)	• Provided preliminary feedback onsite selection and constraints

Stakeholder	Engagement activities	Consultation outcomes
Landowners	• discussions with directly affected landowners on commercial and land security issues via letters, phone calls and face-to-face meetings • Negotiating and finalising formal land security contracts with host landowners	• Largely positive feedback with some landowners non-committal
Local community	• meeting at Gulgong RSL 29 August 2018 (43 attendees) • meeting at Gulgong RSL 6 December 2018 (37 attendees) • targeted discussions with near neighbours in March-October 2019 • community information drop-in session on 28 October 2020	• Mixed feedback. Some near neighbours who initially were concerned about the project became more comfortable as a result of consultation efforts • Other near neighbours have expressed concern about the potential visual change posed by the project, as well as construction and traffic noise, workforce and accommodation management • Key change to the project plan is the removal of the access from Barneys Reef Road, which is opposite a non-involved residence
Ulan Mine, Wilpinjong Mine and Moolarben Mine	• discussions via email, phone and face-to-face meetings on the project in the second half of 2018	• Early stages discussion including potential for a transmission line through the mining corridor to Wollar

5.6 Agency response to the scoping report

In preparing the SEARs, DPIE consulted with key agencies and stakeholders to provide feedback on the potential issues that should be considered by the EIS. A brief overview of the comments received and where they are addressed in the EIS is provided in **Table 5-4**. Copies of the agency letters are included in **Appendix A**.

Table 5-5: Summary of agency comments on the scoping report and where issues have been addressed

Issues summary	Where addressed
Mid-Western Regional Council	
• requests a traffic study for both construction and operation, including investigations into road ownership and authorisation/approvals in the event that a road is not within the road reserve or belongs to Crown Roads	**Chapter 13** and **Appendix H**
• requests that the EIS include details on the required workforce and associated social impacts on surrounding towns during construction, along with timing and delivery of other state significant projects to address cumulative impacts	**Chapter 16**
• requests that information be provided on the building materials to be used during construction and associated truck movements and social and economic impacts, along with details on waste generated during construction and operation	**Chapter 17** (waste and resources), **Chapter 16** (social) and **Chapter 13** (truck movements)
• requests details to allow for adequate assessment of noise and visual amenity (including mitigation and management measures), both of which are expected to be key issues for neighbours and local residents	**Chapter 12** (noise) and **Chapter 11** (visual)
• requests an agricultural impact assessment which includes soil testing to determine the agricultural capability of the site and requirements for returning the site to agricultural land use, and an economic analysis be to demonstrate the impact of removing valuable Class 5 agricultural land from the local economy	**Chapter 9**
• requests consideration of provisions of the Mid-Western Regional Development Control Plan 2013, particularly section 6.5 on Solar Energy Farm	**Section 3.1.4**
• requests details on proposed communications plan and mechanisms for the community to provide feedback during construction and operation, and approach to dealing with complaints and compliance issues	**Section 5.8** and **Appendix B**

Issues summary	Where addressed
DPIE - Biodiversity and Conservation Division (BCD)	
• recommends the EIS adequately address Biodiversity and offsetting, Aboriginal cultural heritage, water and soils, and flooding	**Chapter 6** (biodiversity), **Chapter 7** (Aboriginal heritage), **Chapter 9** (soils) and **Chapter 14** (water and flooding)
• requests a Biodiversity Development Assessment Report (BDAR) in accordance with Section 7.9 of the *Biodiversity Conservation Act 2017* and the Biodiversity Assessment Method including application of avoid, minimise and offset framework and measures to address the offset obligation, to be prepared by an accredited person, and submitted with all spatial data	**Appendix C**
• requests an Aboriginal Cultural Heritage Assessment Report (ACHAR) be prepared in accordance Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (OEH 2010) and the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011) and consultation with BCD regional branch officers, including notifying of objects recorded as part of the assessment	**Appendix D**
• the ACHAR is to include consultation undertaken with Aboriginal people in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW), is to assess impacts to Aboriginal cultural heritage, document cultural heritage values of Aboriginal people, outline avoidance and mitigation measures, and include conservation outcomes.	**Section 5.7.2** and **Appendix D**
• the EIS is to map relevant water and soils features, describe background conditions for water resources likely to be affected by the project, and assess impacts to water quality and hydrology, including proposed monitoring	**Chapter 9** (soils) and **Chapter 14** (water)
• the EIS is to map relevant flooding features, and include a flood assessment and modelling to determine the design flood levels for events and the impact of the project on flood behaviour	**Chapter 14** and **Appendix I**
DPI – Agriculture	
• the project needs a full soil assessment, closure strategy (especially if the site is returned to agricultural use), and a land use conflict risk assessment (LUCRA) to identify potential land use conflicts	**Chapter 9** (soils), **Chapter 10** (land use) and **Appendix E**

Issues summary	Where addressed
• the EIS should demonstrate that significant impacts on agriculture and resources can be avoided or mitigated, consider cumulative impacts and costing forgone production, strategies to manage impacts of aerial spraying and options for land use sharing with agriculture	**Chapter 10**
• the EIS should include a biosecurity risk assessment, a biosecurity response plan, contingency plan for failures, and monitoring and mitigation measures in weed, disease and pest management plans	**Chapter 6** and **Appendix C**
• there should be consideration of the route for movements including travelling stock reserves (TSR) and movement of livestock or farm vehicles	**Chapter 10**
• requests an assessment of changes to natural contours of the land, details on material to be removed, stockpiled, managed and reused in rehabilitation, and soil survey as a benchmark for rehabilitation, along with a draft Rehabilitation and Decommissioning/Closure Management Plan	**Chapter 9** (soils), **Chapter 10** (land use)
• requests cables/pipes be buried >500 millimetres depth in land with cropping history or of category 3 or better under the land and soil capability assessment scheme, and trenching through sodic soils during to include soil amendment with Gypsum at a minimum rate of 10 tonnes per hectare depending on soil testing, to be included in the CEMP	To be completed prior to construction
• requests a complaints register be established that includes reporting and investigating procedures and timelines, and liaison with Council in relation to complaint issues	**Section 5.3**
DPI – Fisheries	
• requests the EIS address impacts on aquatic ecology and controls for access tracks or underground cabling in key fish habitat, and impacts on riparian vegetation and threatened species	**Chapter 6** and **Appendix C**
• access tracks or underground cables through Key Fish Habitat should be constructed in accordance with DPI Fisheries Guideline document: Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013), and terrestrial buffer zones are recommended under the Policy and Guidelines for Fish Habitat Conservation and Management to maintain the riparian buffer zone and limit disturbance and susceptibility to bed or bank erosion	To be completed prior to construction. Refer to management measures in **Chapter 20**
• requests a threatened aquatic species assessment be undertaken, and notes that the project is located within an area considered habitat of the threatened species Southern Purple Spotted Gudgeon (Mogurnda adspersa)	**Chapter 6** and **Appendix C**

Issues summary	Where addressed
DPI – Water and NRAR	
• requests the SEARs include a description of watercourses near the project and riparian setbacks, details of water supply requirements and arrangements, assessment of surface water, groundwater and flooding impacts and mitigation and management measures, and erosion and sediment control measures including that the proponent develops an erosion and sediment control plan in consultation with DPIE Water	**Chapter 14** and **Appendix I** Erosion and sediment control plan to be completed prior to construction
• requests the SEARs include consideration of relevant legislation, policies and guidelines, including the NSW Aquifer Interference Policy (2012), the Guidelines for Controlled Activities on Waterfront Land (2018) and the relevant Water Sharing Plans	**Chapter 14** and **Appendix I**
Environment Protection Authority	
• recommends the EIS include measures to minimise dust emissions, noise and vibration, protect surface waters including appropriate sediment and erosion controls, measures for appropriate storage of chemicals, fuels and batteries, and consideration of waste management and resource recovery	**Section 18.1** (dust), **Chapter 12** (noise), **Chapter 14** (water), **Chapter 15** (dangerous goods storage) and **Chapter 17** (waste and resources)
Heritage Council	
• requests a statement of heritage impact (SOHI) be prepared in accordance with the guidelines in the NSW Heritage Manual to address impacts on heritage significance	**Chapter 7** (Aboriginal heritage), **Chapter 8** (historic heritage) and **Appendix D**
• requests that an historical archaeological assessment be prepared in accordance with the guidelines *Archaeological Assessment* (1996) and *Assessing Significance for Historical Archaeological Sites and Relics* (2000), and a research design and excavation methodology to guide any proposed excavations or salvage program	**Appendix D**
NSW Department of Regional NSW – Mining, Exploration and Geoscience (MEG)	
• requests that the EIS include and map a mineral, coal and petroleum titles and applications search, and that the proponent check for new mineral and energy titles during all decision-making stages of the project	**Chapter 10**

Issues summary	Where addressed
• requests that consultation be undertaken including with Hunter Gas, noting that consultation has now occurred with MEG regarding AUTH286 and no resource sterilisation concerns were raised, and MEG regarding proposed biodiversity offset areas or other biodiversity measures that may impact on mineral exploration or extraction	**Section 5.7.3** and **Section 5.7.4**
Transport for NSW	
• requests that a traffic impact assessment (TIA) be prepared in accordance with Austroads Guide to Traffic Management Part 12, relevant Roads and Maritime Supplements and the RTA Guide to Traffic Generating Developments, including consideration of cumulative impacts, and the need for improvements to the road network	**Chapter 13** and **Appendix H**
• requests that a traffic management plan be prepared in consultation with relevant Councils and TfNSW	To be completed prior to construction. Refer to management measures in **Chapter 20**
Fire and Rescue NSW	
• recommends that an emergency response plan (ERP) is prepared and stored in a prominent emergency information cabinet adjacent to the main entry points of the solar farm, and which addresses fire events and other emergency incidents or potential hazmat incidents, and detail appropriate risk control measures	To be completed prior to construction. Refer to management measures in **Chapter 20**
• requests that, once constructed and prior to operation, that the operator of the solar farm contact the relevant local emergency management committee (LEMC)	To be completed prior to construction
• requests that a fire safety study (FSS) be prepared as a condition of consent for the BESS part of the site and submitted to FRNSW for review and determination	To be completed prior to construction

5.7 Engagement activities during the preparation of the EIS

5.7.1 Government consultation

There is general support from government agencies, and local government for the project and the wider program of renewables in the region. Most notably, the NSW Government announced its Central West Orana “pilot REZ” plans in late 2019, and more recently in 2020 has made further announcements on its commitment to developing 3 gigawatts of renewables in the region under the NSW Electricity Infrastructure Roadmap. In the lead up to that announcement, DPIE consulted with Councils and the community in the region. This highlights how well aligned the proposed project is with the key strategic policy direction of the NSW Government with respect to electricity infrastructure.

A summary of the engagement activities undertaken with government agencies during preparation of the EIS is provided in **Table 5-6**.

Table 5-6: Summary of State government engagement activities

Stakeholder	Engagement activities	Key consultation outcomes
Local government		
Mid-Western Regional Council	• Ongoing emails/phone calls • Face-to-face meetings on 27 August 2019, 4 February 2020, 29 October 2020 and 11 November 2020 • Aboriginal cultural heritage consultation (Stages 1 and 2)	• Introduced the proposed project location and provided general information on the size of the project and proposed choice of technology, surrounding landowners etc • Provided a general update on the project including anticipated timeframes and the communication strategy • Council assisted UPC\AC to contact near neighbours who had not responded to previous communications • A meeting was held on 29 October 2020 to discuss outcomes of the community information session (refer to **Section 5.8.2**) and key issues to be addressed in the EIS including traffic impacts and interactions with council infrastructure provision including waste management. Additional information on traffic matters was subsequently provided by UPC\AC at Mid-Western Regional Council’s request • A meeting was held on 11 November to provide input into the workforce and accommodation strategy for the project • Commenced consultation to determine the appropriate treatment of Blue Springs Road during construction (refer to **Section 13.3.1**)

Stakeholder	Engagement activities	Key consultation outcomes
State government		
DPIE Assessment Branch	• Ongoing emails/phone calls • Face-to-face meetings on 13 February 2020	• Provided a general update on the project including anticipated timeframes and the communication strategy • Discussed extension of the Study Area to avoid more environmental and cultural value without increasing the project capacity
DPIE Energy Infrastructure	• Ongoing emails/phone calls • Face-to-face meetings in July 2018, June 2019, December 2019, January 2020, and April 2020	• Discuss concept behind central highlands energy developments, consultation around proposed CWO REZ, provide update on progress UPC\AC developments
DPIE - BCD	• Aboriginal cultural heritage consultation (Stages 1 and 2)	• Aboriginal stakeholder list provided on 22 May 2020
LLS	• Aboriginal cultural heritage consultation (Stages 1 and 2)	• Refer to Aboriginal Cultural Heritage Assessment Report for details on consultation undertaken
Office of The Registrar: ALRA	• Aboriginal cultural heritage consultation (Stages 1 and 2)	• Refer to Aboriginal Cultural Heritage Assessment Report for details on consultation undertaken
Commonwealth government		
NNTT	• Aboriginal cultural heritage consultation (Stages 1 and 2)	• Provided notification on 20 May 2020: *"Records held by the National Native Title Tribunal as of 20 May 2020 indicate that the identified parcels appear to be freehold, and freehold tenure extinguishes native title."*
AEMO	• Phone calls and emails	• Discuss proposed project and its feasibility for connection to the 330kV transmission network

5.7.2 Community Consultation

Landowners

UPC\AC has been engaging with landowners since 2018 regarding the project and potential impacts to land. Discussions with the associated "host" landowners focussed initially on the project concept, commercial opportunity associated with the project, potential for agricultural co-location, risk of long term impacts on land and land security.

There are ten dwellings within two kilometres of the study area, three of which are associated with the project. In the early stages of engagement in the second half of 2018, UPC\AC sent letters and made phone calls to a wide range of landholders surrounding the now-proposed development site. A number of these landowners expressed an interest in learning more about the project concept and the commercial opportunity and UPC\AC continued to engage with these landowners over the course of 2019.

The landowners now associated with the project eventually agreed to a commercial arrangement to lease land to UPC\AC and that land forms the project study area and development footprint. UPC\AC has continued to keep other neighbouring landholders informed of progress from time to time (several of these are considered neighbours - see below for further information).

All interested landowners were accommodating in allowing the onsite surveys and assessments undertaken on and near their properties during the early stages of the environmental constraints assessment, in the preparation of the Scoping Report and the preparation of the EIS. These landowners have been in regular contact with UPC\AC through a dedicated landowner liaison manager within the company. Landowners were regularly asked to provide feedback, which was taken on board and resulted in several modifications to the plans and development footprint to accommodate their ongoing needs.

Neighbours and the community

UPC\AC made significant attempts to get in touch with all immediate project neighbours (those located within two kilometres of the study area) over a period of time and made all reasonable efforts to at least provide information all immediate neighbours, as well as a large number of residents and farmers in the broader local area. The majority of neighbours who UPC\AC were able to contact were engaged via a combination of telephone discussions, email, Facebook, and materials which were sent by post or email containing detailed information and maps.

Assistance was sought from Mid-Western Regional Council to contact nearby any immediate neighbours who UPC\AC had not heard from to confirm that letters and fact sheets about the project were being sent to the correct addresses. The Council-assisted mailout served to reach several key neighbours who had not received earlier correspondence, and which prompted some of them to contact UPC\AC via the dedicated project hotline or email address.

Despite the Council-assisted mailout and UPC's best endeavours, several local landowners did not get in touch with UPC. It is not known whether they did not receive the information or whether they chose not to provide feedback. However, continued efforts to get in touch with these landowners will be a priority throughout the ongoing EIS process and at later stages of the project.

The project website and Facebook page went live in April 2020 and were both publicly available to the wider community. These were regularly updated to ensure community members were informed on the current stage of the project.

A community information drop-in session was held at the Country Women's Association Hall on Herbert Street, Gulgong on 28 October 2020 between 2pm and 7pm. The session was advertised in the Mudgee Guardian, Dunedoo District Diary, 2MG Radio Mudgee (10 on-air "read outs" in the lead up to the event), via a flyer on the community noticeboard at Stacks Gulgong, as well as updates on the project website and Facebook page advertising the session. Individual invitations to the information session were sent to everyone who had subscribed for project updates via the UPC\AC website, as well as directly to near neighbours.

Five UPC\AC representatives and two representatives from the planning consultants (Ramboll) attended the information session. Covid-19 restrictions in place in NSW at the time were strictly observed during the session.

Throughout the day, approximately 40 people attended to review the information provided, ask questions, and give feedback to the project team. The discussion focussed on the benefits of renewable energy, employment opportunities for local workers and businesses as well as potential visual impact from the solar panels, the proposed environmental exclusion zone and traffic flows and access routes. Feedback from the session has been considered in this EIS.

As a result of feedback received at the information session, further workforce and accommodation availability assessment has been included in this EIS (refer to **Chapter 16**). This involved several desktop studies and further consultation with Mid-Western Regional Council, NSW TAFE and other training and recruitment and hospitality specialists. The purpose of the assessment was to determine the skills capabilities in the local and regional workforce and potential training requirements to help provide more employment opportunities for local workers and businesses. In addition, an assessment of accommodation requirements has also been conducted for construction workforce.

It was also raised during the feedback session that the original option to access the project site from the western boundary via Black Lead Lane and Barneys Reef Road would impact dwellings and create additional traffic in and around the Gulgong Town Centre during construction. As a result, it was determined that the western access off Barneys Reef Road may be constructed, but it would only be used for emergency site access.

A summary of the key issues raised during community consultation and where each matter has been addressed in the EIS is provided in **Table 5-7**.

Table 5-7: Community feedback and matters raised

Environmental aspect	Matters raised	UPC\AC response
Land use	Most farmers in the area considered the continued agricultural use of the land to be of high importance	UPC\AC engaged with host landowners and have a contractual obligation to trial sheep grazing as the preferred form of managing the vegetation within the solar farm
Landscape character and visual	Some parties expressed concern about visual change from neighbouring farming blocks	UPC\AC made changes to the layout to address this concern. UPC\AC prioritised addressing visual impacts on nearby dwellings by speaking to neighbours and conducting viewshed analysis. The visual impact assessment in **Chapter 11** shows that no significant visual impacts are expected on neighbouring dwellings.

Environmental aspect	Matters raised	UPC\AC response
Traffic and transport	Members of the local community expressed concern about a proposed traffic route which incorporated Black Lead Lane and continued up the Barneys Reef Road to access the site from the west. There were legitimate concerns about the impacts from heavy vehicles moving in close proximity to Gulgong town	Since the traffic and transport assessment and in response to community consultation, it was determined that the western access off Barneys Reef Road may be constructed, but it would only be used for emergency site access. This has been taken into consideration in the traffic impact assessment in **Chapter 13**
Socio-economic	Members of the local community communicated that previous solar farms in the area had resulted in skilled worker and accommodation shortages in town	Further workforce and accommodation availability has been included in the social impact assessment in **Chapter 16**
Climate change and greenhouse gas	One near neighbour expressed concern about the "heat island" effect, which is where the residual heat from solar panels allegedly increases the ambient temperature of the local area	UPC\AC provided an independent report examining the heat island effect. The report recommended that an infrastructure setback of 30 m from the shared boundary would mitigate the apparent heat island effect. UPC\AC notes that the shared boundary with the concerned landowner has an infrastructure setback of greater than 30 m due to an environmental exclusion zone for a watercourse and native vegetation

Aboriginal community and stakeholders

Aboriginal stakeholders were identified and consulted in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010a). Further details of the consultation method and activities undertaken are included in the Aboriginal Cultural Heritage Assessment Report (ACHAR) in **Appendix D**.

The Aboriginal cultural heritage consultation undertaken included four main stages:

- Stage 1 – notification of project and registration of interest
- Stage 2 – presentation of information about the proposed project
- Stage 3 – gathering information about cultural significance
- Stage 4 – review of draft cultural heritage assessment report.

<u>Stage 1</u>

The aim of Stage 1 is to identify the RAPs who wish to be consulted about the project. A log and copies of correspondence with Aboriginal community stakeholders, including published advertisements, is included in **Appendix D**.

An advertisement was placed in the 'Mudgee Guardian' on 22 May 2020 and in the Dunedoo District Diary' on 3 June 2020 requesting expressions of interest for those who wish to be consulted about the project. In addition, the following agencies were contacted to identify potential stakeholders for the area:

- Biodiversity and Conservation Division (BCD now Heritage NSW)
- Mudgee Local Aboriginal Land Council (LALC)
- Office of The Registrar: Aboriginal Land Rights Act
- National Native Title Tribunal (NNTT)
- Native Title Service Corporation (NTSCORP)
- Mid-Western Regional Council
- Central Tablelands Local Land Services.

As a result, the following groups or individuals registered to be consulted about the project:

- Muronggialinga
- Wellington Valley Wiradjuri Aboriginal Corporation (WVWAC)
- Paul Brydon
- Corroboree Aboriginal Corporation (CAC)
- Gallanggabang Aboriginal Corporation (GAC)
- Gunjeewong Cultural Heritage Aboriginal Corporation (GCHAC)
- Mudgee Local Aboriginal Land Council (MLALC)
- Warrabinga Native Title Claimants Aboriginal Corporation
- North-Eastern Wiradjuri.

These groups or individuals constitute the RAPs for the project.

<u>Stages 2 and 3</u>

The objective of Stages 2 and 3 is provide information about the project to the RAPs and to acquire information regarding Aboriginal cultural values associated with the project either through consultation and/or field work. Outcomes of Stages 2 and 3 are included in the ACHAR prepared by OzArk included as **Appendix D** and summarised in **Chapter 7**.

RAPs were sent information about the project and were provided with a copy of the proposed assessment methodology on 7 July 2020. RAPs were provided the required 28 days to review and comment on these documents (i.e. until 4 August 2020). OzArk received several comments from RAPs regarding the assessment methodology. These comments are included in **Appendix D** and summarised in **Table 5-8**. The feedback was incorporated into the assessment methodology prior to the fieldwork occurring.

Table 5-8: RAP comments on the draft assessment methodology

RAP	Comment	Response
GAC and WVWAC	Page 17 states the following: "*Archaeological potential is generally reduced on steep landforms unsuitable for camping, and landforms disturbed by erosion and historical impacts (e.g. farming and infrastructure installation*)". GAC Object to this as our Cultural heritage sites and artefacts are often found on landforms disturbed by erosion and historical impacts e.g. farming and infrastructure installation	The assessment methodology was adjusted, and the survey included disturbed landforms (including but not limited to areas of erosion, ploughing, dams, farming infrastructure and vehicle tracks)

RAP	Comment	Response
GAC and WVWAC	Page 17 states the following: "*The study area will be assessed by sampling the different landforms as outlined in Section 3.1 using pedestrian survey. The landforms will be refined as necessary during the survey. Survey transects will be approximately 100 m wide, with surveyors spaced approximately 30 m apart*". GAC object to the 30 m spacing as due to experience on other Solar Farms within the Region at Wollar, First Solar Wellington North, AGL Wellington North and Beryl Solar Farm, the 30m spacing has been to greater gap and (*sic*) on revisiting these other projects to collect artefacts or do sub-surface testing a multitude of additional sites and artefacts were required to be recorded. We as RAP's then have been questioned by Archaeologists who were not present during the initial survey as to why these sites were not found which causes issues around salvage of sites. We will concede to an absolute maximum of 20 m to assist Field Officers during the survey	The assessment methodology was adjusted, and surveyors were spaced approximately 20 m apart instead of 30 m
GAC and WVWAC	Page 18 states the following: "*The study area is 1743 ha. The proposed sampling will cover approximately 1046 ha, meaning that approximately 60% of the overall study area will be surveyed. It is estimated that survey of the sample areas will be undertaken in eight days by two archaeologists and up to four RAP representatives*". GAC Object to the 60% survey coverage of the overall study area, as too many cultural and or artefact sites will be missed and cause later issues and potential loss by site destruction by the development as we have seen at the Wellington North Solar Farm	The sampling strategy covered all landform types within the study area as per the Code. It also included more intensive survey in areas with higher archaeological sensitivity as determined through the course of the survey and in discussion with RAP site officers

<u>Stage 4</u>

Stage 4 involves issuing the draft ACHAR to the RAPs for their consideration. The draft ACHAR was issued to the RAPs for comment on 27 October 2020. RAPs were provided the required 28 days to review and comment on the draft ACHAR (i.e. until 24 November 2020). Comments are included in Appendix 1 of **Appendix D**.

WVWAC provided comments on the draft ACHAR relating to the field survey methodology including concerns over:

- spacing of Cultural Heritage Field Officers being greater than 20 metres in some areas
- the splitting of RAP's Cultural Heritage Field Officers into two groups in an attempt to cover more area within a short time period
- missed artefact sites that may have been present between the spaced Cultural Heritage Field Officers
- loss of unrecorded sites that have not being properly identified, recorded and salvaged
- the study area being the boundary of three Clan areas and therefore is highly culturally significant as meetings took place in and around the study area.

The WVWAC provided recommendations around:

- remaining areas of the study area be comprehensively surveyed with all RAP's Field Officers present as one large group
- preparation of a Cultural Heritage Management Plan
- preparation of a protocol for unexpected finds of human skeletal remains.

OzArk responded to the comments on 9 December 2020 and incorporated these into the final ACHAR. OzArk's response to WVWAC provided clarification of the survey methodology used in reference to the Code of Practice and reiterated that the higher potential sections of the study area have been comprehensively surveyed. The unsurveyed areas of the study area were determined to have low potential for archaeological deposits or Aboriginal sites to be present. Some deviations to the 20 metre spacing were made due to physical constraints such as fences, dams and swampy ground. Further field assessments are not necessary provided all land-disturbing activities remain within the development footprint.

Social impact assessment consultation

Socio-economic specific consultation was completed to inform an understanding of the social baseline including labour force skill and availability, accommodation availability and pressures, and community values attitudes. This consultation comprising targeted and opportunistic discussions with:

- Mid-Western Regional Council staff
- employment services providers
- real estate agents
- accommodation providers
- Mudgee Tourist Information Centre
- food and beverage service providers.

General consultation undertaken for the project described in preceding sections, as well as the outputs of key other environmental investigations, was also considered and included within the social baseline and impact assessments of the socio-economic assessment.

Neighbouring mines

Early stages discussion including potential for a transmission line through the mines. After project refinement, UPC\AC did not need a transmission line to connect to the existing network (onsite connection). UPC\AC sent a notification letter to Hunter Gas, containing a plan of the project site and additional information, in accordance with a request from DPIE.

Local media

Interactions with local media groups undertaken during preparation of the EIS included:

- Newspaper advertisements in the Mudgee Guardian and Dunedoo District Diary on 20 October 2020 and 21 October 2020 to advise the general public of details of the community information session to be held on 28 October 2020
- Facebook posts on 20 October 2020 to advise the general public of details of the community information session
- Flyer on the community noticeboard at Gulgong on the 21 October 2020 advising local residents of the community information session.

Special interest groups
UPC\AC has had ongoing discussions (phone and email) with local community groups in Gulgong including SOS Concerned Residences, the Gulgong Community Action Group and the Gulgong Community Group. Multiple attempts were made by UPC\AC to contact the appropriate representative for the Gulgong Residents for Responsible Renewables, however, was unsuccessful.

5.7.3 Mineral title holders
UPC\AC notified Hunter Gas Pty. Ltd. of its intention to develop the project within PEL0456. A letter describing the proposed development and a map locating the study area and development footprint in relation to PEL0456 was sent on 13 November 2020.

5.7.4 Network service providers
The NSW Transmission Network Service Provider, TransGrid, has been engaged from a very early stage. The workstream of assessing the ability for the project to connect to the existing electrical transmission network is ongoing. There is a formal process which is dictated by TransGrid which must be followed in order to receive an offer to connect to the line. This application and its associated studies are currently underway. Any issues would be resolved prior to commencement of construction.

Consultation is currently underway to determine the suitability of using the existing 330 kilovolt transmission line easement on the western side of the development footprint as the preferred site access in accordance with the *TransGrid Easement Guidelines* and the *TransGrid Fencing Guidelines*. It is expected that TransGrid would provide a submission to the EIS regarding this access.

Consultation with other service providers including for gas and telecommunications will be undertaken prior to construction. Water and sewer connections are not required for the project (refer to discussion in **Section 2.7**).

5.8 Future engagement

5.8.1 EIS exhibition and response to submissions report
When the EIS is placed on public exhibition, UPC\AC will email all the contacts in their consultation database to notify them that public consultation has begun. The notification will include details on the dates when public consultation will occur and will inform recipients of where to find the EIS and how to make a submission.

During public exhibition, UPC\AC will be available to answer questions or concerns from the community, but UPC\AC will avoid interfering with DPIE's public exhibition activities. UPC\AC proposes another community drop-in session to provide an opportunity for community members to discuss the EIS and explain any technical aspects of the project. These dates, times and locations would be advertised in the local newspapers as well as on the project website. UPC\AC would again distribute a factsheet with key details contained in the EIS and outlining the drop-in session date to the community.

UPC\AC will respond to all public submissions made during the public exhibition stage in a 'Response to Submission' report which will be submitted to DPIE.

5.8.2 Ongoing key stakeholder engagement

UPC\AC has identified Mid-Western Regional Council as a key stakeholder to assist and undertake community consultation, due to their knowledge of the area and experience in many recent projects of a similar scale. UPC\AC will continue to engage with both Mid-Western Regional Council and the NSW State Government to seek feedback on the development of management plans and strategies as the project moves from development into pre-construction, construction and operational phases.

5.8.3 Ongoing community engagement

UPC\AC will continue to engage with the community throughout construction, operation and decommissioning of the project. Engagement activities would include:

- Regular updates on the project website and Facebook page
- Distribution of newsletters, fact sheets and FAQs to the local community
- Letter box drops
- Operation of the community enquiry line
- Operation of a complaints line and recording in a complaints register.

The project email address and hotline will remain in place, and UPC\AC representatives will continue to take responsibility for addressing feedback and concerns as and when they arise. UPC\AC representatives will be regularly stationed on site in the local area and will be available to meet with the community and local stakeholders (subject to continued COVID-19 travel restrictions).

5.8.4 Community benefit sharing program

As the project progresses, UPC\AC will develop a community benefit sharing program with Mid-West Regional Council and the local community aimed to help build and support local projects and initiatives. UPC\AC is currently trialling and implementing a similar program for the New England Solar Farm.

As part of the program UPC\AC will provide ongoing financial assistance to ensure that there is a direct benefit from the solar farm to the local community. This could include support for local schools, training or education as well as grants or project support for local community or sporting groups.

The final strategy will be developed in consultation with Mid-Western Regional Council and DPIE and will be presented to all relevant stakeholders prior to commencement of construction.

6. BIODIVERSITY

*This chapter presents an assessment of the potential biodiversity impacts as a result of the project. This chapter has been prepared to address specific SEARs relating to biodiversity as presented in **Section 1.5**.*

*A BDAR has been prepared by ELA in accordance with the BC Act and the BAM. The report is provided in **Appendix B** and a summary presented below.*

6.1 Assessment methodology

The preparation of the biodiversity assessment included the following methodology:

- desktop review of available background information, mapping, and publicly available databases
- field surveys of the study area
- assessment of impacts to biodiversity values, determination of required biodiversity offsets for the project, and provision of management and mitigation measures to minimise identified impacts.

6.1.1 Desktop review

A desktop review was carried out for the assessment and involved a search of the following:

- BioNet Atlas (DPIE, 2020)
- EPBC Protected Matters Search Tool (DAWE, 2020)
- BioNet Vegetation Classification
- Threatened Biodiversity Data Collection (DPIE, 2020)
- Species Profile and Threats Database (DAWE, 2020)
- Register of Declared Areas of Outstanding Biodiversity Value
- Waterway Stream Orders (DPI, 2013)
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7 (DoEE, 2017)
- Stubbo Solar Farm Stage One Ecological Assessment (Red Sand Ecology 2019)
- NSW Department of Primary Industries (DPI) freshwater threatened species distribution maps (Riches, 2016)
- Key Fish Habitat Maps (DPI 2007).

A review of previous field surveys of a larger study area undertaken by RPS and Red Sand Ecology in 2019 was also undertaken, however plot data from those surveys were not used in this assessment.

An assessment area was used for the desktop assessment, comprising a 1.5 kilometre buffer around the development footprint. Therefore, the footprint assessed in the biodiversity assessment is more conservative approach.

6.1.2 Field surveys

Two types of surveys were conducted in the study area:

- vegetation surveys
- targeted species surveys.

A preliminary vegetation survey was undertaken on 25 and 26 May 2020 to collect rapid data points to broadly identify the extent and type of native vegetation and plant community types (PCTs) present and inform initial vegetation mapping.

Vegetation integrity surveys were then undertaken within the development footprint and broader study area including the central environmental exclusion zone as initially identified in the Scoping Report on 2 to 4 September 2020, 15 to 18 September 2020 and 15 to 16 October 2020. A total of 33 full-floristic vegetation plots were surveyed to identify PCTs and threatened ecological communities (TECs). A total of 33 vegetation integrity plots were undertaken in accordance with the BAM (refer to **Figure 6-1**). All field data collected at full-floristic and vegetation integrity plots is presented in **Appendix B**.

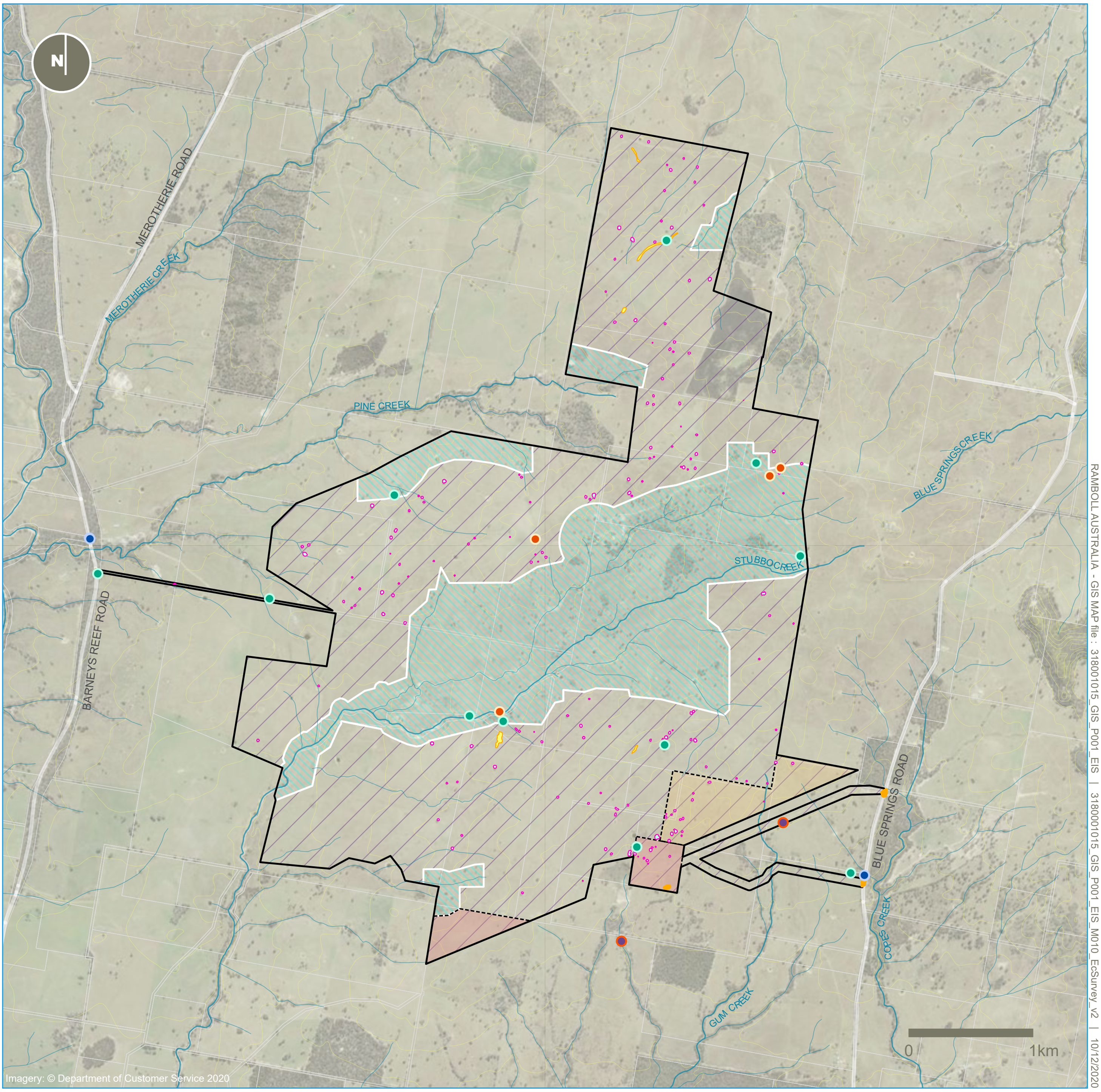
Targeted surveys were undertaken for species credit species within the study area (refer to **Figure 6-1**). These involved:

- parallel transects for threatened flora, involving transects across areas of potential habitat for threatened species on 15 and 16 October 2020
- call play-back for koala at two locations in September 2020, involving call sequence broadcasting followed by periods of listening. Barking owl and powerful owl surveys were also conducted on three nights in September 2019 along with daytime searches to locate roost or nest sites
- spotlighting surveys for owls and koala on three nights in September 2019 along transects through potential habitat areas within the development footprint, environmental exclusion zone, and surrounding area
- two koala spot assessment technique (SAT) surveys in September 2020, targeting areas representing the highest quality and most connected habitat
- bird surveys in September 2019 and May, September and October 2020 using the 20 minute/two hectare search method with all species that were heard and/or observed recorded. Diurnal surveys were also undertaken which included playback targeting the Regent Honeyeater and Swift Parrot. Searches for large stick nests such as those used by the White-bellied Sea-Eagle were also undertaken during vegetation surveys in September and October 2020
- active searches (rock turning) for the Pink-tailed Worm Lizard in October 2020 in areas of potential habitat over two days.

6.1.3 Statutory context, policy and guidelines

The preparation of the biodiversity assessment has been undertaken with consideration of the following relevant Commonwealth and State Acts and Policies:

- NSW EP&A Act
- Commonwealth EPBC Act
- NSW BC Act
- NSW FM Act
- *Mid-Western Regional Local Environmental Plan 2012*.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Recorded threatened species (bird)
- Owl call playback
- Koala call playback
- Bird surveys
- Targeted flora tracks
- Barking Owl species area
- Rock areas - active search

Figure 6-1 | Field surveys – plots and targeted survey locations

6.2 Existing environment

6.2.1 Landscape features

The study area is wholly contained within the NSW South Western Slopes Interim Biogeographic Regionalisation for Australia (IBRA) region, and the Inland Slopes IBRA subregion.

The study area lies within the Rouse Soil Landscape, described as undulating hills and low hills with granite outcropping as tors and sloping pavements. Parent rocks are granite, adamellite and granodiorite. Soils are mainly shallow Siliceous Sands and Earthy Sands on mid-slopes and upper slopes. Yellow Soloths and yellow Solodic Soils on lower slopes and in depressions (DPIE, 2020). The land within the study area is gently undulating lower slopes and flats associated with Stubbo Creek, an ephemeral waterway that drains westward through the centre of the study area, with elevation ranges from approximately 550 metres in the east to 450 metres in the west. The study area and assessment area do not contain any areas of geological significance such as karsts, caves, crevices or cliffs.

There are some connectivity features along the edge of the study area, associated with road reserves and vegetated drainage. These areas contain higher quality, more connected woodland habitats within the assessment area and may facilitate movement of threatened species across their local range, although these areas are very limited in extent, with only 0.17 hectares present within the development footprint. The waterways within the study area include:

- Stubbo Creek (first to fourth order stream) which includes a riparian buffer of 10 to 40 metres
- unnamed second order drainage line (second order stream) which includes a riparian buffer of 20 metres
- unnamed first order drainage line (first order stream) which includes a riparian buffer of 10 metres.

None of these waterways were identified to contain any significant habitat features. No areas of outstanding biodiversity value were identified within the study area or assessment area.

6.2.2 Native vegetation

Overview

The study area has a history of cropping and grazing and is largely cleared of native vegetation (refer to **Figure 6-2**). The large paddocks contain pastural grasses, legumes with scattered native paddock trees. All large patches of remnant vegetation have been avoided by the project and are excluded from the development footprint. The extent of native vegetation within the development footprint is 5.53 hectares of the total 1,243 hectares of land that makes up the development footprint (0.44 per cent). Aerial imagery reviewed as part of the desktop assessment previously identified a greater extent of native vegetation, however approximately 30 paddock trees have since been removed.

A BDAR for an SSD project is not required to assess the impacts of any clearing of native vegetation and loss of habitat on land classified as 'Category 1 – exempt land' (Category 1 Land) under the LLS Act, other than impacts 'prescribed' in Clause 6.1 of the NSW *Biodiversity Conservation Regulation 2017*.

All paddock areas within the study area are considered to qualify as Category 1 Land. For any part of the project that is on Category 1 Land, only 'prescribed impacts' require further assessment.

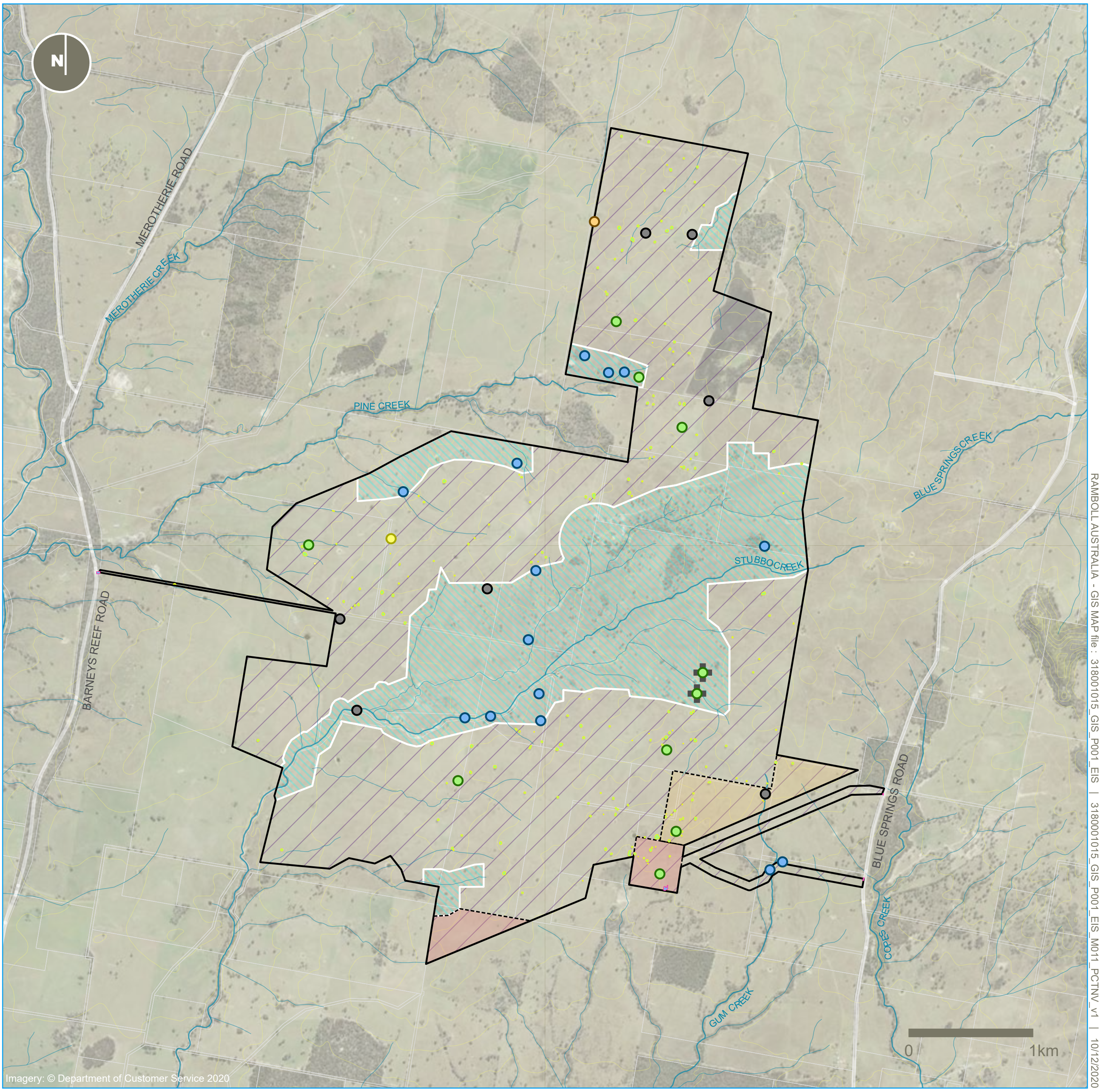
Figure 6-2: Current cropping shown in bright green and evidence of past cropping/ploughing

Plant community types

Two PCTs were identified in the study area, based on an analysis of floristic plot data. These PCTs are presented in **Table 6-1** and the locations within the study area are shown in **Figure 6-3**. The estimated percentage cleared value for each PCT, sourced from the Vegetation Information System is also presented in **Table 6-1**.

Table 6-1: Plant community types in the study area

Plant community type	Vegetation Class	Vegetation Formation	Area (ha)	Percentage cleared
281 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	Grassy Woodlands	5.29	67
1770 - Narrow-leaved Ironbark - Red Stringybark - Black Pine woodlands on sandstone substrates of the Brigalow Belt South	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	0.24	11



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek

Vegetation integrity survey plots

- PCT 281 (low)
- PCT 281 (moderate-good)
- PCT 1770 (low)
- PCT 281 (planted, indirect impact)
- Category 1 land
- Excluded from calculations

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act and NSW BC Act)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (NSW BC Act)
- Vegetation zone 1: PCT 281 - Box Gum Woodland (low)
- Vegetation zone 2: PCT 281 - Box Gum Woodland (moderate-good)
- Vegetation zone 3: PCT 1770 - Narrow-leaved Ironbark - Red Stringybark - Black Pine woodlands on sandstone substrates of the Brigalow Belt South (low)

Figure 6-3 | Plant community types and native vegetation extent

It has been estimated that all 5.29 hectares of PCT 281 within the development footprint comprises the NSW BC Act listed critically endangered ecological community (CEEC) *White Box Yellow Box Blakely's Red Gum Woodland.* This includes disturbed remnants of vegetation. However only 0.17 hectares of this PCT was also found to represent the EPBC Act listed CEEC *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, as the remaining portion did not meet the condition thresholds for the listing.

6.2.3 Habitat

Fauna habitat

Fauna habitats within the study area were found to be typical of a predominately cleared grazing farmland, with the available habitat features considerably degraded.

Hollows are abundant in the woodland areas, and common farmland birds such as Galah (*Eolophus roseicapilla*), Eastern Rosella (*Platycercus eximius*) and Sulphur-crested Cockatoo (*Cacatua galerita*) were observed using hollows. Higher condition woodland areas contain some shrubs and a higher diversity of native groundcover species, however woodlands within the development footprint generally have poor connectivity as they were found to be present as isolated paddock trees or small patches (refer to **Figure 6-4**). Habitat corridors are present at the periphery of the development footprint along public road reserves.

Granite rock outcrops also occur across the study area, varying from large boulders to smaller scatter surface rock. Five outcrop areas with some loose surface rock were considered to contain marginal or potential habitat for Pink-tailed Worm Lizard.

Figure 6-4: Low condition woodland within the development footprint comprising isolated mature trees with degraded/exotic groundcover

Aquatic habitats within the study area include:

- ephemeral stream with semi-permanent pools and small patches of aquatic vegetation
- drainage lines within cleared paddocks
- farm dams.

Riparian areas are generally cleared or contain scattered eucalypts with predominantly exotic, degraded groundcover vegetation. There are numerous small farm dams across the study area providing habitat for common species such as ducks, herons and grebes. However, habitat quality is low due to low eroded banks and lack of vegetation.

Stubbo Creek would be crossed by internal access roads and cable crossings as part of the project. The area surrounding the western crossing was found to contain small patches of aquatic plants such as *Typha* sp. (Bullrush), with predominantly exotic pastures and weeds on eroded banks. No significant habitat features were observed in the area surrounding the eastern crossing. Several first order drainage lines were also observed in the study area, however, were not found to contain any significant habitat features.

The study area contains mapped KFH at the location of the western crossing of Stubbo Creek, however no other areas of KFH were identified within the development footprint (**Figure 6-5**).

Flora habitat

Due to habitat degradation, no potential habitat was identified for shrub or groundcover threatened flora species within Category 1 Land or Low condition woodland. Higher condition areas were considered to contain potential habitat for two threatened flora species:

- Ausfeld's Wattle (*Acacia ausfeldii*)
- Silky Swainson-pea (*Swainsona sericea*).

These areas of potential habitat cover a small portion (0.17 ha or 0.01 per cent) of the development footprint and are present as narrow strips of road reserve vegetation and a small patch at the edge of the development footprint near the southern boundary.

6.2.4 Threatened species

An assessment was undertaken to determine the threatened species that are likely to be present in the study area, including a consideration of their habitat constraints, geographic limitations, and site degradation. This process therefore excluded a large number of species credit species from further assessment that were identified in the desktop assessment. As a result, the following species were considered for further assessment:

- Ausfeld's Wattle (*Acacia ausfeldii*)
- Silky Swainson-pea (*Swainsona sericea*)
- Koala (*Phascolarctos cinereus*)
- Pink-tailed Worm Lizard (*Aprasia parapulchella*)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Superb Parrot (*Polytelis swainsonii*)
- Barking Owl (*Ninox connivens*).

Ecosystem credit species were identified through operation of the BAM Credit Calculator in accordance with the BAM. No ecosystem credit species identified during desktop assessment were excluded from the assessment. The 19 identified ecosystem credit species are presented in **Appendix B**.

Targeted surveys were then undertaken to identify threatened species in the study area, as discussed in **Section 6.1.2**.

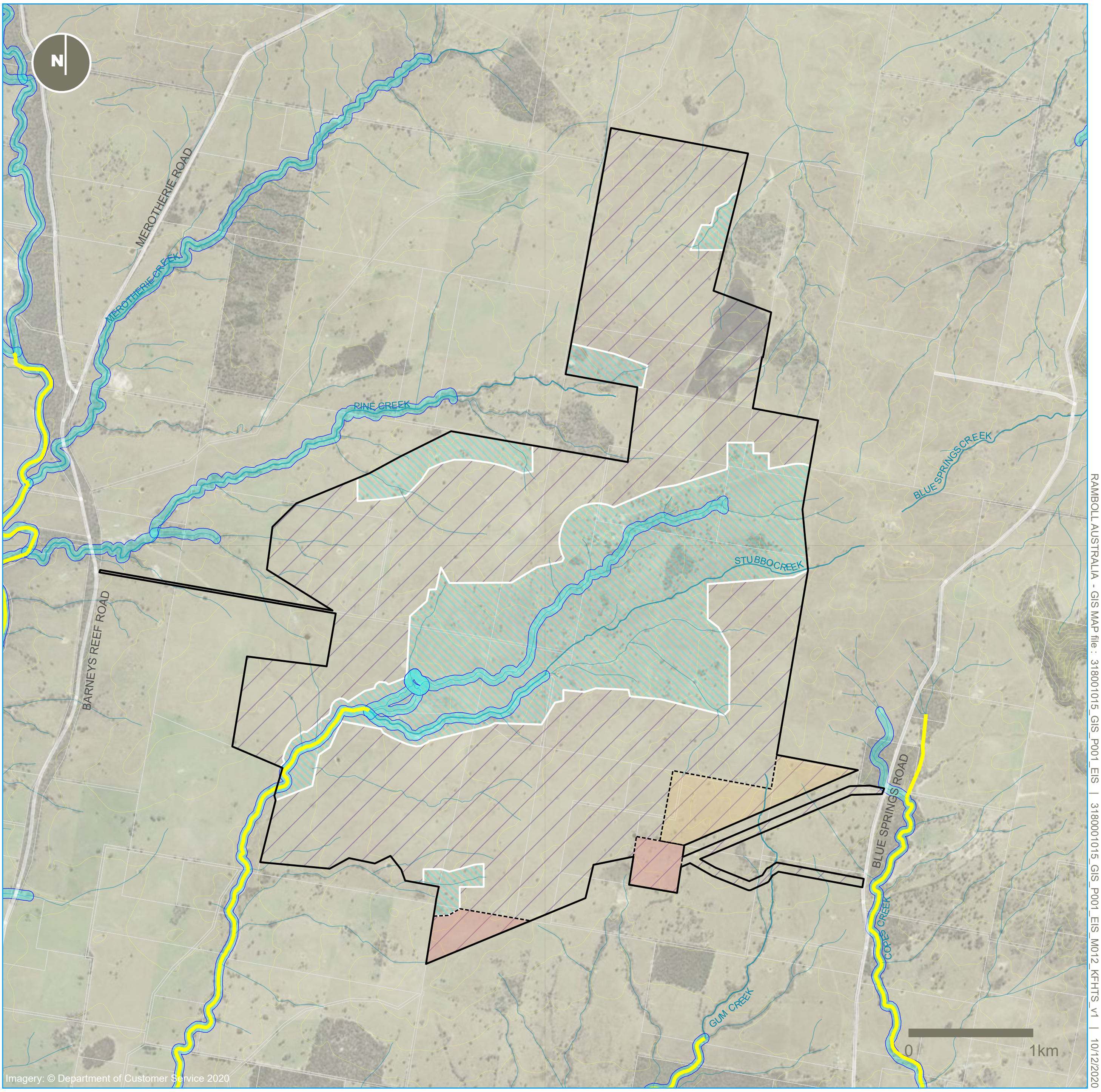
No threatened species were identified in the study area. However, a Barking Owl was recorded approximately 500 metres south of the study area on 25 May 2020. The species has therefore been assumed to be present. In addition, a Black Falcon (*Falco subniger*) has previously been recorded on the south west side of the study area. Black Falcon is also an ecosystem credit species.

The study area contains one area mapped within the indicative distribution of the Purple Spotted Gudgeon (*Mogurnda adspersa*) (**Figure 6-5**), which is also listed as endangered under the FM Act. However, habitat quality for this species within the study area is considered to be low due to:

- limited covering habitat such as overhanging trees and banks, snags and rocks
- absence of surrounding vegetation
- ephemeral nature (i.e. the site would be dry at times)
- high level of disturbance and eutrophication from agricultural activities.

The Purple Spotted Gudgeon is therefore considered to have a low likelihood of occurring in the study area.

The development footprint is not within the indicative distribution of any other threatened freshwater fish species listed under the FM Act, or are they considered likely to occur based on the habitats present.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Key fish habitat (NSW Fisheries)
- Indicative distribution: Purple Spotted Gudgeon

Figure 6-5 | Key Fish Habitat and threatened species distribution

6.3 Assessment of potential impacts

Potential biodiversity impacts resulting from the project would most likely occur during the construction stage when vegetation clearance and ground disturbance works would be undertaken. The assessment presented below therefore focuses on impacts associated with the construction stage unless otherwise indicated.

6.3.1 Avoidance of impacts

The project has been located to avoid and minimises impacts to biodiversity values. This has included selecting the location of the study area with consideration of limiting the amount of intact vegetation to be removed. The original investigations for the Stubbo Solar Farm included a broader area than the current study area, and multiple refinements of the study area and development footprint have resulted in a development footprint that largely avoids intact native vegetation with most of the proposed development footprint being located on Category 1 Land with little to no biodiversity value.

Additional environmental exclusion zones have been added to reduce impact to areas of greater biodiversity values, along with an expansion of the main environmental exclusion zone after completion of the initial biodiversity assessment to further avoid and minimise impacts to environmental values (refer to **Figure 3-2**:). The selection of the development footprint and layout of project have also considered avoidance and minimisation of biodiversity values, including locating ancillary facilities in areas in Category 1 Land and outside of patches of native vegetation where possible.

6.3.2 Direct and indirect impacts

The main impact of the project on biodiversity values would result from the removal of vegetation and subsequent loss of habitat and associated indirect impacts. Direct impacts are also expected as a result of disturbance to waterways for the construction of waterway crossings. The project may result in direct impacts on:

- native vegetation
- threatened ecological communities
- threatened species and threatened species habitat
- prescribed biodiversity impacts.

It is anticipated that there would be direct impacts on both PCTs identified in the study area. Approximately 5.29 hectares of PCT 281 (i.e. the whole area of this PCT identified in the development footprint), comprising the NSW BC Act listed CEEC *White Box Yellow Box Blakely's Red Gum Woodland*, with 0.17 hectares of this PCT also representing the EPBC Act listed CEEC *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.* The project would also directly impact on all 0.24 hectares of PCT 1770 identified within the development footprint.

The project is also expected to result in a direct impact to 4.4 hectares of habitat for the Barking Owl (*Ninox connivens*), which is assumed to be present in the study area due to a recording of a Barking Owl approximately 500 metres south of the study area (refer to **Section 6.2.4**).

Potential indirect impacts associated the project include:

- water quality impacts associated with sedimentation and contaminated and/or nutrient rick run-off in rainfall events during construction and decommissioning
- increase noise dust or light spill from operating machinery and equipment, predominantly during the day during construction and decommissioning, and at night during operation

- potential spread of illegal rubbish dumping by site personnel and spread via wind to adjacent vegetation during construction and operation
- increase in predatory species and pest species populations following disturbance to vegetation and fauna habitat during construction and operation
- increased risk of fire in adjacent vegetation resulting from potential sparks from electrical or machinery works during construction and operation.

As the project is not likely to significantly impact groundwater (refer to **Chapter 14**), no impacts to Groundwater Dependent Ecosystems (GDE), if present, are expected to occur.

The project may impact on the connectivity of different areas of habitat for threatened species that facilitates the movement of those species across their range. Impacts on connectivity are expected to be minor as the areas to be removed are only suitable as connective habitat for highly mobile species that would continue to be able to move throughout their local range and the main connectivity features within the locality would be retained.

Impacts of vehicle strike are unlikely to be significant as traffic management and speed limits would reduce the likelihood of vehicle strike. Threatened species would unlikely be funnelled towards roads as a result of the project but may affect common species such as Kangaroos and Wombats.

Potential direct impacts to aquatic habitat are associated with the western crossing of Stubbo Creek. However, the project would aim to avoid obstruction of fish passage or dredging/reclamation works.

A risk assessment undertaken to identify residual impacts following the implementation of management and mitigation measures found that the potential impacts of the project pose a low to very low risk to biodiversity values, provided the measures are adequately implemented.

6.3.3 Serious and irreversible impacts

One threatened ecological community has been considered a potential entity to meet the serious and irreversible impacts principle, being the White Box Yellow Box Blakely's Red Gum Grassy Woodland. However, the expected impacts are not considered to be serious and irreversible impacts.

The project would result in direct removal of 5.29 hectares of this community. Approximately 5.12 hectares of this community is considered low condition and present as scattered paddock trees among exotic pasture. Only 0.17 hectares is present as moderate to good quality woodland.

This community occurs widely across NSW in a variety of condition states and is fragmented over a wide distribution. The estimated extent of this community outside the development footprint is 155 hectares within 1.5 kilometres. The project would therefore represent the removal of approximately three per cent of the community within 1.5 kilometres. There is an estimated 689 hectares of this community within 5 kilometres, resulting in the removal of approximately 0.76 per cent of the community within 5 kilometres as a result of the project. In addition, the condition of this community likely varies within these areas with higher quality remnants likely to be present in road reserves and along drainage lines. Higher quality and larger areas of the community have been retained within the environmental exclusion zone and in the surrounding landscape.

The extent and overall condition of the community is unlikely to be significantly changed as a result of the project due to the small area and low condition of the areas to be impacted. The project is also unlikely to impact on abiotic factors that are critical to the long-term survival of this community (e.g. reduction in groundwater levels or substantial alteration of surface water patterns), as the area to be impacted is already highly disturbed and modified.

The project would result in minor increases to the fragmentation which already exists within the highly modified farming landscape comprising widely scattered paddock trees, however more intact areas would be retained. Impacts to this community would also be offset in accordance with the Biodiversity Offset Scheme under the BC Act.

6.3.4 Impacts requiring offsets

Impacts expected to occur as a result of the project require offsetting. These include:

- direct impacts to 5.29 hectares of PCT 281 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- direct impacts to 0.24 hectares of PCT 1770 Narrow-leaved Ironbark - Red Stringybark - Black Pine woodlands on sandstone substrates of the Brigalow Belt South
- direct impacts to 4.4 hectares of Barking Owl (*Ninox connivens*) habitat.

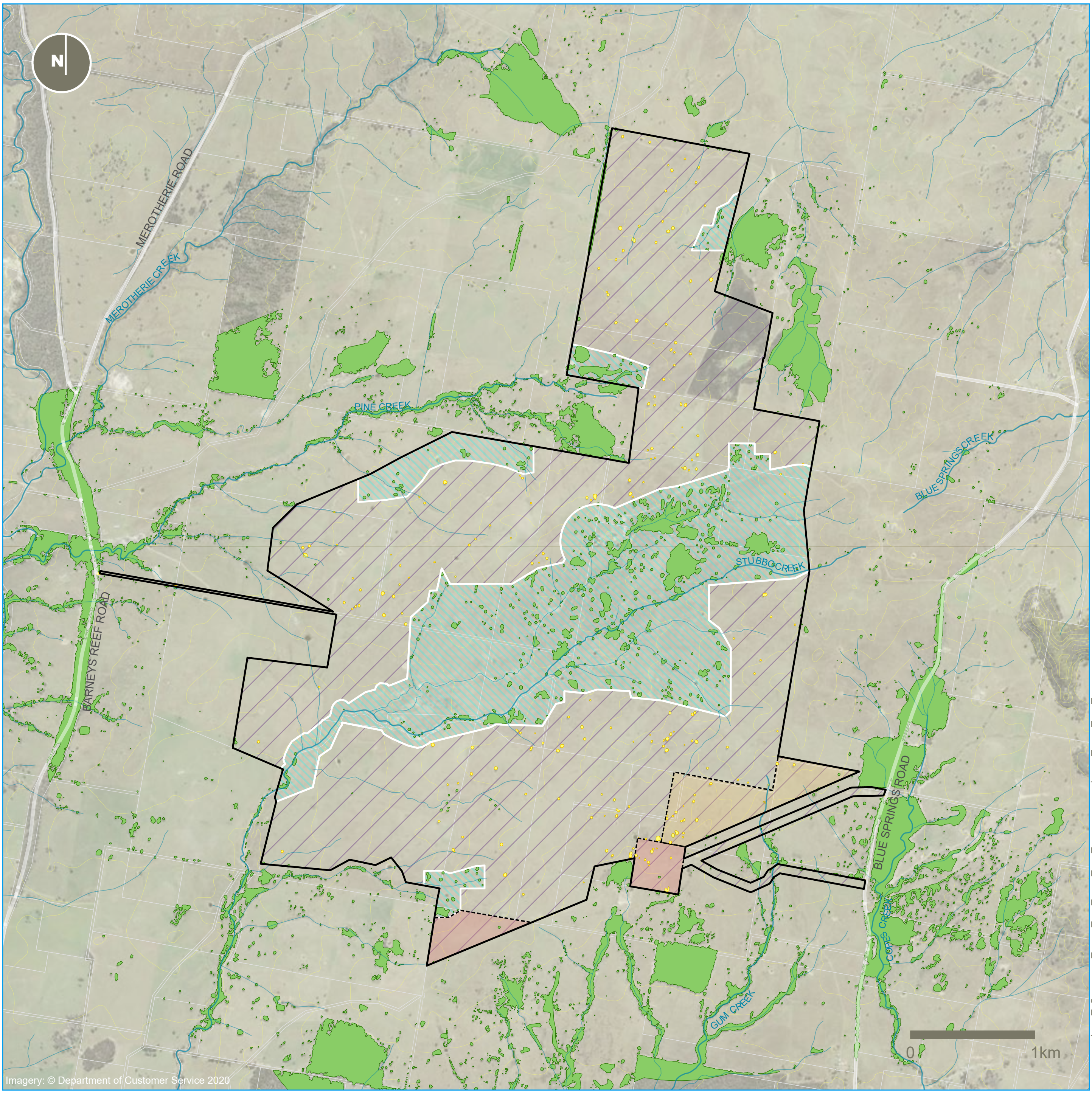
Native vegetation requiring offsets is shown in **Figure 6-6**.

A total of 87 ecosystem credits and 66 species credits are required to offset the above impacts of the project. A biodiversity credit report is provided in appendix C of **Appendix B.**

6.4 Matters of national environmental significance

An assessment of the impacts of the project on MNES was undertaken to determine whether there is potential for any significant impacts requiring a referral to the Commonwealth Minister for the Environment.

A likelihood of occurrence assessment of each species is presented in appendix E of **Appendix B**. Significant impact assessments were completed for one ecological community and four species, with a summary presented in **Table 4-2**. The assessments concluded that significant impacts are unlikely to occur and referral under the EPBC Act is not required.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Vegetation to be removed
- Native vegetation to be retained

Note:
IBRA sub-region : NSW South Western Slopes / Inland Slopes covers the entire study area

Figure 6-6 | Native vegetation requiring offsets

6.5 Environmental management and mitigation measures

As discussed in **Section 6.3.1**, significant steps have been taken throughout the development of the project to avoid or minimise impacts to biodiversity values through the selection of location and layout of the study area and development footprint. This has resulted in a development footprint that largely avoids intact vegetation.

Additional measures proposed to further minimise impacts to biodiversity values are presented in **Table 6-2**.

Table 6-2 Management and mitigation measures - biodiversity

ID	Management/mitigation measure	Timing
B1	Clearing protocols will be developed that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance (e.g. removal of native vegetation by chainsaw instead of heavy machinery where only partial clearing is proposed). Fencing (or other barriers as required) and signage will be placed around those areas of vegetation to be maintained to prevent any accidental construction damage and provide a permanent barrier between the development footprint and retained areas. The type of fencing during construction may be of a temporary nature and scale that is robust enough to withstand damage during this stage of work. Use of appropriate machinery for vegetation removal adjacent to retained areas.	Prior to construction / construction
B2	Pre-clearance surveys will be undertaken prior to tree clearing. Active breeding or nesting identified during pre-clearance surveys will be avoided in August, September and October which is the breeding/nesting period for most fauna species. A qualified ecologist/licenced wildlife handler will supervise tree removal in accordance with best practise methods.	Prior to construction / construction
B3	A procedure will be developed for the relocation of habitat features (e.g. fallen timber, hollow logs) to adjacent retained habitat.	Prior to construction
B4	Monitoring will be undertaken within the environmental exclusion zones to confirm biodiversity values are not significantly affected by indirect impacts. This may include: • comparison against EIS baseline monitoring • consideration of natural seasonal variation • development of trigger values for the commencement of adaptive management actions • details of proposed adaptive management actions to reduce or eliminate recorded impacts.	Construction / decommissioning
B5	Appropriate controls will be implemented to manage exposed soil surfaces and stockpiles to prevent sediment discharge into waterways. All works within proximity to the drainage lines will have adequate sediment and erosion controls (e.g. sediment barriers, sedimentation ponds). Revegetation will also commence as soon as is practicable to minimise risks of erosion.	Prior to construction / construction

ID	Management/mitigation measure	Timing
B6	Construction works will only be undertaken during daylight hours and night lights will not be used. Lights associated with operation will be directional to avoid unnecessarily shining light into adjacent retained vegetation where possible.	Construction / operation
B7	Dust suppression measures will be implemented to limit dust onsite. Revegetation will also be commenced as soon as practicable to minimise areas likely to create dust.	Construction
B8	All machinery will be cleaned prior to entering and exiting the study area to minimise the transport of weeds to vegetated areas to be retained. Weeds that are present within the study area that are listed under the *NSW Biosecurity Act 2015* will be managed.	Construction
B9	All personnel working on the project will undertake an environmental induction as part of their site familiarisation. This will include: • site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and noxious weeds) • what to do in case of environmental emergency (e.g. chemical spills, fire, injured fauna) • key contacts in the case of an environmental emergency.	Construction
B10	A Traffic Management Plan will be developed which includes speed limits and controls to reduce risk of fauna strike. Any vehicle strike incidents will be recorded.	Construction / operation
B11	A strategy will be developed and implemented to protect vegetation and habitat adjacent to the project. This will outline the following: • rubbish disposal guidance • prohibition of wood collection • prohibition of lighting of fires • no-go-zones for native vegetation outside the development footprint • speed limits on the surrounding road network	Construction
B12	Suitable species will be used as ground cover species in any revegetation areas.	Construction
B13	All waterway crossings will be designed in accordance with *Policy and Guidelines for Fish Friendly Waterway Crossing* (DPI, n.d.) where appropriate.	Detailed design

7. ABORIGINAL HERITAGE

This chapter presents a summary of the assessment and identifies potential Aboriginal cultural heritage impacts within the study area and surrounding locality. This chapter has been prepared to address specific SEARs relating to Aboriginal cultural heritage as presented in ***Section 1.5****.*

An ACHAR has been prepared by OzArk. The report is summarised below and provided in full in ***Appendix D****.*

7.1 Assessment methodology

7.1.1 Assessment approach

The purpose of the Aboriginal cultural heritage assessment is to meet the following objectives:

- undertake background research on the study area to formulate a predicative model for site location within the study area
- identify and record objects or sites of Aboriginal heritage significance within the study area, as well as any landforms likely to contain further archaeological deposits
- assess the likely impacts of the proposed work to Aboriginal cultural heritage and provide management recommendations.

Aboriginal cultural sites may include:

- Isolated finds - may be indicative of the random loss or deliberate discard of a single artefact, the remnant of a now dispersed and disturbed artefact scatter, or an otherwise obscured or sub-surface artefact scatter. They may occur anywhere within the landscape but are more likely to occur in topographies where open artefact scatters typically occur.
- Open artefact scatters - defined as two or more artefacts, not located within a rock shelter, and located no more than 50 metres away from any other constituent artefact. This site type may occur almost anywhere that Aboriginal people have travelled and may be associated with hunting and gathering activities, short- or long-term camps, and the manufacture and maintenance of stone tools.
- Aboriginal scarred trees - contain evidence of the removal of bark (and sometimes wood) in the past by Aboriginal people, in the form of a scar. Bark was removed from trees for a wide range of reasons such as in the manufacture of various tools, vessels and commodities such as string, water containers, roofing for shelters, shields and canoes or for food gathering purposes.
- Quarry sites and stone procurement sites - typically consist of exposures of stone material where evidence for human collection, extraction and/or preliminary processing has survived.
- Burials - are generally found in soft sediments such as aeolian sand, alluvial silts and rock shelter deposits. Burials are generally only visible where there has been some disturbance of sub-surface sediments or where some erosional process has exposed them.

The Aboriginal cultural heritage assessment was undertaken in consultation with the Aboriginal stakeholders (RAPs) identified for the project. A summary of the consultation undertaken as part of the Aboriginal cultural heritage assessment is included in **Section 5.7.2** with details and correspondence records provided in **Appendix D**.

A desktop search of the following databases was conducted on 12 June 2020 to identify any potential previously recorded heritage within the study area:

- Commonwealth Heritage Listings
- National Native Title Claims Search
- New South Wales AHIMS Database
- Mid-Western Regional Council LEP.

A field assessment of the study area was undertaken by OzArk Senior Archaeologists, Dr Alyce Cameron and Stephanie Rusden, on 10 to 14 August and 17 to 19 August 2020. Representatives from several RAPs were present during the survey including:

- Steven George Flick (Muronggialinga) – 10 to 11 August 2020
- Larry Flick (Muronggialinga) – 12 August and 17 to 19 August 2020
- Brenda Waters (WVWAC and GAC) – 11 to 13 August and 17 to 18 August 2020
- Tammy Peterson (MLALC) – 10 to 14 August and 17 to 19 August 2020
- Scott Perrin – (Warrabinga Native Title Claimants Aboriginal Corporation) 10 to 11 August 2020
- Tyron Pennell – (Warrabinga Native Title Claimants Aboriginal Corporation) 12 to 14 August 2020
- Tayla Pennell – (Warrabinga Native Title Claimants Aboriginal Corporation) 17 to 19 August 2020
- Terri McConnell (North-Eastern Wiradjuri) – 11 to 14 August and 17 August 2020.

The study area was assessed by sampling the different landforms using pedestrian survey. The sampled areas are shown on Figure 6-1 in **Appendix D**. The survey transects were approximately 60–80 metres wide, with surveyors spaced approximately 20 metres apart as requested by RAP feedback on the assessment methodology in Stage 3 of the consultation (see **Section 5.7.2**). Survey transects were narrower where visibility was higher and in areas of higher archaeological potential (i.e. near watercourses).

The sampling covered approximately 1101 hectares, constituting around 63 per cent of the overall study area. Surveyed areas were prioritised within the development footprint, though areas of the environmental exclusion zone were also included in the survey due to its higher archaeological potential and to gain a holistic archaeological understanding of the study area. Further details on the effective survey coverage are included in Section 6.3 of the ACHAR (**Appendix D**).

7.1.2 Study area

The study area for the Aboriginal cultural heritage assessment represents the study area boundary as presented on **Figure 7-1**. The study area generally represents an area slightly larger than the development footprint. The development footprint represents the survey area after it was refined to avoid environmental constraints including identified Aboriginal heritage sites.

7.1.3 Statutory context, policy and guidelines

Protection of Aboriginal objects (sites, objects and cultural material) and Aboriginal places is afforded under the following statutory documents:

- Part 4 of the EP&A Act
- Part 6 of the NP&W Act
- The EPBC Act by way of the National Heritage List and Commonwealth Heritage List established under the Act
- Heritage Act
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
- *Protection of Movable Cultural Heritage Act 1986*.

The Aboriginal cultural heritage assessment has been undertaken in accordance with the following guidelines, policies and standards:

- *Code of Practice for the Investigation of Aboriginal Objects in New South Wales* (DECCW 2010) (Code of Practice)
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRs) (DECCW 2010)
- *Burra Charter* (Australia International Council on Monuments and Sites (ICOMOS) 2013).

7.2 Existing environment

7.2.1 Landscape context

An understanding of the environmental contexts of an area is requisite in any Aboriginal archaeological investigation. Natural geomorphic processes of erosion and/or deposition, as well as humanly activated landscape processes, influence the degree to which material cultural remains are retained in the landscape as archaeological sites; and the degree to which they are preserved, revealed and/or conserved in present environmental settings.

The topography of the study area is primarily gentle slopes, with the highest point being in the north-eastern corner. There are four main types of landforms identified within the study area as summarised in **Table 7-1** and shown on Figure 2-2 in the ACHAR report.

Table 7-1: Landform types within the study area

Landform type	Description	Area (ha)
Drainage	Banks and elevated terraces adjacent to drainage lines or watercourses. This includes Stubbo Creek and its tributaries, Pine Creek which intersects the study area from the north-western corner, and the numerous minor ephemeral drainage lines which have formed in shallow valleys between hill slopes	175.0
Flat	Flat or very gently sloping landforms, primarily located around drainage lines within the central environmental exclusion zone	154.4
Slopes	Gentle to moderate slopes, often intersected with minor drainage lines	1373.9
Ridgelines or crests	Elevated crests and minor ridgelines. This landform also includes spurs	68.6
Total		**1771.9**

The study area is mostly cleared of vegetation, consisting of a variety of grasses with scattered remnant trees throughout. There is a concentration of trees around the existing homestead, 'The Pinnacle', located near the centre of the study area. There are rock outcrops of varying sizes throughout the study area.

The study area is located at the eastern edge of the NSW South Western Slopes bioregion, specifically, the Inland Slopes sub-bioregion. This bioregion is characterised by hot summers and no dry season, with more temperate climates appearing at higher elevations.

The topography, hydrology and climate of the study area would have been conducive to occupation and use by Aboriginal people. As the water sources inside the study area appear to be relatively constant during periods of normal weather conditions (i.e. not drought periods), occupation could have occurred year-round.

7.2.2 Land use context

The study area has been used for sheep and cattle grazing, as well as limited cropping. The historic and ongoing use of the land for grazing purposes, means that any sites located within the study area are likely to have been at least partially disturbed. Cropping and the use of ploughing, affects the integrity of archaeological Aboriginal sites, in particular open camp sites, especially if such sites have potential for subsurface deposits. However, ploughing would usually only affect the top 20 centimetres of topsoil, and so there is the potential for intact subsurface deposits below the 'plough-zone'.

The clearing of vegetation inside the study area is widespread, despite some remnant trees remaining in particular areas. This is likely to have had an impact on any modified trees which may have been present.

Many areas along the incised drainage lines of Stubbo Creek and its tributaries show signs of erosion. This erosion has potentially removed sites had they been in close proximity to the drainage lines.

7.2.3 Historic context

At the time of European settlement, the study area was situated within the territory of people belonging to the *Wiradjuri* tribal and linguistic group. The Wiradjuri tribal area is situated within the Murray Darling Basin and extends across three general physiographic regions: the highlands or central tablelands in the east, the riverine plains in the west, and the transitional western slopes zone in-between.

Within the Wiradjuri region, the presence of Aboriginal people in the Darling Basin has been dated to 40,000 years ago. A spread east into the mountains is thought to have occurred between 14,000 to 12,000 years ago.

The Wiradjuri is one of the largest language groups within New South Wales extending across the districts of Mudgee, Bathurst, Dubbo, Parkes, West Wyalong, Forbes, Orange, Junee, Cowra, Young, Holbrook, Wagga Wagga, Narrandera, Griffith, and Mossgiel.

There are a number of broad scale regional archaeological studies which either cover the study area itself or are in general proximity to it, including:

- PhD thesis – changing land use and settlement patterns in the upper Macquarie River region of NSW from prehistoric times to 1860 (Pearson 1981)
- An assessment of Aboriginal sites in the Dubbo City Area (Koettig 1985)
- Assessment of the prehistoric heritage in the Mudgee Shire (Haglund 1985)
- Aboriginal heritage study: Dubbo local government area (OzArk 2006)
- Archaeological survey of the Proposed Beryl to Ulan 132 kilovolt electricity transmission line (Cubis 1981)
- Ulan Coal Mine (Kuskie and Webster 2002; Corkill 1991; Haglund 1981, 1996, 1999)
- Indigenous and non-Indigenous Heritage Assessment: Wollar – Wellington 330 kilovolt Electricity Transmission Line (OzArk 2005)
- Cobbora Coal Project (EMM 2012)
- Beryl Solar Farm (NGH Environmental 2017).

Appendix D includes a summary of the findings of these regional archaeological studies. Main findings relevant to the study area include:

- Previous investigations have identified some archaeological sites in the area within the vicinity of the creek and drainage lines, including:
  - Cubis (1981) recorded two open sites, two isolated artefacts, a shelter and a possible stone arrangement during the 35-kilometre transmission line survey between Beryl and Ulan. These sites, recorded south of the study area, included open site #36-3-0048 that contained artefacts of chert and quartzite and site #36-3-0047 containing quartzite, chert, basalt, siltstone and greywacke artefacts.
  - Cubis (1981) also recorded two isolated finds on Stubbo Creek and Sportsmans Hollow Creek, both southeast and outside of the study area.
  - OzArk (2005) undertook an assessment of a proposed 330 kilovolt electricity transmission line between Wollar and Wellington, located adjacent to the southeast boundary of the study area and intersects a small area of it. A total of 28 Aboriginal sites were recorded, three of which are in the general vicinity though outside of the study area: #36-3-0670, #36-3-0669, and #36-3-0671.
- Past archaeological investigations near the study area indicates that the most commonsite type would likely be stone artefact sites (isolated finds and artefact scatters). Other site types, such as grinding grooves, modified trees and rock shelters are rare or non-existent.
- Stone artefact sites tend to be associated with elevated level ground associated with water sources, and a number of these sites have also been recorded with potential archaeological deposits (PAD).
- Of the stone artefact sites recorded during previous assessments, quartz is the predominant material for stone artefacts in the area, though volcanic materials, silcrete, quartzite, mudstone, chert and chalcedony could also be present based on nearby results.

7.2.4 Previously recorded sites

A desktop search was conducted on local, state and national heritage databases to identify any potential previously recorded Aboriginal cultural heritage within the study area. The results of this search are summarised in **Table 7-2** and presented in detail in **Appendix D**.

Table 7-2: Aboriginal cultural heritage desktop-database search results

Database	Type of Search	Results
Commonwealth Heritage Listings	Mid-Western Regional Council LGA	No places listed on either the National or Commonwealth heritage lists are located within the study area
National Native Title Claims Search	NSW	One Native Title Claim covers the study area: NC2018/002, NSD857/2017, Warrabinga-Wiradjuri #7
AHIMS	6 x 6 km centred on the study area	63 AHIMS sites were recorded within the vicinity but only two occur within the study area: #36-3-2515 (TRE 21) and #36-3-1423 (IF23)
Local Environmental Plan	Mid-Western LEP	None of the Aboriginal places noted occur near the study area

As noted in **Table 7-2**, of the 63 AHIMS sites recorded within the vicinity of the study area only two occur within the study area: #36-3-2515 (TRE 21) and #36-3-1423 (IF23). Both sites are recorded on a landform between Stubbo Creek and a major tributary (see **Figure 7-1**). The sites were recorded during the 2009–2010 heritage survey for the Cobbora Coal Project. Although site #36-3-2515 is recorded as an isolated find with PAD on the AHIMS extensive search, the site card records the site as a scarred tree with three scars. As the site card description agrees with the nomenclature of the site name, this site is regarded as a culturally modified tree, not an artefact scatter. Site #36-5-1423 is an isolated quartz core with one negative flake scar.

The most frequent site type recorded in the vicinity of the study area is artefact scatters (49 per cent), isolated finds (17 per cent), and isolated finds with PAD (11 per cent). Axe grinding grooves and/or waterholes and wells (3 per cent), burial/s (3 per cent) and shelters with deposit (3 per cent) are slightly more frequently recorded than the remaining site types. Aboriginal resource and gathering with PAD, art sites with either an artefact scatter or grinding grooves, modified trees, PADs, and stone arrangements, only occur once each within the designated search area.

Several other sites have also been recorded within the general vicinity, however, are located outside of the study area:

- 36-3-1422, an isolated find located 100 metres northwest of the study area
- 36-3-1421, an isolated find located 68 metres northwest of the study area
- 36-3-2511, an isolated find with PAD located 170 metres northwest of the study area, adjacent to a tributary of Pine Creek.
- 36-3-0671, a low-density artefact scatter located 490 metres southeast of the study area, adjacent to Copes Creek
- 36-3-0669, a low-density artefact scatter located 2.1 kilometres southeast of the study area, adjacent to Stubbo Creek
- 36-3-0670, a low-density artefact scatter located 4.6 kilometres southeast of the study area, adjacent to Slapdash Creek.

One Native Title Claim covers the study area: NC2018/002, NSD857/2017, Warrabinga-Wiradjuri #7. Records held by the NNTT as of 20 May 2020 indicate that the identified parcels appear to be freehold, and freehold tenure extinguishes native title.

7.3 Assessment of potential impacts

7.3.1 Predictive modelling

A model was formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist throughout the study area and where they are more likely to be located. Site location is affected by the availability of and/or accessibility to a range of natural resources including permanent water sources, plant and animal foods; stone and ochre resources and rock shelters; as well as by their general proximity to other sites/places of cultural/mythological significance. Consequently, sites tend to be found along permanent and ephemeral water sources, along access or trade routes or in areas that have good flora/fauna resources and appropriate shelter.

Results of the predictive modelling undertaken by OzArk indicate that:

- Isolated finds may occur within the study area as they may occur anywhere and have been recorded within the region and one isolated find has been previously recorded within the study area
- Open artefact scatters may occur within the study area, most likely to occur on level or low gradient contexts, however, there are some areas along Stubbo Creek and its tributaries which appear to be heavily eroded, meaning that site preservation may be affected
- Modified (scarred) trees have a low-moderate to moderate likelihood to occur within the study area, most likely due to the prevalent clearing of native vegetation. However, it is possible that culturally modified trees may be present in stands of remnant native vegetation and it is noted that one scarred tree has been previously recorded within the study area
- The study area has low-moderate to moderate potential to contain stone artefact sites, these have increased potential to be located along the edges of Stubbo Creek and its tributaries
- The study area has a low to low-moderate potential to contain burial sites, especially along the edges and on the slopes adjacent to Stubbo Creek and its tributaries
- The low to low-moderate levels of disturbance throughout the study area indicates that sites have an increased likelihood of being located in their original context.

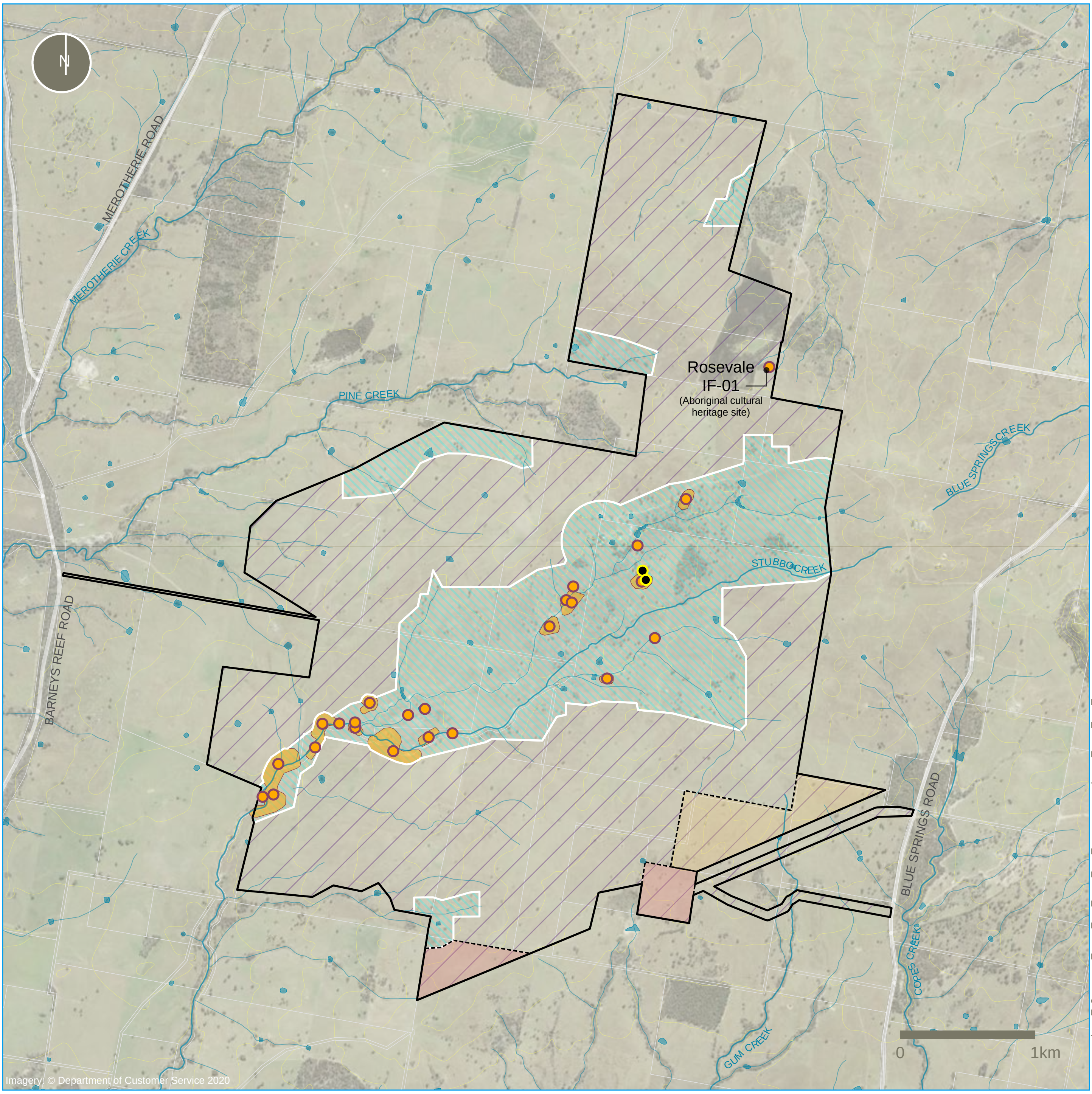
Within the study area, the highest areas of archaeological sensitivity remain to be along the main watercourses (Stubbo Creek and its tributaries), which would have provided at least a semi-permanent source of water in the area. The remainder of the study area, especially the higher to mid-slopes have a much lesser degree of archaeological sensitivity. The ridgelines and crests of the low-lying rolling hills are also less sensitive for archaeological sites than the landforms immediately adjacent to the main watercourses.

7.3.2 Sites recorded during the field survey

Table 7-3 summarises the Aboriginal cultural heritage sites recorded during the survey of the study area and **Figure 7-1** shows the location of the sites. Photos and detailed descriptions of the identified sites are included in **Appendix D**.

Table 7-3: Aboriginal cultural heritage sites recorded during the survey

Site name and number	Feature(s)	Landform	No. of artefacts and/or features
Stubbo Creek IF-01	Isolated find	Drainage	1
Stubbo Creek IF-02	Isolated find	Drainage	1
Stubbo Creek IF-03	Isolated find	Drainage	1
Stubbo Creek IF-04	Isolated find	Drainage	1
Stubbo Creek IF-05	Isolated find	Drainage	1
Stubbo Creek IF-06	Isolated find	Drainage	1
Rosevale IF-01	Isolated find	Slopes	1
The Pinnacle IF-01	Isolated find and PAD	Drainage	1
The Pinnacle IF-02	Isolated find and PAD	Drainage and flats	1
The Pinnacle IF-03	Isolated find	Drainage	1
The Pinnacle IF-04	Isolated find and PAD	Drainage	1
The Pinnacle IF-05	Isolated find	Slopes	1
Stubbo Creek OS-01	Artefact scatter and PAD	Drainage	98
Stubbo Creek OS-02	Artefact scatter and PAD	Drainage	43
Stubbo Creek OS-03	Artefact scatter	Drainage	18
Stubbo Creek OS-04	Artefact scatter and PAD	Drainage	23
Stubbo Creek OS-05	Artefact scatter and PAD	Drainage	16
Stubbo Creek OS-06	Artefact scatter and PAD	Drainage	53
Stubbo Creek OS-07	Artefact scatter and PAD	Drainage	8
Stubbo Creek OS-08	Artefact scatter and PAD	Drainage	27
The Pinnacle OS-01	Artefact scatter	Drainage	3
The Pinnacle OS-02	Artefact scatter and PAD	Drainage	2
The Pinnacle PAD-01	PAD	Drainage	1
36-3-1423	Artefact scatter and PAD	Flats	6
36-3-2515	Scarred tree	Flats	1



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Farm dams
- Aborigial cultural heritage sites recorded during survey
- Previously recorded Aboriginal sites
- Aboriginal cultural heritage sites including buffer

Note:
Native title claim NC2018/002 - Warrabinga-Wiradjuri #7 covers the entire study area

Figure 7-1 | Aboriginal heritage sites identified within the study area

The survey resulted in 23 new Aboriginal sites being recorded. The Aboriginal sites inside the study area consist of nine isolated finds, three isolated finds with PADs, two artefact scatters, nine artefact scatters with PADs, one PAD, and one modified tree.

In total, 309 stone artefacts were recorded during the survey. The predominate material for stone artefacts was quartz (n=246, 79.6 per cent), followed by chert (n=22, 7.1 per cent), mudstone (n=16, 5.2 per cent) and volcanics (n=13, 4.2 per cent). Also present though in much lower quantities were silcrete, petrified wood, greywacke and chalcedony. The most frequent type of stone artefact is flakes.

Most sites were recorded in the 'drainage' landforms along Stubbo Creek or the two main tributaries northwest and southwest of Stubbo Creek. The artefact sites (scatters and isolated finds) are located predominately in erosion scalds on the edges of elevated terraces, indicating there is potential for subsurface archaeological deposits where the terrace still has topsoil and A-horizon soils present.

The two previously recorded AHIMS sites within the study area, #36-3-1423 and #36-3-2515 (see **Section 7.2.4**), were also ground-truthed during the field survey to assess their current condition. Site recording captured all the information required to complete current AHIMS site recording forms (e.g. site location, site boundary, site plan, representative photographs, artefact recording and feature recording).

No specific cultural values were shared by RAP representatives during the field assessment, except for the observation that every site and artefact is important to Aboriginal people. There were multiple discussions during the field assessment concerning archaeological potential and which areas of the study area were most likely to contain sites. The discussions concluded that it was unlikely larger sites would be present on the higher slopes and occupation sites would be more likely along Stubbo Creek and its tributaries.

7.3.3 Significance assessment

The appropriate management of cultural heritage items is usually determined based on their assessed significance, as well as the likely impacts of any proposed developments. A significance assessment was undertaken to characterise the social or cultural, archaeological or scientific, aesthetic and/or historic values of the identified sites. The overall cultural heritage values of a site, place or area are resolved through the combination of these elements.
Table 7-4 presents a summary of the significance assessment of Aboriginal cultural heritage sites recorded during the assessment. Further details of each of the assessment criteria are provided in **Appendix D**.

Table 7-4: Aboriginal cultural heritage significance assessment

Site Name	AHIMS ID	Social or Cultural Value	Archaeological / Scientific Value	Aesthetic Value	Historic Value
Stubbo Creek IF-01	36-3-3685	High	Low	Low	None
Stubbo Creek IF-02	36-3-3686	High	Low	Low	None
Stubbo Creek IF-03	36-3-3687	High	Low	Low	None
Stubbo Creek IF-04	36-3-3688	High	Low	Low	None
Stubbo Creek IF-05	36-3-3689	High	Low	Low	None
Stubbo Creek IF-06	36-3-3690	High	Low	Low	None
Rosevale IF-01	36-3-3691	High	Low	Low	None
The Pinnacle IF-01	36-3-3670	High	Low–moderate	Low	None
The Pinnacle IF-02	36-3-3671	High	Low–moderate	Low	None
The Pinnacle IF-03	36-3-3672	High	Low	Low	None
The Pinnacle IF-04	36-3-3673	High	Low–moderate	Low	None
The Pinnacle IF-05	36-3-3674	High	Low	Low	None
Stubbo Creek OS-01	36-3-3675	High	Moderate–high	Low	None
Stubbo Creek OS-02	36-3-3676	High	Moderate–high	Low	None
Stubbo Creek OS-03	36-3-3677	High	Low–moderate	Low	None
Stubbo Creek OS-04	36-3-3678	High	Moderate–high	Low	None
Stubbo Creek OS-05	36-3-3679	High	Moderate–high	Low	None
Stubbo Creek OS-06	36-3-3680	High	Moderate–high	Low	None
Stubbo Creek OS-07	36-3-3681	High	Moderate–high	Low	None
Stubbo Creek OS-08	36-3-3682	High	Moderate–high	Low	None
The Pinnacle OS-01	36-3-3683	High	Low	Low	None
The Pinnacle OS-02	36-3-3684	High	Moderate–high	Low	None
The Pinnacle PAD-01		High	Low-moderate	Low	None

7.3.4 Impacts to identified sites

Table 7-5 presents a summary of potential impacts to Aboriginal cultural heritage associated with the project. This includes the two preferred access points.

Table 7-5: Aboriginal cultural heritage impact assessment

Site Name	AHIMS ID	Type of Harm (Direct/Indirect / None)	Degree of Harm (Total/Partial / None)	Consequence of Harm (Total/Partial/No Loss of Value)
Stubbo Creek IF-01	36-3-3685	None	None	No loss of value
Stubbo Creek IF-02	36-3-3686	None	None	No loss of value
Stubbo Creek IF-03	36-3-3687	None	None	No loss of value
Stubbo Creek IF-04	36-3-3688	None	None	No loss of value
Stubbo Creek IF-05	36-3-3689	None	None	No loss of value
Stubbo Creek IF-06	36-3-3690	None	None	No loss of value
Rosevale IF-01	36-3-3691	Direct	Total	Total
The Pinnacle IF-01	36-3-3670	None	None	No loss of value
The Pinnacle IF-02	36-3-3671	None	None	No loss of value
The Pinnacle IF-03	36-3-3672	None	None	No loss of value
The Pinnacle IF-04	36-3-3673	None	None	No loss of value
The Pinnacle IF-05	36-3-3674	None	None	No loss of value
Stubbo Creek OS-01	36-3-3675	None	None	No loss of value
Stubbo Creek OS-02	36-3-3676	None	None	No loss of value
Stubbo Creek OS-03	36-3-3677	None	None	No loss of value
Stubbo Creek OS-04	36-3-3678	None	None	No loss of value
Stubbo Creek OS-05	36-3-3679	None	None	No loss of value
Stubbo Creek OS-06	36-3-3680	None	None	No loss of value
Stubbo Creek OS-07	36-3-3681	None	None	No loss of value
Stubbo Creek OS-08	36-3-3682	None	None	No loss of value
The Pinnacle OS-01	36-3-3683	None	None	No loss of value
The Pinnacle OS-02	36-3-3684	None	None	No loss of value
The Pinnacle PAD-01		None	None	No loss of value
TRE 21	36-3-1423	None	None	No loss of value
IF 23	36-3-2515	None	None	No loss of value

Twenty-four of the 25 Aboriginal sites identified within the study area would be conserved and not be directly impacted by the project as they now all fall within the central environmental exclusion zone, including buffer areas. The central environmental exclusion zone was expanded during the assessment to include all buffer areas. One site (Rosevale IF-01) would be directly impacted by the project as it is located within the northern portion of the development footprint (refer to **Figure 7-1**).

7.3.5 Unanticipated finds

It is possible further artefact sites would be present inside the study area, including in the development footprint. Such sites are most likely to include isolated finds and open artefact scatters located on flat elevated landforms adjacent or overlooking Stubbo Creek and its tributaries. There are some areas along Stubbo Creek and its tributaries which appear to be heavily eroded, meaning that site preservation may be affected. Quarry sites and stone procurement sites and burials are not expected to occur within the study area.

Additionally, based on the proximity of the access track located from Barneys Creek Road (refer to **Figure 2-1**) to Pine Creek, further assessment of this area would be required prior to commencement of construction in the form of a pedestrian survey if this access track were constructed.

7.3.6 Construction

Impacts to the one site (Rosevale IF-01) that would be directly impacted by the project would occur during construction of the northern array area (refer to **Figure 7-1**). The heritage impact value of this loss is considered low as the site consists of an isolated artefact with low potential for in situ subsurface deposits.

The remaining 24 sites identified occur within the central environmental exclusion zone and would not be directly impacted by the project.

Stone artefacts may occur sporadically within the development footprint in areas outside the transect paths. The following ground disturbance activities have the potential to disturb unanticipated Aboriginal objects during construction:

- construction of temporary facilities including construction compounds, laydown areas, site offices and amenities, parking areas and container storages)
- site preparation (grading) and installation of the photovoltaic modules (i.e. driving or screwing piles into the ground)
- trenching for underground cabling (if required) or overhead supports
- clearing for internal access tracks and PCU placement
- the construction of the substations and BESSs
- construction of operational and maintenance infrastructure including staff office, meeting facilities and amenities, temperature-controlled spare parts storage facility, SCADA facilities, workshop and associated infrastructure
- internal access tracks and car parking facilities
- installation of security fencing.

7.3.7 Operation

No additional impacts to Aboriginal cultural heritage are anticipated during operation of the project. However, the unanticipated finds procedure would apply to any works involving ground disturbance.

7.3.8 Decommissioning

No additional impacts to Aboriginal cultural heritage are anticipated during decommissioning of the project. However, the unanticipated finds procedure would apply to any works involving ground disturbance.

7.4 Environmental management and mitigation measures

Proposed measures to manage and/or mitigate Aboriginal cultural heritage impacts from the project are detailed in **Table 7-6**.

Table 7-6: Management and mitigation measures – Aboriginal cultural heritage

ID	Management/mitigation measure	Timing
AH1	The proponent will develop the ACHMP which is to be agreed to by the RAPs and DPIE. The ACHMP will also include an unanticipated finds protocol, unanticipated skeletal remains protocol and long-term management of any artefacts.	Prior to construction
AH2	The Aboriginal site (Rosevale IF-01) within the development footprint for the project will be salvaged by a surface collection of visible artefacts. The recommended methodology for the salvage will be finalised after the approvals process has been completed in the ACHMP but will include the measures outlined in Section 9.3.1 of the ACHAR (**Appendix D**). The salvage works will include the mapping, analysis and collection of the surface artefact at the affected site. Results will be included in a brief report to preserve the data in a useable form and an Aboriginal Site Impact Recording Form (ASIRF) will be submitted to AHIMS.	Prior to construction
AH3	All land-disturbing activities will be confined to within the development footprint and associated tracks and/or crossings. Should the parameters of the proposed work extend beyond this, then further archaeological assessment may be required.	Construction

8. HISTORIC HERITAGE

*This chapter presents a summary of the assessment and identifies potential historic heritage impacts within the study area and surrounding locality. This chapter has been prepared to address specific SEARs relating to historic heritage as presented in **Section 1.5**.*

*A historic heritage assessment has been prepared by OzArk. The report is summarised below and provided in full in **Appendix D**.*

8.1 Assessment methodology

8.1.1 Assessment approach

The purpose of the historic heritage assessment is to meet the following objectives:

- To identify whether historical heritage items or areas are, or are likely to be, present within the study area
- To assess the significance of any recorded historical heritage items or areas
- Determine whether the project is likely to cause harm to recorded historical heritage items or areas
- Provide management recommendations and options for mitigating impacts.

A desktop search of the following databases was conducted on 12 June 2020 to identify any potential previously recorded heritage within the study area:

- National and Commonwealth Heritage Listings
- SHR
- Historic Heritage Information Management System (HHIMS)
- Mid-Western Regional Council LEP.

A field assessment of the study area was undertaken by OzArk Senior Archaeologists, Dr Alyce Cameron and Stephanie Rusden, on 10 to 14 August and 17 to 19 August 2020, concurrently with the Aboriginal cultural heritage assessment. Representatives from several RAPs were present during the survey as discussed in **Section 7.1.1**.

The study area was assessed using standard archaeological field survey and recording methods (Burke and Smith 2004).

8.1.2 Statutory context, policy and guidelines

Protection of historic heritage is afforded under the following statutory documents:

- Part 4 of the EP&A Act
- The EPBC Act by way of the National Heritage List and Commonwealth Heritage List established under the Act
- Heritage Act.

The historic heritage assessment has been undertaken in accordance with the Heritage Council's *Historical Archaeology Code of Practice* (Heritage Council 2006).

8.2 Existing environment

8.2.1 Historic context

Early European exploration of the region occurred in the 1820s. One of the first land holders and cattle runs in the area was owned by the sons and grandsons of William Cox, who had built the road across the Blue Mountains. Their cattle run was called 'Guntawang' and was established 1822, 8 kilometres southwest of the present town site of Gulgong.

Conflict with the local Wiradjuri groups soon caused the withdrawal of these early settlers. The homestead is still occupied and registered as a Commonwealth and State heritage item. The Rouse brothers took over Guntawang and brought cattle to the property in 1825 and the area eventually became the village of Guntawang.

The Gulgong goldfield was gazetted in 1866 but initial finds were negligible. One of Rouse's shepherds, Tom Saunders, uncovered a large find on the future town site (at Red Hill) on April 14, 1870, thereby sparking a major goldrush.

There was spectacular growth in Gulgong during the 1870s, with the mines around Gulgong producing twice as much gold as the Meroo field produced over half a century in 1872. When the town was gazetted in 1872 there were reputedly 20,000 people in the area.

Gulgong became a municipality in 1876 although the gold had already begun to dwindle. By 1881 the population was 1,212 and the boom years were over. From that point, wheat and wool production, boosted by the arrival of the railway in 1909, sustained the town.

The 1886 parish maps of Stubbo and Narragamba show that J.W. Lee, J.R. Lee and C.W. Lee, V.J. Dowling, and J.L Tayler owned much of the land the study area is located on. The very southern extent of the study area extends into the northern extension of the Gulgong gold field.

The current day township of Gulgong is well known for its historic streetscape and association with gold mining. The township has approximately 130 National Trust listed buildings, as well as Australia’s oldest operating opera house (the Prince of Wales Opera House), and many museums relating to the gold rush and pioneer history of the town.

8.2.2 Land use context

The current land use is for grazing and limited cropping. There is potential for historic heritage sites relating to the historic use of the land to be present inside the study area. Such sites could include items such as old farming equipment or the physical remains of huts, sheds and historic homesteads.

Due to the proximity of the study area to the township of Gulgong, in particular the Gulgong Gold Fields, there is potential for historic sites in the form of gold diggings to be present along the southern extent of the study area.

8.2.3 Previously recorded sites

A desktop search was conducted on local, state and national heritage databases to identify any potential previously recorded historic heritage within the study area. The results of this search are summarised in **Table 7-2** and presented in detail in **Appendix D**.

Table 8-1: Historic heritage desktop-database search results

Database	Type of Search	Results
National and Commonwealth Heritage Listings	World Heritage List Commonwealth Heritage List National Heritage List	No items within 10 km of the study area
SHR	NSW	No items within 5 km of the study area. The closest listing 8.3 km southwest is the Gulgong Railway Bridge over Wialdra Creek
HHIMS	NSW	No items within 10 km of the study area
LEP	Mid-Western LEP	No items within 10 km of the study area

As noted in **Table 8-1**, no records for historical heritage sites are recorded in the study area. The closest item listed on the SHR is the Gulgong Railway Bridge over Wialdra Creek located 8.3 kilometres southwest of the study area. The closest LEP historic item is The Lagoon Homestead located 10.3 kilometres southwest of the study area.

8.2.4 Sites recorded during the field survey

No historic sites were recorded during the survey.

8.3 Assessment of potential impacts

There are no historic sites recorded within the study area. As such, there would be no impact to any historic sites during the proposed works. Overall, there was limited potential for historic heritage to be present inside the study area. The structures which make up The Pinnacle homestead are not of historic heritage significance.

8.4 Environmental management and mitigation measures

Proposed measures to manage and/or mitigate historic heritage impacts from the project are detailed in **Table 8-2**.

Table 8-2: Management and mitigation measures – historic heritage

ID	Management/mitigation measure	Timing
HH1	If items of historic heritage significance are uncovered during the project, then the Unanticipated Finds Protocol for Historic Heritage included in Appendix 5 of the Aboriginal cultural heritage and historic heritage assessment (**Appendix D**) will be enacted.	Construction
HH2	To avoid the potential for harm to historic objects on unassessed adjacent landforms, all ground surface disturbing activities will be confined to the development footprint.	Construction
HH3	An unanticipated finds protocol for historic heritage will be developed and implemented as required during construction.	Construction

9. GEOLOGY, SOILS AND LAND CAPABILITY

*This chapter presents a summary of the geology, soils and land capability impacts within the study area for the project. This chapter has been prepared to address specific SEARs relating to geology, soils and land capability as presented in **Section 1.5**.*

9.1 Assessment methodology

9.1.1 Assessment approach

A soil and erosion assessment (including contamination) has been undertaken for the project, focusing on identifying potential impacts associated with contamination; and determining the soil characteristics and potential for erosion to occur within the study area. The assessment has involved:

- desktop review of relevant available registers and other publicly available information to identify existing geology/geomorphology and soil qualities, and soil limitations, within and surrounding the study area. This task involved a search of the publicly available databases and mapping resources, as presented in **Section 9.2**
- site inspection undertaken on 21 and 22 September 2020 to: verify results of the desktop results; identify site specific information relating to soils that may not be captured in publicly available regional data; and to gain further appreciation of the study area and surrounds
- assessment of potential impacts to site soils during the construction, operation and decommissioning phases of the project and how the soils would be returned to their pre-existing use
- identification of management and mitigation measures to avoid or minimise impacts to soils within the proposed development footprint and surrounds.

Desktop review

A desktop assessment was undertaken using existing information on soils and soil environments within the study area, with a focus on the development footprint. The desktop analysis was sourced from the following publicly available datasets:

- NSW soil and land information system (SALIS)
- Soil profile attribute data (eSPADE) online database
- Great soil group mapping of NSW
- land and soil capability classes mapping
- Australian soil classification system soil type mapping of NSW
- hydraulic soil group mapping.

Site inspection

The site inspection involved an experienced soil scientist driving across the study area with more a more detailed walkover in selected areas. The inspection was designed to cover as much of the study area as possible, prioritising the development footprint and making observations concerning the topography, vegetation cover, shallow soil types and areas of existing erosion across the study area.

It should be noted that regional soil data has been relied upon for this assessment in the absence of detailed study area soil and physical chemical data and has been obtained for soil survey sites within a five-kilometre radius of the study area. Given the low risk profile of the project to adversely impact soils within the study area and immediate surrounds, regional soil data accompanied with a detailed site walk-over to ground truth desktop studies were deemed adequate for the purposes of this EIS.

9.1.2 Statutory context, policy and guidelines

An assessment of the potential impacts to soils and land capability was undertaken consistent with the *Guidelines for Surveying Soil and Land Resources* (CSIRO, 2009).

9.2 Existing environment

9.2.1 Geology

The surface geology of the development footprint as represented by the Gulgong 1:100,000 Geological Map (Watkins J.J., 2000), and is largely characterised by Carboniferous Intrusions, namely the Gulgong Plutonic Suite comprising Gulgong Granite which is described as leucocratic medium to coarse grained porphyritic megracrystic granite with minor aplite phases and minor quartz monzonite. Additional Carboniferous Intrusions within the development footprint include localised Aplite and quartz-feldspar porphyritic thyolite.

Caniozoic units are present along Stubbo Creek including Quaternary alluvial silts, clays and sands with variable humic content and sporadic pebble to cobble sized unconsolidated conglomeratic lenses. In the central western portion of the study area there are Tertiary Tholeiites described as alkali basalt, basanite, nephelinite, limburgite, trachyte and rare obsidian.

9.2.2 Soils

Desktop assessment

The desktop assessment identified that two primary soil types have been mapped within the study area, comprising siliceous sands and yellow solodic soils/soloths.

Siliceous sands are present on mid-slopes and upper slopes. Topsoils within the siliceous sands are dark brown to brown loamy sand to clayey sand, have very weak structure and are slightly acidic, and typically extend to 200 millimetres depth. There is a distinct change to the subsoils which are bright brown to reddish-brown loamy sands to light sandy clay loams; circumneutral pH, typically extending to 500 millimetres depth. These subsoils grade into weathered granite or yellowish-brown, loamy sand to light sandy clay loams (Department of Planning, Industry and Environment, 2020).

Yellow solodic soils/soloths observe topsoils described as weakly structured, brown to dull yellowish-orange to yellowish-brown coarse sandy loam, circumneutral pH and typically extending to 100 - 200 mm depth. Subsoils are yellowish-brown to dull yellowish-orange to bright yellowish-brown sandy clay loams with a neutral pH.

Basic Paralithic Black-Orthic Tenosols were also identified approximately 900 metres north of the study area (Department of Planning, Industry and Environment, 2020). Tenosols are mainly used for grazing of native pastures rather than cropping. Tenosols have a weakly developed soil profile which is typically very sandy without distinct horizons. The major part of these soils is not strongly acid and no part of the soils is calcareous. The upper 500 mm of the solum colour class is black, overlies partially weathered or decomposed rock or saprolite, are not gravelly throughout, the soil material is either loose or only weakly coherent both moist and dry, may have aeolian cross bedding, and its texture is sandy throughout.

There are no known occurrences of acid sulfate soils within the study area.

A review of NSW DPIE soil profile and soil map information website, 'eSPADE', indicated the study area is located entirely within the Rouse soil landscape described as 335 square kilometres of undulating hills and low hills with granite outcropping as tors and sloping pavements, located 18 kilometres north and 12 kilometres east of Gulgong (**Figure 9-1**).

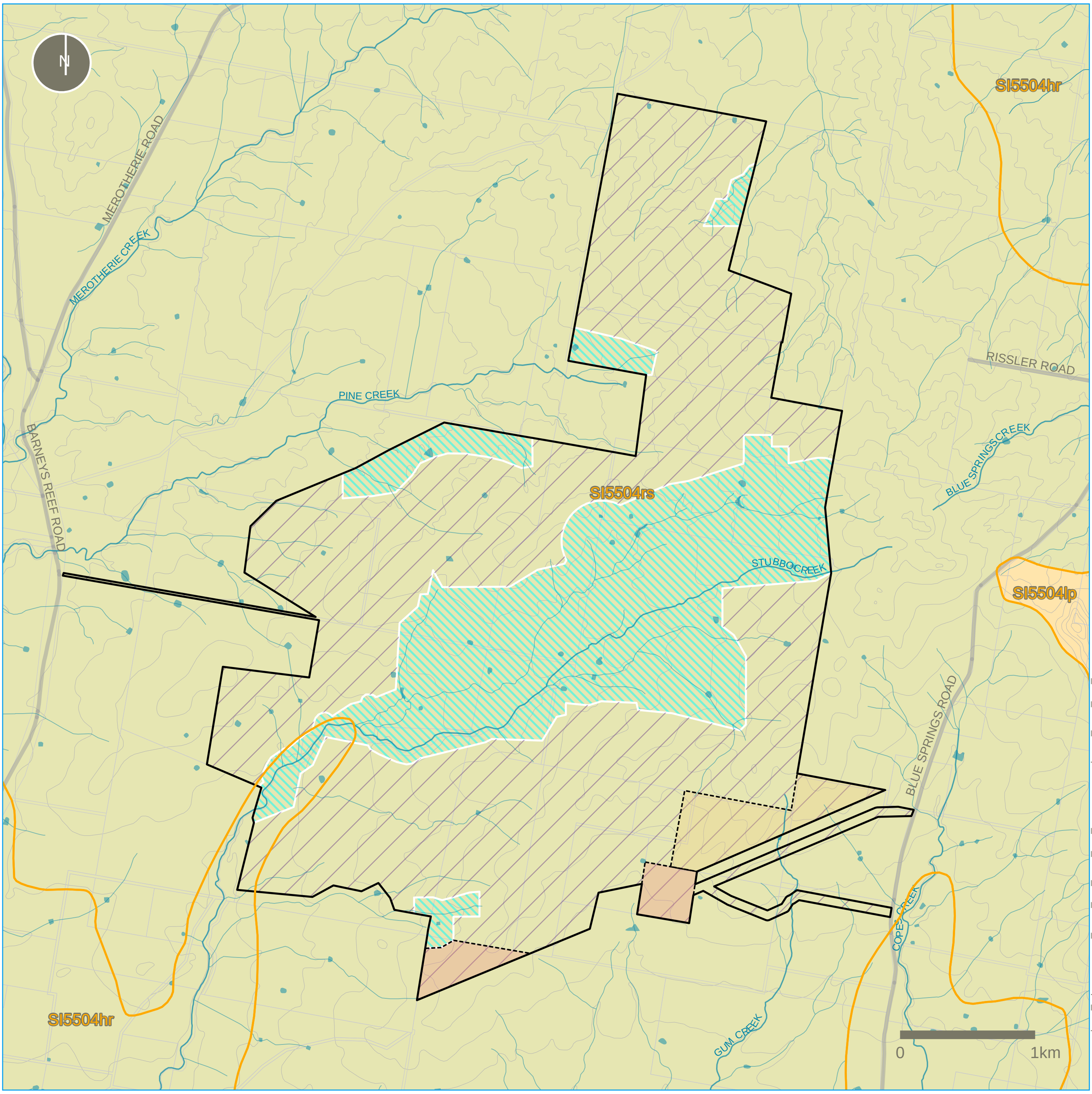
This landscape is resultant from remnant granite country (acid plutonics including granite, granordiorite and adamellite) and is characterised by:

- gently undulating country of long low slopes of less than 5 per cent to 15 per cent, and 500 to over 1000 metres long
- shallow siliceous sandy soils and earthy sands, with some yellow sololiths and solidic soils in low areas and depressions
- limiting factor for the soils include little water retention (free draining), acidic and of low fertility and moderate erodibility
- on areas with low surface cover and under higher flows is prone to rill and gully erosion.

Site inspection

The site inspection undertaken on 21 and 22 September 2020 found the study area is consistent with the Rouse soil landscape type identified in the desktop assessment, with the following attributes (refer to **Photo 9-1** to **Photo 9-6**):

- the study area is an area of low rolling topography generally sloping to the east to northeast in the northern half and to the southeast and southwest in the south
- slopes were observed to be generally shallow (3-10 per cent) with remnant granite tors and pavements typically at the higher topographic areas
- at the time of the inspection, more regular rainfall had regenerated much of the cover since the previous drought conditions. The land areas were heavily grassed, or in the case of the landholding to the north, planted in feed crop (oats)
- tree cover was sparse, comprising lone trees and occasional smaller copses, (usually along water courses)
- some limited hand excavation across the site indicated shallow siliceous sands and loamy sands consistent with the soil landscape type
- in limited areas where soils had been exposed through water flow (from uncontrolled stormwater flows along tracks) or by stock traffic, moderate to severe rill and gully erosion was noted. This was exacerbated in the central water course, (Stubbo Creek) which bisects the site west to east
- discussions with a landholder confirmed that where soil was exposed and subject to high water rainwater flows, erosion was rapid and would require repair (backfill) to remain trafficable.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Soil landscapes

ASC - Order Level

- Rudosols and Tenosols
- Sodosols

Figure 9-1 | Soil landscape

Photo 9-1: Looking west in the northwest of the study area showing long low slopes and remnant granite tors

Photo 9-2: Looking north-north east across the study area, showing long gentle slopes, well grassed sparse trees

Photo 9-3: Looking north and north west grassed slopes 4 to 6 per cent sparse trees with shallow drainage lines with small earth south of Stubbo Creek

Photo 9-4: Minor drainage rills on track, on unvegetated area slope 4-5 per cent, in the north west of the study area

Photo 9-5: Washout and drainage rills on road and adjacent track, on unvegetated soils in the north east of the study area

Photo 9-6: Typical shallow soil profile with brown, coarse grained, loamy sand, (no cohesive fines) to 500mm in the study area

9.2.3 Land and soil capability

The Land and Soil Assessment Capability Scheme (NSW OEH, 2012) has been developed for NSW, and outlines eight land and soil capability (LSC) classes. The LSC class provides an indication of the land management practices that can be applied to a piece of land without resulting in degradation to the land and soil within the study area and to the environment offsite (NSW OEH, 2012). Unsuitable land use can lead to a decline in natural ecosystem values, agricultural productivity and infrastructure functionality. As land capability decreases, the management of land requires more attention to mitigate impacts.

The LSC classes outlined in the Land and Soil Assessment Capability Scheme range from class 1 (extremely high capability land which has no limitations and requires no special land management practices), to class 8 (extremely low capability land with limitations that are so severe that the land is incapable of sustaining any land use aside from natural conservation). The study area is located within an area mapped as class 5 (moderate-low capability land) (refer to **Figure 9-2**). Class 5 land is defined by the scheme as having severe limitations for high impact land management uses such as cropping and there are few management practices available to overcome these limitations. The land is therefore more suited to grazing with some limitations for pasture establishment.

Mid-Western Regional Council noted during consultation that although the study area may be mapped as class 5, this constitutes one of the higher value classes within the LGA and therefore is considered to be valuable agricultural land.

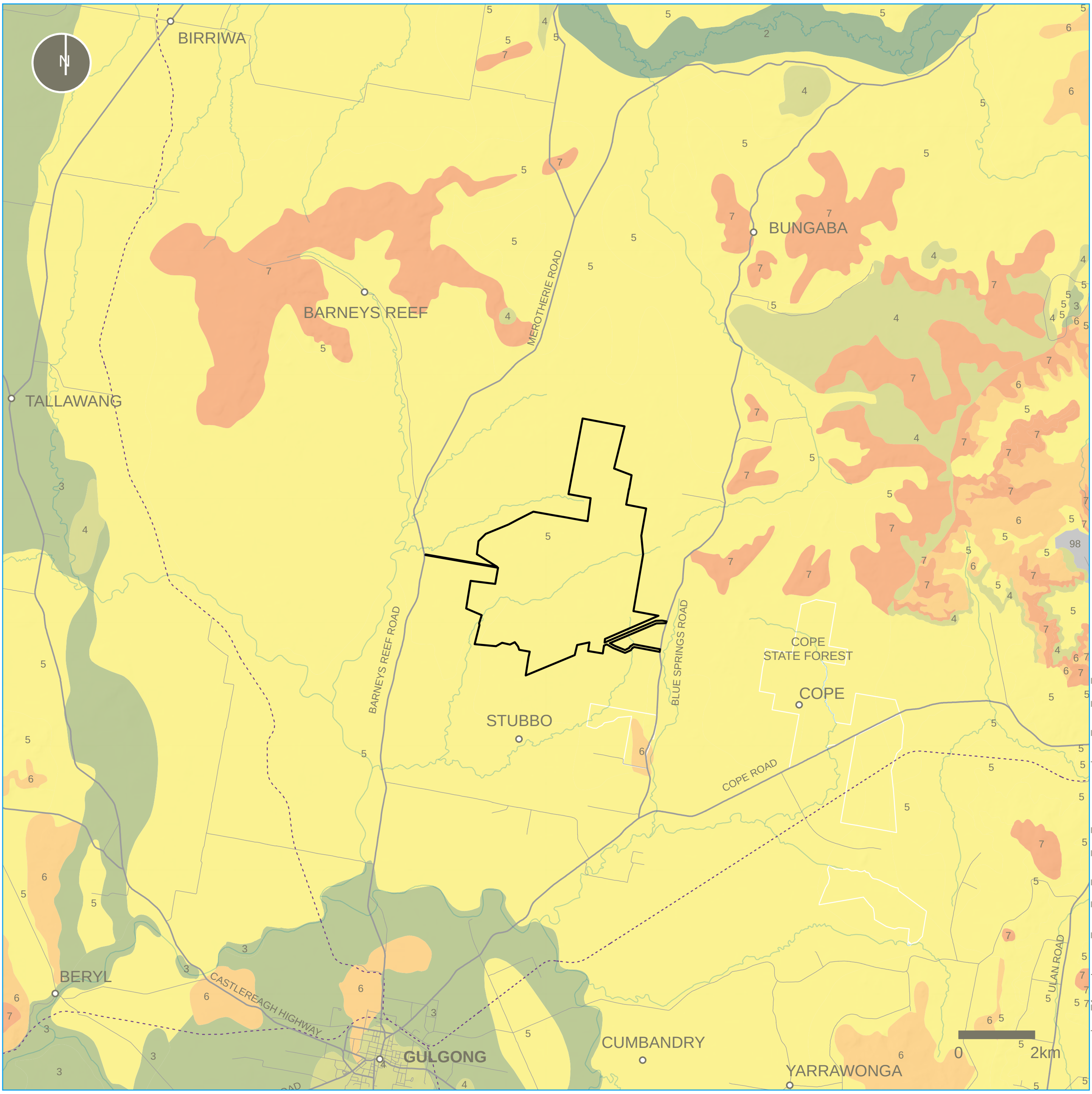
The scheme describes class 5 land as generally sloping (10 to 20 per cent) with highly erodible soils, significant existing erosion, or susceptibility to wind erosion if left bare. As a result, soil erosion can be severe without adequate controls. Class 5 land can be occasionally cultivated for fodder crops and pasture, and it is important to minimise soil disturbance and maintain cover. Salinity can be a severe hazard in class 5 land, along with acidification.

9.2.4 Contaminated land

A search of the EPA's contaminated land public record of notice and list of sites notified to the EPA under Section 60 of the CLM Act in August 2020 did not return any information on reported contamination or any regulatory notices issued for the land within the study area (NSW Environment Protection Authority, 2020).

The contaminated land planning guidelines, *Managing Land Contamination Planning Guidelines: SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning 1998), identify agricultural and horticultural activities as activities which can potentially cause contamination. The study area is located on land that is zoned Primary Production (RU1) under the Mid-Western Regional LEP 2012 and is currently used for agricultural purposes including grazing of sheep and cattle. The primary chemicals of concern associated with these historic land uses include organochlorine pesticides and arsenic. No evidence of gross contamination was noted in the study area during the site inspection.

Earthworks required for the project would be limited to locations requiring resurfacing activities for temporary construction facilities, and permanent operational infrastructure such as the substation, BESS and ancillary infrastructure. Minor earthworks would also be required to prepare the array areas including grading or levelling, and the need for heavy earthworks would be minimised as much as practicable. The level of surface disturbance, and likelihood of exposing unknown contaminated land is therefore likely to be minimal.



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Key

Study area
Road
Rail
Creek

Most Limiting LSC
2 - Slight but significant limitations
3 - Moderate limitations
4 - Moderate to severe limitations
5 - Severe limitations
6 - Very severe limitations
7 - Extremely sever limitations
Disturbed Terrain

Figure 9-2 | Land capability

9.3 Assessment of potential impacts

9.3.1 Construction

As discussed in **Section 2.4**, earthworks would be undertaken in areas that require resurfacing activities for temporary construction activities as part of initial site preparation (including vegetation clearance, establishment of laydown areas, construction compounds, carparking areas and access roads), along with permanent operational infrastructure. Minor earthworks would also be required to prepare the arrays including grading or levelling where required.

The extent of excavations required would depend on the geotechnical conditions and final locations of infrastructure, however heavy earthworks such as grading/levelling and compaction would be minimised as much as practicable.

Following initial site preparation activities, the following construction activities are expected to require earthworks:

- Installation of steel piles and mounting system for the solar panels
- Installation of DC cabling
- Installation of PCU footings
- construction of permanent site office, meeting facilities and amenities, spare parts storage facility, SCADA facilities and workshop
- construction of the onsite substation and connections
- establishment of the BESS compound
- removal of temporary construction facilities.

As discussed in **Section 9.2.2**, the site inspection noted some areas of moderate to severe rill and gully erosion where soils had been exposed through water flow or stock traffic. Discussions with a landholder during the site inspection also confirmed that erosion was rapid and would require repair where soil was exposed and subject to high water rainwater flows. The study area is also noted to be in an area of class 5 land, which is susceptible to severe erosion with a need to minimise soil disturbance and maintain cover.

As a result of the identified characteristics of the existing soils in the study area, the above construction activities may lead to increased levels of soil erosion during construction. The disturbance of soils in the study area may therefore result in the following impacts:

- removal of topsoil during vegetation clearing and other ground disturbance works, resulting in increased erosion and sedimentation, and associated impacts on waterways
- reduced soil stability resulting in an increased potential for erosion due to vegetation removal or exposure to elements such as wind or precipitation
- reduced permeability of the soil as a result of soil compaction for hardstand areas and access roads, resulting in increased run-off
- potential for disturbance and exposure of contaminants (e.g. pesticides) as a result of ground disturbance activities.

In addition to the potential disturbance of contaminants that may be present within the study area, there is potential for soil contamination during construction as a result of:

- accidental spills and leaks of chemicals, fuel or oil
- inappropriate storage of hazardous materials
- poorly maintained vehicles, plant and equipment.

Significant erosion, runoff, and contamination is not anticipated with implementation of the measures outlined in **Section 9.4**. Topsoils that are removed during ground disturbance activities would also be stripped and stockpiled, where possible, for reuse in post-construction rehabilitation and site restoration works. Once the construction is completed and the ground vegetation cover is progressively re-established, significant impacts to soils are not expected. However, soils that are replaced after restoration are often less stable and have reduced structure with potentially lower value.

9.3.2 Operation

The land within the study area has some areas of moderate to severe rill and gully erosion where soils have been exposed through water flow or stock traffic. In addition, given the study area is located in class 5 land, it is likely to be susceptible to severe erosion. Activities that may involve ground disturbance during operation and have the potential to increase existing levels of erosion include:

- maintenance and replacement of infrastructure and equipment as required
- site maintenance including vegetation management, weed management, fence and access road maintenance and remediation of drainage channels if required
- ongoing disturbance to the surface soils through the use of unsealed internal access roads, including heavy vehicle use.

When required, washing of the photovoltaic panels would also be undertaken throughout operation. This, along with precipitation events may result in concentrated run-off from the photovoltaic panels resulting in localised erosion if there is insufficient ground cover beneath the panels.

As discussed in **Section 9.3.1**, construction activities may result in increased levels of soil erosion. In addition, soil structure beneath the permanent infrastructure and buildings may potentially be lost for the duration of the project, given soils that are replaced after restoration are often less stable with reduced structure. However once construction is complete, progressive stabilisation of the study area and revegetation would be undertaken, and significant impacts to soils are not anticipated given the limited ground disturbance expected for ongoing operation and maintenance of the solar farm. In addition, options are currently being investigated for shared land use with sheep or cattle grazing activities within portions of the study area which may assist in weed management and subsequent management of the vegetative ground cover.

There is a minimal potential for soil contamination during operation, as a result of accidental spills and leaks, inappropriate storage of hazardous materials and maintenance of vehicles. Implementation of the measures outlined in **Section 9.4** would minimise the potential for contamination.

9.3.3 Decommissioning

Once the solar farm has reached the end of its operational life, all project infrastructure would be decommissioned and removed from the study area, and the study area would be returned to a standard suitable for agricultural land use. This would include removal of the photovoltaic panels, steel piles and mounting system, substation, BESS compound, site offices, and other aboveground infrastructure. However, any underground cabling below 500 millimetres would remain in-situ, as this would be a sufficient depth to allow opportunity for agricultural activities following decommissioning and avoid disturbance of soils and increase their susceptibility to erosion.

Removal of the above infrastructure would involve ground disturbance, and result in greater areas of exposed soils, making them susceptible to erosion and sedimentation with associated impacts to nearby waterways such as Stubbo Creek which traverses the study area. Further disturbance of soils may also occur as a result of additional heavy vehicle movements required on unsealed internal access roads to transport decommissioned infrastructure.

While decommissioning activities would involve some ground disturbance, the extent of exposed soils is expected to be minimal compared to the construction phase where some heavy earthworks may be undertaken. Progressive soil restoration and rehabilitation of groundcover would also be undertaken during in accordance with a decommissioning and rehabilitation management plan.

As with construction, there is potential for soil contamination during operation as a result of:

- accidental spills and leaks of chemicals, fuel or oil
- inappropriate storage of hazardous materials
- poorly maintained vehicles, plant and equipment.

These activities have the potential to result in run-off of contaminants to nearby receiving environments such as waterways. However, the decommissioning phase would not require the same quantity of plant and equipment, or heavy vehicles, thereby presenting a minimal risk of contamination compared to the construction phase. Implementation of the measures outlined in **Section 9.4** would minimise the potential for contamination.

9.4 Environmental management and mitigation measures

Measures to mitigate and manage impacts associated with geology, soils and land capability are presented in **Table 9-1**.

Table 9-1: Management and mitigation measures – Geology, soils and land capability

ID	Management/mitigation measure	Timing
S1	Disturbed areas will be progressively stabilised and rehabilitated as construction is completed to minimise the extent of bare soil.	Construction
S2	The following measures will be implemented to manage the risk of contaminants and impacts on surrounding environments: • appropriate storage (including bunding) of all potential contaminants (i.e. chemicals and fuels) onsite to reduce risks of spills contaminating waterways and land • protocol for the discovery of contaminants in the study area during works, including requirements to stop work, remediate and dispose of contaminants as necessary • measures for mitigating soil contamination by fuels or other chemicals (including notification to EPA, emergency response requirements etc) • measures for the ongoing inspection and maintenance of machinery/vehicles to confirm that they remain in a clean condition free of fluid leaks.	Prior to construction / prior to operation
S3	The photovoltaic arrays will be designed to allow for enough space between rows of panels for establishment of groundcover and implementation of weed controls.	Detailed design

10. LAND USE

*This chapter presents an assessment of impacts to land within the study area and surrounds. This chapter has been prepared to address specific SEARs relating to land use as presented in **Section 1.5**.*

*This assessment has also involved the preparation of a land use conflict risk assessment (LUCRA). Results of the LUCRA assessment are presented in **Appendix E** and are summarised below. The impacts of the project on soils, surface water resources and flooding are addressed in **Chapter 9**, **Chapter 14** and **Appendix E**.*

10.1 Assessment methodology

10.1.1 Assessment approach

The assessment methodology to identify potential impacts on existing and future land use involved:

- desktop review of relevant available registers and other publicly available information to identify existing land uses and interests within and surrounding the study area, including land use zones, agricultural operations, mining and mineral leases, and areas of crown land. National Parks and reserves, registered Aboriginal land claims (including native title) and areas of flood prone land have been identified from other specialist studies (refer to **Chapters 6, 7**, and **14**)
- consultation with affected landholders, neighbouring properties, community and other relevant stakeholders to identify existing land uses not available via publicly available information, particularly existing agricultural operations within the local area (refer to **Chapter 5**)
- site walkover undertaken on 21 to 22 September 2020, to verify results of the desktop results and identify any other existing land uses and gain an appreciation of the study area and surrounds
- assessment of potential impacts to existing and future land uses, including the preparation of a land use conflict risk assessment (LUCRA) and consideration of how the project aligns with zoning provisions applying to the land including subdivision. This has also included consideration of impacts during the decommissioning phase of the project and how the land would be returned to its pre-existing use
- identification of appropriate management and mitigation measures to avoid or minimise impacts to land use as a result of the project.

An assessment of the potential impacts to land use was undertaken in accordance with the following Acts, guidelines and policies:

- *Native Title Act 1993*
- *Local Land Services Act 2013*
- NSW *Noxious Weeds Act 1993*
- Commonwealth *Biosecurity Act 2015* and NSW *Biosecurity Act 2015*
- Mid-Western Regional LEP 2012
- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP)
- *Central Tablelands Local Strategic Plan 2016-2021*
- *Central Tablelands Regional Strategic Weed Management Plan 2017 – 2022*
- Land Use Conflict Risk Assessment Guide (Department of Primary Industries, 2011).

10.2 Existing environment

10.2.1 Land use zones

The study area is located in the Mid-Western Regional Council LGA and is zoned as primary production (RU1) under the Mid-Western Regional LEP 2012 (refer to **Figure 10-1**). The objectives of this zone are discussed in **Section 4.1.4.1**. The study area primarily consists of cleared agricultural land used for livestock grazing (sheep and cattle) and intermittent cropping (RPS Group, 2020).

It should be noted that electricity generation is prohibited within the primary production (RU1) zone under the Mid-Western Regional LEP. However, the provisions of the Infrastructure SEPP override the LEP in accordance with Clause 4.38(2) of the EP&A Act which states "*Development consent may be granted if the development is wholly prohibited by an environmental planning instrument*."

Surrounding land use zones include several areas zoned as environmental management (E3) approximately four kilometres north of the study area, and an area zoned as large lot residential (R5) approximately 2.5 kilometres south of the study area.

10.2.2 Crown land

The study area contains a total of 13.99 hectares of Crown Land. The corridors of Crown Land include the western emergency access route from Barneys Reef Road which is 7.69 hectares and a Crown Waterway, Stubbo Creek which is 6.3 hectares.

10.2.3 Mining and minerals

As search of the NSW Department of Trade and Investment's NSW titles viewer on 9 September 2020 identified one exploration licence that intersects the study area (**Figure 10-2**). PEL456 exploration licence was granted to Hunter Gas in 2008 under NSW *Petroleum Onshore Act 1991* for the exploration of petroleum. The licence was renewed in 2016 with an expiry date of March 2018 however, another renewal application has been lodged which has not been determined. Until determination takes place, activities under the existing title remain in effect.

No mining leases were identified within the study area. The closest mining lease (ML1466) is located approximately four kilometres west of the study area. ML1466 was granted to Sibelco Australia in 2000 for the mining of kaolin a Group 5 mineral as defined by the *Mining Act 1992*. The lease is due to expire in April 2021.

A number of exploration licences have also identified near the study area (**Figure 10-2**), with the closest being:

- EL8405, located approximately 1.7 kilometres south of the study area. EL8405 is an exploration licence granted to Bowdens Silver in 2015 for the exploration of Group 1 minerals as defined by the *Mining Act 1992*. The licence was last renewed in 2019 and is due to expire in November 2024
- Auth286, located approximately 2.6 kilometres north of the study area. Auth286 is an exploration licence granted to the Secretary of Regional NSW in 1981 under the NSW *Mining Act 1973* for the exploration of Group 9, Group 9a minerals as defined under the *Mining Act 1992*. The licence was renewed in 2017 and is due to expire in November 2021
- EL8160, located approximately 3.1 kilometres south east of the study area. EL8160 is an exploration licence granted to Bowdens Silver in 2013 for the mining of Group 1 minerals as defined under the *Mining Act 1992*. The lease was last renewed in 2019 and is due to expire in August 2025.

10.2.4 National parks and reserves

No National Parks or reserves have been identified near the study area, with the nearest comprising the Goodiman State Conservation Area and Yarrobil National Park, located approximately 14.4 kilometres and 16 kilometres west of the study area respectively.

Several areas of state forest (Cope State forest) were also identified approximately 1.3 kilometres south of the study area.

10.2.5 Flood prone land

The study area is traversed by a number of waterways, farm dams and overland flow paths. The general topography of the study area shows higher ground to the east (greater than 500 metres AHD) and lower to the west (to approximately 46 metres AHD). Due to the topography and hydrology characteristics, the study area generally has a low flooding risk.

Refer to **Chapter 14** and **Appendix I** for a description of the site hydrology and further detail on the potential flood impacts of the project.

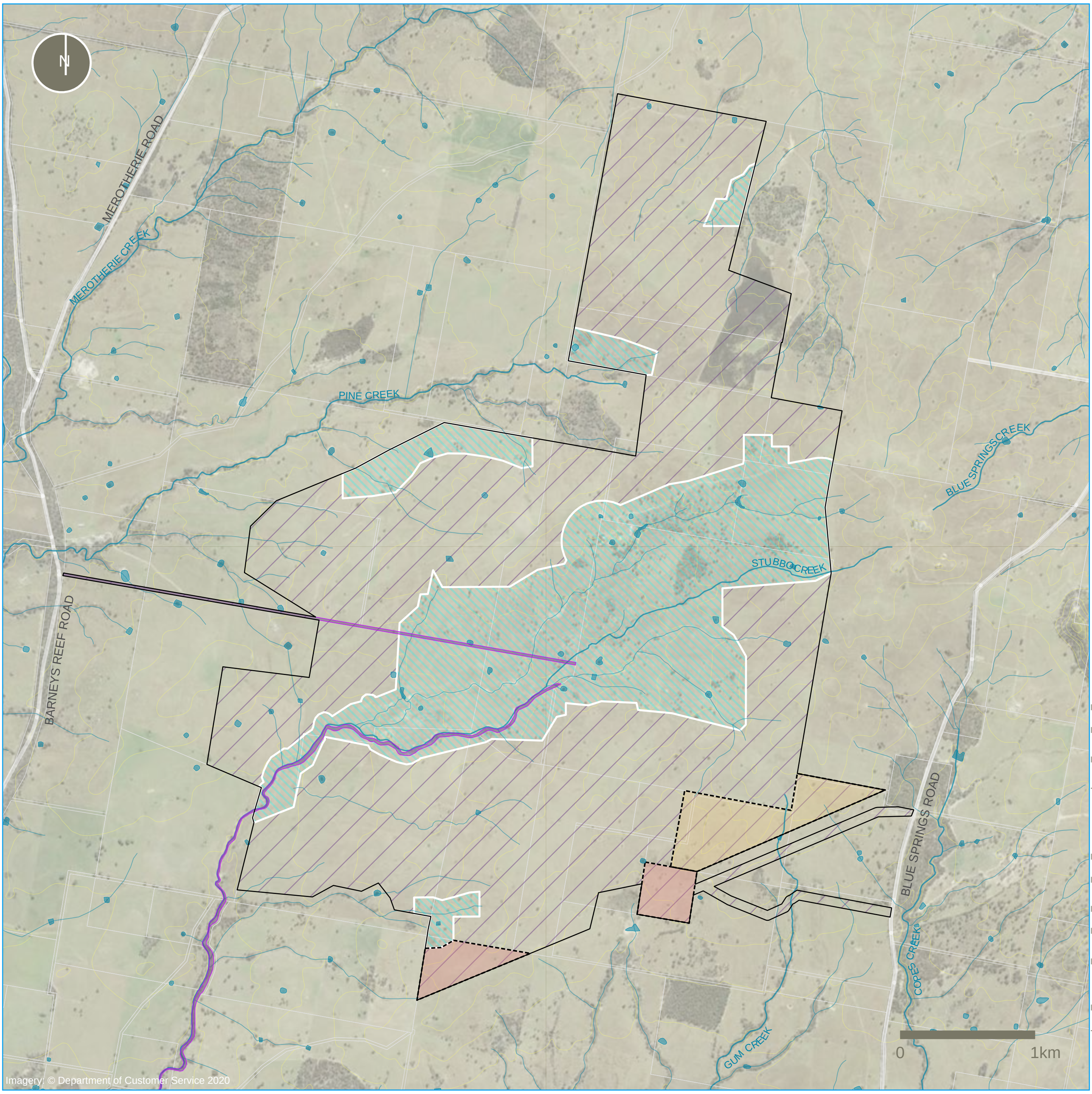
10.2.6 Aboriginal land claims

The National Native Title Tribunal Register of Native Title Claims holds information about all native title claimant applications that have been registered. Applications are registered where they meet certain registration test conditions set out in sections 190B and 190C of the Commonwealth *Native Title Act 1993*.

A search of the National Native Title Tribunal Register of Native Title Claims undertaken 02 September 2020 for the Mid-Western Regional LGA identified three active native title claims within this LGA:

- NC2018/002 - Warrabinga-Wiradjuri #7. This claim was filed with the Federal Court of Australia on 31 August 2018 and was registered from 22 November 2018. This claim covers the entire study area
- NC2016/005 - Warrabinga Wiradjuri #6. This claim was filed with the Federal Court of Australia on 12 October 2016 and was registered from 08 November 2016. The area covered by this claim is approximately 25.5 kilometres east of the study area, approximately 15 kilometres east of Ulan.
- NC2011/006 - Gomeroi People. This claim was filed with the Federal Court of Australia on 20 December 2011 and was registered from 20 January 2012. The area covered by this claim is approximately 9.4 kilometres north of the study area.

No areas that have been determined as native title have been identified within the study area.

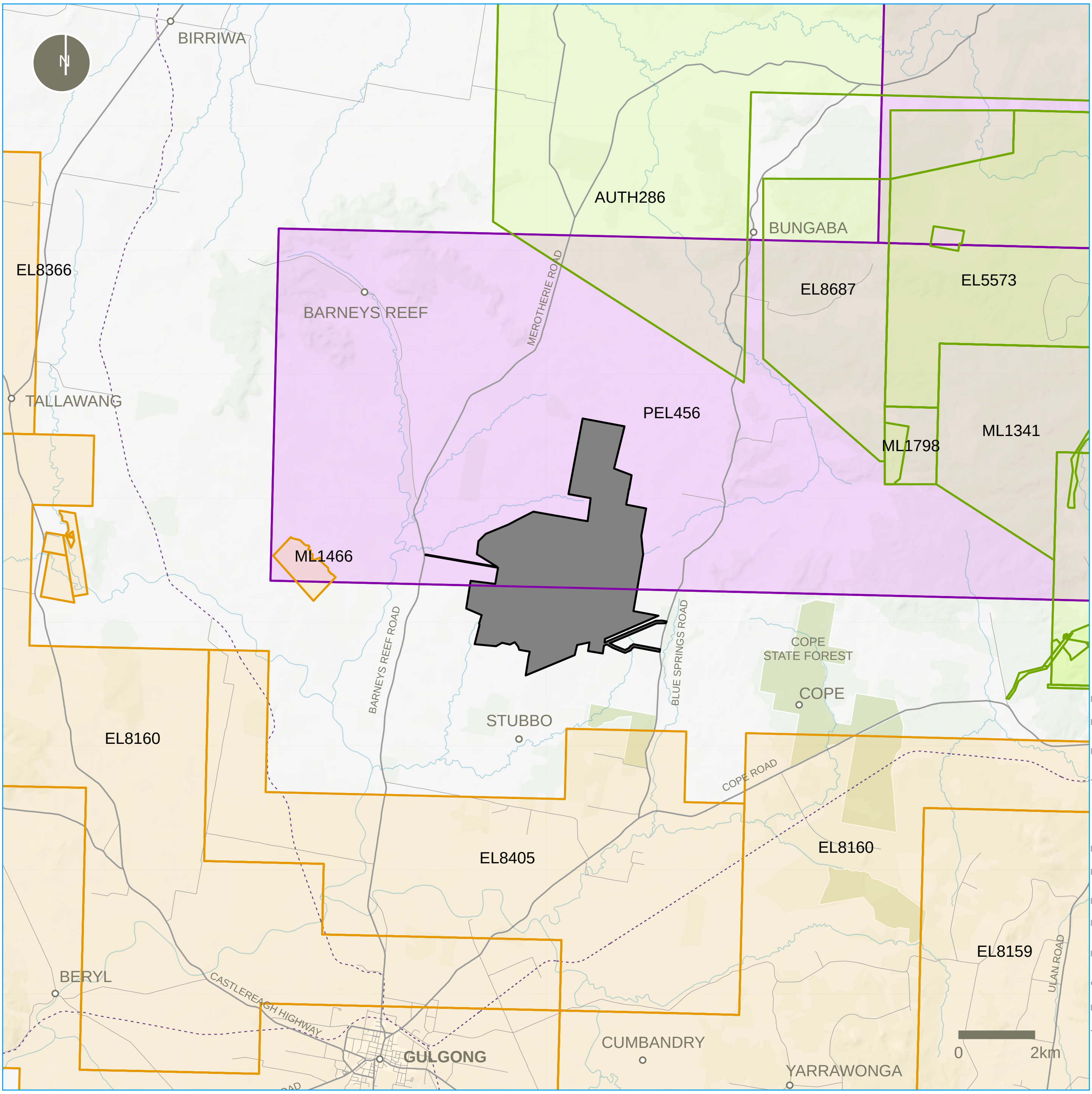


A4
1:42,500

Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Farm dams
- Crown land

Figure 10-1 | Land use



A4
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Key

Study area
State Forest
Road
Rail
Creek
Coal titles
Minerals title
Petroleum titles

Figure 10-2 | Exploration and mining titles

10.2.7 Agricultural land

The study area is within the Mid-Western Regional LGA, which is located in the central ranges of NSW which covers an area of 8,752 square kilometres. The study area is made up of 30 lots, covering an area of 1,772 hectares (17.72 square kilometres), and the development footprint covers an area of 1,243.2 hectares (12.43 square kilometres). In addition, environmental exclusion zones comprise approximately 528.7 hectares (5.29 square kilometres).

The entire study area (1,772 hectares) is currently utilised for agricultural production purposes. The study area represents an area of approximately 0.2 per cent of the total area within the LGA, including the environmental exclusion zone. Refer to **Section 2.2** for further information about the location of the study area and comprised lots.

A Local Strategic Plan 2016-2021 has been prepared for the Central Tablelands (where the study area is located) to assist NSW Local Land Services achieve its vision of resilient communities in productive healthy landscapes (NSW Local Land Services, 2016). The plan was prepared to be consistent with the *Local Land Services Act 2013*, which requires a state strategic plan that sets a vision, priorities and provides an overarching strategy for Local Land Services with a focus on economic, social and environmental outcomes.

The plan identifies the region as agriculturally highly diverse, comprising horticulture, viticulture, livestock, cropping and forestry industries, and contributing approximately 4.2 per cent of NSW's annual value of agricultural production. Grazing is identified as the most significant land use followed by broad acre crops and horticulture. The plan identifies numerous statewide goals and strategies, including Goal 2: Biosecure, profitable, productive and sustainable primary industries. A number of regional priorities have been identified to drive regional actions for this goal including:

- prevention of widespread livestock and plant pests and diseases establishment and their effects on ecological and production systems
- market access for agricultural production systems
- consideration of and participation in biosecurity at the property and community scale
- integration of agriculture and natural resource management for production, community and ecosystem outcomes
- maintenance of ground cover across the region including native and perennial pastures
- landholder and production system capacity to adapt to change
- management of pest plant and animal impacts on production and natural ecosystems
- capacity of Landholders to manage pest animals and plants.

BSAL is defined as land that has high quality soil and water resources that are capable of sustaining high levels of productivity. A total of 2.8 million hectares of BSAL have been mapped across the state, comprising an initial 1.74 million hectares mapped in the Upper Hunter and New England North West regions in 2013, followed by an additional one million hectares mapped across the rest of NSW in 2014 (DPIE, 2019). A site verification process was developed under the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) to determine the existence of BSAL at the study area of a potential development (DPIE, 2019).

The study area is not located within an area of BSAL mapped under the Mining SEPP, with the nearest located approximately 8.3 kilometres to the west of the study area. However, agricultural activities are undertaken within the study area, with the area primarily consisting of cleared agricultural land used for livestock grazing and intermittent cropping (RPS Group, 2020).

10.2.8 Biosecurity

Biosecurity protects the Australian economy, environment and community from the impacts of weeds, pests and disease and is administered under the Commonwealth *Biosecurity Act 2015* which aims to provide greater flexibility in responding to, managing and controlling biosecurity risks across the country (NSW Local Land Services, n.d.), and the NSW *Biosecurity Act 2015* which has repealed the NSW *Noxious Weeds Act 1993*. The Commonwealth Act supports the Biosecurity Strategy 2013-2021 which shares responsibilities for biosecurity across government, industry and the community (NSW Local Land Services, n.d.).

NSW Local Land Services provides services to land managers in agricultural advisory services, biosecurity, emergency management and natural resource management (NSW Local Land Services, 2016). As discussed previously, Goal 2 of the Local Strategic Plan 2016-2021 is *"Biosecure, profitable, productive and sustainable primary industries".* Strategy 3 of the plan is to *"provide products and services that support and enable customers, land managers and the community to prevent, prepare, respond and recover from biosecurity and natural disaster events."* Biosecurity and pest impacts are identified as a regional issue in the plan. A range of regional priorities established for Goal 2 have been discussed previously, with many associated with the management/control and prevention of pest animal and plant species and diseases. Several of the other goals of the plan also outline priorities relating to the management of pests.

The *Central Tablelands Regional Strategic Weed Management Plan 2017 – 2022* provides a framework for regional weed management and supports the implementation of the NSW *Biosecurity Act 2015* at a regional level. The plan was prepared by the Central Tablelands Regional Weed Committee on behalf of the Central Tablelands Local Land Services (NSW Local Land Services, 2017). The plan outlines four goals relating to weed management:

- **Goal 1**: Responsibility for weed biosecurity is shared by the Central Tablelands community, involving actions that focus on a whole of community approach to weed management
- **Goal 2**: Weed biosecurity supports profitable, productive and sustainable primary industries
- **Goal 3**: Weed biosecurity supports healthy, diverse and connected natural environments, involving actions that focus on weed biosecurity to protect the environment and encourage economic growth
- **Goal 4**: Weed biosecurity is supported by coordinated, collaborative and innovative leadership, involving actions that focus on a consistent approach to implementing the plan.

The plan identifies that the greatest potential impact of invading weed species is on the large areas of non-arable grazing land (i.e. where the study area is located) and conservation areas. Historically, there has been a comparatively low number of weed invasions in the region, however present high risks to the agricultural industry (NSW Local Land Services, 2017). The plan identifies a large number of priority high risk weeds and the development of the regional priority weed list for the region. These include a list of species determined as priority weed species at the state level (as determined by NSW DPI), and regionally determined priorities for the Central Tablelands. Priority weed species are grouped together under the following categories with an associated regional strategic response:

- prevention – comprising weed species that are not found in the state/region, however, pose a significant biodiversity risk and need to be prevented
- eradication – comprising weed species that are present in a limited distribution and abundance in NSW, and therefore need to be eliminated

- containment – comprising weed species that are widely distributed in areas of the state/region, and the associated risks posed by these species need to be minimised
- asset protection – comprising weeds that are widely distributed, and the spread of these weeds therefore needs to be minimised to protect certain assets.

There are a number of pest animals in the Central Tablelands, including locusts in the west, foxes in the east, and pockets of rabbits across the entire region (NSW Local Land Services, n.d.). Controlling pest species in the region can be challenging due to the landscape and demography. The diversity of land use also makes engagement of land managers and the implementation of a co-ordinated approach challenging.

The Central Tablelands Regional Strategic Pest Animal Management Plan 2018-2023 outlines a framework to protect the environment, community and economy from the impacts of pest animals and support positive outcomes for biosecurity (NSW Local Land Services, 2018). The plan is consistent with the NSW Invasive Species Plan 2017-2021, which in turn supports the NSW Biosecurity Strategy 2013-2021. The plan outlines a number of pest species for the Central Tablelands, prioritised based on the level of risk and feasibility of control:

- wild dog
- European red fox
- feral pig
- wild rabbit
- feral goat
- feral cat
- wild deer present in the region (Red, Rusa, Fallow and Sambar)
- European starling
- Indian myna
- carp.

10.2.9 Property vegetation plans

A public register of property vegetation plans (PVP) is maintained by the Land Management Authority under the repealed NSW *Native Vegetation Act 2003*. No new PVPs can be approved however existing PVPs can be varied, and the public register is updated to reflect variations in existing PVPs (DPIE, 2019).

A search of the public register of approved clearing PVPs for the Central Tablelands local land service (i.e. where the study area is located) for the period 01 October 2015 to 24 August 2017 (the most recent records available), did not identify any PVPs for the Central Tablelands. It is therefore assumed that there are no PVPs near the study area that may be affected by the project. PVPs have therefore not been discussed further in this chapter.

10.3 Assessment of potential impacts

10.3.1 Residential development and subdivision

The study area and land immediately surrounding, is zoned as primary production (RU1) under the Mid-Western Regional LEP 2012 (refer to **Figure 4-2**). The area immediately surrounding the study area is therefore sparsely populated. Given the zoning of primary production and associated minimum lot sizes of 100 hectares under the Mid-Western Regional LEP 2012, the study area would not support subdivision for the purposes of residential land use under the current zoning provisions.

There are several clusters of dwellings in the wider area surrounding the study area associated with large lot residential zones (R5), including several areas approximately 2.5 and 5 kilometres south of the study area around Cope Road, and a third area approximately 4.5 kilometres north west of the study area surrounding Blue Springs Road in Bungaba. However, the closest township with a more substantial concentration of dwellings is Gulgong, located approximately 10 kilometres south of the study area.

Several of the dwellings surrounding the study area are participating residences that would receive monetary compensation for the life of the project under a landholder agreement. However, there have been numerous refinements to the study area, development footprint, and layout of infrastructure, in order to minimise impacts to identified environmental constraints, disturbance to existing agricultural operations and impacts to neighbouring residences, and in response to stakeholder engagement, particularly with local landholders. Impacts to agricultural land use are discussed in more detail in following sections.

Refer to **Section 3.4** for further information about the refinements made, and associated environmental constraints considered as part of the project development process and selection of proposed development footprint. Potential impacts have been considered in a number of technical assessments prepared as part of this EIS, including the assessment of landscape and visual (**Chapter 11**), noise and vibration (**Chapter 12**), traffic and transport (**Chapter 13**), socio-economic (**Chapter 16**), and air quality (**Section 18.1**.

The land on which the substation is constructed is likely to require subdivision (if required by TransGrid. However, the development footprint is located within zone 'AD' for subdivision, and under Section 4.1 of the Mid-Western Regional LEP, the size of any lot resulting from a subdivision of land in zone AD is not to be less than 100 hectares. The subdivision of one or more lots may be required for the substation, resulting in lots that are less than the minimum 100 hectares. However, the proposed subdivision would be permissible under Section 4.38 of the EP&A Act subject to the approval of the Minister for Planning.

Following decommissioning of the project, the subdivided lots would be reconsolidated back into the original lot. Consultation would be undertaken with Mid-Western Regional Council, DPIE and the associated landholders once the final location of the substation was determined.

10.3.2 Crown land

The access road from Barneys Reef Road is proposed as a potential emergency vehicle access route.

Access between the northern and southern study areas is required and the indicative access provisions shown on **Figure 2-1** span Stubbo Creek which is Crown land. As stated above, consultation with NSW Crown Land would be required and an appropriate agreement, lease or licence acquired under the *Crown Land Management Act 2016*.

10.3.3 Mining and minerals

There are several exploration titles within the study area as discussed in **Section 10.2.1**. The extraction of any resources within the development footprint during construction and operation would not be possible, potentially impacting on exploration licence holders. However, the extent of impacts depends on whether the current licence holders decided to renew their licences following expiration.

Given the reversible nature of the project, it is expected that exploration activities could resume following the decommissioning stage of the project. It is noted that any vegetation offset areas within these areas may also place a long-term restriction on the exploration/extraction of material.

Notification has been provided to relevant licence holders during the project development phase and preparation of the EIS. Refer to **Chapter 5** for further detail on consultation.

10.3.4 National parks and reserves
The project is not anticipated to impact on National parks or reserves given the nearest identified National park and State Conservation Area are located more than 15 kilometres away from the study area.

Refer to **Chapter 6** for further detail on the potential impacts of the project on biodiversity values within and surrounding the study area.

10.3.5 Flood prone land
Impacts to flood prone land associated with the project are addressed in **Chapter 14**.

10.3.6 Aboriginal land claims
One active native title claim was identified within the study area and may be affected by the project.

Consultation with the claimants has been undertaken during the project development phase and preparation of the EIS. Refer to Chapter 4.1 in **Appendix D** for further detail on consultation undertaken with native title claimants and Aboriginal groups.

10.3.7 Agricultural land capability and land use

Construction
The project would result in a change of the land use in the development footprint from its existing use agriculture, to electricity generation. The project may result in some temporary impacts to surrounding land uses during construction as a result of amenity impacts associated with increases in noise, traffic from an increase in heavy vehicle movements, impacts to water quality, and reduced air quality. Impacts associated with noise, traffic, water, and air quality are discussed in **Chapters 12**, **13**, **14** and **Section 18.1** respectively.

There have been numerous refinements to the study area, development footprint, and layout of infrastructure to minimise impacts to existing agricultural operations following consultation with local landholders. Project refinements are detailed in **Chapter 3**.

It is anticipated that landholders would continue to use remaining portions of their properties (not subject to the landholder agreement) for agricultural activities. Consultation has already commenced with participating and neighbouring landholders to identify potential transport requirements associated with the movement of stock between paddocks and seasonal based agricultural activities and determine appropriate temporary routes/access arrangements or scheduling of vehicle movements to minimise disruption to planned agricultural activities during construction of the project.

Operation

Considering most of the ground disturbance works would occur during construction, impacts to surrounding land uses during operation are expected to be manageable, and associated with ongoing maintenance activities. Disturbed areas would be reinstated and stabilised with vegetation progressively during construction which would minimise risks of soil erosion during operation.

Given that landholders would receive monetary compensation for the life of the project under a landholder agreement, they may have more financial capability to effectively manage their remaining parcel of land for agricultural operations. Options are also currently being investigated for shared land uses with sheep or cattle grazing activities within portions of the study area that aren't expected to be occupied by infrastructure. Consultation would be undertaken with landholders to determine suitable areas of the study area that may potentially be used for agricultural activities.

The study area represents an area of approximately 17.72 square kilometres of the total area within the Mid-Western Regional Council LGA. The project would reduce the total area available for agricultural use however the study area represents a very small percentage (0.20 percent) of the land available within the LGA and Central Tablelands region, and the project does not require the construction of transmission infrastructure beyond the study area, as it would connect to the existing Wellington to Wollar 330 kV transmission line (line 79). In addition, the study area is not located within an area of BSAL mapped under the Mining SEPP the project is therefore not anticipated to have a significant impact on the availability of productive agricultural land within the LGA.

Decommissioning

Once the project has reached the end of its operational life, all project infrastructure would be decommissioned and removed, except for underground cabling deeper than 1000 millimetres, which would remain in-situ following decommissioning. The land within the study area would then be returned to its pre-existing land use, suitable for grazing of sheep and/or cattle, or another land use as agreed by the project owner and the landholder at that time. As a result, impacts to agricultural land capability are not anticipated following decommissioning of the project. The results of the soil survey presented in **Chapter 9** would inform the process and indicators required to return the land to a similar or improved land capability.

10.3.8 Biosecurity

The Central Tablelands Regional Strategic Weed Management Plan 2017 – 2022 identifies that the spread of weeds in the region are likely to be due to the use of highways and regional roads, travelling stock routes, rail corridors and rivers (NSW Local Land Services, 2017). Climate change also has the potential to lead to an increase in weeds coming from the north and east as well as increasing altitude ranges of some species already within the region. In addition, extreme climatic events are likely to be an advantage for those species that have superior colonising ability when compared to native and crop plants (NSW Local Land Services, 2017).

If not adequately managed, the project has the potential to introduce and transport weeds as a result of the increase in vehicle movements to and from the study area during construction. This could lead to the further invasion of weeds to the local area, thereby resulting in changes to vegetation communities over time and associated loss of habitat for native species.

The project may also encourage pest animals to the local area as a result of potential increase in food sources associated with the construction activities and ground disturbance, particularly the priority pest species for the Central Tablelands identified in **Section 10.2.8**.

10.3.9 Land use conflict risk assessment

A LUCRA is a tool used to identify and assess potential land use conflicts between neighbouring land uses (NSW DPI, 2011). NSW DPI identifies that land conflicts can occur when one land user is seen to infringe on the rights, values or amenity of another, including commonly occurring conflicts between agricultural and residential land uses in rural areas. Land use conflicts can also occur between agricultural land uses and other industries such as mining, forestry, aquaculture and fishing enterprises (NSW DPI, 2011). NSW DPI identifies direct impacts from neighbouring land uses on farming operations as including:

- harassment of livestock as a result of straying domestic animals
- trespassing
- changes to storm water flows or availability of water
- poor management of weeds and pest animals.

A LUCRA has been undertaken for the project in accordance with the *Land Use Conflict Risk Assessment Guide* (2011) (LUCRA Guide) and is presented in **Appendix E**. Potential land use conflicts presented in the LUCRA have been identified through the preparation of technical assessments that informed this EIS, and via engagement with landholders and neighbouring residences, and other stakeholders including Mid-Western Regional Council and the local community.

The LUCRA has been undertaken using the risk ranking matrix presented in the LUCRA Guide. This matrix ranks the identified potential land use conflicts, assessing environmental, public health and amenity impacts according to the probability of occurrence and consequence of the impact. The matrix produces a risk ranking from 25-1, with 25 representing the highest magnitude of risk and 1 representing the lowest. Five probability ratings are presented, representing the likelihood of a consequence occurring. These range from Level A (almost certain) to Level E (rare).

The consequence ratings presented in the LUCRA Guide comprise the following:

- Level 1: Severe
- Level 2: Major
- Level 3: Moderate
- Level 4: Minor
- Level 5: Negligible.

Combining the probability ratings and consequence ratings allow the user to determine the overall risk ranking as shown in **Figure 10-3**.

PROBABILITY	A	B	C	D	E
Consequence					
1	25	24	22	19	15
2	23	21	18	14	10
3	20	17	13	9	6
4	16	12	8	5	3
5	11	7	4	2	1

Source: *NSW DPI, 2011, Land Use Conflict Risk Assessment Guide*

Figure 10-3: LUCRA Guide risk ranking matrix

As part of the LUCRA, 39 potential conflicts have been identified, however only 18 high risks were identified (i.e. those with a score of 11 or above), prior to implementing any mitigation (i.e. before the application of risk reduction controls). These risks are largely associated with:

- removal of existing agricultural land for the construction of the solar farm and reduced agricultural productivity due to the presence of permanent infrastructure
- increased soil erosion and changes to water quality and flows, particularly where access roads are required to traverse the environmental exclusion zone
- temporary and permanent impacts to water storage associated with the removal of farm dams in the study area
- impacts to existing mining or exploration titles, native title claims, and parcels of crown land
- impacts to surrounding properties and agricultural operations associated with increases in noise, traffic, dust, and reduced visual amenity
- risk of inadequate waste facilities to accept construction waste resulting from the project
- safety and security risks associated with increased vehicle movements on local roads, and risk of structural fires and bushfires, along with theft and vandalism of neighbouring residences.

Risk reduction controls were then identified to reduce the identified risk ratings, and risk ratings were revised. According to the LUCRA Guide, the objective is to identify controls that lower the risk ranking score to 10 or below. The number of high risks were subsequently reduced from 18 to 8. Those remaining over the score of 10 included:

- removal of existing agricultural land for the construction of the solar farm and reduced agricultural productivity due to the presence of permanent infrastructure
- impacts to existing mining or exploration titles, native title claims, and parcels of crown land
- impacts to surrounding properties and agricultural operations associated with increases in noise and reduced visual amenity
- safety risks associated with increased vehicle movements on local roads, and risk of structural fires and bushfires.

Performance targets have been proposed to confirm that the controls outlined in the LUCRA continue to be effective in addressing the potential land use conflicts. Effectiveness of the identified strategies will be measured as part of the EMS, which will comprise the specific management plans. The EMS will contain a review schedule to confirm the management strategies remain effective and current and will include:

- roles, responsibility, authority and accountability of all key personnel involved in the environmental management of the project

- establish procedures for consulting with the local community and relevant agencies regarding the operation and environmental performance of the project
- establish procedures for handling of complaints, disputes, non-compliances and emergency response.

10.4 Environmental management and mitigation measures

Measures to mitigate and manage impacts associated with land use are presented in **Table 10-1**.

Table 10-1: Management and mitigation measures – land use

ID	Management/mitigation measure	Timing
LU1	Land management within the study area will include measures to minimise impacts to surrounding agricultural land use with reference to DPI's publication *Infrastructure proposals on rural land* (Kovac, M and Briggs, G, 2013). These measures will also be implemented during operation of the project and will include strategies to minimise impacts of aerial spraying. The land management measures will aim to minimise impacts on: • land and soil capability within the development footprint • biosecurity both at a local and regional level • soil erosion • surface water runoff • agricultural activities on neighbouring properties.	At all times
LU2	Biosecurity management will include: • measures to manage the impacts of weeds, disease and pest animals during construction, operation, and decommissioning activities • biosecurity response measures where impacts are identified • contingency measures in the event that existing measures are inadequate in managing the risk/impact.	At all times
LU3	Consultation will be undertaken with Mid-Western Regional Council, DPIE and other relevant stakeholders including mining and exploration licence holders, and native title claimants in order to identify potential impacts on surrounding land uses and develop measures to address concerns.	Detailed design / prior to construction
LU4	Consultation will continue to be undertaken with participating landholders to minimise disruption to agricultural activities during construction and operation.	Detailed design / prior to construction
LU5	Options will be further investigated to consider the feasibility of grazing within the study area throughout operation, in consultation with landholders.	Detailed design / prior to operation

11. LANDSCAPE CHARACTER AND VISUAL

This chapter presents an assessment of the potential landscape and visual impacts within the study area and surrounding road network as a result of the project. This chapter has been prepared to address specific SEARs relating to visual impacts as presented in ***Section 1.5****.*

A landscape and visual assessment has been prepared by Moir Landscape Architecture (Moir). The report is provided in ***Appendix F*** *and summarised below.*

11.1 Assessment methodology

11.1.1 Assessment approach

Landscape character definition

The landscape character of a site refers to the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. The existing landscape character of the study area was defined by identifying key landscape features of the study area and surrounds. The landscape character of the study area was assessed at a regional, local and site scale.

Zone of visual influence

A visibility assessment was undertaken to define the 'Zone of Visual Influence' for the project, which is the theoretical areas from which the proposed solar farm would be visible. This is referred to as the 'Visual Catchment'. The Zone of Visual Influence was defined by using a Digital Terrain Model which identifies areas that are screened by topography and therefore have no visual impact from the project. This output informed the field assessment by determining areas where potential for impact exists.

Visual impact definition

The potential visual impact of the project is then assessed based on the relationship between the visual sensitivity and visual effect. Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different areas. Visual effect is defined as the interaction between a project and the existing visual environment. It is generally expressed as the level of visual contrast of the project against its setting or background in which it is viewed. The visual impact is the combined effect of visual sensitivity and visual effect.

The sensitivity rating definitions used in the assessment for determining the visual sensitivity, visual effect and visual impact are outlined in **Table 11-1** to **Table 11-3**.

Table 11-1: Visual sensitivity ratings

Land use	Distance from the study area				
	0-1 km	1-2 km	2 - 4.5 km	4.5 -7 km	> 7 km
Townships	High	High	High	Moderate	Low
Recreational Reserve	High	High	High	Moderate	Low
Homestead	High	High	High	Moderate	Low
Rural Township	High	High	Mod	Low	Nil
Main Highway	Mod	Mod	Low	Low	Nil - Low
Local Roads	Mod	Mod	Low	Low	Nil - Low
Farm Road	Low	Low	Nil - Low	Nil - Low	Nil
Agricultural Land	Low	Low	Nil - Low	Nil - Low	Nil

Table 11-2: Visual effect ratings

Visual Effect Level	Description
Low	Occurs when a project blends in with its existing viewed landscape due to a high level of integration of one or several of the following: form, shape, pattern, line, texture or colour. It can also result from the use of effective screening ie. Topography and vegetation.
Moderate	Occurs where a project is visible and contrasts with its viewed landscape however, there has been some degree of integration (e.g. Good siting principles employed, retention of significant existing vegetation, provision of screen landscaping, appropriate colour selection and/or suitably scaled development).
High	Results when a project has a high visual contrast to the surrounding landscape with little or no natural screening or integration created by vegetation or topography.

Table 11-3: Visual impact ratings

		Visual effect		
		High	Moderate	Low
Visual sensitivity	High	High impact	High impact	Moderate impact
	Moderate	High impact	Moderate impact	Low impact
	Low	Moderate impact	Low impact	Low impact

Viewpoint analysis
A viewpoint analysis assessment was undertaken to consider the likely impact that the project would have on the existing landscape character and visual amenity by selecting prominent sites, referred to as 'viewpoints. Viewpoints were selected to be representative of the range of views within the study area, informed by topographical maps, field work observations and other relevant influences such as access, landscape character and the popularity of vantage points. Viewpoints were selected based on a combination of:

- areas of high landscape or scenic value
- visual composition (e.g. focused or panoramic views, simple or complex landscape pattern)
- range of distances
- varying aspects
- various elevations
- various extent of development visibility (full and partial visibility)
- views from major routes.

Panoramic photographs were taken at each viewpoint on a level tripod at a height of 150 centimetres to represent eye level, using a 50-millimetre fixed focal lens which closely represents the central field of vision of the human eye.

The visual impact of each viewpoint was assessed onsite and using with the topographic and aerial information using the definitions described in **Section 11.3.2**. Viewpoint photographs and analysis are included in **Appendix F**.

Photomontages
Photomontages were created for the project to visualise a realistic representation of proposed or potential changes to a view by superimposing an image onto a photograph of the site. The images that the photo simulations have been based on have been were captured with a 50-millimetre fixed focal lens which closely represent the central field of vision of the human eye. The process for generating these images involves computer generation of a wire frame perspective view of the site.

Two photomontages were prepared for Viewpoint SSF05 and SSF12 (refer to**Figure 11-4**) which are were determined to have the greatest potential for visibility of the project and therefore the highest visual impact. Due to the character of the project being a progression which would occur over time, the photomontages were based on a worst-case scenario panel height of 4.3 metres.

11.1.2 Statutory context, policy and guidelines

In addition to the SEARs, the Large-scale Solar Energy Guidelines (NSW DPIE, 2019) provides the community, industry, applicants and regulators with general guidance on the planning framework for the assessment and determination of Stage significant large-scale solar energy projects. The following guidelines and frameworks are also considered in the assessment:

- Mid-Western Regional Local Environmental Plan 2012
- *The Dark Sky Planning Guideline* (2016).

11.2 Existing environment

11.2.1 Mid-Western Regional Council

The study area is located within the Mid-Western Regional Council LGA. The study area is zoned RU1 Primary Production under the Mid-Western Regional Local Environmental Plan 2012. The project is broadly consistent with the objectives of the RU1 zone which are as follows:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To encourage diversity in primary industry enterprises and systems appropriate for the area.
- To minimise the fragmentation and alienation of resource lands.
- To minimise conflict between land uses within this zone and land uses within adjoining zones.
- To maintain the visual amenity and landscape quality of Mid-Western Regional by preserving the area's open rural landscapes and environmental and cultural heritage values.
- To promote the unique rural character of Mid-Western Regional and facilitate a variety of tourist land uses.

11.2.2 Dark Sky Planning Guideline

The *Dark Sky Planning Guideline* (2016) is a matter for consideration for all development under the EP&A Act before development consent is granted within the local government areas of Coonamble, Dubbo, Gilgandra and Warrumbungle. The project falls within the Dark Sky Region which consists of the land within a 200-kilometre radius of Siding Spring Observatory. An assessment of night lighting in regard to the Dark Sky Planning Guidelines associated with the project has been included in **Section 11.3.1**.

11.2.3 Existing landscape character

Land use

The land use characteristics of the study area is described in detail in **Chapter 10**. The study area is predominately characterised by grazing and modified pasture for with some small pockets of dryland cropping.

Roads

Roads in the area immediately surrounding the study area are limited to minor roads which are generally utilised for access to isolated homesteads. The nearest main road is Cope Road which is located approximately five kilometres south of the study area connecting Gulgong and Ulan.

Blue Springs Road runs in a generally north direction from Cope Road to the east of the study area connecting to Birkalla Road to the north. Access to the eastern side of the site would be via Blue Springs Road. Barneys Reef Road runs from Gulgong in a north direction to the west of the study area. Barneys Reef Road diverges to the west of the study area and Merotherie Road continues to the north west of the Site and onto the Golden Highway.

Towns

The study area is located approximately 10 kilometres north of Gulgong in the locality of Stubbo. The population of Gulgong is 2,521. Stubbo is a rural area defined by large lot rural residential properties to the south of the study area. In the 2016 Australian Bureau of Statistics (ABS) Census, there were 232 people living in Stubbo (Australian Bureau of Statistics, 2016).

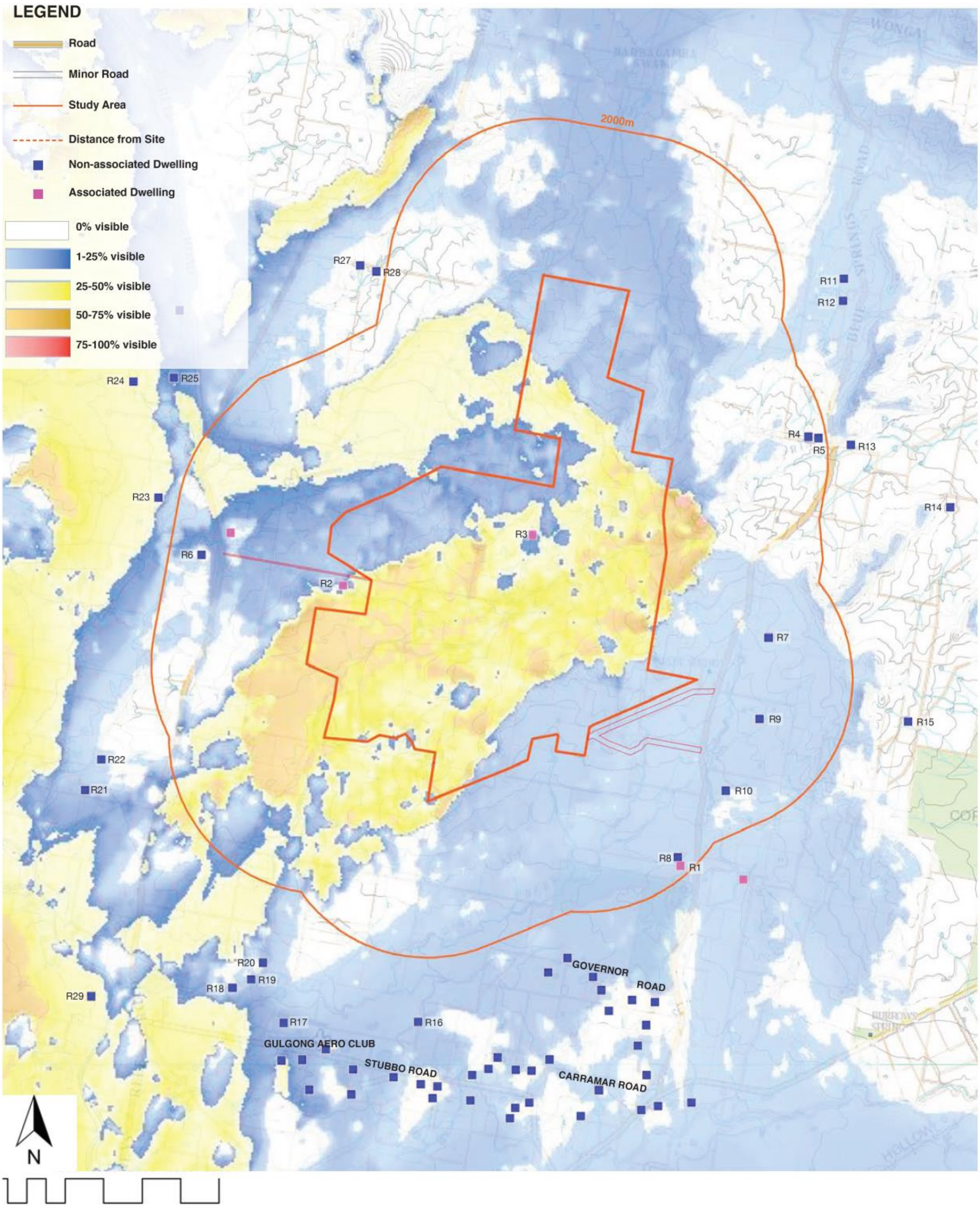
Infrastructure
Existing 330 and 132 kilovolt transmission lines runs in a generally south west direction from Blue Springs Road to Barneys Reef Road along the southern boundary of the study area.

Vegetation
Vegetation of the study area is described in detail in **Chapter 6**. Land within the study area has been extensively cleared with the exception of scattered vegetation associated with the Stubbo Creek and its tributaries which are within the main environmental exclusion zone. Remnant vegetation within the area is typically Blakely's red gum-narrow-leaved red ironbark woodland community.

Topography
Land in the study area consists of undulating hills and low hills with granite outcropping as tors and sloping pavements. The topography of the study area is higher ground to the east, reaching to above 500 metres AHD, and lower to the west, to around 460 metres AHD. There is a depression in the middle of the study area which forms the upper reaches of Stubbo Creek and is included in the central environmental exclusion zone.

Air traffic
There are no commercial airports within close proximity to the study area. Gulgong Aero Park is located approximately 3.6 kilometres south of the study area and is utilised for recreational sports aviation.

11.2.4 Zone of visual influence
The Zone of Visual Influence for the project is shown on **Figure 11-1**. The Zone of Visual Influence identified large areas of land surrounding the study area to the east and north from which topography would screen views to the project. The figure illustrates topography would screen views from four dwellings within two kilometres of the study area (R4, R5, R6 and R10). A number of dwellings identified in excess of two kilometres would also be screened by topography.



***Source**:* (Moir Landscape Architecture, 2020)

Figure 11-1: Zone of visual influence

11.3 Assessment of potential impacts

11.3.1 Photomontages

During construction, the landscape within the array areas would undergo physical changes through installation of project infrastructure. This infrastructure would add new features to the visual landscape within the array areas.

Visual impacts associated with the project are likely to be higher during the construction phase and mitigated overtime with the implementation of measures to ultimately achieve a low or negligible visual impact level.

The photomontages prepared for Viewpoint SSF05 and SSF12 (refer to **Figure 11-4** for viewpoint locations) showing a visualisation of the project infrastructure within the existing environment are presented in **Figure 11-2** and **Figure 11-3**.

Figure 11-2: Photomontage 01 (Viewpoint SSF05)

Figure 11-3: Photomontage 02 (Viewpoint SS12)

11.3.2 Assessment of associated infrastructure

Substation and Battery Storage Facilities
The proposed substation is situated in the northern end of the study area. The footprint of the substation is around 120 metres by 60 metres, although only approximately a half of this would be built form. The majority of the substation would remain under 10 metres high. The lightening poles would reach up to 20 metres high and the gantry up to 18 metres high. Both the proposed substation locations are generally isolated. Overtime the proposed substation and battery storage facilities would be screened at either proposed location with the implementation of the mitigation methods outlined in **Table 17-3**.

Transmission Lines
Transmission lines feature in the existing landscape and form part of the existing landscape character of the area. Although there are already transmission lines in the view shed, additional structures may increase the dominance of these structures in the landscape. There is potential to mitigate the visual impact of the proposed development through vegetation.

Lighting
There would be no permanent night lighting installed within the array. Night lighting would only be used in the case of maintenance and in the event of an emergency and would be designed to confirm reduce disturbance to neighbouring properties. Any lighting installed would be in accordance with *AS4228-1997 - Control of Obtrusive Effects of Outdoor Lighting*. Lighting would also be designed with regards to principles identified within the *Dark Sky Planning Guidelines* which include:

- eliminate upward spill light
- direct light downwards, not upwards
- use shielded fittings
- avoid 'over' lighting
- switch lights off when not required
- use energy efficient bulbs
- use asymmetric beams, where floodlights are used
- confirm lights are not directed towards reflective surfaces
- use warm white colours.

Solar panels – reflectivity
Due to the materials used in the construction of photovoltaic panels being primarily glass and steel there is a perceived issue of glint and glare surrounding the reflectivity solar panels. As a result of the perceived reflection levels, there is a concern of possible distractions to motorists, aircraft and the hazard of eye damage.

Solar panels are designed to absorb the sun energy and directly convert it to electricity. Current photovoltaic modules absorb approximately 93.5 per cent of the light received. The solar panels are designed using anti-reflective solar glass effectively reducing reflectivity. Thin slivers of metal stripping on the face of the panels further reduce any potential glare issues that may occur.

The level of glare and reflectance from the photovoltaic solar panels are considerably lower than the level of glare and reflectance of common surfaces, particularly those surrounding the proposed solar farm. The PV panels would reflect approximately 6.5 per cent of energy which is less than typical rural environments which have a reflectivity of approximately 15 to 30 per cent.

Impact of solar PV on aviation and airports undertaken by the Solar Trade Association concludes they do not believe that there is cause for concern in relation to the impact of glint and glare from solar PV on aviation and airports, nor relating to infringement on airspace or interference with communications equipment. Solar photovoltaic panels are designed to absorb not reflect light, and their level of reflectivity is lower than that of other objects commonly visible on and around aerodromes, e.g. metal roofs, glass windows, cars, and bodies of water.

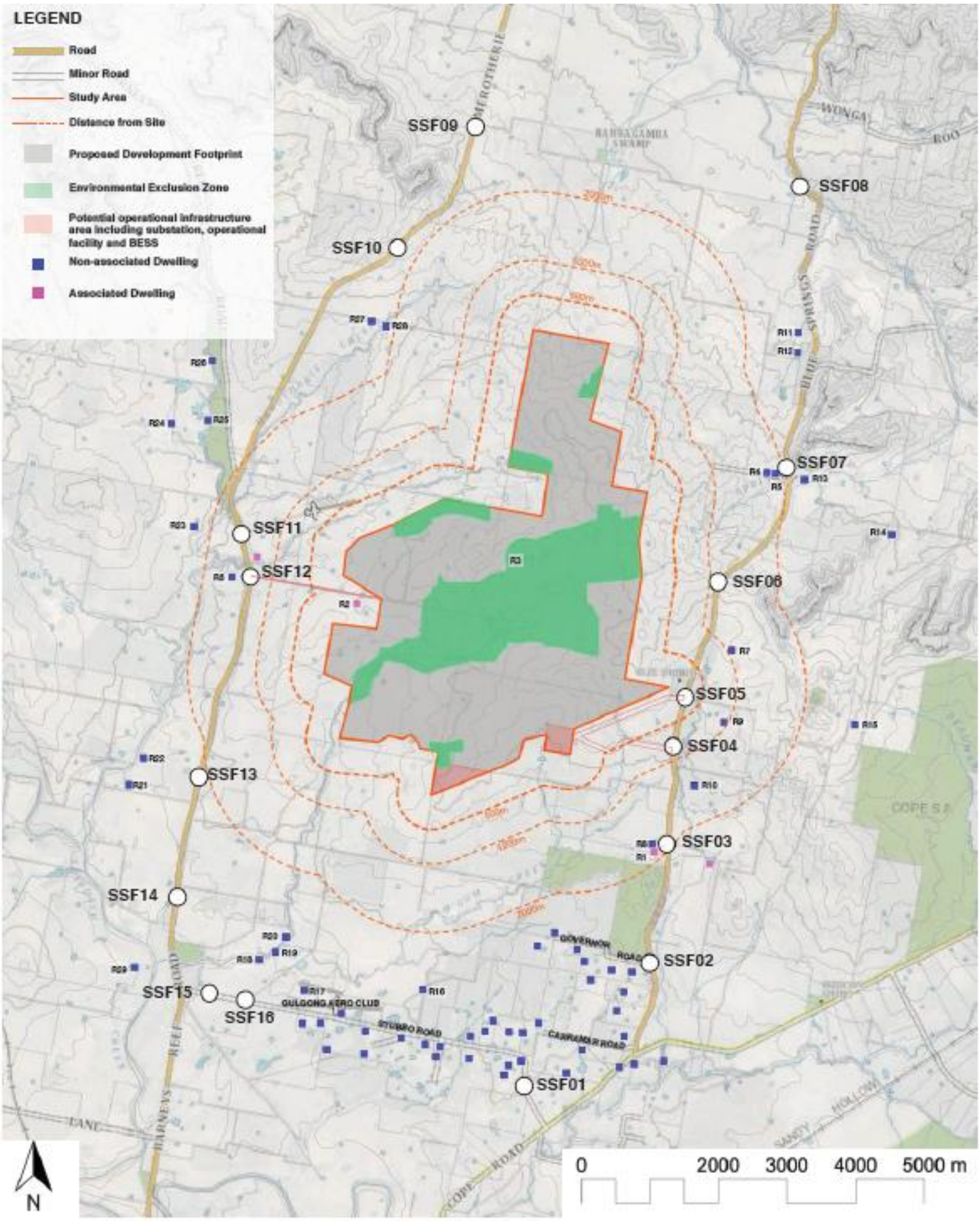
An assessment of potential glare impacts for each non-associated receiver is provided is **Section 11.3.5**.

11.3.3 Visual impact on selected viewpoints

A total of 16 viewpoints were recorded as part of the field work process. The selected viewpoints are shown on **Figure 11-4**, along with the general viewing direction of each viewpoint in relation to the project. **Table 11-4** provides a summary of the characteristics for each selected viewpoint. The majority of these viewpoints for this study have been taken only from accessible public land (typically gates, walking tracks, roads, recreation reserves and lookouts) which were identified as having a potentially high visual impact through the desktop review process.

Table 11-4: Description of selected viewpoints

Viewpoint	Location	Viewing direction	Elevation (m)	Distance to the study area (km)	Land use
SSF01	Beela Road	North	448	4.4	Low use road
SSF02	Blue Springs Road	North	467	3.25	Low use road
SSF03	Blue Springs Road	Generally northwest	486	1.91	Low use road
SSF04	Blue Springs Road	Generally west	506	0.80	Low use road
SSF05	Blue Springs Road	Generally west	521	0.28	Low use road
SSF06	Blue Springs Road	Generally west	560	1.11	Low use road
SSF07	Blue Springs Road	Generally west	519	2.45	Low use road
SSF08	Blue Springs Road	Generally south	447	3.60	Low use road
SSF09	Merotherie Road	Generally south	486	3.06	Low use road
SSF10	Merotherie Road	Generally southeast	531	2.32	Low use road
SSF11	Barneys Reef Road	Generally east	462	1.54	Low use road
SSF12	Barneys Reef Road	Generally east	462	1.36	Low use road
SSF13	Barneys Reef Road	Generally east	448	2.14	Low use road
SSF14	Barneys Reef Road	Generally northeast	440	3.31	Low use road
SSF15	Stubbo Road	Generally north	433	4.33	Low use road
SSF16	Stubbo Road	Generally north	440	4.02	Low use road



***Source**:* (Moir Landscape Architecture, 2020)

Figure 11-4: Viewpoint assessment locations

Table 11-5 provides a summary of the visual impact on selected viewpoints determined in the visual assessment. These impacts would occur during construction and operation. Photos from each viewpoint to the study area are included in **Appendix F**. Generally, there are very limited opportunities to view the project.

Of the 16 viewpoints selected, the project would be visible from a total of nine viewpoints. All viewpoints from which the project would be visible were assessed to have a visual impact rating of 'low'. The viewpoints that were rated as low contained limited views to the study area and adequate screening or roadside vegetation obscure views.

Table 11-5: Summary of visual impact on selected viewpoints

Viewpoint	Location	Visual Sensitivity	Visual Effect	Potential Visual Impact
SSF01	Beela Road	Low	Nil	Nil
SSF02	Blue Springs Road	Low	Nil	Nil
SSF03	Blue Springs Road	Low	Low	Low
SSF04	Blue Springs Road	Low	Low	Low
SSF05	Blue Springs Road	Moderate	Low	Low
SSF06	Blue Springs Road	Low	Nil	Nil
SSF07	Blue Springs Road	Low	Nil	Nil
SSF08	Blue Springs Road	Low	Nil	Nil
SSF09	Merotherie Road	Low	Low	Low
SSF10	Merotherie Road	Low	Low	Low
SSF11	Barneys Reef Road	Low	Nil	Nil
SSF12	Barneys Reef Road	Low	Low	Low
SSF13	Barneys Reef Road	Low	Low	Low
SSF14	Barneys Reef Road	Low	Low	Low
SSF15	Stubbo Road	Low	Nil	Nil
SSF16	Stubbo Road	Low	Low	Low

The potential visual impacts for those viewpoints identified as having low visual impact are as follows:

- SSF03 - Views towards to the majority of the proposed development are likely to be fragmented in the north by vegetation in the foreground and to the north west by vegetation in the distance. Opportunities to view a small portion of the proposed development are likely to be fleeting and due to the distance, are likely to be difficult to discern from this location.
- SSF04 - An access road associated with the proposed development is likely to be located to the west of this viewpoint. The proposed access road is likely to be in keeping with the existing character of the landscape.

- SSF05 - A small portion of the proposed development is likely to be visible from this viewpoint, however the existing infrastructure visible in the foreground already forms part of the visual character of the landscape. A photomontage has been created for this viewpoint as **Figure 11-2**.
- SSF09 - A small portion of the proposed development may be visible from this viewpoint. A combination of vegetation and distance is likely to fragment the view, making the project difficult to discern from this location.
- SSF10 - Distant views toward the proposed development are likely to be available from this viewpoint. A portion of the proposed development is likely to be screened by vegetation to the south east.
- SSF12 - Views toward a small portion of the proposed development may be available in the break in vegetation to the east from this viewpoint. A large portion of the proposed development is likely to be screened by vegetation in the middle ground to the north east. A photomontage has been created for this viewpoint as **Figure 11-3**.
- SSF13 - Distant views toward a small portion of the proposed development may be available from this viewpoint, however opportunities to view the proposed development are likely to be fleeting and due to the distance, are likely to be difficult to discern from this location. A large portion of the proposed development is likely to be screened by vegetation associated with Stubbo Creek in the background.
- SSF14 - The proposed development is likely to be largely screened by the existing vegetation in the north east of the view, with the exception of a small portion that may be available at the break in vegetation. Due to the distance, views toward this portion of the development are likely to be fleeting and difficult to discern.

11.3.4 Visual impact on public land

The project would result in very minor modification to the existing visual landscape. There are very limited opportunities to view the project from publicly accessible land and there are no accessible viewing locations within the study area to view the project in its entirety. Due to the relatively small vertical scale of the project, existing landscape features including roadside vegetation and topography screen the project from the majority of locations. Publicly accessible viewing locations are generally limited to the minor roads which transverse the landscape which have very low frequency of use, providing access to isolate dwellings.

The highest visual effect is likely to be experienced from areas within close proximity to the study area during construction and operation. However, due to the isolated location, there is no publicly accessible land within close proximity to the study area.

The study area is set back from all roads by at least one kilometre with the exception of a small portion of Blue Springs Road where the study area boundary is located within relatively close proximity. Roadside vegetation and direction of travel along this portion of road would limit opportunities to view the project. Views may be available to the study area along the existing cleared transmission line easement when travelling in a north direction along Blue Springs Road. Photomontage 01 (**Figure 11-2**) shows the low visibility of the project in this location. Views to the project are likely to be limited reduced to a fleeting glimpse that is unlikely to be noticeable to the general public.

11.3.5 Visual impact on residences

Table 11-6 includes a summary of the visual impacts to non-associated residences within two kilometres of the study area that has the potential to occur from the project. **Table 11-7** includes a summary of the visual impacts to non-associated residences between two and five kilometres from the study area that has the potential to occur from the project. The location of these dwelling is shown on **Figure 11-5**.

The highest potential visual impact is likely to be experienced from dwellings within close proximity to the study area during construction and operations, which includes seven residences located within two kilometres of the study area. The project would be screened by either topography, vegetation or both from all these dwellings.

Views to the project from rural residential properties located to the south of the study area within the locality of Stubbo are likely to be screened by vegetation from dwellings associated with Governor Road, Carramar Road, Cope Road and the southern side of Stubbo Road.

No mitigation measures are recommended to minimise visual impacts on dwellings. Once decommissioned, the visual landscape has the capacity to return to the current state.

Table 11-6: Summary of visual impact on non-associated residences within two kilometres

Non-associated Dwelling	Location	Distance to study area (m)	Extent of visibility based on ZVI	Visual Assessment	Potential glare	Recommended mitigation measures
R4	917 Blue Springs Road, Stubbo	1915	Nil	The project is located to the south west of this dwelling. A low rise in topography is likely to screen views to the project from this dwelling.	Nil	Not required
R5	915 Blue Springs Road, Stubbo	1932	Nil	The project is located to the south west of this dwelling. A low rise in topography is likely to screen views to the project from this dwelling.	Nil	Not required
R6	1251 Barneys Reef Road, Stubbo	1635*	Nil	A combination of topography and dense roadside vegetation associated with Barney Reef Road would screen views to the project from this dwelling.	Nil	Not required
R7	654 Blue Springs Road, Stubbo	1069	1-25%	Dwelling is located on a slight rise in topography on the eastern side of Blue Springs Road. The potential to view the project is limited due to intervening vegetation (to the west of the dwelling) associated with Blue Springs Road.	Nil	Not required
R8	305 Blue Springs Road, Stubbo	1410	1-25%	Views towards to the project from this dwelling are likely to be fragmented by vegetation associated with Gum Creek. There is potential for a small portion of the project to be visible in the distance to the north west, however the project would occupy only a small portion of the view and be difficult to discern from this distance.	Nil	Not required

Non-associated Dwelling	Location	Distance to study area (m)	Extent of visibility based on ZVI	Visual Assessment	Potential glare	Recommended mitigation measures
R9	440 Blue Springs Road, Stubbo	680	1-25%	Dwelling is located on a slightly elevated position to the east of Blue Springs Road. The potential to view the project is limited due to intervening vegetation (to the north west of the dwelling) associated with Blue Springs Road.	Nil	Not required
R10	384 Blue Springs Road, Stubbo	585	Nil	Dwelling is surrounded by vegetation to the east of Blue Springs Road. It is unlikely views to the project would be visible from this dwelling due to the vegetation.	Nil	Not required

*The distance given to the study area for this dwelling is measured to the closest area to be developed with solar arrays. The distance to the proposed emergency access is approximately 285 meters however this distance is not considered relevant to the visual assessment due to the minor visual effects associated with the development of the emergency access.

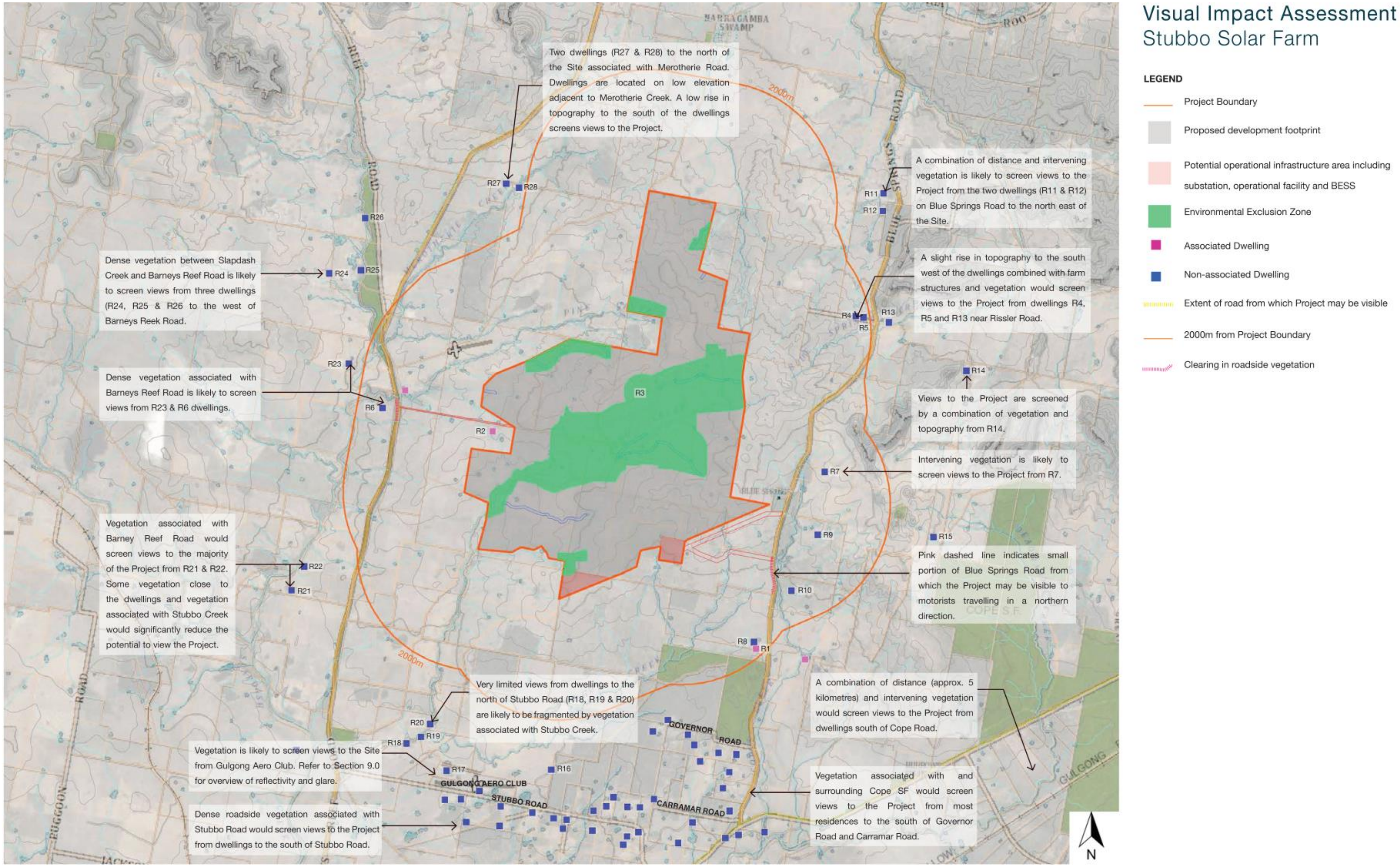
Table 11-7: Summary of visual impact on non-associated residences 2000 metres to 5000 metres

Non-associated Dwelling	Location	Distance to study area (m)	Extent of visibility based on ZVI	Visual Assessment	Potential glare	Recommended mitigation measures
R11	1083 Blue Springs Road	2780	1-25%	Dwelling appears to be surrounded by vegetation and views would therefore be screened.	Nil	Not Required
R12	1083 Blue Springs Road	2760	1-25%	Intervening vegetation between the dwelling and project would be likely to screen views.	Nil	Not Required
R13	898 Blue Springs Road	2310	Nil	Not visible due to topography.	Nil	Not Required

Non-associated Dwelling	Location	Distance to study area (m)	Extent of visibility based on ZVI	Visual Assessment	Potential glare	Recommended mitigation measures
R14	802 Blue Springs Road	3650	Nil	Not visible due to topography.	Nil	Not Required
R15	658 Blue Springs Road	2840	Nil	Not visible due to topography.	Nil	Not Required
R16	354 Carramar Road	2820	1-25%	Intervening vegetation to the north of the dwelling would be likely to screen views to the project.	Nil	Not Required
R17	Gulgong Aero Club	3370	1-25%	Intervening vegetation to the north of the dwelling is likely to screen views to the project.	Nil	Not Required
R18	97 Stubbo Road	3400	1-25%	A combination of distance and intervening vegetation between the dwelling and project is likely to screen views.	Nil	Not Required
R19	99 Stubbo Road	3170	1-25%	Intervening vegetation between the dwelling and project would be likely to screen views.	Nil	Not Required
R20	101 Stubbo Road	2920	1-25%	Intervening vegetation between the dwelling and project would be likely to screen views.	Nil	Not Required
R21	913 Barneys Reef Road	3060	1-25%	Vegetation associated with Barneys Reef Road and Stubbo Creek would screen views to the project.	Nil	Not Required
R22	955 Barneys Reef Road	2820	1-25%	Vegetation associated with Barneys Reef Road and Stubbo Creek would screen views to the project.	Nil	Not Required

Non-associated Dwelling	Location	Distance to study area (m)	Extent of visibility based on ZVI	Visual Assessment	Potential glare	Recommended mitigation measures
R23	1309 Barneys Reef Road	2230	25-50%	Roadside vegetation associated with Barneys Reef Road would screen views to the project.	Nil	Not Required
R24	1451 Barneys Reef Road	3160	25-50%	Roadside vegetation associated with Barneys Reef Road would screen views to the project.	Nil	Not Required
R25	1449 Barneys Reef Road	2800	1-25%	Vegetation between Slapdash Creek and with Barneys Reef Road would screen views to the project.	Nil	Not Required
R26	1535 Barneys Reef Road	3380	1-25%	Vegetation between Slapdash Creek and with Barneys Reef Road will screen views to the project.	Nil	Not Required
R27	272 Merotherie Road	2400	Nil	Not visible due to topography.	Nil	Not Required
R28	272 Merotherie Road	2080	Nil	Not visible due to topography.	Nil	Not Required
Governor Road	Dwellings associated with Governor Road	Varies (in excess of 2.4 km)	Nil / 1-25%	Views from dwellings associated with Governor Road would be screened by dense vegetation to the north.	Nil	Not Required
Carramar Road	Dwellings associated with	Varies (in excess of 3.8 km)	Nil / 1-25%	Views from dwellings associated with Carramar Road would be screened by dense vegetation to the north.	Nil	Not Required

Non-associated Dwelling	Location	Distance to study area (m)	Extent of visibility based on ZVI	Visual Assessment	Potential glare	Recommended mitigation measures
	Carramar Road					
Stubbo Road	Dwellings associated with Stubbo Road	Varies (in excess of 3.4 km)	Nil / 1-25%	Dwellings associated with Stubbo Road are generally located on the south of Stubbo Road. Roadside vegetation associated with Stubbo Road would screen views to the project.	Nil	Not Required



Source: (Moir Landscape Architecture, 2020)

Figure 11-5: Visual impact on residences

11.4 Environmental management and mitigation measures

Measures to mitigate and manage impacts associated with landscape and visual impacts are presented in **Table 11-8**.

Table 11-8: Management and mitigation measures – landscape and visual

ID	Management/mitigation measure	Timing
LCV1	The design will retain the existing roadside planting where possible along the eastern boundary of the site to reduce the overall visual impact.	Detailed design
LCV2	Consideration will be given to the colours of the PCUs, the battery facility, O&M buildings and storage shed to confirm minimal contrast and to help blend into the surrounding landscape to the extent practicable.	Detailed design
LCV3	Existing vegetation within the environmental exclusion zones will be retained and protected to maintain the existing level of screening.	Construction / operation

12. NOISE AND VIBRATION

This chapter presents a summary of the assessment and identifies potential noise and vibration impacts within the study area and surrounding locality. This chapter has been prepared to address specific SEARs relating to noise and vibration as presented in ***Section 1.5****.*

A noise and vibration assessment has been prepared by RAPT Consulting. The report is summarised below and provided in full in ***Appendix G****.*

12.1 Assessment methodology

12.1.1 Assessment approach

The noise and vibration assessment included the following methodology:

- undertake initial desktop review to identify noise sensitive receivers from aerial photography
- undertake noise monitoring to determine ambient and background noise levels
- establish project noise goals for the construction and operation of the project
- identify the likely principal noise sources during construction and operation, and their associated noise levels
- assess the potential noise, vibration and sleep disturbance impacts associated with construction, operational and decommissioning aspects of the project
- provide feasible and reasonable noise and vibration mitigation and management measures where noise or vibration objectives may be exceeded.

Ambient noise monitoring was then undertaken at two locations from 17 to 24 August 2020 that were considered to be indicative locations of the background and ambient noise environment at the nearest affected receivers for the project. **Figure 12-1** shows the locations of the noise monitors.

Noise monitoring was undertaken using RION NL-42 noise loggers with Type 2 Precision, programmed to accumulate environmental noise data continuously over sampling periods of 15 minutes for the entire monitoring period to establish background and ambient noise levels. The L_{A90} descriptor is used to measure the background noise level. This descriptor represents the noise level that is exceeded for 90 per cent of the time over a relevant period of measurement. The L_{Aeq} is the equivalent continuous noise level which would have the same total acoustic energy over the monitoring period as the varying noise actually measured, so it is in effect an energy average. L_{Amax} refers to the maximum sound level recorded during the monitoring period.

Noise modelling using Bruel and Kjaer's "Predictor" was then undertaken to assess the potential noise, vibration and sleep disturbance impacts of the project. Both standard and noise enhancing meteorological conditions were considered with consideration to the *Noise Policy for Industry* (NPfI). Although it is unlikely that all construction equipment would be operating at their maximum sound power levels at any one time, this was considered in the modelling as a conservative approach to represent a 'worst-case scenario'.

12.1.2 Statutory context, policy and guidelines

The noise and vibration assessment was undertaken in accordance with the following guidelines, policies and standards:

- ICNG
- NPfI
- *Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006)
- *British Standard BS7385.2 - 1993 Evaluation and Measurement for Vibration in Buildings, Part 2 - Guide to damage levels from ground borne vibration 1993* (BS 6472–1992)
- *German Standard DIN 4150: Part 3-1999 Structural vibration – Effects of vibration on structures 1999* (DIN 4150)
- *NSW Road Noise Policy* (Department of Environment, Climate Change and Water (DECCW), 2011) (RNP)
- Transport for NSW *Construction Noise and Vibration Strategy* (CNVS).

12.2 Existing environment

12.2.1 Sensitive receivers

The study area and land immediately surrounding, is zoned as primary production (RU1) under the *Mid-Western Regional Local Environmental Plan 2012* and is therefore sparsely populated with a limited number of residential receivers. Sensitive noise receivers that could potentially be impacted by the project have been identified as shown on **Figure 12-1**. These are listed in **Table 12-1**, along with their distance from the study area and include three residences that are associated with the project and seven non-associated residences.

Other noise sensitive (non-residential) receivers are defined in the ICNG as including classrooms and other educational institutions, hospitals, places of worship, active or passive recreational areas, or community centres, industrial premises, offices and retail outlets. No sensitive non-residential receivers were identified near the study area.

Table 12-1: Sensitive receivers and their distance to the study area

Receiver ID	Distance from the study area	Association with the project
R1	1475 m	Associated
R2	100 m	Associated
R3	Within Study Area	Associated
R4	1915 m	Not Associated
R5	1932 m	Not Associated
R6	285 m	Not Associated
R7	1069 m	Not Associated
R8	1410 m	Not Associated
R9	680 m	Not Associated
R10	585 m	Not Associated

12.2.2 Existing background and ambient noise

The ambient noise environment is considered to be rural with the primary noise sources being wildlife and occasional road noise.

In line with the procedures described in the EPA's NPfI, the assessment background level (ABL) is established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or RBL representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring duration. The RBL is representative of the average minimum background sound level, or simply the background level.

The background noise levels and ambient noise levels for day, evening and night-time resulting from the noise monitoring are provided in **Table 12-2**.

Table 12-2: Background and Ambient Noise Monitoring Results

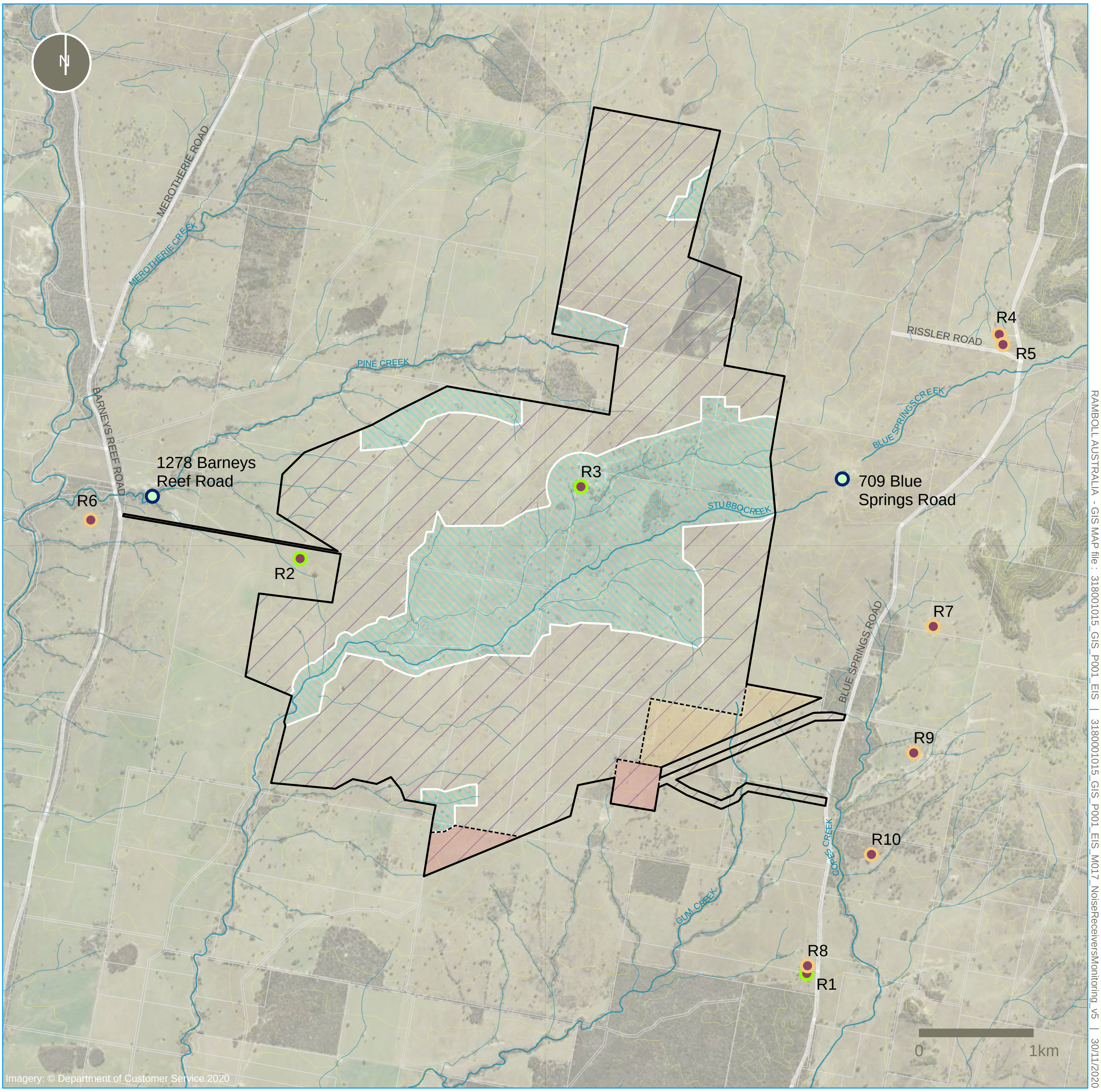
Address	Rating background level, L_{A90}, dB(A)			Ambient noise levels, L_{Aeq} dB(A)		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
1278 Barneys Reef Road	35[2] (27)	30[2] (25)	30[2] (23)	43	40	31
709 Blue Springs Road	35[2] (31)	31[3] (33)	30[2] (29)	48	52	44

Notes:

[1]*Day: 7:00 to 18:00 Monday to Saturday and 8:00 to 18:00 Sundays and Public Holidays; Evening: 18:00 to 22:00 Monday to Sunday & Public Holidays; Night: 22:00 to 7:00 Monday to Saturday and 22:00 to 8:00 Sundays and Public Holidays*

[2]*Table 2.1 of the NPfI specifies a minimum assumed rating background noise level of 35dB(A) for day and 30 dB(A) for evening and night time. Number in brackets represents actual measured RBL determined for assessment period.*

[3]*As outlined in the NPfI, the evening and night criteria or management levels are set no louder than that daytime levels. Number in brackets represents actual measured RBL determined for assessment period.*



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Sensitive receivers: Associated
- Sensitive receivers: Non-associated
- Noise monitoring locations

Figure 12-1 | Noise sensitive receivers and noise monitoring locations

12.2.3 Noise and vibration criteria

Construction noise criteria

Construction noise is assessed with consideration to the ICNG. There are two methods described for the assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration and involves the measurement and prediction of noise levels and assessment against set criteria. Given the expected scale of the construction works, a quantitative assessment has been undertaken for the construction phase of the project.

The ICNG sets out noise management levels (NMLs) for recommended standard construction hours and for works undertaken outside these recommended standard hours. The recommended standard hours are:

- Monday to Friday 7am to 6pm
- Saturday 8am to 1pm
- no work on Sundays or public holidays.

The ICNG requires a strong justification for construction works to be undertaken outside standard hours. Where an exceedance of the NML is predicted, the ICNG advises that receivers can be considered to be 'noise affected' and are considered 'highly noise affected' when noise levels reach 75 dB(A). NMLs outlined in the ICNG are presented in **Appendix G**.

The construction NMLs adopted by the project for residential receivers are presented in **Table 12-3**. NMLs are also outlined in the ICNG for other (non-residential) sensitive receivers, however none of these receivers have been identified near the study area.

Table 12-3: Construction noise management levels for residential receivers

Period[1]	Rating Background Level (RBL), L_{A90}, dB(A)	Standard hours NMLs, L_{Aeq},15min, dB(A)	Out-of-hours NMLs, L_{Aeq},15min, dB(A)
Day	35	45	40
Evening	30	-	35
Night	30	-	35

Notes:
[1]Day: 7:00 to 18:00 Monday to Saturday and 8:00 to 18:00 Sundays and Public Holidays; Evening: 18:00 to 22:00 Monday to Sunday and Public Holidays; Night: 22:00 to 7:00 Monday to Saturday and 22:00 to 8:00 Sundays and Public Holidays

Construction sleep disturbance

The ICNG requires a sleep disturbance assessment to be undertaken where construction works are planned to extend over more than two consecutive nights. The ICNG makes reference to the EPA's *Environment Criteria for Road Traffic Noise* (ECRTN), now superseded by the NSW RNP, for the assessment of sleep disturbance. The RNP references the recommendations in the ECRTN as providing the most appropriate assessment guidance.

The guidance provided in the RNP for assessing the potential for sleep disturbance recommends that to minimise the risk of sleep disturbance during the night-time period (10pm to 7am), the $L_{A1(1\ min)}$ noise level outside a bedroom window should not exceed the $L_{A90(15\ min)}$ background noise level by more than 15 dB(A).

The EPA considers it appropriate to use this metric as a screening criterion to assess the likelihood of sleep disturbance. If this screening criterion is found to be exceeded, then a more detailed analysis must be undertaken that should include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

Construction is generally expected to take place during standard hours, and therefore sleep disturbance is not expected to be an issue. However, out of hours work and extended construction hours may be required on limited occasions such as for special deliveries or in the case of emergencies. As such, construction noise sleep disturbance assessment levels adopted for the project are presented in **Table 12-4**.

Table 12-4: Construction noise sleep disturbance assessment levels

Night-time rating background level (dB(A))	Sleep disturbance screening level $L_{A1(1\ min)}$ criteria (dB(A))	Standard hours NMLs, L_{Aeq},15min, dB(A)
30	45	60

Construction road traffic noise

As the proposed vehicle access to the study area is much greater during the construction stage than the operational stage, road traffic noise assessment is only considered for the construction stage.

Noise from construction traffic on public roads is not covered by the ICNG. However, the ICNG does refer to the ECRTN, which is now superseded by the RNP, for the assessment of noise relating to construction traffic on public roads.

An initial screening test is undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion then noise mitigation should be considered for those affected receivers.

Vibration criteria

The impacts associated with vibration during construction activities have been assessed under the following categories:

- human exposure - refers to disturbance to the building occupants
- building damage - refers to vibration that may affect the structural integrity of a building or structure, or where the building contents may be impacted.

Vibration and its associated effects are usually classified as:

- **continuous** – vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities
- **impulsive** – vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with durations of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities
- **intermittent** – vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity, impact pile driving, jack hammers.

Human exposure

The preferred and maximum values for continuous and impulsive vibration are defined in Table 2.2 of the guideline and are reproduced in **Table 12-5** for the applicable receivers.

Table 12-5: Preferred and maximum levels for human comfort

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Continuous vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14

Notes:

[1]Daytime is 7:00am to 10:00pm and Night-time is 10:00pm to 7:00am

Vibration goals to assess human exposure have been sourced from the DECCW's *Assessing Vibration: a technical guideline*, which is based on guidelines contained in BS 6472–1992. Intermittent vibration is assessed using the vibration dose value (VDV). Acceptable values of vibration dose are presented in **Table 12-6**.

Table 12-6: Acceptable vibration dose values for intermittent vibration (m/s$^{1.75}$)

Location	Daytime (07:00 to 22:00)[1]		Night time (22:00 to 7:00)[1]	
	Preferred value	Maximum value	Preferred value	Maximum value
Critical areas (e.g. hospitals, precision laboratories)	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes:

[1]Daytime is 7:00 to 22:00 and night-time is 22:00 to 7:00

[2]Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be needed to assess intermittent values against the continuous or impulsive criteria for critical areas.

Building damage

Currently, there is no Australian Standard that sets the criteria for the assessment of building damage caused by vibration. Guidance of limiting vibration values is attained from reference to international standards BS 6472–1992 and DIN 4150-3. The recommended Peak Particle Velocity (PPV) guidelines to be used for short-term vibration cosmetic impacts on residential structures in accordance with DIN 4150-3 are presented in **Appendix G**. For residential buildings, these are:

- 5 mm/s for vibration at the foundation at a frequency of 1 Hertz (Hz) to 10 Hz
- 5-15 mm/s for vibration at the foundation at a frequency of 10 Hz to 50 Hz
- 15-20 mm/s for vibration at the foundation at a frequency of 50 Hz to 100 Hz
- 15 mm/s for vibration of horizontal plane of highest floor at all frequencies.

The recommended photovoltaic guidelines to be used for transient for vibration impacts on residential structures in accordance with BS 6472–1992 are presented in **Appendix G**. For residential buildings, these are:

- 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz
- 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

Operational noise criteria

Intrusive noise and amenity noise levels

The NPfI provides guidance on the assessment of operational noise impacts associated with the project's operation. The NPfI assessment procedure has two components:

- controlling intrusive noise impacts in the short-term for residences
- maintaining noise level amenity for residences and other land uses.

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the $L_{Aeq,15min}$ descriptor) does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). The project intrusive noise levels that determined the trigger levels for residential receivers are presented in **Appendix G**.

The project amenity noise levels for different time periods of day are determined with consideration to Section 2.4 of the NPfI. The NPfI recommends amenity noise levels ($L_{Aeq,period}$) for various receivers including residential, commercial, industrial receivers and sensitive receivers such as schools, hotels, hospitals, churches and parks. These "recommended" amenity noise levels represent the objective for total industrial noise experienced at a receiver location. However, when assessing a single industrial development and its impact on an area, "project" amenity noise levels apply. The NPfI recommended amenity noise levels, and project amenity noise levels are presented in **Appendix G**.

The project noise trigger level is the lower of the intrusiveness and the amenity noise levels. The project noise trigger levels for intrusive and amenity noise levels for rural residential receivers are presented in **Table 12-7**.

Table 12-7: Intrusive and amenity noise trigger levels for operations

Period		Intrusive noise trigger levels, $L_{Aeq,15min}$ dB(A)	Amenity noise trigger levels, $L_{Aeq,15min}$ dB(A)	Project noise trigger levels, $L_{Aeq,15min}$ dB(A)
Day	7:00 to 18:00 Monday to Saturday and 8:00 to 18:00 Sundays and Public Holidays	40	48	40
Evening	18:00 to 22:00 Monday to Sunday and Public Holidays	35	43	35
Night	22:00 to 7:00 Monday to Saturday and 22:00 to 8:00 Sundays and Public Holidays	35	38	35

Sleep disturbance

The NPfI requires the potential for sleep disturbance to be assessed by considering maximum noise levels events during the night-time period.

Where the subject development/premises night-time noise levels at a residential location exceed the following screening levels a detailed maximum noise level event assessment should be undertaken:

- LAeq,15min 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- LAFmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers are 40 $L_{Aeq,15min}$ and 52 L_{AFmax}.

12.3 Assessment of potential impacts

12.3.1 Construction

Noise generating activities

Noise and vibration generating activities during construction would include:

- site preparation and establishment
- pile driving and foundations for substations, BESS
- underground cabling
- installation of photovoltaic modules and associated infrastructure
- installation of operation and maintenance buildings
- grading around lower order streams and drainage channels
- removal of temporary site compound.

The works would be undertaken during standard construction hours in accordance with the ICNG (i.e. Monday to Friday 7am to 6pm; Saturday 8am to 1pm; and no work on Sundays or public holidays). While not expected, certain works may need to occur outside standard hours out of hours work and extended construction hours may be required on limited occasions such as for special deliveries to minimise disruption or in the case of emergencies. Where low intensity construction activities are required to be undertaken outside standard construction hours, such as cabling, minor assembly or use of hand tools, they would be managed such that they are not audible at any residential receivers.

A list of the typical construction plant and equipment adopted in the noise modelling for each construction activity, their associated sound power levels, and per cent usage over a 15-minute scenario are presented in Table 4-1 of **Appendix G**. The equipment likely to be required for construction includes:

- dump trucks
- grader
- roller
- compactor
- crane
- forklift
- water truck
- generator
- piling rig
- road trucks
- excavator
- concrete trucks
- cable trenching and laying equipment
- powered hand tools
- compressor
- pneumatic wrench
- light vehicles.

While sound power levels have been nominated for each of the above equipment, construction machinery would likely move about the study area, altering the directivity of the noise source. In addition, it is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one time. Certain types of construction machinery would also only be present in the study area for brief periods. The modelled construction noise levels presented in the following sections are therefore considered to represent a worst-case scenario.

Construction noise

The site preparation works and pile driving and foundations for substations, BESS within each of these scenarios have the most potential for noise impacts given the number of plant to be used, their cumulative emission levels, duration and locations of other construction activities. The modelling has therefore focused on this stage of construction as a worst-case, with other construction stages expected to generate lower noise levels at the nearest receivers.

As site preparation works and construction of the substation and BESS have the highest potential for generation of noise impacts, construction works at both potential locations were assessed and included within the noise model.

The construction NMLs adopted for the project for residential receivers are presented in **Table 12-3**. Modelled construction noise results predicted to be experienced at each residential receiver based on a worst-case scenario are presented in Table 4-2 of **Appendix G**. Results of the modelling indicate that all construction NMLs are expected to be complied with during standard hours. If necessary, activities undertaken outside of standard hours would generate much lower noise levels than predicted and would comply with out of hours work NML's. The only out of hours work exceedance predicted is at R2 which is associated with the project.

Sleep disturbance

Typical maximum noise level events have also been assessed, such as truck air brakes, and excavator/dozer activities. A worst-case maximum noise level event of L_{max} 125 dB(A) was adopted to cover any of these possible events. The predicted L_{Amax} noise levels during construction are predicted to meet the maximum noise level assessment with the exception of R2 (a residence associated with the project) in the north west construction scenario, which is predicted experience an exceedance of the sleep disturbance awakening reaction criteria to be exceeded by 1 dB(A). However, 1 dB(A) is unlikely to be discernible to the human ear. The predicted L_{Amax} noise levels are presented in Table 20 in **Appendix G**.

Construction road traffic noise

The project is expected to generate 230 light vehicles and 60 heavy vehicles daily during the peak construction period on the road network. To assess noise impacts from construction traffic, an initial screening test is undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A). In order to increase noise levels by 2 dB(A) an increase in traffic volume of 60 per cent would be required. As construction vehicles are not expected to increase overall traffic volumes by 60 per cent, construction road traffic noise unlikely to increase the existing road traffic noise levels by more than 2 dB(A), and a detailed assessment is not required.

Vibration

The Transport for NSW CNVS provides guidance for minimum working distances from sensitive receivers for cosmetic damage and human comfort. Minimum distances for specific plant items are presented in **Table 12-8**.

Table 12-8: Recommended minimum safe working distances for vibration intensive plant

Plant item	Rating/description	Minimum distance for cosmetic damage		Minimum distance for human exposure (EPA Guideline)
		Residential and light commercial (BS 7385)	Heritage items (DIN 4150, Group 3)	
Vibratory Roller	<50 kN (1-2 tonne)	5 m	11 m	15 m to 20 m
	<100 kN (2-4 tonne)	6 m	13 m	20 m
	<200 kN (4-6 tonne)	12 m	15 m	40 m
	<300kN (7-13 tonne)	15 m	31 m	100 m
	>300kN (13-18 tonne)	20 m	40 m	100 m
	>300kN (>18 tonne)	25 m	50 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 tonne excavator)	2 m	5 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 tonne excavator)	7 m	15 m	23 m
Large Hydraulic Hammer	1600 kg (18 to 34 tonne excavator)	22m	44 m	73 m
Vibratory Pile Driver	Sheet Piles	2 m to 20 m	5 m to 40 m	20 m
Pile Boring	< 800 mm	2 m (nominal)	5 m	4 m
Jack Hammer	Handheld	1 m (nominal)	3 m	2 m

The nearest residences are located more than 100 metres from the study area. This combined with the items of plant expected to be required during construction indicates that the minimum distances can be achieved. There are no known Aboriginal or non-Aboriginal heritage items at risk of vibration impacts. Therefore, impacts associated with cosmetic damage and human exposure are therefore not anticipated.

12.3.2 Operation

Noise sources that were considered during the operational phase of the project include inverters with integrated transformers, tracker motors (photovoltaic modules), substation transformers, BESS components and light vehicles. The operational noise sources and associated sound power levels are presented in **Table 12-9**. Noise from the inverters with integrated transformers can be tonal in nature and therefore a 5 dB penalty was applied to the predicted noise contributions from this source.

Table 12-9: Operational noise source sound power levels

Noise source	L_{Aeq} sound power level per unit (dB)
Tracker motor (NEXtracker or similar)	58
Inverters	99 (includes 5 dB adjustment)
BESS	101
Light vehicle	76
LV-MV transformer	68
MV-HV transformer (50 MVA)	90
MV-HV transformer (100 MVA)	94
MV-HV transformer (200 MVA)	98
Grid transformer (450 MVA)	103

Results of the modelling are presented in Table 4-11 of **Appendix G**. Results of the modelling indicate that all project noise trigger levels can be met for day, evening and night-time periods, with all residences experiencing noise levels below 35 dB. In addition, given the plant items have been modelled at their expected sound power levels, the results also indicate the maximum noise levels would not exceed the sleep disturbance criteria.

12.3.3 Decommissioning

In practice, decommissioning of a solar farm is not intensive from a noise generating perspective. No piling or other noise intensive activities are involved. Noise sources during decommissioning include light vehicles, forklifts and hand tools. Noise emanating from decommissioning is therefore expected to be far less than construction activities modelled and therefore would comply with the NML's.

12.4 Environmental management and mitigation measures

Proposed measures to manage and/or mitigate noise and vibration impacts from the project are presented in **Table 12-10**.

Table 12-10: Management and mitigation measures – noise and vibration

ID	Management/mitigation measure	Timing
NV1	Construction noise and vibration management measures will be implemented consistent with recommendations contained within the ICNG.	Construction

13. TRAFFIC AND TRANSPORT

*This chapter presents an assessment of the potential traffic and transport impacts within the study area and surrounding road network as a result of the project. This chapter has been prepared to address specific SEARs relating to traffic and transport as presented in **Section 1.5**.*

*A traffic and transport assessment has been prepared by SCT Consulting. The report is provided in **Appendix I** and summarised below.*

13.1 Assessment methodology

13.1.1 Assessment approach

The traffic and transport impacts of the project would largely be confined to the construction phase. A quantitative assessment has therefore been undertaken to determine the potential impacts of additional light and heavy vehicle movements (including over dimensional vehicles) during construction on the local road network. A qualitative assessment has been undertaken to assess broadscale impacts on local roads, access, public and active transport, and parking, along with potential impacts of the project during operation and decommissioning.

A qualitative assessment has also been undertaken to assess the cumulative impacts of the project, involving a review of nearby developments including Wollar Solar Farm and the proposed Dunedoo Solar Farm, and consideration of the likely traffic volumes, distribution and access routes (refer to **Chapter 13**).

Traffic surveys were undertaken on 8 September 2020 at the following seven key intersection locations (refer to **Figure 13-1**):

1. Ulan Road / Main Street
2. Cope Road / Blue Springs Road
3. Cope Road / Beela Road
4. Cope Road / Black Lead Lane
5. Barneys Reef Road / Black Lead Lane
6. Barneys Reef Road / Stubbo Road
7. Medley Street / Castlereagh Highway.

The surveys were undertaken between 6am and 9am and between 4pm and 7pm which represent peak traffic periods.

Tube count equipment was also installed on Cope Road, approximately 1.7 kilometres to the west of the Blue Springs Road intersection from 8 September 2020 to 14 September 2020, to capture 7-day, 24-hour mid-block traffic demand profile. The data was obtained by 15-minute increments and classified by direction and Austroads vehicle classes.

Future year traffic generation was estimated for the construction, operation, and decommissioning phases and an analysis of the future year conditions with and without the project was undertaken. As there are no specific generation rates for solar farms in the *Guide to Traffic Generating Developments version 2.2* (RTA 2002), the traffic generation demand was determined using the forecast employee, workforce and construction vehicles for each phase of the project (i.e. construction, operation and decommissioning). It was assumed that the peak construction period would occur in 2023.

Source: SCT Consulting, 2020
Figure 13-1: Traffic survey locations

A safe intersection sight distance (SISD) assessment was undertaken for the Cope Road and Blue Springs Road intersection based on *Austroads Guide to Road Design Part 4A* due to it being the main convergence point for construction traffic and the presence of a bend in Cope Road. The SISD refers to the minimum sight distance that should be provided on the major road at any intersection.

13.1.2 Statutory context, policy and guidelines

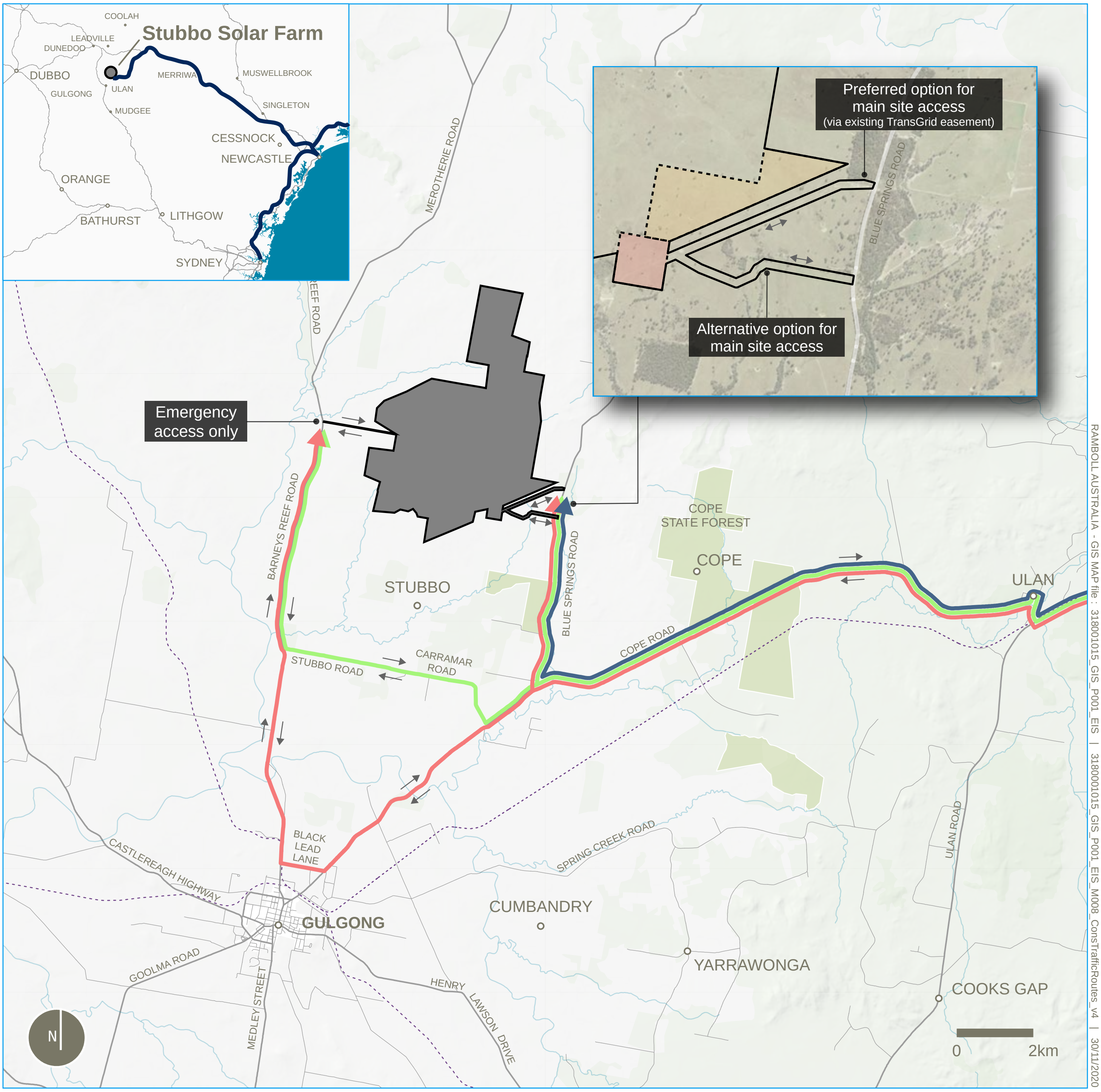
The assessment was undertaken in accordance with the following guidelines:

- *Guide to Traffic Generating Developments version 2.2* (RTA 2002)
- Austroads *Guide to Road Design Part 3: Geometric Design* (Austroads 2016)
- Austroads *Guide to Road Design Part 4: Intersections and Crossings: General* (Austroads 2017)
- Austroads *Guide to Traffic Management Part 12: Traffic Impacts of Development* (Austroads 2016).

13.2 Existing environment

13.2.1 Existing road network

The existing road network is shown on **Figure 13-2** including the possible construction traffic routes. A description of the major and minor roads near the project is provided in **Table 13-1**.



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Key

- Study area
- State Forest
- Road
- Rail
- Creek
- Route A (main site access route proposed)
- Route B
- Route C

Figure 13-2 | Construction traffic routes assessed

Construction materials and infrastructure would be transported to the study area via road from the Port of Newcastle. Some deliveries may also come from Sydney or the North Coast. Traffic accessing the site from Sydney or Newcastle would use the Golden Highway, Ulan Road, Cope Road and then either Barneys Reef Road or Blue Springs Road (i.e. avoiding the steeper route over the Blue Mountains from the Port of Sydney).

The heavy vehicle routes would occur along approved B-double routes within the road network surrounding the study area (via Ulan Road, Cope Road and Blue Springs Road or Barneys Reef Road). The only restriction noted is that the left-out movement from Blue Springs Road to Cope Road is prohibited for a 19 metre B-double or larger vehicle due to the existing skewed intersection geometry.

Workforce personnel is assumed to predominantly travel to the site from/via Gulgong (around 10 per cent) or Mudgee (around 90 per cent). Traffic from Mudgee would use the Castlereagh Highway and then either Barneys Reef Road or Cope Road and Blue Springs Road. Traffic from Gulgong would use either Barneys Reef Road or Cope Road and Blue Springs Road.

While Merotherie Road is listed for assessment in the SEARs, it is not proposed to be used for access to the study area and therefore has been excluded from the assessment. Additionally, assessment of the Golden Highway has been excluded as it is distant from the study area and the impact of any project-generated traffic would be minimal compared to the existing available capacity.

Table 13-1: Major and minor roads

Road	Description
Castlereagh Highway	A state road (B55) passing by Gulgong to the southwest of the town. It has one lane in each direction and intersects with Medley Street in Gulgong. The signposted speed limit within Gulgong is 50 km/h, which rises to 80 km/h outside of Gulgong. This road would be used for site workers commuting between the site and their accommodation in Mudgee
Ulan Road	A regional road between Mudgee in the south and the Golden Highway in the north. This sealed road has one lane in each direction with a carriageway width of 10 m. It forms a T-intersection with Main Street / Cope Road near Ulan Village. The centre line is marked on most sections whereas road edge lines are not marked on the section near Goulburn River. Ulan Road is an approved B-double route
Main Street / Cope Road	A regional road that starts from Ulan Road in the east and ends in Stubbo in the west. This sealed road has one lane in each direction. The centre line is marked in most sections whereas road edge lines are only provided between Blue Springs Road and Gulgong. Main Street in Ulan Village contains a school zone, while Cope Road has a variable signposted speed limit from 50-100 km/h for different segments of the road. There is a railway crossing on Main Street, just north of Ulan Road, and on Cope Street on the approach to Gulgong. Cope Road is an approved B-double route
Blue Springs Road	A local access road starting from Cope Road in the south and provides sealed access to the project from the east. The unsealed section starts from about 8 km north of the site and extends to the Golden Highway to the north. It has no marking for centre line or road edges

Road	Description
Barneys Reef Road	A local access road, which extends from Medley Street in Gulgong to Merotherie Road (unsealed) to the north which further connects Golden Highway. It provides sealed access to the project from the west. There is minimal centre line or road edge marking. There is a railway crossing on Barneys Reef Road between Racecourse Road and Prosperity Lane
Stubbo Road / Carramar Road / Beela Road	Local access roads to the south of the development footprint connecting Blue Springs Road and Barneys Reef Road in the form of two T-intersections. They are unsealed roads that provide a potential route for project related traffic travelling from / to the western access point
Black Lead Lane	A local access road on the northern periphery of Gulgong connecting Blue Springs Road and Barneys Reef Road. There are no centre line or road edge markings on this sealed road. A railway crossing exists close to the intersection with Barneys Reef Road. It provides a potential sealed route for site traffic travelling from / to the western study area access point

13.2.2 Intersections

Key intersections on the road network that would be used by project related traffic include:

1. Ulan Road / Main Street
2. Cope Road / Blue Springs Road
3. Cope Road / Beela Road
4. Cope Road / Black Lead Lane
5. Barneys Reef Road / Black Lead Lane
6. Barneys Reef Road / Stubbo Road
7. Medley Street / Castlereagh Highway.

Basic left turn / right turn treatments exist on most intersections currently except Main Street / Ulan Road intersection, where auxiliary turning lanes are provided for the right turn and left turn on Ulan Road. The layouts for each intersection are presented in section 2.2.2 of **Appendix I**.

13.2.3 Existing traffic conditions

Background traffic in the area comprises both mine-related traffic from several coal mines in the area as well as general community-related traffic. The *Ulan Road Strategy* (ARRB, 2011) analysed the forecast growth considering both traffic sources and forecasted a growth rate of 1.8 per cent per annum up to 2032. It has therefore been estimated that annual traffic growth for major roads including Ulan Road, Cope Road / Main Street and Castlereagh Highway would occur at a rate of 1.8 per cent per annum up to 2032.

The surveyed peak hour traffic volumes for critical intersections around the development footprint are presented in **Table 13-2**. Based on the aggregated traffic demand for all surveyed intersections, peak traffic hours occur between 6am and 7am and between 4pm and 5pm.

There is no significant difference in peak hour traffic volume across the weekdays on Cope Road, with an average demand of about 110 vehicles (five heavy vehicles) and 80 vehicles (two heavy vehicles) in the AM and PM peak hours respectively. There is an average heavy vehicle percentage of 5 per cent in the AM peak hour and 2.5 per cent in the PM peak hour. The average peak hour to daily factor is about nine per cent for the weekday based on an average of about 1,110 vehicles per day.

Stubbo Solar Farm

Table 13-2: Hourly traffic data at critical intersections

Intersection	Peak hour	Major Road (a)			Minor Road (b)		
		Total vehicle	Heavy vehicle	% of heavy vehicle	Total vehicle	Heavy vehicle	% of heavy vehicle
Ulan Road (a) / Main Street (b)	AM	473	13	3%	117	10	9%
	PM	326	19	6%	34	6	18%
Cope Road (a) / Blue Springs Road (b)	AM	110	13	12%	8	0	0%
	PM	87	7	8%	7	2	29%
Cope Road (a) / Beela Road (b)	AM	117	14	12%	2	0	0%
	PM	98	9	9%	2	0	0%
Cope Road (a) / Black Lead Lane (b) / Happy Valley (b)	AM	105	10	10%	4	0	0%
	PM	130	8	6%	7	1	14%
Barneys Reef Road (a) / Black Lead Lane (b)	AM	20	1	5%	1	0	0%
	PM	44	2	5%	4	0	0%
Barneys Reef Road (a) / Stubbo Road (b)	AM	8	1	13%	0	0	-
	PM	15	2	13%	4	1	25%
Medley Street (b) / Castlereagh Highway (a)	AM	61	15	25%	36	5	14%
	PM	139	13	9%	67	2	3%

13.2.4 Road design standards

The *Austroads Guide to Road Design Part 3 Geometric Design* specifies road width design standards for low volume (generally rural) roads based on daily traffic volumes. The corresponding design standards, based on 2020 surveyed traffic volume for the rural roads around the study area, are shown in **Table 13-3**.

It is noted that, even though the current daily traffic volume on Blue Springs Road is greater than 150 vehicles per day, the sealed road width on Blue Springs Road varies between 4 metres and 6 metres, which is less than the 7.2 metres sealed width recommended in the Austroads guidance.

Table 13-3: Daily traffic volumes and corresponding design standards

Daily traffic volume category	Applicable roads	Existing daily traffic volume	Austroads (2016) design standards*
1-150 vehicles	Beela Rd / Stubbo Rd	41	8.7 m wide total carriageway (if unsealed); or minimum 3.7 m wide seal
	Black Lead Lane	128	
150-500 vehicles	Blue Springs Rd	174	Minimum 7.2 m wide seal
	Barneys Reef Rd	390	
500-1,000 vehicles	N/A	-	Minimum 7.2 m – 8 m wide seal
1,000-3,000 vehicles	Cope Rd	1,239	Minimum 9 m wide seal
	Main St	1,483	
>3,000 vehicles	Ulan Rd	5,304	Minimum 10 m wide seal

Source*: SCT Consulting, based on Matrix traffic survey data, 2020*
**Austroads Guide to Road Design Part 3, Table 4.5*

13.2.5 Road safety

The most recently available road crash data has been obtained for a five-year period (between 2014 and 2018 inclusive) using the Transport for NSW interactive accident history database. The results show that Cope Road has recorded four serious and moderate injuries from 2014 to 2018 between the vicinity of Blue Springs Road and Gulgong. One serious injury was also recorded on Carramar Road in 2014.

Two fatal accidents were recorded during this period, the first occurring on Cope Road in 2018 about one kilometre to the east of Blue Springs Road, and a second also occurring in 2018 on Blue Springs Road, about one kilometre north of Cope Road. This is a relatively high proportion of fatal accidents in comparison with the NSW average. None of the fatal cases appear to be intersection-related, as they are about a kilometre away from the intersection. It appears that the main cause of the accidents is due to driver error or vehicles not travelling to the conditions of the road carriageway.

13.2.6 Rail services

Part of the Sandy Hollow-Gulgong railway line owned by the Australian Rail Track Corporation (ARTC) is located south of the study area. Some roads have level crossings with the rail line including Barneys Reef Road, Black Lead Lane, Cope Road and Main Street.

The current train timetable for the corridor shows one train every 30 minutes or up to three trains per hour (GTA, 2015). In addition, there is no evidence that the rail track to the west of Gulgong, which includes level crossings on Cope Road/Station Street, Barneys Reef Road and Black Lead Lane, is in use.

13.2.7 Bus services and active transport

There are no regular public bus services in the vicinity of the development footprint. However, the Eastend Bus Service operates several school bus services to and from Gulgong, one of which travels in a loop along Cope Road, Blue Springs Road, Merotherie Road and Barneys Reef Road. There are no active transport facilities or regular public bus services in the vicinity of the study area given the rural nature of the study area.

13.3 Assessment of potential impacts

Potential traffic and transport impacts resulting from the project would most likely occur during the construction stage when the maximum volume of traffic movements would be undertaken. The assessment presented below therefore focuses on impacts associated with the construction stage unless otherwise indicated.

13.3.1 Road capacity impacts

Construction

The two-year construction phase of the solar farm is expected to generate the following peak daily construction traffic demand for the project:

- 60 heavy vehicles per day
- 230 light vehicles per day to transport staff from Gulgong or Mudgee
- 20 over dimensional vehicles.

The vehicle movements would peak during 12 months of the approximate two-year construction phase, when the majority of photovoltaic modules are being delivered to site and the peak workforce numbers are reached. These traffic generation numbers also include other construction materials such as gravel, sand, concrete, water trucks, etc. On either side of this peak time period, the vehicle movements would be fewer than at the peak, as the level of activity onsite and the number of deliveries would be ramping up/down.

During the daily AM and PM peak hours, it is anticipated that six heavy vehicles would enter and six heavy vehicles would leave the site in each peak hour; with 230 cars entering the site in the AM peak hour and 230 cars leaving the site in the PM peak hour.

Most of the heavy vehicles would come from the Port of Newcastle. Some heavy vehicles may also come from Sydney or the North Coast.

After considering the potential impacts, the main route proposed for accessing the site for all heavy vehicle deliveries is via the south site, which would be Golden Highway → Ulan Road → Cope Road → Blue Springs Road.

The route to the northern portion of the site would be the same as the main route from the Golden Highway to Cope Road, however, three options from the Blue Springs Road / Cope Road intersection have been assessed:

- Option 1: 100 per cent using Blue Springs Road → internal site roads to get to the north portion of the development
- Option 2: 75 per cent using Blue Springs Road → internal site roads and 25 per cent using Cope Road → Black Lead Lane → Barneys Reef Road
- Option 3: 75 per cent using Blue Springs Road → internal site roads and 25 per cent using Cope Road → Beela Road / Carramar Road / Stubbo Road → Barneys Reef Road.

Based on the findings of the traffic and transport assessment that considered these three options and following consultation with the local community, including holding discussions at the community drop-in information session held in Gulgong on the 28 October 2020; it was decided by UPC\AC that access to site would be proposed as follows:

- All heavy vehicle access to site will be via the main site access off Blue Springs Road to the south portion of the development and then internal roads to access the north portion
- The proposed secondary access off Barneys Reef Road would only be used for emergency site access, such as in the event of bushfire for local fire crew access or for evacuation. This decision mitigates potential impacts to the local road network and the nearby residences located along Barneys Reef Road.

Conservatively, it was assumed that a maximum of 230 light vehicle (cars) would enter and leave the site in each AM and PM peak hour during construction. This equates to a total of 460 light vehicle trips per day. This is based on a scenario where no shuttle busses are used by the construction contractor for transporting workers to site. The contractor is likely to use shuttle buses, and this would reduce the number of light vehicle movements commensurately.

It is assumed that approximately 10 per cent of the construction workforce would be generated from Gulgong and 90 per cent from Mudgee. The traffic distribution for light vehicles during the construction phase based on the forecast peak construction demands and workforce origin destinations is presented in **Table 13-4**.

Table 13-4: Traffic generation and distribution for private cars during construction phase

Origin	Site section	Percentage	Access route
Gulgong	South	8%	Station Street → Cope Road → Blue Springs Road
	North	3%	Medley Street → Barneys Reef Road
Mudgee	South	68%	Castlereagh Highway → Herbert Street → Station Street → Cope Road → Blue Springs Road
	North	23%	Castlereagh Highway → Medley Street → Barneys Reef Road
Total		**100%**	

The forecast daily traffic volumes during the construction phase are presented in **Table 13-5**. These volumes include the future base traffic (year 2023) and future year (2023) with construction movements added.

As a result of the proposed site access, the traffic is forecast to increase on Blue Springs Road during the construction period (thereby moving this road into a higher daily traffic volume category). However, the minimum road width for both categories Is 7.2 metres. The additional construction traffic associated with the project therefore does not trigger the need for any road upgrades to Blue Springs Road relative to the baseline scenario.

Consultation with Mid-Western Regional Council was undertaken on 29 October 2020 with additional information provided at Mid-Western Regional Council's request on 4 and 10 November 2020. Subsequently Mid-Western Regional Council advised that a formal response to matters discussed would be provided during the submissions phase of the approval pathway. In the meantime, UPC\AC will continue to consult with Mid-Western Regional Council to determine the appropriate treatment for the safe use of Blue Springs Road during construction.

If the western access from Barneys Reef Road is only used for emergency site access, it would be highly unlikely to move Barneys Reef Road into a higher daily traffic volume category. The circumstances under which the emergency access point via Barneys Reef Road would be utilised will be specified in the Traffic Management Plan and monitored closely during construction.

Table 13-5: Forecast daily traffic volumes during construction

Daily traffic volume category for future year base	Applicable roads	Future year base daily traffic volume (2023)	Construction daily traffic volume (2023)	Total daily traffic volume (2023)	Percentage increase
1-150 vehicles	Beela Rd/ Stubbo Rd	41	30	71	42%
150-500 vehicles	Black Lead Lane	128	30	158	19%
	Blue Springs Rd	174	465	639	73%
	Barneys Reef Rd	390	145	535	27%
500-1,000 vehicles	N/A	N/A	N/A	N/A	N/A
1,000-3,000 vehicles	Cope Rd	1,288	120	1,408	9%
	Main St	1,531	120	1,651	7%
>3,000 vehicles	Ulan Rd	5,576	120	5,696	2%

Operation and decommissioning

There would be significantly less project related traffic during the operational phase than the construction phase. A total of ten operational staff is forecast to generate 20 daily light vehicle trips. It is assumed that ten cars would enter the site during AM peak hour and ten cars would leave the site in the PM peak hour respectively, assuming a worst case that staff do not share cars. In addition, provision for employee parking is expected to be provided onsite along with space for maintenance and delivery vehicles.

The decommissioning phase would see lower traffic generation in relation to expected mechanical decommissioning processes and reduced labour force compared to the construction phase.

13.3.2 Intersection capacity and layout/geometry

Site access intersections

The site access locations are shown on **Figure 2-1**. The main access point to site is proposed to be via Blue Springs Road to the east of the development footprint providing access from the south. Internal access roads and a crossing over the environmental exclusion zone would provide access to the north portion of the development, including for all equipment deliveries.

The proposed construction and operations access via Blue Springs Road would require a new basic rural intersection, suitable for all heavy and light vehicles to access and leave the site at one of two potential site entrance locations:

- Option 1 - via the existing TransGrid 330 kilovolt easement
- Option 2 – via a new entrance to the south of the easement.

The preferred option is via the existing TransGrid easement and consultation is currently underway to determine the suitability of this access in accordance with the *TransGrid Easement Guidelines* and the *TransGrid Fencing Guidelines*.

A second, minor access point, from Barneys Reef Road to the west of the development footprint would provide access from the north for emergency access only.

In the Traffic and Transport Impact Assessment, the proportion of construction traffic using the two access points was based on the forecast scale of construction works for each section, i.e. about 75 per cent and 25 per cent for the south and north section respectively. However, based on other environmental and planning considerations, including social impact, noise impact, community consultation feedback, it was decided that access to the site from Barneys Reef Road would be used for emergency access only, as described above. These new intersections would be designed according to Austroads standards. The north and south portions of the proposed development footprint would be connected via up to two internal access tracks.

Based on the forecast traffic volumes, the new proposed project access intersections on Blue Springs Road and Barneys Reef Road would only require a basic rural intersection treatment (i.e. no additional turning bays required).

Road network intersections

The six key intersections that would be used by the project related traffic (discussed in **Section 13.2.2**) were assessed against the Austroads warrant design charts for rural intersection turning lanes. The results of the assessment found that the forecast major road traffic volumes and turning volumes would not trigger the need for any upgrades to intersections.

The proposed heavy vehicle routes would occur along designated B-double routes. However, it is noted that the Transport for NSW Restricted Vehicle Access map does indicate that the left turn movement from Blue Springs Road into Cope Road is prohibited for a 19 metre B-double or larger vehicle due to the existing skewed intersection geometry.

Herbert Street in Gulgong may also form part of the access route for construction workers travelling from Mudgee as it forms a priority intersection with Castlereagh Highway and connects to Station Street and then to Cope Road. However, given it is a historical road that leads to the Gulgong Information Centre, it is more likely to be used by tourists and have less background traffic during the peak hours for construction workers.

In addition, Castlereagh Highway is wide at Herbert Street intersection and the northbound carriageway can accommodate two lanes. Any right turn traffic would therefore have little impact on northbound through traffic movements on Castlereagh Highway during the AM peak hour. Traffic returning to Mudgee during the PM peak hour would also cause minimal impact as southbound Herbert Street traffic gives way to the southbound Castlereagh Highway traffic.

Based on the SISD analysis at the Cope Road / Blue Springs Road intersection, the following conclusions can be made for each speed limit:

- Assuming a speed limit of 100 kilometres per hour, with an 85th percentile speed of 110 kilometres per hour, the required sight distance from Blue Springs Road would need to be about 256 metres. This would result in tree removal work to confirm sight distance requirements to the east of Blue Springs Road
- Assuming a speed limit of 80 kilometres per hour, with an 85th percentile speed of 88 kilometres per hour, the required sight distance from Blue Springs Road would be about 188 metres. This may require some tree removal work to confirm sight distance requirements to the east of Blue Springs Road
- Assuming a speed limit of 70 kilometres per hour, with an 85th percentile speed of 77 kilometres per hour, the required sight distance from Blue Springs Road would be about 158 metres. This can be satisfied by the existing conditions on Cope Road.

This indicates that either tree removal is required, or the speed limit needs to be temporarily reduced to 70 kilometres per hour on the Cope Road eastern approach to the Blue Springs Road intersection to allow safe intersection sight distance.

13.3.3 Parking

Up to 230 parking spaces may be required for the construction workforce during the peak construction period. All parking demand during the construction phase would be accommodated onsite within the development footprint. There is no formal parking provided in the vicinity of the study area due to the rural nature of the area and so any impact on existing parking is not anticipated.

13.3.4 Rail services, public transport, and active transport

Given the low frequency of rail service and associated low probability of delay, no impact on the rail corridor and level crossings is anticipated during construction.

The low volume of project-generated traffic is not forecast to impact on any public transport services. Given the proposed weekday construction hours are from 7am to 6pm, the construction workforce trips would typically occur before 7am and after 6pm, which would generally not coincide with school bus services.

Heavy vehicles would arrive and depart throughout the day, however, given the low forecast heavy vehicle demand (about six heavy vehicles arriving and six heavy vehicles departing the site per hour), minimal impact is expected on the school bus services. Any potential interaction with school bus operations and stops would be considered in the CTMP to minimise any delays, disruptions, and safety risks.

The project is not anticipated to result in significant impacts on pedestrian and cyclist facilities during construction. Given that the proposed construction working hours are from 7am to 6pm, the staff car trips would be mostly generated before 7am and after 6pm, which are outside the normal peak period for walking and cycling activity in Gulgong. Heavy vehicles would reduce speed at the school zone on Main Street in Ulan and would be directed to use the access via Blue Springs Road to enter site, thus avoiding Gulgong town altogether.

13.4 Environmental management and mitigation measures

Measures to mitigate and manage impacts associated with traffic and transport are presented in **Table 13-6**.

Table 13-6: Management and mitigation measures – traffic and transport

ID	Management/mitigation measure	Timing
T1	UPC\AC will continue to consult with Mid-Western Regional Council to agree the appropriate treatment or upgrade requirements for the safe use of Blue Springs Road during construction and the process for undertaking any treatment or upgrade works in accordance with Development Consent conditions	Prior to construction

T2	A construction traffic management plan will be prepared in consultation with TfNSW and Mid-Western Regional Council. The plan will include:
	• details of the transport route to be used for all project-related traffic
	• details of any road upgrade works required by Development Consent
	• a protocol for undertaking independent dilapidation surveys to assess the existing condition of the proposed construction routes prior to construction, upgrading or decommissioning activities and the condition of the proposed construction routes following construction, upgrading or decommissioning activities
	• a protocol for the repair of the construction routes if dilapidation surveys identify these roads to be damaged during construction, upgrading or decommissioning works
	• details of the measures that will be implemented to minimise traffic impacts during construction, upgrading or decommissioning works, including:
	  ◦ temporary traffic controls, including detours and signage
	  ◦ notifying the local community about project-related traffic impacts
	  ◦ procedures for receiving and addressing complaints from the community about project-related traffic
	  ◦ minimising potential for conflict with school buses, other road users during peak hours and rail services as far as practicable (measures also required during operation of the project)
	  ◦ minimising dirt tracked onto the public road network from project-related traffic
	  ◦ scheduling of haulage vehicle movements to minimise convoy length or platoons
	  ◦ responding to local climate conditions that may affect road safety such as fog, dust and wet weather
		Prior to construction

ID	Management/mitigation measure	Timing
	- responding to any emergency repair or maintenance requirements - a traffic management system for managing over-dimensional vehicle trips to and from the project • a program to confirm drivers associated with the project receive suitable training on the Driver Code of Conduct and any other relevant obligations under the CTMP • a flood response plan detailing procedures and options for safe access to and from the site in the event of flooding • controls for transport and use of dangerous goods in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development, Australian Dangerous Goods Code and Australian Standard 4452 Storage and Handling of Toxic Substances.	
T3	The safe sight distance analysis undertaken at the Cope Road / Blue Springs Road intersection and at the proposed site access points from Blue Springs Road and Barneys Reef Road, will be ground-truthed to determine if vegetation trimming or speed limit reductions need to be applied to provide the required safe sight distance for all vehicle types expected to access the project.	Prior to construction
T4	Parking requirements for the project construction and operation workforce will be provide onsite and parking will not be provided on public roads adjacent to the site.	Prior to construction

14. WATER

*This chapter presents a summary of the assessment and identifies potential surface water, groundwater and flooding impacts within the study area and surrounding locality. This chapter has been prepared to address specific SEARs relating to water as presented in **Section 1.5**.*

*A hydrological assessment has been prepared by Water Technology Pty Ltd. The report is summarised below and provided in full in **Appendix I**.*

14.1 Assessment methodology

14.1.1 Assessment approach

A flood investigation was undertaken for 5 per cent, 1 per cent, 0.5 per cent and 0.2 per cent Annual Exceedance Probability (AEP) events and the Probable Maximum Flood (PMF) events. AEP is a measure of the likelihood a flood level or flow will be equalled or exceeded in any given year. The PMF is the largest flood that could be conceivably expected to occur at a particular location.

The flood investigation consisted of:

1. hydrologic modelling – development of flows from converting rainfall to runoff
2. hydraulic modelling – determining water levels, velocities and depths.

The hydrologic model generated flows from the upstream catchment and determined the critical storm durations used in the hydraulic model, which in turn determined flood behaviour.

Hydrologic modelling was conducted using RORB to calculate flood hydrographs upstream and throughout the study area. The methodology for determining the design flows to develop the hydrographs included:

- catchment delineation
- determination of Kc (equilibrium constant) and 'm' (RORB routing parameters)
- design inputs (e.g. rainfall, losses)
- verification of model results
- selection of temporal patterns
- determination of design hydrographs.

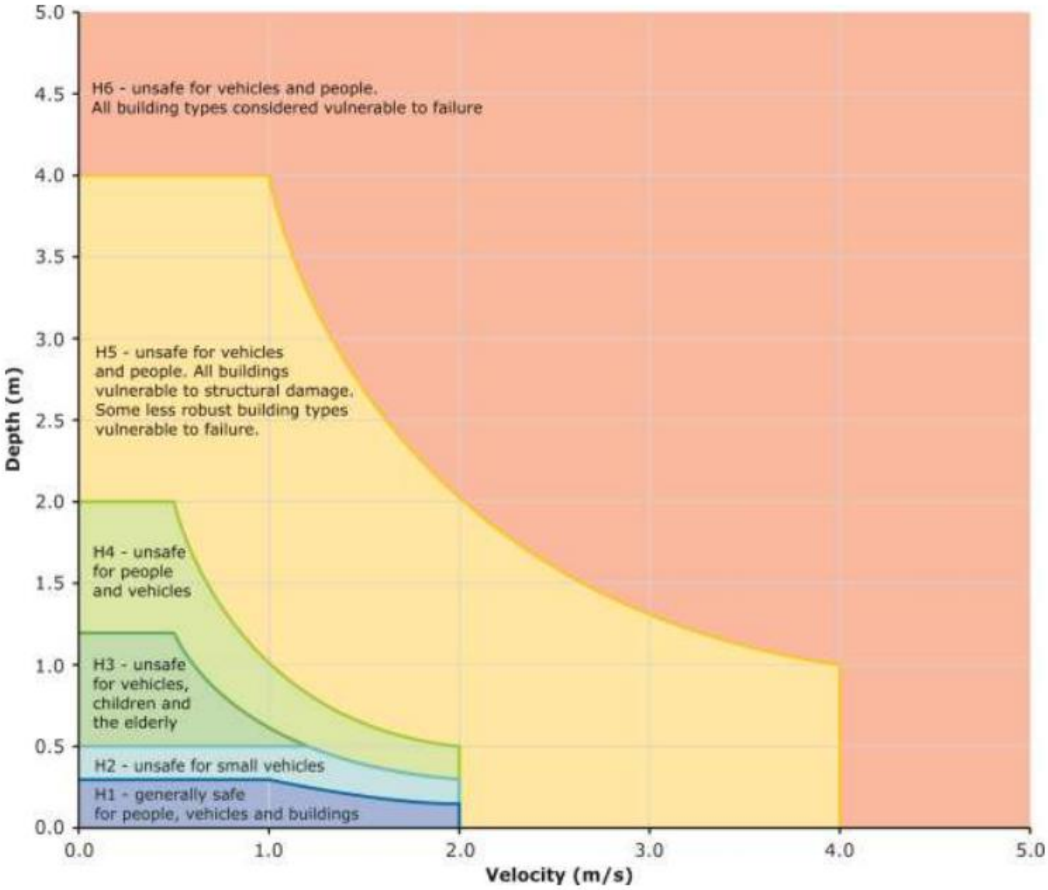
Hydraulic modelling of the study area was completed using a two-dimensional (2D) TUFLOW flood model. The model determined flood levels, depths velocities and flood hazard for each of the modelled AEPs, critical storm durations and temporal patterns. The hydraulic model was run for both existing and climate change conditions. The PMF rainfall depth was estimated from the Probable Maximum Precipitation (PMP) rainfall depth.

Only results for the 5 per cent and 1 per cent AEP and PMF events are discussed in this report.

The flood hazard was assessed in accordance with *Australian Rainfall and Runoff: A Guide to Flood Estimation* (ARR2019). In accordance with the ARR2019, the assessment considered:

- velocity of floodwaters
- depth of floodwaters
- combination of velocity and depth of floodwaters
- isolation during a flood
- effective warning time
- rate of rise of floodwater.

Six hazard categories are defined in the ARR2019 which are shown on **Figure 14-1**.



Source: (Australian Institute for Disaster Resilience, 2019)

Figure 14-1: General flood hazard vulnerability curves

14.1.2 Statutory context, policy and guidelines

The hydrological assessment was undertaken in accordance with the ARR2019 and with consideration of the relevant provisions of the NSW *Floodplain Development Manual* (2005). The mapping within the ARR2019 is consistent with the NSW *Floodplain Development Manual* (2005) but provides additional detail and updated recommendations on hazard category thresholds.

The study area is within the Mid-Western Regional Council LGA. There are no specific floodplain risk management plans prepared by Mid-Western Regional Council which cover the study area. The most recent floodplain risk management plan prepared within Mid-Western Regional Council is the *Floodplain Risk Management Study and Floodplain Risk Management Plan for Kandos & Rylstone* (2017). This document uses the NSW Government's *Floodplain Development Manual* (2005) to characterise and map flood hazard. The hydrological assessment has used updated guidance from ARR2019 to characterise and map Flood Hazard which Mid-Western Regional Council is expected to use in their future floodplain risk management plans.

There are no Rural Floodplain Management Plans covering the study area, but the analysis and reporting carried out in the hydrological assessment is in line guidance from ARR2019 is consistent with the expectations of a Rural Floodplain Management Plan.

14.2 Existing environment

14.2.1 Rainfall and evaporation

The nearest Bureau of Meteorology (BoM) meteorological station that provides long-term climate statistics is the Gulgong Post Office (station number 062013) located approximately 10 kilometres south of the study area. The station has data from 1970 to 2020. The average annual rainfall is 649.1 millimetres.

The mean and median rainfalls are highest during Spring/Summer, with the highest mean monthly rainfall occurring in January (70.3 millimetres) and the lowest mean monthly rainfall occurring in April (44.2 millimetres) (Bureau of Meteorology, 2020). The highest daily rainfall values indicate storm events are most likely to occur during February and March with peak daily totals exceeding 120 millimetres.

The rainfall burst depths for the modelled AEP events estimated for the centroid of the catchment are shown in **Table 14-1**.

Table 14-1: Design rainfall depths (mm) for various event durations and AEPs

AEP (1: Year)	30 min	1.5 hr	2.0 hr	3.0 hr	6.0 hr	12.0 hr
5	24.1	34.3	37.3	42.3	53.0	67.5
10	28.3	40.1	43.7	49.4	61.9	79.1
20	32.5	46.0	50.0	56.4	70.7	90.7
50	38.4	53.8	58.4	65.9	82.7	107.0
100	43.1	60.0	65.1	73.3	92.1	120.0
200	49.2	68.5	74.2	83.6	105.0	137.0
500	57.5	80.3	86.9	97.7	122.0	159.0

The average annual evaporation across the study area is estimated to be between 1,600 and 1,800 millimetres per year.

14.2.2 Hydrology

The study area is located within the Macquarie-Bogan Rivers System and is within the upper catchment of Stubbo Creek. Surface water at the study area is managed under the *Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water Sources 2012* (Cooyal Wialdra Creek Water Source).

The waterways proximate to the study area are shown on **Figure 14-2**. The main surface water feature in the area is the Stubbo Creek, which transverses the study area within the main environmental exclusion zone. Stubbo Creek is a semi-permanent stream around 1 to 4 metres wide and up to 30 centimetres deep, on a fine gravel substrate. Stubbo Creek is also mapped as KFH (refer to discussion in **Section 6.2.3**).

Pine Creek and Merotherie Creek are located to the north of the study area. Both waterways discharge to Slapdash Creek, approximately 1.7 kilometres west of the study area at its closest point. Gum Creek is located to the south of the study area and is also connected to Slapdash Creek. Slapdash Creek flows south and discharges to Waldra Creek, which flows into Cudgegong River, connecting to Lake Burrendong, located south of Gulgong.

The total catchment area of the study area is 14 square kilometres and has a general slope varying between 1 per cent to 2 per cent. The topography of the study area (**Figure 14-2**) is higher ground to the east, reaching to above 500 metres Australian Height Datum (AHD), and lower to the west, to around 460 metres AHD. There is a depression in the middle of the study area which forms the upper reaches of Stubbo Creek. Sub-catchments were delineated using the Stubbo 2 metre Light Detection and Ranging (LiDAR) and are shown in **Figure 14-2**. The selected sub-catchments are those within the study area that contribute flow to Stubbo Creek, which is the major watercourse in the area.

14.2.3 Groundwater

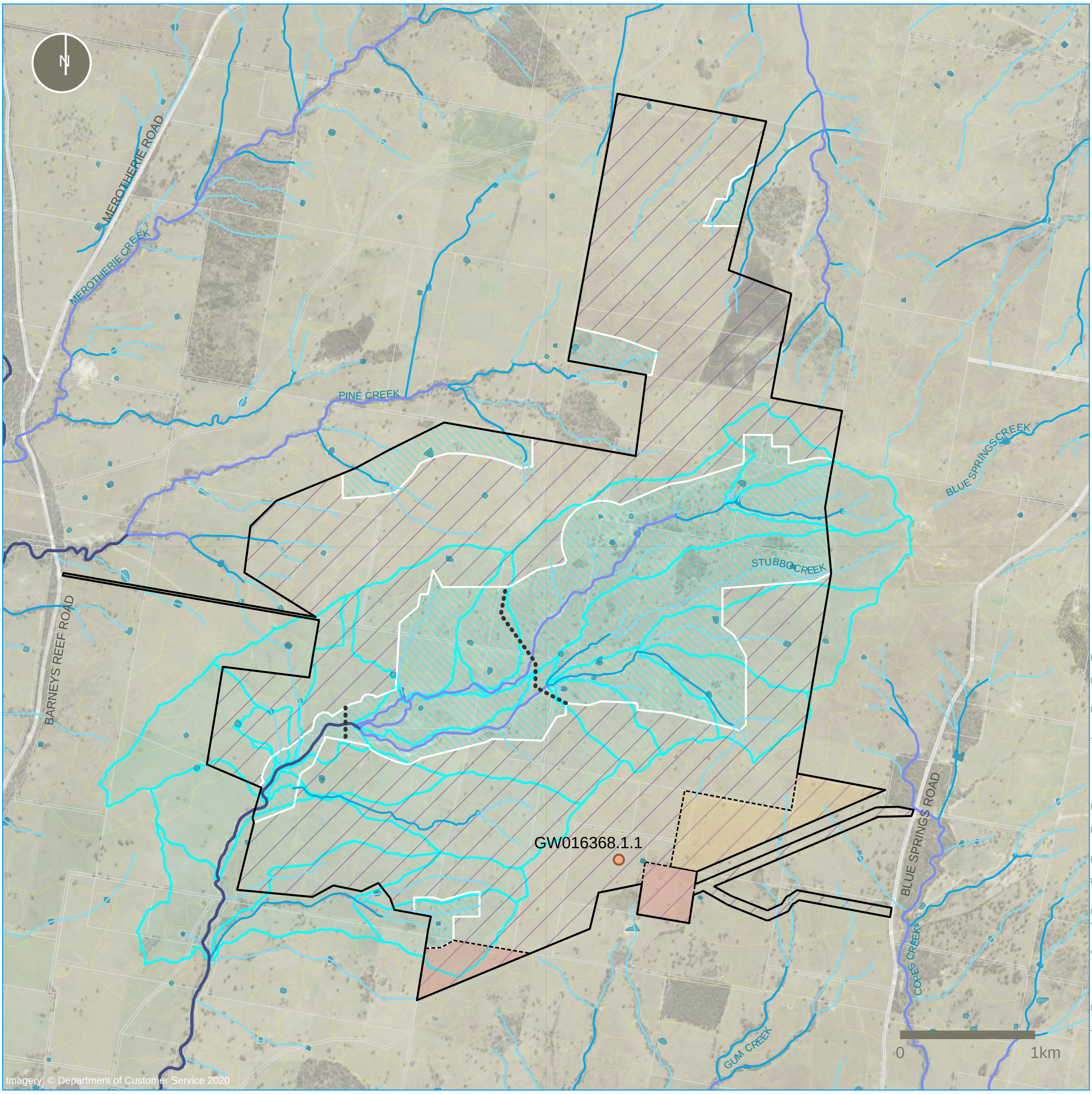
Groundwater at the study area is managed under the Water Sharing Plan *NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011* (Lachlan Fold Belt Murray Darling Basin (Lachlan Fold Belt MDB) Groundwater Source). The study area geology comprises Carboniferous I-type granites that are interpreted to form by melting of igneous source rocks. Common minerals are quartz, feldspar, and biotite. A small section of the study area also comprises Cenozoic mafic volcanic rocks.

Groundwater in lower parts of the study area and surrounding the study area creek systems are noted in the Mid-Western Regional LEP as 'Groundwater Vulnerability'. The objective of this LEP, amongst other things, is to *'encourage the proper management, development and conservation of resources within Mid-Western Region by protecting, enhancing and conserving… water'.* The intent of identifying areas as 'Groundwater Vulnerability' is to maintain and protect groundwater systems. Planning applications are to consider the likelihood of groundwater contamination, consider impacts from the development on groundwater dependent ecosystems, assess any cumulative impacts to groundwater that could result from the development and to consider what measures could be implemented to protect these areas.

The Lachlan Fold Belt MDB is described as a fractured rock aquifer system where groundwater occurs mainly within the fractures and joints. Aquifer usage is relatively limited however there are some areas of intense groundwater utilisation due to locally favourable groundwater availability and water quality. 73,599 entitlement shares are managed under the water sharing plan for the Lachlan Fold Belt with the majority used for irrigation purpose (Department of Planning, Industry and Environment, 2019).

WaterNSW registered groundwater bores identify one groundwater bore (GW016732) located within the study area to the north of Pine Creek. The bore is described as being in a gravel water supply, 1.9 metres in depth and for stock watering purpose. A second bore (GW016368) is located immediately south of the study area (**Figure 14-2**) and is also a gravel water supply. The bore is for stock and domestic purposes. There are no water levels recorded for the bore, however the lithology log indicates that groundwater may occur at a depth of 0.61 metres below ground level (WaterNSW, 2020). Both bores are described as being of timber construction and approximately 1.2 metres to 1.4 metres in diameter and are large diameter wells in areas where springs occur.

Within the Lachlan Fold Belt MDB the depth of water strike is highly variable and dependent on the depth to rock fracturing. Whilst shallow and likely spring fed bores are identified, bores drilled to the west (GW801270) and south (GW016368) of the study area in granite rock, were drilled to 17 metres below ground level and 60 meters below ground level. The depth of the water bearing zone was not recorded however the depth of the groundwater bore is an indication of the depth of drilling required to establish a water supply.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Farm dams
- Groundwater bore

Strahler stream order
- 1
- 2
- 3
- 4
- Stubbo Creek catchments

Figure 14-2 | Hydrological context

The Lachlan Fold Belt MDB aquifer supports a number of identified high priority groundwater dependent ecosystems and springs are noted in the vicinity of the study area (Department of Planning, Industry and Environment, 2019).

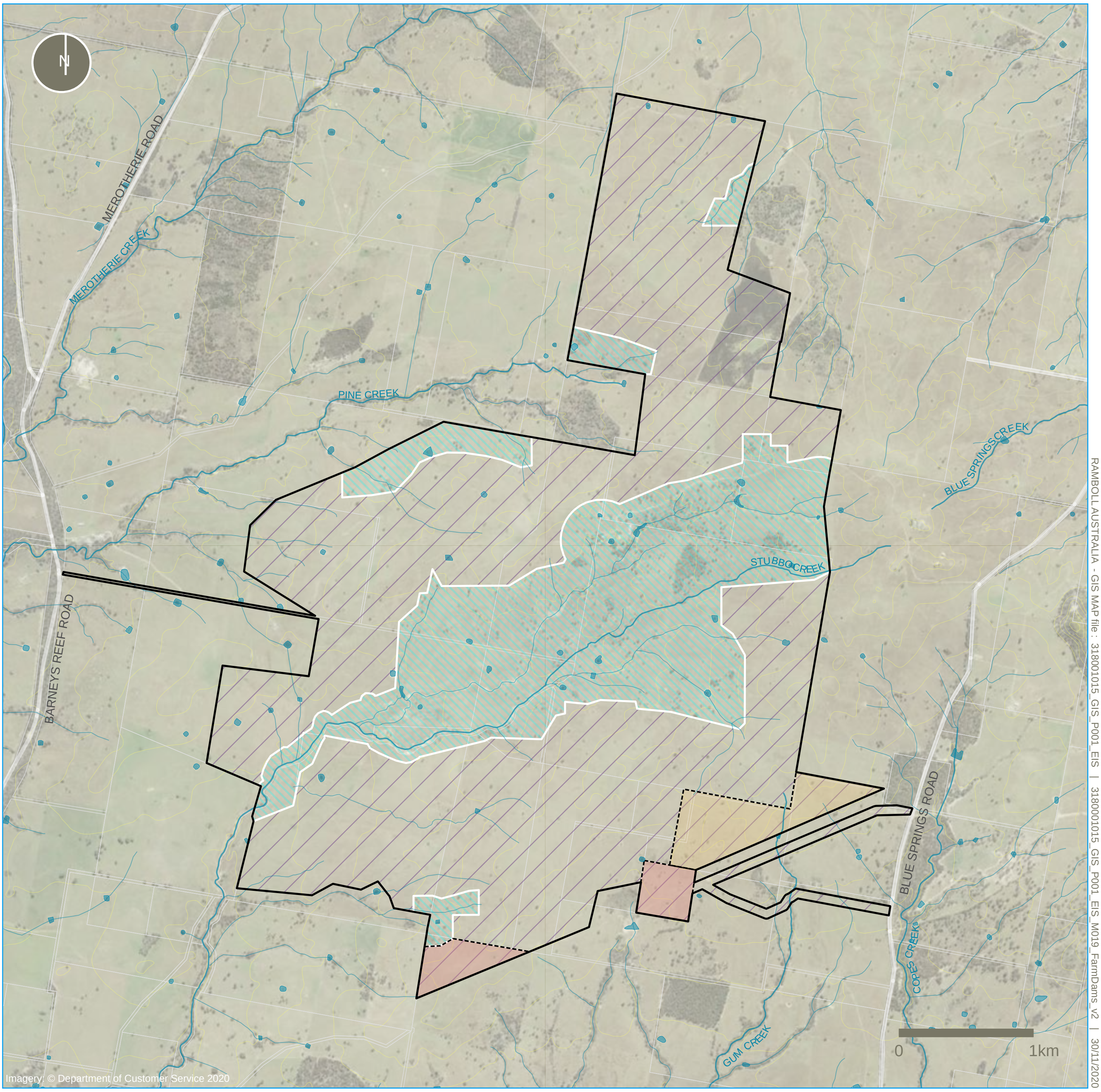
Extraction of groundwater is not proposed for the project and therefore impacts to the groundwater resource or supported ecology from extraction are unlikely. The presence of shallow groundwater or springs would occur in association with rock fractures identified by valleys present in the study area. The majority of these occur within the central environmental exclusion zone. Outside of these fracture zones, groundwater is expected to occur at greater depths from the surface and at depths greater than the development proposed excavation depths of 1.5 to 2.4 metres.

No groundwater dependent ecosystems were identified within the vicinity of the study area (EcoLogical Australia, 2020).

14.2.4 Water supply and use

Water supply arrangements for the project are described in **Section 2.7.1**. Water would be sourced from water trucks collecting water from commercial suppliers of treated wastewater, opportunistically from farm dams located within the study area or as a last resort, from town water. Groundwater extraction is not required for the project within the study area.

There are around 19 small farm dams present within the study area where water pooling occurs for extended periods, as shown in **Figure 14-3**. The existing dams and stock and domestic water use is unlikely to be licenced as the dams are likely to capture water under a harvestable right. Licences are not required for harvestable rights dams built on minor streams that capture 10 per cent of the average regional rainfall run-off on land in the Central and Eastern Divisions of NSW (where the study area is located). The total capacity of all dams on a property allowed under the harvestable right is called the Maximum Harvestable Right Dam Capacity. The Maximum Harvestable Right Dam Capacity for the study area is approximately 105 megalitres. Additionally, the dams are likely to be built before 1999, and therefore not require a licence, provided these dams are only used for stock and domestic watering purposes and are located on a minor stream.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Farm dams

Figure 14-3 | Location of farm dams within the development footprint

14.3 Assessment of potential impacts

14.3.1 Hydrological flows

Runoff management is an important consideration on solar farm sites as the addition of panels across large areas has the potential to increase erosion and runoff. There would be a shadow under each of the panels where rainfall would not fall directly on the ground, however runoff from the uphill panel would be able to flow across the ground and under the downhill panel, meaning that the photovoltaic array would not effectively increase the fraction impervious in the same way a paved road or a building does.

As the photovoltaic panels are not fixed and change direction to track the sun, the drip line of runoff from the panels would vary depending on the time of the day. Research suggests that a solar farm would not have a significant impact on the hydrology of the study area under the following conditions:

- the soil profile has not been overly compacted due to heavy machinery during construction
- vegetation cover has been established
- the study area is established to encourage distributed flow across the surface rather than concentrated flows along narrow flow paths
- the gap between each row of solar panels is greater than or equal to the width of the solar panel rows to allow the runoff from the upslope panel a buffer strip to spread across the surface and allow vegetation growth
- revegetation occurs along any concentrated drainage paths
- Construction and operation of access tracks and crossings is completed ensuring appropriate sediment control and drainage is designed and implemented (e.g. silt fencing and sedimentation basins are used and swale are vegetated).

While there may be some increase to the impervious fraction of the study area through the creation of roads and some small operational buildings this increase is very minor when compared to the study area as a whole. Given there is no significant increase to the study area fraction impervious no increase to runoff volumes are anticipated.

No artificial structures planned to be installed in the creek in the central environmental exclusion zone except for two waterway road and cable crossings. The waterway road and cable crossings would be designed and constructed in compliance with the Department of Primary Industries (Office of Water) *Guidelines for riparian corridors on waterfront land* (2012) and *Guidelines for watercourse crossings on waterfront land* (2012). For the unnamed creek located to the south of Stubbo Creek, a setback of 20 metres from each bank has been adopted in the site design layout to minimise potential impacts.

Given there is no significant increase to the study area fraction impervious, no increase to runoff volumes or flow rates, no increases in erosion, siltation, destruction of riparian vegetation or reduction in the stability of the river banks or watercourses is anticipated to occur as a result of the project.

14.3.2 Water quality

Runoff water quality changes are most likely to be impacted during construction with limited operational impact. Construction of the project would disturb soils which can potentially lead to sediments or pollutants mobilising in runoff and entering local waterways. These activities include:

- Installation of steel piles and mounting system for the solar panels
- Installation of DC cabling
- Installation of PCU footings
- construction of permanent site office, meeting facilities and amenities, spare parts storage facility, SCADA facilities and workshop
- construction of the onsite substation and connections
- establishment of the BESS compound (if centralised)
- removal of temporary construction facilities.

Additionally, water pollution risks from the project are associated with the following activities:

- hydrocarbon spill risk from use and re-fuelling of construction vehicles and machinery
- onsite concreting for building and equipment foundations, through inappropriate washing of concreting equipment
- storage and use of paints, cleaning solvents and other chemicals such as pesticides and herbicides
- fertilisers used for revegetation
- runoff from waste materials stored onsite.

Sediments and pollutants present in runoff may enter the drainage lines onsite and have the potential to flow into Stubbo Creek, Pine Creek, Merotherie Creek and Gum Creek which discharge to Slapdash Creek.

The project is not anticipated to have any negative water quality impacts provided the recommendations set out in **Table 12-10** are met and construction and operation activities meet best practice guidelines for stormwater management and quality.

Water quality monitoring is proposed, including baseline water quality testing prior to construction and ongoing monitoring through construction and operation. Water quality testing will be undertaken in accordance with best practice guidelines and ANZECC (2000) *Guidelines for Fresh and Marine Water Quality* and/or local objectives.

14.3.3 Flooding

Annual Exceedance Probability

Results of the modelling suggest that the study area is mostly characterised as H1: 'Generally safe for vehicles, people and buildings', with the exception of waterways and confined drainage lines which are mostly within the environmental exclusion zone during both 5 per cent AEP and 1 per cent AEP events (**Figure 14-4** and **Figure 14-5**).

Flood depths during a 5 per cent AEP event are generally less than 100 millimetres at the upstream reaches of each watercourse. The major watercourses such as Stubbo Creek and others within the environmental exclusion zone have flood depths between 500 millimetres and 1 metre. A similar flood depth range is observed for farm dams. Minor watercourses such as of those that flow northwest to Pine Creek have flood depths generally less than 300 mm. The same flood depth range is observed for the watercourses at the northern part of the study area.

For a 1 per cent AEP event, flood depths remain generally less than 100 millimetres, with flood depths greater than 300 millimetres only observed within watercourses or defined overland flow paths. A similar flood depth range is observed within the Study Area's dams. Similar to the 5 per cent AEP event, the major watercourses within the environmental exclusion zone and farm dams have flood depths between 500 millimetres and one metre, and minor watercourses have flood depths generally less than 300 millimetres.

The same flood depth range is observed for the watercourses to the north of the study area. The southern section of the study area including the main creek running parallel to Stubbo Creek has flood depths varying between 500 millimetres and one metre. Other unnamed watercourses that flow south a have flood depths less than 300 millimetres, except for farm dams where the flood depths are much higher.

Access to the study area is also relatively flood free making the development compatible with the Flood Hazard of the land. The south eastern access point may experience flooding during a 1 per cent AEP event with a flooding depth of below 100 millimetres. The alternate access points on the western side of the study area not inundated up to a 1 per cent AEP event providing an alternative access location during flooding events. An Emergency Response Plan will be prepared covering the management and response to flooding. This document will be discussed with NSW SES and Mid-Western Regional Council prior to construction commencement.

The study area is covered by numerous overland flow paths which convey overland flood flows. There are no proposed photovoltaic arrays in these areas and most of areas considered floodways or to hold flood storage are within the environmental exclusion zone and no works (aside from crossings area) are proposed in these areas.

No adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the study area is anticipated.

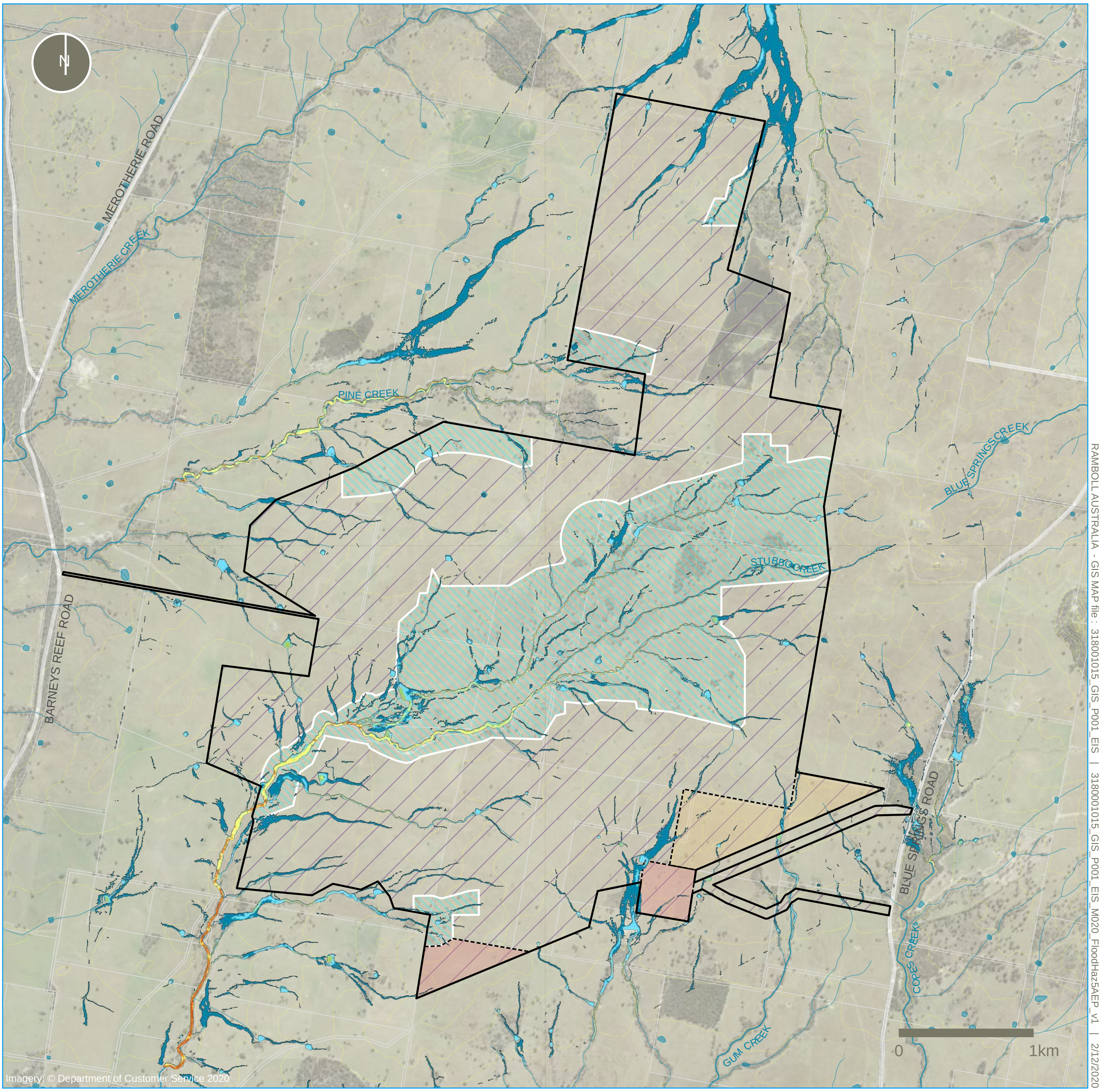
Probable maximum flood

As expected, the inundation extent and depths for a PMF event are much larger than the previously discussed AEPs given it is significantly larger event (closer to a 1:100,000 year AEP). Depths reach up to 500 millimetres in the defined overland flow paths and isolated instances where the velocities exceed 2 metres per second.

The flood hazard outside the environmental exclusion zone generally remains as H1: 'Generally safe for vehicles, people and buildings', but there are areas of up to H4: 'Unsafe for vehicles and people' with isolated areas up to H6: 'Unsafe for vehicles and people All building types considered vulnerable to failure' within the centre of waterways or major drainage lines (**Figure 14-6**).

Climate change

The 1 per cent AEP climate change flood depths are only marginally larger than that of existing conditions. Higher AEP events show similar results indicating the inundation impact of climate change may not be a significant issue for the development. The study area is able to drain effectively without a significant floodplain area which could hold water at high depths for extended periods of time.



A4
1:42,500

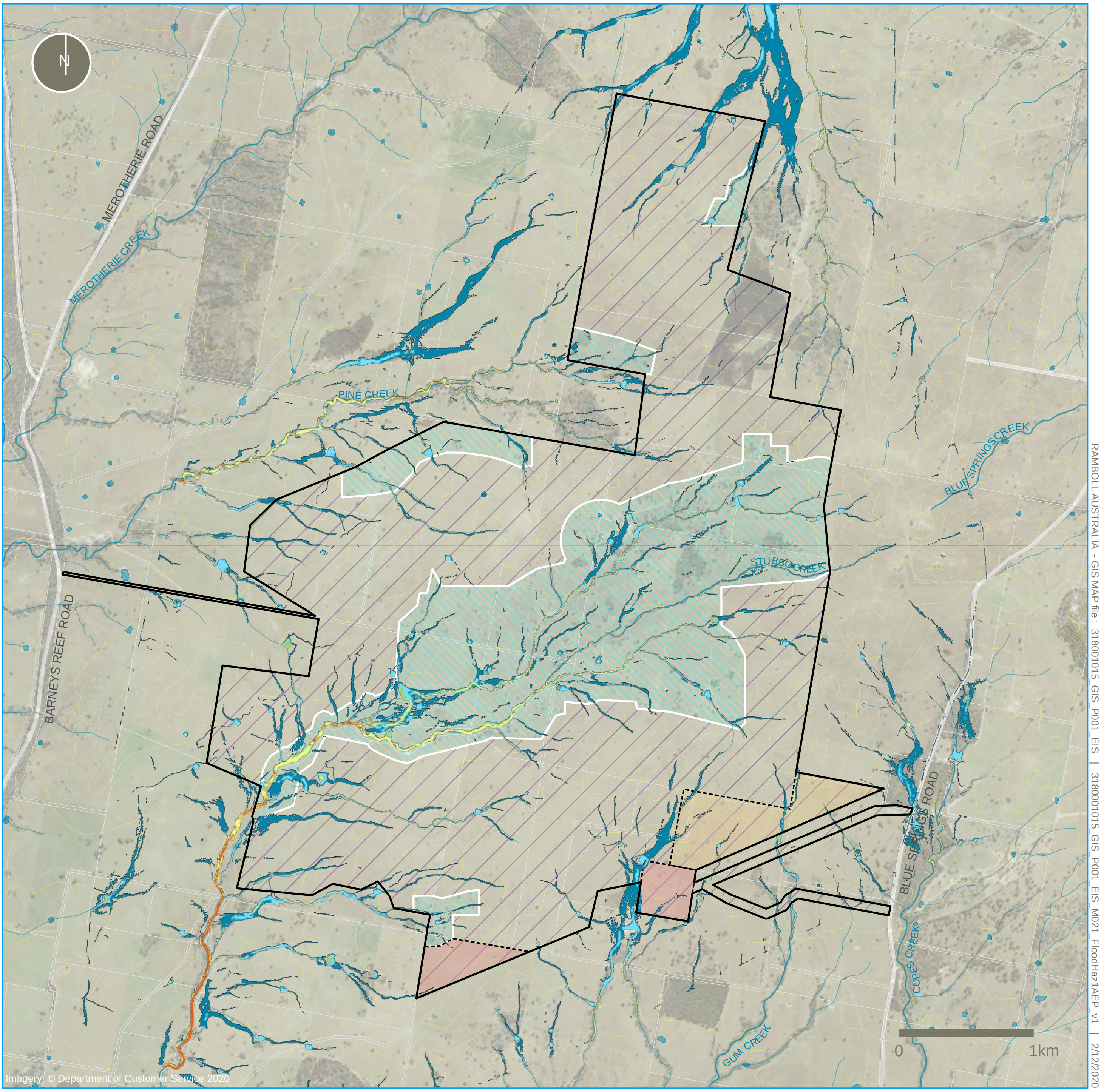
Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Proposed development footprint
- Environmental exclusion zones
- Road
- Creek
- Farm dams

Flood hazard level

- H1
- H2 | H3
- H4
- H5
- H6

Figure 14-4 | 5% AEP flood hazard for existing condition



A4
1:42,500

Key

Study area

Indicative temporary construction ancillary facilities (site compound, laydown area and car park)

Proposed operational infrastructure area including substation, operational facility and BESS

Proposed development footprint

Environmental exclusion zones

Road

Creek

Farm dams

Flood hazard level

H1

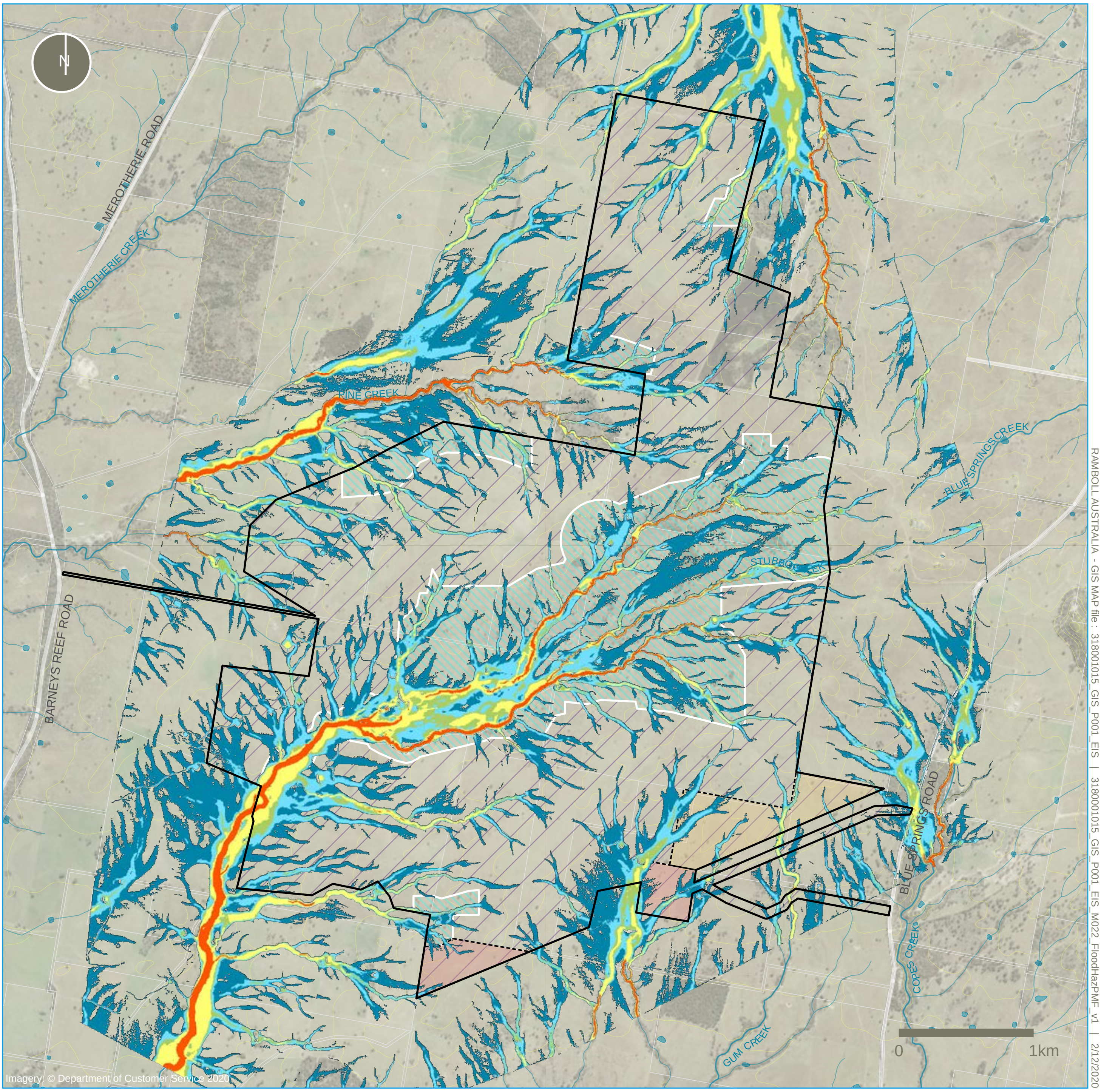
H2 | H3

H4

H5

H6

Figure 14-5 | 1% AEP flood hazard for existing condition



A4
1:42,500

Key

Study area

Indicative temporary construction ancillary facilities (site compound, laydown area and car park)

Proposed operational infrastructure area including substation, operational facility and BESS

Proposed development footprint

Environmental exclusion zones

Road

Creek

Farm dams

Flood hazard level

H1

H2 | H3

H4

H5

H6

Figure 14-6 | PMF flood hazard for existing condition

14.3.4 Groundwater

While groundwater analysis has not been undertaken in this project, the project is not anticipated to have any groundwater interaction with no changes to groundwater infiltration or extraction proposed. The deepest infrastructure to be installed would be the mounting frames to a depth of between 1.5 metres to 2.4 metres below ground level.

Impacts to groundwater dependent ecosystems would not occur as a result of the project as there are none identified within the vicinity of the study area.

14.3.5 Water supply and use

The priority hierarchy of water supply sources is discussed in **Section 2.7.1** and includes:

1. commercial suppliers of treated wastewater in the nearby region
2. opportunistically sourced from farm dams located within the study area
3. sourced from town water.

The majority of the water required during construction would be non-potable water used primarily for dust suppression. Washing of equipment and plant and other emergency requirements such as fire protection would also be required. Water use during the construction phase would be up to approximately 200 kilolitres per day. Assuming a carrying capacity of 20 kilolitres, this would result in about 10 water trucks per day. The assumptions on vehicle movements provided in **Chapter 13** incorporate these vehicle movements.

Based on recent equivalent developments undertaken by UPC\AC, it is expected that approximately four litres of potable water per person per day, or a total of 1.6 kilolitres per day at peak construction, would be required.

During operations, approximately five megalitres of non-potable water would be required per year for ongoing maintenance activities such as cleaning the photovoltaic modules, vegetation management and amenities. A negligible volume of potable water would also be required by operational staff.

No water is proposed to be taken from the study area requiring a WAL.

Water sourced opportunistically from the farm dams present in the study area (**Figure 14-3**) would be undertaken in consultation with the relevant landowner if required and would not exceed that currently used for agricultural purposes.

Wastewater management is discussed in **Section 2.7.4**. Amenity facilities would be pumped out via tanker and delivered to the most appropriate sewage treatment facility, or as agreed with Mid-Western Regional Council during construction. It is likely that a septic system would be installed for the operational amenities. This would be constructed and managed in accordance with the relevant Mid-Western Regional council requirements.

Although not proposed or expected, should any filling or levelling of the farm dams be required for the construction of photovoltaic arrays and/or ancillary infrastructure, individual or collective assessments would be undertaken prior to commencement of construction. The farm dams within the study area do not have significant capacity and filling them is unlikely to cause any significant adverse impacts to flood behaviour within receiving watercourses but may increase general day to day flows within receiving waterways due to a decrease in catchment storage. This would be considered further in a management plan to define the degree of potential impact.

14.4 Environmental management and mitigation measures

Proposed measures to manage and/or mitigate water impacts from the project are presented in **Table 14-2**.

Table 14-2: Management and mitigation measures – water

ID	Management/mitigation measure	Timing
W1	Infrastructure with the potential to cause pollution to waterways in the event of flooding, such as inverters and battery storage will be located with a minimum 300 mm freeboard above the maximum 1% AEP flood level.	Detailed design
W2	Solar panels will be designed to provide a minimum of 300 mm freeboard for the lowest edge above the maximum 1% AEP flood level.	Detailed design
W3	The panel structure will be designed to withstand the flood velocities expected at the site.	Detailed design
W4	No infrastructure will be placed within 20 m of any Strahler 3 or above order streams.	Detailed design
W5	All waterway crossings will be designed and constructed in compliance with the Department of Primary Industries, Office of Water, Guidelines for riparian corridors on waterfront land and Guidelines for watercourse crossings on waterfront land.	Detailed design
W6	Further flood investigations and hydrological and hydraulic modelling will be carried out where required during detailed design to confirm the flood immunity objectives and design criteria for the project are met. The modelling will be used to define the nature of both main stream flooding and major overland flow across the development footprint under pre- and post- project conditions and to define the full extent of any impact that the project will have on patterns of both main stream flooding and major overland flow.	Detailed design

W7	A construction soil and water management plan (CSWMP) will be prepared to outline measures to manage soil and water impacts associated with the construction works, including contaminated land. The CSWMP will provide:
	• Measures to minimise/manage erosion and sediment transport both within the construction footprint and offsite including requirements for the preparation of erosion and sediment control plans (ESCP) for all progressive stages of construction Measures to manage waste including the classification and handling of spoil
	• Procedures to manage unexpected contaminated finds
	• Measures to manage stockpiles including locations, separation of waste types, sediment controls and stabilisation
	• Measures to manage accidental spills including the requirement to maintain materials such as spill kits
	• Controls for receiving waterways which may include:
	    ○ Designation of 'no go' zones for construction plant and equipment
	    ○ Creation of catch/diversion drains and sediment fences at the downstream boundary of construction activities where practicable to support containment of sediment-laden runoff
		Prior to construction

ID	Management/mitigation measure	Timing
	Erosion and sediment control measures will be implemented and maintained at all work sites in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water 2008b), commonly referred to as the “Blue Book”.	
W8	The use of any farms dams during construction will be agreed with the landholder and the estimated maximum harvestable right dam capacity will not be exceeded.	Construction

15. HAZARD AND RISKS

This section identifies the potential hazards and risks posed by the project and the management measures proposed to address these potential hazards and risks in accordance with the requirements of SEPP 33.

15.1 Assessment methodology

15.1.1 Assessment approach

Preliminary hazard analysis

Preliminary risk screening
A Preliminary Hazard Analysis (PHA) is required to be prepared in accordance with SEPP 33 for a potentially hazardous or offensive development. Appendix 3 of the *Hazardous and Offensive Development Application Guidelines Applying SEPP 33* (Department of Planning, 2011) (SEPP 33 Guideline) lists industries that may be potentially hazardous or offensive development. Appendix 3 of the SEPP 33 Guideline does not include solar farms and energy storage facilities.

For developments where the applicability of SEPP 33 is not immediately apparent, a risk screening procedure is provided in Appendix 2 of the guideline as a checklist to identify other potentially developments that may be hazardous or offensive. The risk screening process considers the type and quantity of hazardous materials to be stored onsite, distance of the storage area to the nearest site boundary, as well as the expected number of transport movements.

'Hazardous materials' are defined in the SEPP 33 guideline as substances that fall within the classification of the Australian Dangerous Goods Code (ADGC) and have a Dangerous Goods (DG) classification. A development which exceeds the screening thresholds in the guidelines would be considered potentially hazardous and a PHA would be required.

The *Large-Scale Solar Energy Guideline for State Significant Development* (NSW Government 2018) identifies battery storage (and associated chemicals) as a key element of a solar farm to be considered.

The project is considering two BESS options:

- **Centralised system**: a centralised "AC Coupled" BESS adjacent to one the grid substation within the development footprint. The centralised system adjacent to the grid substation would be either the large battery building or small enclosures/cabinets.
- **Decentralised system**: a distributed "DC Coupled" BESS with small BESS units connected to some or all of the solar inverters. The decentralised system would only be small enclosures/ cabinets

Further details on these two BESS options are presented in the project description in **Section 2.3.5**.

This assessment has considered the maximum quantities of hazardous materials that would be onsite, as well as the potential for multiple locations.

Preliminary hazard analysis

The PHA was undertaken for the project in accordance with *Hazard Industry Planning Advisory Paper No.6 – Guidelines for Hazard Analysis* (DoP, 2011) (HIPAP) and *Multi-Level Risk Assessment* (DoP, 2011). A qualitative assessment has been undertaken for the PHA. The SEPP 33 Guideline says that a qualitative assessment can be undertaken if the criteria listed in **Table 15-1** are met (which is achieved by the project and this assessment).

Table 15-1: PHA qualitative assessment criteria and how achieved

PHA qualitative assessment criteria	How criteria has been achieved
Screening and risk classification and prioritisation indicate there are no major offsite consequences and societal risk is negligible	The quantities of hazardous materials to be stored onsite do not exceed the SEPP 33 threshold levels
The necessary technical and management safeguards are well understood and readily implemented	Technical and management safeguards are inherent to the project elements that store and use the hazardous materials
There are no sensitive surrounding land uses	The nearest residence is more than 1500 m from the proposed location of the hazardous material storage areas

The methodology applied for the PHA included:

- identification and analysis of potential hazards associated with the project
- analysis of the potential consequence of each of the identified hazards
- estimate the likelihood of each of the potential hazards occurring
- determination of a risk level for the project
- assessment against risk criteria
- outline relevant operational, maintenance and management procedures required to manage potential hazards associated with the project.

Details of the definitions used to define the consequence, likelihood and overall risk of identified hazards are included in **Appendix J**.

Electromagnetic risk

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a federal government agency with the responsibility for protecting the health and safety of people and the environment from electromagnetic fields (EMF). The ARPANSA website notes that "*exposure to ELF* (extremely low frequency) *EMF at high levels can affect the functioning of the nervous system*" but that "*Most of the research indicates that ELF EMF exposure normally encountered in the environment, including in the vicinity of powerlines, does not pose a risk to human health*". Generally, distances beyond 50 metres from a high voltage powerline are not expected to have higher than typical magnetic fields and for substations magnetic field levels at distances of 5 to 10 metres away are no higher than background levels in a typical home.

Therefore, the EMF risk assessment presented in this section addresses predominantly the effects of exposure to ELF magnetic fields associated with the proposed project infrastructure.

Typical exposure levels to EMF for the project infrastructure have been assessed against the International Commission on Non-Ionizing Radiation Protection (ICNIRP) *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields* (2020) (the ICNIRP Guidelines).

The ICNIRP Guidelines defines general public and occupational exposures as follows:

- **General public** – individuals of all ages and of varying health status which might increase the variability of the individual susceptibilities.
- **Occupational exposure** – adults exposed to time-varying EMF from 1 Hz to 10 MHz at their workplaces, generally under known conditions, and while completing their regular or assigned job.

The ICNIRP Guidelines reference levels for exposure to EMF at 50 Hz are presented in **Table 15-2**.

Table 15-2: Reference levels for EMF levels at 50 Hz

Exposure	ICNIRP Reference Levels	
	Electric field (V/m)	Magnetic field (μT)
General public	5,000	200
Occupational	10,000	1,000

Bushfire risk

The *Large-Scale Solar Energy Guideline for State Significant Development* (NSW Government 2018) lists bushfire hazard and risk associated with construction and operation of a solar farm as an issue to be considered. In particular, the potential for fire spreading to the solar development or being caused by the onsite solar equipment and associated cables, panels or transmission lines.

RPS (2019) prepared the *Bushfire Due Diligence Threat Assessment Report* (RPS Assessment) that included a Bushfire Hazard Assessment and Bushfire Assessment of three areas that UPC\AC Renewables investigated for solar farms, including the study area. The RPS Assessment was prepared in accordance with the methodology and procedures outlined in Appendix 1 of *Planning for Bushfire Protection 2019* (NSW RFS, 2018) and clause 44 of the *Rural Fire Regulation 2013* (RF Regulation).

The bushfire risks assessed in this section is based on the findings of the RPS Assessment, with consideration of the *Planning for Bushfire Protection 2019* (NSW RFS, 2019) that was published since the RPS Assessment was prepared.

15.1.2 Statutory context, policy and guidelines

The hazard and risk assessment was undertaken in accordance with the following guidelines:

- *State Environmental Planning Policy No 33—Hazardous and Offensive Development* (SEPP 33)
- *Hazardous and Offensive Development Application Guidelines Applying SEPP 33* (Department of Planning, 2011)
- *Hazard Industry Planning Advisory Paper No.6 – Guidelines for Hazard Analysis* (DoP, 2011)
- *Multi-Level Risk Assessment* (DoP, 2011)
- *AS/NZS ISO 31000:2018 Risk Management – Principles and Guidelines*
- *Planning for Bushfire Protection* (NSW RFS, 2019)
- *Guidelines for limiting exposure to Time-varying Electric, Magnetic and Electromagnetic Fields* (ICNIRP, 2020)

15.2 Key project elements

15.2.1 Preliminary hazard analysis

Hazardous materials

Table 15-3 lists the hazardous materials to be handled during the project, the expected maximum quantity stored at one time throughout all project stages, the predicted transport movements, and the potential hazards associated with each material.

The vehicle movements presented in **Table 15-3** are those forecast during the construction and/ or commissioning stages. The transportation of the majority of these materials would either: only occur during construction and/ or commissioning of the project; or be substantially lower during operation of the project.

In addition to the hazardous materials described in **Table 15-3** the project would also require storage and use of the following chemicals:

- Transformer oil
- MCPA (2-methyl-4-chlorophenoxyacetic acid) (for use as herbicide/pesticide).

Both of these chemicals are not classified as hazardous material and are therefore excluded from the risk screening. They would not be stored with other flammable materials and therefore they are not considered to be potentially hazardous under SEPP 33.

Other hazards and risks

UPC\AC has undertaken hazard identification with consideration of the following project factors:

- project infrastructure
- type of equipment
- hazardous materials present
- proposed operation and maintenance activities
- external factors.

Events with the potential to result in major consequence impacts to people (injury and/or fatality), the environment and project assets (excluding workplace health and safety hazards such as slips, trips and falls) were identified:

- electrical: exposure to voltage
- arc flash: release of energy
- electromagnetic fields (EMF): exposure to EMF (refer to Section 15.2.2)
- fire: infrastructure fire (refer to Section 15.3.3)
- chemical: release of hazardous materials
- reaction: battery thermal runaway
- external factors: bushfire, vandalism, lightning storm

15.2.2 Electromagnetic fields

Electromagnetic fields (EMF) occur both naturally in the environment and are produced wherever there is a flow of electricity. Electric fields are associated only with the presence of electric charge, whereas magnetic fields are the result of the physical movement of electric charge.

The 330 kilovolt transmission line that forms part of the southern boundary of the study area is an existing EMF source.

Table 15-3: Hazardous materials, expected quantities and potential hazard

Material/ Usage	DG Class	Hazardous material Category	Expected maximum stored quantity (tonnes)	Peak storage project stage	Vehicle movements		Minimum quantity per load (tonne)	
					Cumulative annual	Peak weekly	Bulk	Packages
Liquefied Petroleum Gas (LPG)	2.1	Flammable gas	9.5	Construction	>500	>30	2	5
Refrigerant	2.2	Non-flammable Non-toxic gas	14.3	Operation	-	-	-	-
Gasoline	3 PG II	Flammable liquids	5	Construction	>750	>45	3	10
Battery Energy Storage System (BESS)	9	Miscellaneous dangerous goods	4,800	Operation	>1000	>60	No limit	-

The project includes a number of potential EMF sources. The final EMF levels would depend on the specific technology and supplier selected, however the typical EMF levels recorded during previous field studies for these sources are as discussed below (Sherpa Consulting, 2018):

Solar arrays, photovoltaic modules and PCUs

A field study undertaken at two large scale solar facilities operated by the Southern California Edison Company in Porterville and San Bernardino (Shepra Consulting, 2018) found the following:

- There was no evidence of magnetic fields created from the photovoltaic modules. The study assumed, however, that the magnetic fields from the photovoltaic module do not exceed the background static magnetic field observed at the study locations (52-62 μT)
- The highest DC magnetic fields were measured adjacent to the inverter (277 μT) and transformer (258 μT). These levels are lower than the ICNIRP's occupational exposure limit
- The highest AC magnetic fields were measured adjacent to the inverter (110 μT) and transformer (177 μT). These fields were lower than the ICNIRP's occupational exposure limit
- The strength of the magnetic field attenuated rapidly with distance: within two to three metres away, the fields reduces to background levels.
- Electric fields were negligible to non-detectable. This is mostly likely attributed to the enclosures on the electricity generating equipment

Underground MV cables

A typical 33 kilovolt underground cable produces a maximum magnetic field of approximately 1 μT at one metre above ground level. The magnetic field density would be indistinguishable from the background magnetic field at distances greater than 20 metres from the cable.

Substations and transformers

Main sources of magnetic fields within a large substation (such as a transmission substation) include transformer secondary terminations, cables to the switch room, capacitors, reactors, busbars, and incoming and outgoing feeders. In most cases the highest magnetic fields at the boundary come from incoming and outgoing transmission lines.

Generally, the application of electrical safety standards and codes (including the provision of fencing, enclosures and distance) result in exclusion of general public exposures from these sources. This is consistent with the reported typical magnetic field which ranges between 1 to 8 μT at a substation fence

Transmission lines

The magnetic field from transmission lines would vary with configuration, phasing and load. The typical magnetic fields near overhead transmission lines measured at one metre above ground level range between 1 to 20 μT (directly underneath) and 0.2-5 μT (at the edge of a transmission line easement)

Battery Energy Storage System

The magnetic field associated with a BESS varies depending on several factors including configuration; capacity; and type of housing. Due to the limited information on typical measurement of magnetic fields around BESS associated with large scale solar energy generating facilities, it has been assumed the typical magnetic field is similar to that of a substation given the proposed designs which include dedicated housing (enclosures). It is also assumed that the BESS would be installed in accordance with electrical safety standards and codes which would result in exclusion of general public exposures from these sources.

15.2.3 Bushfire risk

The *Guideline for Bush Fire Prone Land Mapping* (RFS 2015) requires councils to record grassland vegetation as being bushfire prone and Australian Standard A.S. 3059 – 2009 also includes grassland vegetation as bushfire prone vegetation.

While no land within the study area is mapped as bushfire prone, the RPS Assessment concluded that the site constitutes a bushfire risk. The RPS Assessment found the land surrounding the project contains vegetation consistent with grassland and woodland. The vegetation that forms a bush fire threat exists in all direction on and surrounding the study area.

The study area has low relief, rolling hills with a slope gradient not greater than 5 degrees. It does include small patches woodland vegetation downslope with a gradient of 0 to 5 degrees, as well as upslope with a flat gradient.

The project is situated in the Northern Slopes of NSW within the NSW Mid-western Regional Council area. In accordance with *Planning for Bushfire Protection 2019* construction of buildings in bushfire-prone areas is designated a Fire Danger Index (FDI) of 80. Bushfire weather is therefore associated with long periods of drought, high temperatures, low humidity and gusty often north-westerly winds.

15.3 Assessment of potential impacts

15.3.1 Preliminary hazard analysis

Risk screening

Table 15-4 identifies the hazardous materials to be stored on and transported to the study area and consideration of the applicable SEPP 33 threshold. As this shows none of the SEPP 33 threshold levels are predicted to be exceeded during any phase of the project.

Table 15-4: SEPP 33 Risk Screening Summary – Storage and Transport

Material/ Usage	Project storage (tonne)	Minimum quantity per transport load (tonne)		SEPP 33 threshold (tonne)	Exceed threshold?
		Bulk	Packages		
Liquefied Petroleum Gas (LPG)	9.5	2	5	For above ground storage, the screening threshold is 10 tonnes.	No
Refrigerant	14.3	N/A	N/A	No threshold identified based on SEPP 33 and excluded from risk screening. Class 2.2 are not considered to be potentially hazardous with respect to offsite risk.	No

Material/ Usage	Project storage (tonne)	Minimum quantity per transport load (tonne)		SEPP 33 threshold (tonne)	Exceed threshold?
		Bulk	Packages		
Gasoline	5	3	10	For quantity up to 5 tonnes, the amount is unlikely to represent a significant risk and therefore is not potentially hazardous	No
Battery Energy Storage System (BESS)	4,800	No limit		No threshold identified based on SEPP 33 and excluded from risk screening. Class 9 is not classified as potentially hazardous material as per SEPP 33.	No

Despite the conclusions of the preliminary risk screening, the SEARs require that a PHA be prepared, demonstrating that the BESS is suitably located and minimises risks to neighbouring land uses. The PHA includes consideration of the potential hazards presented by the BESS and the other materials in **Table 15-4**.

Potential hazards

Hazardous materials

The key risks associated with the materials are:

- LPG: flammable; containerised gas (under pressure) presents a risk of explosion if heated
- refrigerant: containerised gas (under pressure) presents a risk of explosion if heated
- gasoline: extremely flammable; may cause lung damage if swallowed; skin irritation; vapours can cause drowsiness and dizziness
- BESS: adverse reaction with water; contents harmful if swallowed or in contact with skin
- transformer oil: may be fatal if swallowed and enters airways
- MCPA: harmful if swallowed; causes serious eye irritation; toxic to aquatic life

Other hazards and risks

Appendix J presents the detailed outcome of the hazard identification process undertaken by UPC\AC. The Hazard Identification and Analysis table in **Appendix J** identifies the following:

- the type of hazard:
  - electrical
  - arc flash
  - EMF
  - fire
  - chemical
  - reaction
  - external factors
- the infrastructure or area of the potential hazard
- the hazard event (for example, a switch room fire as a form of Fire hazard)

- the cause/s of the hazard event
- the potential consequences of the hazard event
- the Consequence Rating
- the controls to be implemented to mitigate or minimise the potential of the hazard event
- other comments (to assist in informing the basis of the analysis)
- the Likelihood Rating.

Consequence analysis

Hazardous materials

Table 15-5 identifies the hazardous materials that would be handled during construction and operation of the project, the key management approach and the potential residual consequence using the consequence assessment methodology described in the *Multi-level Risk Assessment* (DoP, 2011) and defined in **Appendix J.**

Table 15-5: Proposed management and potential residual consequence of hazardous materials

Hazardous material	Management approach	Potential residual consequence
Liquefied Petroleum Gas (LPG)	• Protect from sunlight and store in a cool, well-ventilated place. • Keep away from heat, sparks, open flames and hot surfaces. • No smoking in the vicinity of the storage area • Use of personal protective equipment • Compliance with Safety Data Sheet	Onsite – major Offsite - insignificant
Refrigerant	• Protect from sunlight and store in a cool, well-ventilated place. • Use of personal protective equipment • Compliance with Safety Data Sheet	Onsite – major Offsite - insignificant
Gasoline	• Store in a segregated and cool, well-ventilated place. • Use of personal protective equipment • Compliance with Safety Data Sheet	Onsite – major Offsite - insignificant
Lithium batteries (BESS)	• Store in a cool (preferably below 30°C) and ventilated area away from moisture, sources of heat, open flames, food and drink • Use of personal protective equipment • Compliance with Safety Data Sheet	Onsite – moderate Offsite - insignificant
Transformer oils	• Use of personal protective equipment • Compliance with Safety Data Sheet	Onsite – minor Offsite - insignificant
MCPA	• Use of personal protective equipment • Compliance with Safety Data Sheet	Onsite – moderate Offsite - insignificant

Other hazards and risks
The detailed outcome of the hazard identification process in **Appendix J** presents the consequence rating of the potential hazard events. These ratings are based on the consequence definitions in **Appendix J**.

Likelihood analysis
The detailed outcome of the hazard identification process in **Appendix J** presents the likelihood rating of the potential hazard events. These ratings are based on the consequence definitions in **Appendix J**.

Risk level
Table 15-6 presents a summary of the key hazards from those detailed and assessed in **Appendix J** and the associated risk levels. The highest Risk Level associated with the project is medium. Medium level risks can be managed with the measures inherent to the project (as described in **Section 20**), the controls described in **Appendix J** and the additional measures described in **Section 15.4**.

Table 15-6: Hazard and Risk Analysis Summary

Hazard	Event	Consequence (to People)	Likelihood	Risk
Electrical	Exposure to voltage	Major	Very Unlikely	Medium
Arc flash	Arc flash	Major	Very Unlikely	Medium
EMF	Exposure to EMF	Insignificant	Extremely Unlikely	Low
Fire	Fire – Transformers and PCUs	Major	Very Unlikely	Medium
	Fire – Switchrooms	Major	Extremely Unlikely	Medium
	Fire – Construction compound	Major	Very Unlikely	Medium
	Bushfire	Major	Very Unlikely	Medium
Reaction	Thermal runaway in battery	Major	Very Unlikely	Medium
Chemical	Release of electrolyte from the battery cell (liquid/vented gas) resulting in fire and/or explosion	Major	Very Unlikely	Medium
	Battery coolant leak	Minor	Very Unlikely	Low
	Refrigerant leak (BESS and refrigeration/chiller units)	Minor	Very Unlikely	Low
	Exposure to hazardous material (herbicide/pesticide)	Minor	Very Unlikely	Low
	Release of LPG from storage vessel or filling point	Major	Very Unlikely	Medium

Hazard	Event	Consequence (to People)	Likelihood	Risk
	resulting in fire and/or explosion			
	Release of gasoline from storage tank or filling point resulting in fire	Major	Very Unlikely	Medium
External factors	Water ingress resulting in fire (BESS, PCUs or Switchrooms)	Major	Extremely Unlikely	Medium
	Vandalism due to unauthorised personnel access	Moderate	Unlikely	Medium
	Lightning strike	Major	Very Unlikely	Medium

15.3.2 Electromagnetic risks

The project includes the following key elements designed to limit exposure to EMF to below the general public and occupational exposure limits:

- the design, selection and procurement of electrical equipment for the project would comply with relevant international and Australian standards for generation of and exposure to EMF
- selection of suitable locations for EMF-generating project infrastructure (through provision of separation distance to surrounding land uses including neighbouring properties and agricultural operations) and fencing along the project boundary would limit the exposure to EMF for the general public
  As identified in **Figure 2-1** the key EMF sources (transformers and substations) are more than 2 kilometres from the nearest residence, and 1.5 kilometres from the nearest public road.
- exposure to EMF (specifically magnetic fields) from electrical equipment would be localised and the strength of the field attenuates rapidly with distance
- fencing around key EMF generating infrastructure (substations, inverters and transformers) within the project to limit occupational exposures
- duration of exposure to EMF for personnel onsite would be transient. Where personnel need to undertake maintenance activities on infrastructure with higher EMF emissions, work would be undertaken in accordance with Safe Work Method Statements describing the required safety procedures and personal protective equipment.

15.3.3 Bushfire risk

The main potential sources of ignition of, and fuel for, unplanned fires caused by construction and operation of the project are:

- vehicle and machine movement over long, dry grass
- human error, such as non-compliance with hot works procedures (and associated generation of sparks) or incorrect disposal of cigarette butts
- diesel (stored and used in generators)
- flammable liquids (stored and used in machinery)

Other potential sources outside of the project include escaped back burning; lightning strikes; incorrect disposal of cigarette butts and litter; arson; and arcing, sagging or damaged to the adjacent transmission lines.

Several Bushfire Protection Measures would be inherent to the project design and layout, and would also be incorporated into the construction and operating procedures:

- vegetation control along and around access roads, parking areas and temporary assets (such as site offices) during construction and for permanent assets during operation
- minimising vehicle movements off access roads and through long grasses
- the construction induction would highlight the bushfire risks and the importance of compliance with construction procedures, in particular hot works procedures, vehicle movement restrictions, material storage requirements and the bushfire emergency response procedures.
- the construction induction would also discuss the importance for the correct disposal of cigarette butts. In times of high fire risk, restrictions on where and when smoking can occur may be implemented
- establishment and maintenance of one of the following Asset Protection Zones (APZ) strategies:
  - a 50 metre APZ to provide a Low Bushfire Attack Level (BAL), which would result in "*minimal attack from radiant heat and flame due to the distance of the site from the vegetation, although some attack by burning debris is possible. There is insufficient threat to warrant specific construction requirements*" (*Planning for Bushfire Protection 2019*)
  - to establish a BAL of 12.5 (as defined under AS3959) a 20 metre APZ to grassland, 22 metre APZ to woodland (where vegetation is upslope of flat from infrastructure) and a 28m APZ to woodland (where woodland is downslope) would be required. A BAL of 12.5 requires a construction level of BAL-12.5 under Australian Standard AS 3959 *Construction of buildings in bushfire prone areas* or the National Association of Steel Framed Housing (2014) *Steel Framed Construction in Bush Fire Areas* (NASH Standard). and section 7.5 of *Planning for Bushfire Protection 2019* is applied
- no combustible fencing would be installed within 10 metres of any structure
- the ground below the individual photovoltaic modules would be fuel reduced to both prevent direct flame contact from grassfires and reduce the likelihood of sparking from the modules, potentially causing ignition
- internal roads would be maintained within the study area to allow for the safe movement of construction and operation personnel in the event of a fire event, and designed to accommodate emergency services vehicles
- static water tanks would be provided in strategic locations throughout the project infrastructure, and in accordance with the requirements of *Planning for Bushfire Protection 2019*
- wherever possible electricity supply and distribution within the study area would be underground and so not contribute to fire risk
- any fuels and chemicals stored as part of the project would be stored in accordance with their Safety Data Sheet and *Planning for Bushfire Protection 2019.*

15.4 Environmental management and mitigation measures

Proposed measures to manage and/or mitigate hazards and risks (in addition to those that form part of the project) are detailed in **Table 15-7**.

Table 15-7: Management and mitigation measures – hazards and risks

ID	Management/mitigation measure	Timing
H1	A Construction Bushfire Management Plan (BMP) will be prepared in consultation with the Rural Fire Service, and to the satisfaction of the Secretary. The BMP will include the management and mitigation measures described in **Section 15.3.3**.	Prior to construction
H2	An Operation BMP will be prepared in consultation with the Rural Fire Service, and to the satisfaction of the Secretary. The BMP will include the management and mitigation measures described in **Section 15.3.3**.	Prior to operation
H3	A Bush Fire Emergency Management and Evacuation Plan will be prepared consistent with *'Development Planning A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan* (NSW RFS, 2014) and Australian Standard *AS3745 2010 'Planning for Emergencies in Facilities'*. A copy of the plan will be displayed and available for review in a prominent location directly adjacent to the site's main entry point/s	Prior to construction / prior to operation
H4	The operator will contact Mid-Western Local Emergency Management Committee (LEMC) to discuss how the site will be considered under the Mid-Western Local Disaster Plan (DISPLAN).	Prior to operation

16. SOCIO-ECONOMIC

*This socio-economic assessment has been undertaken to identify, predict, evaluate and develop responses to potential social impacts as a result of the project. This chapter presents the assessment process, understanding of the social locality, potential positive and negative social impacts resulting from the project development and proposed mitigation and management measures to enhance or minimise those potential positive and negative social impacts respectively. This chapter has been prepared to address specific SEARs relating to traffic and transport as presented in **Section 1.5**.*

16.1 Assessment methodology

16.1.1 Assessment approach

The key objectives and components of the socio-economic assessment were to:

- understand how and where the project would be undertaken in the context of socio-economic considerations
- understand the socio-demographic baseline of communities potentially affected by the project
- engage with stakeholders and local communities to identify key opportunities and challenges associated with the project
- predict and analyse the potential impacts of the project including impacts on access to, and demand for, workforce, accommodation and community infrastructure against existing baseline conditions
- develop and recommend appropriate mitigation measures and enhancement strategies
- identify means for the project to enable positive and localised social and economic outcomes through the its planning, development and extended operations.

The socio-economic impact assessment draws on the findings of several other technical specialist reports to draw conclusion on potential impacts on amenity, wider economic benefits and way-of-life.

Project-related consultation with regulators and the local community has been underway since early 2019, when the first meetings with near neighbours and Mid-Western Regional Council took place. A number of discussions have also been held more recently specifically targeting the issues related to workforce accommodation and worker availability. Further details regarding the community engagement are provided above in **Chapter 5**, and the Stakeholder and Community Engagement Strategy prepared and implemented by UPC\AC is provided in **Appendix B**.

Social locality definition

The social area of influence, or social locality, has been defined as the Mid-Western Region Local Government Area (LGA). It is expected that the primary area of influence of the project is likely to be Mudgee and Gulgong, other surrounding localities such as Birriwa, Rylstone and Kandos and to a lesser extent the remainder of the Mid-Western Region LGA. Whilst there is potential for positive and negative effects to extend beyond the Mid-Western Region LGA, this social locality has been defined due to proximity to the study area and the potential for available social resources, such as labour and accommodation.

Social Baseline data collection

In order to inform the social baseline of the social locality, qualitative and quantitative information was sourced through:

- desktop assessment, including the following data sources:
  - Australian Bureau of Statistics (2016 Census and other data)
  - Federal Department of Employment, regional labour market information
  - DPIE state and regional population projections and household and dwelling projections
  - Online real estate information including www.realestate.com.au
  - Other quantitative data as referenced throughout this chapter
- socio-economic specific consultation, comprising targeted and opportunistic discussions with:
  - Mid-Western Regional Council staff
  - employment services providers
  - real estate agents
  - accommodation providers
  - Mudgee Tourist Information Centre
  - food and beverage service providers.

Data has been collected for the social locality as well as neighbouring Warrumbungle and Upper Hunter LGAs, and NSW to provide context and comparison to the social baseline presented for the social locality where relevant.

Community consultation undertaken for the project has also been considered and included within the social baseline and impact assessments of the socio-economic assessment presented within this chapter. Consultation undertaken for the EIS is described in **Chapter 5**.

16.1.2 Statutory context, policy and guidelines

An assessment of the potential impacts to the socio-economic environment within the social locality was undertaken in accordance with the *Social Impact Assessment Guideline for State significant mining, petroleum production and extractive industry development* (Department of Planning, Infrastructure and Environment, 2017) and reviewed against the draft *Social Impact Assessment Guideline State significant projects* which was released for comment in October 2020 (Department of Planning, Infrastructure and Environment, 2020).

Discussion on the strategic planning objectives of Commonwealth, State and local government planning documents and how the project aligns with these is provided **Chapter 3**. Further to this is it noted that the *Electricity Infrastructure Investment Bill 2020* (NSW) was passed in November 2020. This Bill includes the appointment of an electricity infrastructure job advocate who is to advise the Minister about strategies and incentives to encourage investment, development, workforce development, employment, education and training in the energy sector in the Hunter and Central Coast, Illawarra, Far West and Central West regions of New South Wales. The establishment of this role would have the potential to influence the availability of a skilled workforce within the social locality and influence the assumptions of the baseline social assessment.

16.2 Existing environment

16.2.1 Population and demographics

The study area is located close to the township of Gulgong, in the Mid-Western Regional Council LGA. Major towns within the social locality include Mudgee, Gulgong, Kandos and Rylstone. Ulan is a small village located within a 15-minute drive of the site. Details on the surrounding population centres are presented in **Table 16-1**.

Table 16-1: Population centres in the social locality

Township	State suburb population	Urban population	Approximate travel distance from study area	Approximate travel time from study area
Gulgong	2,521	1,956	9 km	7 minutes
Mudgee	10,923	10,966	40 km	35 minutes
Ulan	58	-	14 km	10 minutes
Birriwa	50		40 km	30 minutes
Rylstone	920	644	90 km	1 hour 10 minutes
Kandos	1,315	1,261	98 km	1 hour 15 minutes

A summary of the population projections for the social locality and surrounding LGAs up to 2041 is presented in **Table 16-2** (Department of Planning, Industry and Environment, 2019b).

Table 16-2: Summary of population and dwelling projections 2016 to 2041

Local Government Area	2016	2021	2026	2031	2036	2041	Average rate of change (%)
Mid-Western Regional	24,546	25,158	25,729	26,205	26,595	26,924	0.4
Upper Hunter Shire	14,344	14,194	13,948	13,615	13,200	12,712	-0.5
Warrumbungle Shire	9,562	9,187	8,791	8,351	7,861	7,333	-1
NSW Total	7,732,858	8,414,978	9,011,010	9,560,567	10,077,964	10,572,696	1.26

The population of the social locality is projected to increase from 24,546 (recorded in 2016) to 26,924 by 2041, with an expected growth rate of about 0.4 per cent per annum. As a result, the number of total households is also expected to increase, however the household size is predicted to decrease. The surrounding LGAs are expected to see a population decrease over the same period, largely as a result of an aging population and emigration from the region.

Additional demographic data have been collected for the Australian Bureau of Statistics (ABS) Gulgong, Mudgee, Ulan, Rylstone and Kandos State Suburbs, Mid-Western Region LGA, Warrumbungle LGA and Upper Hunter Shire LGA from the 2016 census, with comparison against NSW. This data is presented in **Table 16-3**.

Table 16-3: Other demographic characteristics (2016 Census)

Statistical area	Aboriginal and/or Torres Strait Islander people (% of total population)	Median Age	Unemploy-ment (%)	Median total household income ($/w)	Median mortgage repayments ($/m)	Median rent ($/w)
Population Centres						
Gulgong[1]	7.7	41	8.7	1,086	1,517	250
Mudgee[1]	6.2	37	5.8	1,256	1,733	300
Ulan[1]	-	47	5.5	1,375	-	210
Rylstone[1]	4.0	50	8.2	856	1,495	220
Kandos[1]	5.0	52	16.4	698	867	190
Local Government Areas						
Mid-Western Region LGA	5.4	42	6.5	1,131	1,690	270
Warrumbungle LGA	9.8	49	7.9	878	923	160
Upper Hunter Shire LGA	5.1	41	4.8	1,242	1,688	220
State						
NSW	2.9	38	6.3	1,486	1,986	380

[1] *ABS 2016 Census State Suburb statistical area*

The data in **Table 16-3** shows that key localities within the social locality generally have a higher Aboriginal and/or Torres Strait Islander population and median age than NSW with the exception of the median age in the Mudgee State Suburb.

Unemployment rates show a similar trend with higher unemployment than the state across the social locality except for the Mudgee and Ulan State Suburbs, likely due to strong mining, tourism and viticulture industries present in Mid-Western Regional Council LGA. Rylstone and Kandos have a notably higher unemployment rate at the 2016 Census. The Upper Hunter LGA has a lower unemployment than the NSW average, likely due to the strong agricultural economy in Upper Hunter, which is characterised by a concentration of wineries and thoroughbred studs (refer to **Section 16.2.2**).

Median weekly household income within the social locality is slightly lower than that of the neighbouring Upper Hunter LGA, however notably higher than the Warrumbungle LGA. Consistent with unemployment trends, Rylstone and Kandos residents have a significantly lower household income than the population the centres of Gulgong, Ulan and Mudgee.

More recent data relating to unemployment within the social locality has been sourced from *Small Area Labour Markets, October 2020* (Department of Education, Skills and Employment, Small Area Labour Markets, October 2020) which indicates the unemployment rate was 3.9 per cent in the June 2020 quarter. The unemployment rate for the social locality between June 2017 and June 2020 is presented in **Figure 16-1**.

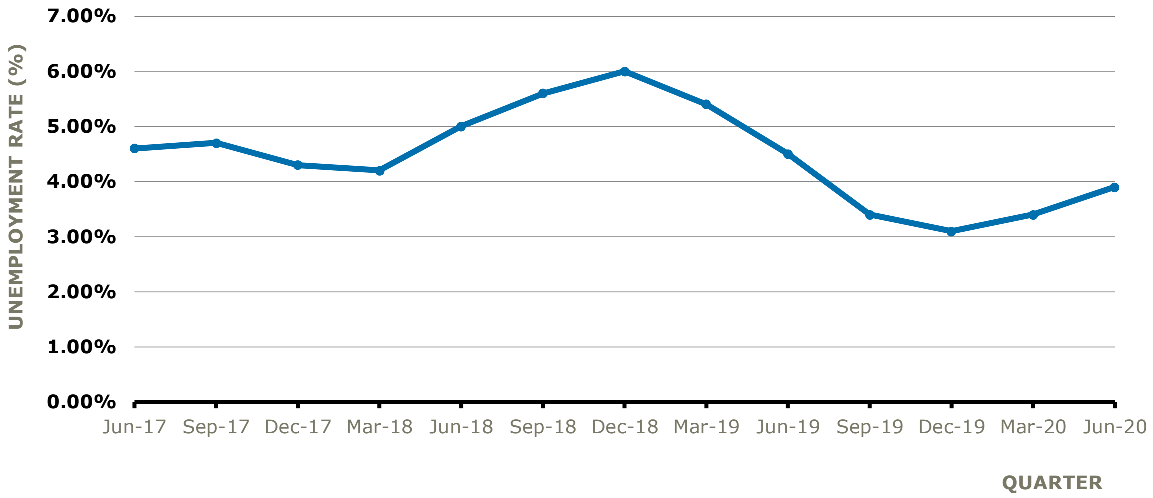


Figure 16-1: Social locality unemployment statistics (June 2017 – June 2020)

The data presented in **Figure 16-1** indicates that the social locality currently has a generally low unemployment rate when compared to the NSW average. Consultation undertaken to inform the socio-economic impact assessment provided a qualitative indication that during the NSW Government COVID-19 response 'lock-down', effected on 31 March 2020, unemployment (or reduced employment) increased significantly, which is supported by the trend shown in **Figure 16-1**. This was a thought to largely be result of reduced onsite worker numbers in industry (including mining) to achieve social distancing requirements, and the reduced capacity or temporary closure of hospitality and tourism establishments.

Mining and tourism are significant industries for employment in the social locality which is further discussed in **Section 16.2.2**. However, the widely held observation of those consulted with was that since the easing of restrictions, tourism in the region was at an unprecedented high. This would be expected as a result of international and interstate border closures. This was further supported by discussions held with the Mudgee Tourist Information Centre, which advised that the number of visitors to the centre in October 2019 was around 1,900 and in October 2020 was 5,900.

16.2.2 Labour market

A summary of the percentage of the total workforce by industry of employment for each of the LGAs at the 2016 Census is provided in **Table 16-4**.

Table 16-4: Industry of employment statistics (2016 Census)

Industry of Employment	Gulgong State Suburb (%)	Mid-Western Regional Council LGA (%)	Warrumbungle Shire LGA (%)	Upper Hunter Shire LGA (%)
Agriculture, Forestry and Fishing	8	9	**28**	**19**
Mining	**34**	**15**	1	12
Manufacturing	5	4	3	5
Electricity, Gas, Water and Waste Services	3	1	1	2

Industry of Employment	Gulgong State Suburb (%)	Mid-Western Regional Council LGA (%)	Warrumbu-ngle Shire LGA (%)	Upper Hunter Shire LGA (%)
Construction	**11**	8	4	6
Wholesale Trade	2	2	2	2
Retail Trade	5	**10**	8	7
Accommodation and Food Services	5	8	6	6
Transport, Postal and Warehousing	5	3	4	3
Information Media and Telecommunications	2	1	1	0
Financial and Insurance Services	0	1	0	1
Rental, Hiring and Real Estate Services	1	1	0	1
Professional, Scientific and Technical Services	1	3	3	4
Administrative and Support Services	2	3	2	3
Public Administration and Safety	3	4	8	5
Education and Training	3	8	11	8
Health Care and Social Assistance	3	**10**	12	8
Arts and Recreation Services	1	1	1	2
Other Services	7	5	3	3
Inadequately described/Not stated	3	3	4	4

Mining is the largest industry of employment category within both the Gulgong State Suburb and the Mid-Western Regional Council LGA comprising 35 per cent and 15 per cent of the total workforce respectively. Construction is the second largest industry of employment in the Gulgong State Suburb followed by agriculture, forestry and fishing. Following mining, retail trade and healthcare and social assistance are the second largest employers across the Mid-Western Region LGA.

Agriculture, forestry and fishing is the largest industry of employment category in the neighbouring LGAs of Warrumbungle and the Upper Hunter Shire employing 28 per cent and 19 per cent of the total workforce respectively.

Statistics on occupation provide an indication of the skillsets of the local workforce. Occupation statistics available within the for the social locality as well as surrounding areas are provided in **Table 16-5**.

Table 16-5: Occupation statistics (2016 Census)

Occupation	Gulgong (%)	Mudgee (%)	Mid-Western Regional Council LGA (%)	Warrumbungle LGA (%)	Upper Hunter LGA (%)	NSW (%)
Managers	11	10	15	**27**	16	13
Professionals	10	15	13	14	12	**24**
Technicians and trades workers	**19**	**18**	**17**	10	**17**	13
Community and personal service workers	11	11	10	11	8	10
Clerical and administrative workers	9	10	10	8	9	14
Sales workers	9	11	9	6	7	9
Machinery operators and drivers	**17**	13	13	7	13	6
Labourers	13	12	12	14	**16**	9
Inadequately described/Not stated	1	1	1	2	1	2

Technicians and trade workers are the largest occupation category within the social locality followed by machinery operators, labourers and professionals. The neighbouring LGA of Upper Hunter has a similar occupation breakdown, however with a higher percentage of labourers than machinery operators. The Warrumbungle Shire has a higher percentage of managers which is likely the result of a higher number of land managers in the agricultural industry.

Comments received during the community drop-in session indicated that there was a skills shortage as a result of the skilled workforce being drawn to the mining industry. It was raised that it was difficult for farmers to fill fruit picking positions, and it was difficult to find tradespeople to service small household jobs. However, during consultation Mid-Western Regional Council and local employment service providers questioned the validity of this statement and advised that there was both skilled and unskilled labour capacity within the social locality.

16.2.3 Housing and accommodation

Housing

As of 19 August 2020, Mudgee had 25 properties available for rent and 131 properties for sale. Median property prices over the preceding year ranged from $460,000 for houses to $337,000 for units. Houses in Mudgee rent out for an average of $420 per week and units rent for around $320 per week. (www.realestate.com.au, 2020)

As of 19 August 2020, Gulgong had two properties available for rent and 26 properties for sale. The median house price in Gulgong in 2019 was $370,000. The two rental properties were available for $370 and $550 per week and were three and four-bedroom houses respectively (www.realestate.com.au, 2020)

Consultation undertaken with real estate agents to inform the socio-economic assessment indicated that the rental housing market was competitive, and many realtors had maintained zero rental vacancies for an extended period (up to 18-months). It was advised that recent residential sales numbers were elevated with the COVID-19 pandemic being noted as the key driver, with their conclusion that remote working opportunities and a shift in values was promoting a tree change mentality for people from metropolitan and urban areas.

Further to the existing supply of housing, Mid-Western Regional Council indicated that the social locality had ample supply of land available for residential development to accommodate the projected population growth associated with continued economic development in mining, renewables and other industry and lifestyle drivers.

Short-term accommodation

Short-term accommodation options within the social locality include options such as hotels, motels, self-contained units, guesthouses, Ulan Green Village (workers accommodation village), caravan parks, campgrounds and short-term house rental accommodation.

Consultation with the Mudgee Tourist Information Centre, Mid-Western Regional Council and short-term accommodation providers indicated that the demand for short term accommodation was extremely high at the time of preparing this EIS (November 2020). This was supported by online accommodation searches of various websites throughout the development of the socio-economic assessment.

As described in **Section 16.2.1**, the increase in domestic travel associated with the COVID-19 pandemic has resulted in a boom to the social locality's tourism industry. Whilst this is expected to taper off as interstate and international travel restrictions ease and tourists travel to alternative locations, there are many periods throughout the annual events calendar, particularly in Spring, where tourist accommodation demand is consistently high, regardless of the effects of the COVID-19 pandemic.

It was also however raised that cost of accommodation was the key selection criteria for non-local employment recruits associated with other recent infrastructure projects in the social locality. As such, caravan parks, campgrounds and communal living (share house) arrangements were strongly preferred.

16.2.4 Community values and attitudes

Consultation with the community undertaken during the development of this EIS has been summarised in **Chapter 5**. Generally, the overall community position on the project was neutral. There was a high value placed on the potential economic and employment benefits to the social locality, in particular opportunities for contractors, local tradespeople and workers who have historically served the mining sector.

The community values and attitudes that relate to potential and perceived adverse socio-economic effects that could result from development of the project include:

- the cumulative effects of future development in the area associated with the NSW Government's Central West Orana REZ

- amenity impacts such as noise, dust and truck movements associated with construction
- the social impact of construction workforce such as impacts on housing and accommodation availability, local recruitment and a perceived lack of availability of tradespeople, and social impacts associated with large volumes of workers from other areas on local towns
- visual amenity, including visual change from neighbouring farmland
- temporary loss of productive agricultural land
- permanent reduction in the productivity of the agricultural land following decommissioning
- changes to the community values of the region, specifically in Gulgong relating to non-Aboriginal heritage, as a result of the potential for influx of non-local hires.

While the above key concerns were raised at the drop-in session, it must be noted there were very few community members who demonstrated a negative view of the project. There was a small number of community members who raised significant concerns regarding cumulative effects of renewable energy development within the social locality on visual amenity, historic value and the social character of the region. This was mainly driven by concerns relating to other projects that had been proposed closer to Gulgong town. The credibility of climate change science and the renewable energy sector as a response measure to climate change, was also questioned by a group of two community members.

Targeted and opportunistic discussions held with local community members and service providers indicated a broad spectrum of views on the renewable energy sector and the development of projects within the region. It was evident that the coal mining industry contributes significantly to the local community through employment opportunities and local investment strategies. Many of the tradespeople and contractors who attended the drop in session voiced a recognition that a transition to an electricity system based on renewable energy is likely to be "the way of the future" and expressed an interested in being involved in this transition in a commercial and professional capacity.

Aside from the strong role of the mining industry and the agricultural sector in the region, the social locality has an identity and economic profile based around a tourism culture of food, wine, arts and crafts and historical value. Mid-Western Regional Council noted during consultation that supporting and maintaining these cultural values was important to the community and the tourism sector. As an example of the way this is currently managed, Mid-Western Regional Council advised that it had come to agreement with the operational mines within the LGA to develop a policy of no high visibility clothing in the township.

16.2.5 Community infrastructure and services

Community infrastructure within the social locality includes:

- health services such as Mudgee hospital and general practitioners
- education facilities including TAFE NSW, high schools and primary schools
- early childhood education (family day care, long day care, preschool, etc.)
- libraries
- pools
- heritage buildings
- public art
- sports facilities
- animal control
- parks and gardens
- public amenities
- community halls and buildings
- aged services
- youth services.

The social locality also has a strong tourism economy attracting approximately 655,000 visitors each year to experience the local wine, food, heritage, natural scenery and sporting and cultural events (Mid-Western Regional Council, 2020).

16.3 Assessment of potential impacts

16.3.1 Construction

Population and demographics

The project is anticipated to require a peak construction workforce of 400 personnel. Construction of the project is expected to commence in early 2022 and last for two years. It has been assumed that the peak construction period would occur in 2023 and last for a period of around 12 months while the bulk of the photovoltaic modules are being installed onsite.

The construction workforce is expected to be resourced through a combination of local and non-local hires. Through consideration of feedback from employment service providers and Mid-Western Regional Council, and assessment of the quantitative data presented in **Section 16.2.1**, it has been estimated that up to 50 per cent (200 FTEs) of the peak construction workforce could potentially be sourced from the social locality. UPC\AC understands that this is roughly consistent with worker numbers from other large-scale solar farm projects built in Australia in recent years.

The local and non-local hire assumption has been selected in an attempt to capture and assess the positive and negative impacts, in particular traffic and social effects. Consideration was given to, but not limited to, the following:

- local hires are more inclined to use personal vehicles rather than company provided buses
- local direct and flow-on economic benefits of local hires over non-local hires
- accommodation pressure associated with non-local hires
- skilled labour competition with other developments and industry challenging local hire availability.

Whilst there is potential for some flow on effects to the population associated with the construction phase of the project, no material permanent change to the population outside of projected growth would be expected as a result of the project. A short-term (approximately two-years, with the peak impact limited to around 12 months) population increase would be associated with the non-local hire proportion of the construction workforce.

It is acknowledged that there are various factors which would determine the actual proportion of local hires versus non-local hires. For the purpose of assessment, the above assumptions have been made. However, commentary around the sensitivity of these assumptions has also been included within the following sections.

Labour market

An indicative breakdown of the expected skilled and non-skilled workforce is:

- 35 per cent (140 FTE) university or TAFE qualified (e.g. engineers, electricians)
- 45 per cent (180 FTE) specialised trained (e.g. machine operator, mechanical mounter)
- 20 per cent (80 FTE) unskilled.

More detailed assumptions around the workforce roles and timing of specific skillsets is expected to be available following detailed design and engagement of a construction contractor.

The following potential benefits relating to the social locality labour market would be generated by the construction phase of the project:

- employment opportunities targeting local communities would diversify industries and improve technical expertise, bringing about increased economic capital at the individual, household and community levels.
- vocational training schemes may build capacity of local tertiary training institutions through partnering and collaboration
- local business opportunities through the supply of natural resources (gravel and base course, concrete and water for dust control and concrete), goods and services and contractor services such as fencing installation, crane operators civil/earthworks, trades, machinery and vehicle hire, fuel supply, road works labour hire, accommodation and property rentals, administration, hospitality, food and beverage industry, transport services, recreation, mixed businesses for groceries, laundromats, storage facilities and office space
- both direct employment, contracting and use of local suppliers has the potential to stimulate the local economy, diversify industries, and increase financial flow in the local area. This could result in enhanced economic capital at the individual, household and community levels.
- local Aboriginal targeted engagement in the project's economic opportunities may advance socio-economic conditions and capabilities at individual, household and community levels.

Housing and accommodation

The project construction phase has the potential to generate a substantial demand for short-term accommodation within the social locality. At the peak of construction there is potential for 200 non-local hires (or more if local hires are not able to be secured) to require short-term accommodation within the social locality.

Without appropriate management, planning and consultation, this has the potential to saturate the local accommodation options which are already approaching capacity. This could result in:

- inadequate accommodation availability to meet tourist demand, with flow on effects to the tourism and tourism support industries
- overcrowding of low-cost accommodation options or unacceptable overcrowding in other short-term accommodation facilities
- inadequate provision of accommodation resulting in a reduction of workers onsite, or health and safety concerns for inappropriately housed workers
- further pressure on a residential rental market with existing limited availability.

While accommodation services providers are experiencing historical high demand due to the COVID-19 lockdowns in the last 9 months, it is noted that given the construction timeframe for the project (not commencing until early 2022), that domestic and international travel restrictions are likely to be eased in this timeframe. This would ease pressure on accommodation availability. Even in the event that such travel restrictions are not eased, it is likely that there are temporary accommodation options in the region that could be utilised to alleviate some of the pressure on tourism services providers – primarily because of the well established mining sector and the service providers to this industry (commercially operated workers camps etc).

Community values

Major infrastructure development has the potential to impact on a host community's values by causing change to social fabric of the area. Through consultation with the local community and Mid-Western Regional Council, such concerns were identified and described in **Section 16.2.4**.

Key issues raised have been addressed and incorporated throughout the environmental assessment chapters of this EIS.

The project presents opportunities for the local community and UPC\AC to jointly set standards for the renewables sector to act as a best case for other renewable energy and major projects, bringing about community pride and social cohesion. This is enhanced by the UPC\AC owner operator model, whereby the relationship with the local community is expected to be long term – ie. UPC\AC has an interest in forming positive relationships with local communities because it intends to be involved in the construction and operation phase of the asset over a 30 year plus timeframe.

It is noted that fact that the NSW Government has announced the Central West Orana REZ as a priority region for development may be driving some of the perceived threat of renewables development generally. It is likely that some concerns voiced by the community are not specifically about the Stubbo Solar Farm project or its potential to impact on social fabric, but rather that a lot of development in general is anticipated to flow from this policy decision.

Community infrastructure accessibility
The local hire proportion of the construction phase workforce is not expected to increase pressures on local community infrastructure such as childcare, education and youth services. There is a potential that the construction workforce would utilise other services including medical and facilities such as parks and recreation. It is considered unlikely that the non-local hires would exceed the capacity of the existing health services.

There is also potential for truck traffic during the construction phase of the project to impact the traffic on the local road network and has the potential to cause issues of public safety if not managed appropriately. **Chapter 13** describes the traffic predicted to be generated by the project, the potential impacts on traffic and how the project would be managed to mitigate traffic impact on the local community and residents. One of the decisions already made by UPC\AC is to limit all construction traffic to use a dedicated route via Blue Springs Road to gain access to site. This would avoid the need for any heavy vehicles to travel through or close to Gulgong town.

16.3.2 Operation
Operation of the project is expected to generate approximately 10 full time jobs. It is expected that these positions would be largely filled locally or would involve the worker relocating to the social locality. For reference, at the community drop in session it was confirmed that two locals had recently secured employment in operations and maintenance roles at another solar farm nearby. A population increase associated with these positions would fall within the expected emigration and is not expected to place any unexpected pressure on existing social resources.

16.3.3 Decommissioning
The decommissioning phase would see lower workforce requirements than construction and would occur within a future social setting making it difficult to predict key issues and potential impacts. As such, social considerations would be built into the decommissioning phase planning to mitigate the potential impacts relevant to the time period.

16.4 Environmental management and mitigation measures
Proposed measures to manage and/or mitigate water impacts from the project are presented in **Table 16-6**.

Table 16-6: Management and mitigation measures – socio-economic

ID	Management/mitigation measure	Timing
SIA1	An Accommodation and Employment Strategy will be developed and implemented for the project in consultation with Mid-Western Regional Council. This strategy will: • propose measures to manage workforce accommodation to minimise the effects of non-local hires during construction on short-term accommodation availability and the local housing market (for example, consider use of existing workers camps, where practical and appropriate) • include a code of conduct for the projects workforce, particularly to avoid anti-social behaviour at peak construction and align with Mid-Western Regional Council's existing industry agreements • to the extent possible and within UPC's control, consider the cumulative impacts associated with other State significant development projects in the area, including nearby mines • investigate options for prioritising the employment of local workers for the construction and operation of the project, where feasible • include a program to report measures undertaken or implemented in line with the strategy • include a program to monitor and review the effectiveness of the strategy over the life of the project, including regular monitoring and review during construction.	Prior to construction
SAI2	A community benefit share fund will be developed. Community projects needing funding will be identified and prioritised based on potential project impacts and in collaboration with representatives of the local community and Mid-Western Regional Council.	Prior to construction
SIA3	Investigation will be undertaken into the value of investment in local tertiary training institutions to address skills shortages where identified during the development of the Accommodation and Employment Strategy. Where value is identified and a strategy is defined, investment will be targeted through the community benefit share fund.	Prior to construction
SIA4	During development of the Accommodation and Employment Strategy, further consultation with local short-term accommodation providers will be undertaken to identify and where appropriate secure, accommodation for the non-local portion of the construction workforce.	Prior to construction
SIA5	During development of the Accommodation and Employment Strategy, further consultation with local employment service providers will be undertaken to identify and where appropriate secure, local hires.	Prior to construction

17. WASTE AND RESOURCES

This chapter presents an assessment of the potential waste and resource impacts as a result of the project. This chapter has been prepared to address specific SEARs relating to waste and resources as presented in ***Section 1.5****.*

17.1 Assessment methodology

The project will produce a number of waste streams during the construction and decommissioning phases. Minor quantities of waste will also continue to be generated by the day-to-day operation of the project.

Assessment of waste and resourcing impacts was undertaken using a desktop assessment to understand the likely and potential waste and resourcing issues for the project. This includes:

- identifying the key resources required throughout the construction, operation and decommissioning phases of the project and their availability
- understanding the statutory context for waste management
- identifying the waste streams that would be produced over the project lifecycle and their waste classification in accordance with relevant legislation
- identifying the existing waste management facilities in the vicinity and their capacity to accept different waste streams
- estimating quantities for key waste streams that would be produced.

A detailed summary of the waste types, classification, proposed management methods, and estimated annual quantities of wastes produced during the construction and ongoing operation of the project will not be available until the detailed design stage of the project has been completed. These will be included in the project's detailed waste management plan prior to construction and will be prepared in consultation with Mid-Western Regional Council.

17.1.1 Statutory context, policies and guidelines

The management of wastes is primarily regulated under the POEO Act, the *Protection of the Environment Operations (Waste) Regulation 2014* (Waste Regulation) and the WARR Act. Unlawful transportation and deposition of waste is an offence under Section 143 of the POEO Act. Littering is an offence under Section 145 of the POEO Act.

The WARR Act includes resource management hierarchy principles to encourage the most efficient use of resources and to reduce environmental harm. This includes the following order:

- avoidance of unnecessary resource consumption
- resource recovery (including reuse, reprocessing, recycling and energy recovery)
- disposal.

The classifications that apply to waste in NSW and the descriptions of each are provided by the POEO Act, the Waste Regulation and supporting guidelines, including the *Waste Classification Guidelines* (Environment Protection Agency, 2014). Many waste types are pre-classified under Schedule 1 of the POEO Act and do not require testing. Pre-classified wastes include:

- general solid waste (non-putrescible) e.g. glass, plastic, rubber, bricks, concrete, metal, paper, cardboard and other domestic waste
- general solid waste (putrescible) e.g. food waste, organics and animal wastes
- hazardous wastes e.g. contaminated soils
- liquid wastes e.g. wastewater effluent and fuels and lubricants
- restricted solid wastes
- special wastes e.g. asbestos, waste tyres, clinical wastes.

17.2 Existing environment

17.2.1 Resources

The majority of the required resources would be used during the construction of the project. **Table 17-1** provides indicative information on the key resources required for the project. The resource quantities would be defined following detail design of the project. Potential sources would be subject to availability and cost.

Table 17-1: Indicative resources required for the project

Resource	Description
Glass	Photovoltaic panels
Metal	Components for mounting system, inverters and delivery system containers, fencing materials
Sand	Bedding for cables
Concrete	Foundations, general building construction
Gravel	Carparking and internal access roads
Wood	General building construction
Water	200 kL per day required for dust suppression during construction and decommissioning A small amount is required during operations for domestic and maintenance purposes

17.2.2 Waste types and classification

Table 17-2 provides the waste types, classification, description, and management details for wastes likely to be generated during the project. All wastes would be transported and disposed of in accordance with the *Waste Classification Guidelines* (Environment Protection Agency, 2014) and the POEO Act.

Table 17-2: Potential construction waste types, classification and management details

Waste type	Description	Classification	Management details
Paper and cardboard	Packaging materials, general office wastes	General Solid Waste (non-putrescible)	Separated for recycling
Wood	Pallets and cable drums, timber offcuts, wood separators (to prevent damage to photovoltaic modules)	General Solid Waste (non-putrescible)	Separated for reuse or recycling
Plastic	Packaging materials, ties, straps and excess building materials such as safety fencing and barriers	General Solid Waste (non-putrescible)	Disposed to landfill
Green waste	Vegetation waste from clearing activities	General Solid Waste (non-putrescible)	Beneficial onsite or offsite reuse or disposal to a green waste facility or landfill

Waste type	Description	Classification	Management details
Soil	Surplus spoil from excavations and earthworks	General Solid Waste (non-putrescible)	Onsite reuse or offsite reuse or disposal at a licenced facility Any contaminated soils (if encountered) would be tested and treated onsite and/or disposed of to a suitably licensed facility
Electrical	Excess building materials or retired equipment	General Solid Waste (non-putrescible)	Separated for reuse or recycling or disposal at an approved facility
Metals	Excess building materials such as safety fencing and barriers or retired equipment	General Solid Waste (non-putrescible)	Separated for reuse or recycling
Liquid waste	Oil and fuels, contaminated water from equipment washing	Liquid waste	Collection in tanks and transported to an offsite licensed facility
Sewage	Biological wastes from onsite septic systems	Liquid waste and General Solid Waste (non-putrescible)	Collection by a contractor and disposed of to a suitably licensed facility
General domestic	Food scraps, aluminium cans, glass bottles, plastic and paper containers	General Solid Waste (putrescible and non-putrescible)	Collection by a waste management contractor and disposed of to a suitably licensed facility
Commercial waste	Oily rags, filters and drums (non-volatile)	General Solid Waste (non-putrescible)	Collection by a contractor and disposed of to a suitably licensed facility

17.2.3 Waste management facilities

There are several licensed waste management facilities in the area available for disposal or management of wastes generated by the project. These include:

- Gulgong Waste Facility located at 62 Mineshaft Lane, Gulgong (approximately 7 kilometres from the project)
- Mudgee Waste Facility located at 31 Blain Road, Caerleon (approximately 33 kilometres from the project)
- Kandos Waste Facility located at 110 Kandos Tip Road, Kandos (approximately 73 kilometres from the project)
- Whylandra Waste and Recycling Centre, Dubbo (approximately 100 kilometres from the project).

Mudgee Waste Facility can accept 27,000 tonnes per annum of waste and has an estimated remaining lifespan of 60 years (Impact Environmental, February 2018). The Whylandra Waste and Recycling Centre can accept 60,000 tonnes per annum of waste and has an estimated remaining lifespan of 200 years (Impact Environmental, February 2018).

Sewerage and wastewater treatment plants are located in Gulgong, Mudgee, Kandos and Rylstone. Discussions with Mid-Western Regional Council regarding waste disposal options have commenced and further discussions will be engaged prior to construction.

17.3 Assessment of potential impacts

17.3.1 Construction

While the use of non-renewable resources can increase material scarcity, the materials required for the project are not currently limited or restricted. In the volumes required, the project is unlikely to place significant pressure on the availability of local or regional resources.

In accordance with definitions in the POEO Act and associated waste classification guidelines, most waste generated during the construction phase would be classified as general solid waste (non-putrescible). Ancillary facilities in the site compound would also produce sanitary wastes classified as general solid waste (putrescible). The majority of the project components are able to be reused or recycled in accordance with resource management hierarchy principles.

The main waste streams generated during construction are anticipated to be the cardboard packaging and the wooden pallets used in transportation of photovoltaic modules and tracker components. Cardboard packaging waste is anticipated to be in the order of several thousand kilograms per week and will be recycled. For wooden pallets, it is estimated that there will be approximately 500 to 1,000 units per week during peak delivery periods. These can be reused if in good condition or sold for wood chip if damaged. PCUs will typically be self-contained (containerised) or pre-assembled on a skid or concrete mounted platform and will generate limited waste materials.

Potential impacts from poor management of waste include pollution of land and water, human and animal health impacts, and 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. Skip bins will be made available onsite to enable waste separation for recycling (e.g. separate skip bins for cardboard recycling and timber collection). General waste bins will be provided for disposal of materials that cannot be cost-effectively recycled.

17.3.2 Operation

Resources used during operations would be associated with:

- maintenance activities and use of machinery and vehicles (e.g. fuels, lubricants and metals)
- potable water requirements
- replacement materials for electrical components such as inverters, transformers and electric cabling as required.

Operational waste quantities would be very low given the low maintenance requirements of the Solar Farm. Operational waste would include a small amount of domestic including food scraps, aluminium cans, glass bottles, plastic and paper containers and putrescible waste generated by site personnel. Additionally, any components removed during maintenance or upgrade of equipment, machinery and vehicles would also require disposal (including battery replacement). These activities would occur infrequently and there would be a high potential for recycling or reuse of any waste.

17.3.3 Decommissioning

During decommissioning, all above ground infrastructure and materials would be removed from the site and recycled or otherwise disposed of at approved facilities. Underground cables buried at 1000 millimetres deep and greater would likely remain in situ. Decommissioning of the site would involve the recycling or reuse of materials including:

- solar panels and mounting system
- metals from posts, cabling, fencing
- buildings and equipment such as the inverters, transformers and similar components would be removed for resale or reuse, or for recycling as scrap.

Any items that cannot be recycled or reused would be disposed of in accordance with applicable regulations and to appropriate facilities. Most project components are recyclable and mitigation measures are in place to maximise reuse and recycling in accordance with resource management hierarchy principles.

17.4 Environmental management and mitigation measures

Proposed measures to manage and/or mitigate waste and resource impacts from the project are detailed in **Table 17-3**.

Table 17-3: Management and mitigation measures – waste and resources

ID	Management/mitigation measure	Timing
WR1	A construction waste management plan will be prepared in consultation with Council. The waste management plan will include: • details of the quantities of each waste type and the proposed reuse, recycling and disposal locations • details on measures to reduce the types and volumes of waste • measures to maximise reuse and recycling	Prior to construction
WR2	All waste generated from the project will be assessed, classified and managed in accordance with the *Waste Classification Guidelines* (EPA, 2014)	At all times
WR3	Wastes will be disposed of at suitable facilities permitted to accept the waste	At all times
WR4	Management of wastes will follow the resource management hierarchy principles in accordance with the WARR Act (i.e. avoid > reduce > reuse > recycle > recover > disposal)	At all times
WR5	Skip bins will be made available onsite to enable waste separation for recycling (e.g. separate skip bins for cardboard recycling, plastics and timber collection)	Construction / operation
WR6	General waste bins will be provided for disposal of materials that cannot be cost-effectively recycled	Construction / operation
WR7	The site septic system will be installed and operated in accordance with Council regulations	Construction / operation
WR8	All trucks transporting waste from the site will have covered loads to prevent spillage and other nuisances	Construction / operation
WR9	All materials will be removed from the site following decommissioning and the site will be left waste-free	Decommissioning

18. OTHER ISSUES

This chapter presents an assessment of the impacts of other issues not included in the SEARs that may occur as a result of the project. The other issues identified for the project include air quality and climate change and greenhouse gas.

18.1 Air quality

18.1.1 Assessment methodology

The SEARs do not require an assessment of the project's potential air quality impacts. However, to address concerns raised by the neighbouring landholders in relation to dust generated during construction, a qualitative assessment of the project's potential air quality impacts has been undertaken.

Assessment of air quality impacts was undertaken using a desktop assessment to understand the likely and potential air quality issues for the project. This includes:

- identifying the nearby receivers that may potentially be impacted by the project
- understanding the existing air quality catchment and present sources of air emissions
- identifying potential cumulative sources of air emissions
- understanding the local climatic influences
- assessing potential sources of air emissions that may occur as a result of project activities.

18.1.2 Existing environment

Sensitive receivers and land use

The study area is situated within a rural setting. Sensitive receivers proximate to the study area are shown on **Figure 18-1**. There are approximately 10 sensitive receivers, including rural residences located within two kilometres of the project, three of which are associated with the project. The majority of the receivers are located over 3 kilometres south of the study area towards the township of Gulgong.

Existing air catchment

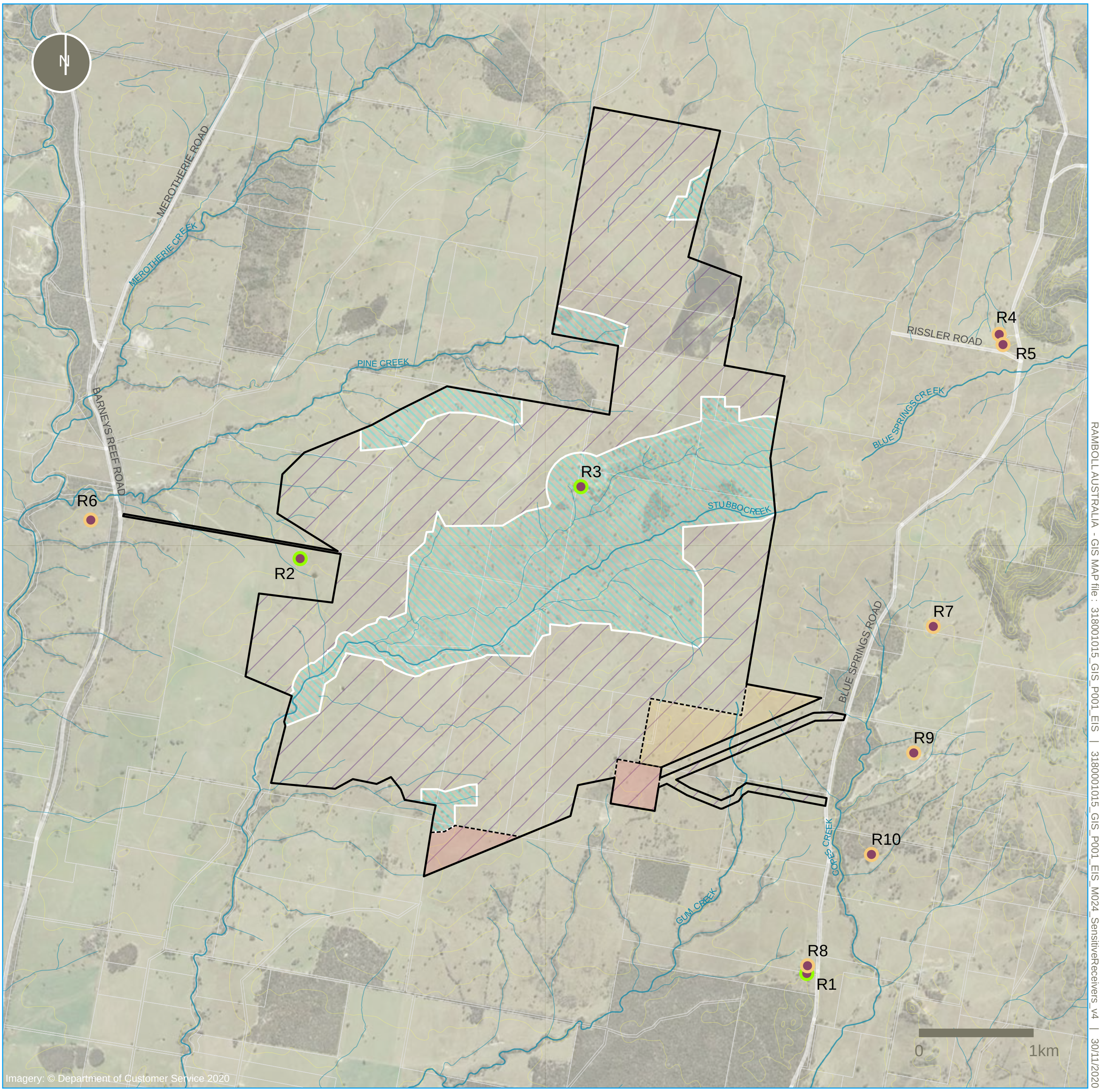
Existing sources of air pollution within proximity to the study area include:

- dust and vehicle and machinery exhaust emissions associated with agricultural production
- dust and vehicle and machinery exhaust emissions associated with nearby mining operations (Moolarben Mine, Ulan Mine and Wilpinjong Mine)
- use of wood burners in residential properties during winter months
- bushfires.

A review of the National Pollution Inventory (NPI) (Commonwealth Department of Environment and Energy, 2020) identified five scheduled facilities that operate within the vicinity of the project (30 km radius) and may also contribute to the local air shed, including:

- Ulan Coal Mine (10 km east of study area)
- Yancoal – Moolarben (14 km east of study area)
- Boral Beryl Quarry (15 km south-west of study area)
- Wilpinjong Coal Mine (24 km south-east of study area)
- Elgas Limited Mudgee.

The locations of Ulan, Moolarben and Wilpinjong coal mines and Beryl Quarry are shown on **Figure 1-1**.



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Key

- Study area
- Indicative temporary construction ancillary facilities (site compound, laydown area and car park)
- Proposed operational infrastructure area including substation, operational facility and BESS
- Environmental exclusion zones
- Proposed development footprint
- Road
- Creek
- Sensitive receivers: Associated
- Sensitive receivers: Non-associated

Figure 18-1 | Sensitive receivers

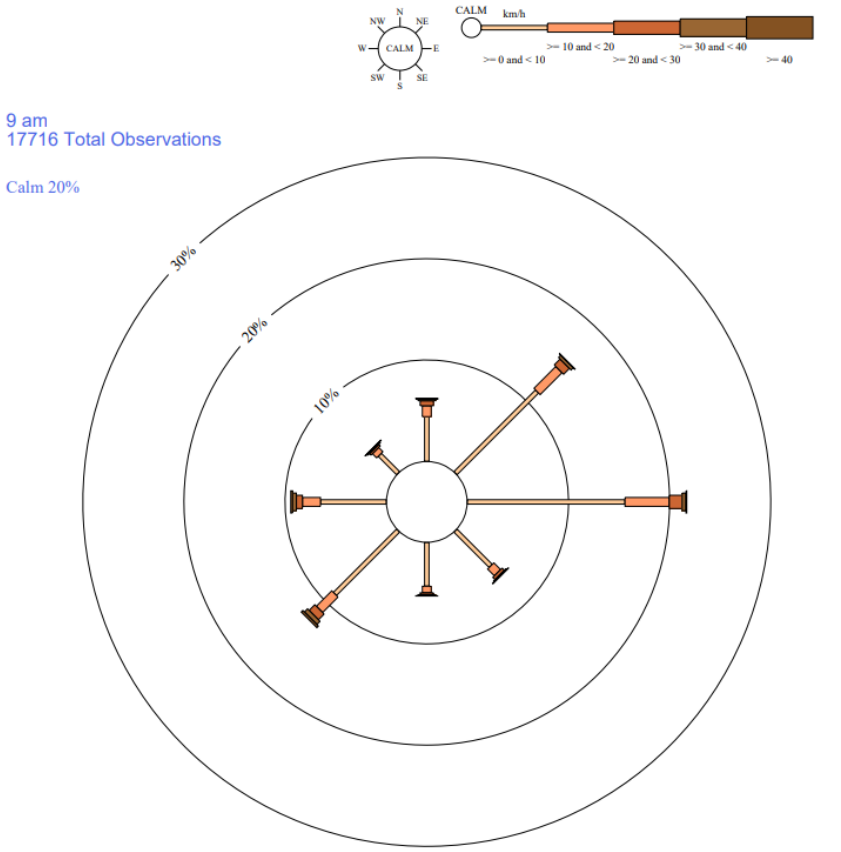
Climate

The nearest Bureau of Meteorology (BOM) meteorological station that provides long-term climate statistics is the Gulgong Post Office (station number 062013) located approximately 10 kilometres south of the study area. The station has data from 1970 to 2020.

Data from the Gulgong Post Office station indicates that temperatures are highest in January, with a mean maximum temperature of 31.4 degrees Celsius. Temperatures are lowest in July, with a mean minimum temperature of 2.6 degrees Celsius (Bureau of Meteorology, 2020).

The average annual rainfall is 649.1 millimetres, with the highest mean monthly rainfall occurring in January (70.3 millimetres) and the lowest mean monthly rainfall occurring in April (44.2 millimetres) (Bureau of Meteorology, 2020).

Annual wind roses from the station are shown in **Figure 18-2**. The prevailing winds are generally from the northeast during the morning period and southwest during the afternoon period (Bureau of Meteorology, 2020b). This means that emissions from the site would generally be carried in a south-westerly direction during the mornings and a north-easterly direction during the afternoons. Wind speed is generally lowest in the autumn and winter months and strongest in spring and summer months (Bureau of Meteorology, 2020).



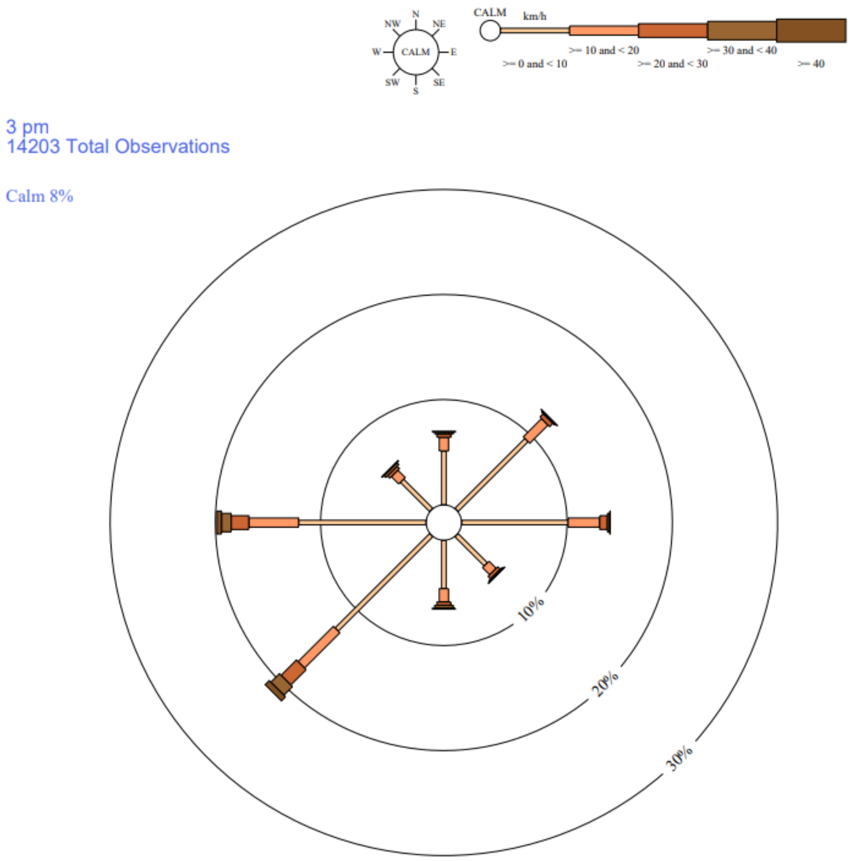


Figure 18-2: Wind roses

18.1.3 Assessment of potential impacts

The key air quality issue associated with construction is anticipated to be dust generated during ground disturbance (construction) or demolition work. Activities with the highest potential to generate dust include:

- heavy civil works such as grading/levelling and compaction and vegetation clearing associated with site preparation of the array areas, construction laydown areas, internal access roads, and substation areas
- driving or screwing piles to provide support for the mounting frameworks required for the photovoltaic modules
- installation of fencing involving ground disturbance
- trench excavation for the cabling network and transmission line
- construction of the BESS and relevant infrastructure.

As rainfall in the area is relatively low, there is a higher potential for dust generation, particularly in the autumn and winter months when rainfall is at its lowest. This has the potential to result in nuisance impacts (e.g. dust soiling) and impacts to human health, however this is usually manageable through standard management methodologies such as application of water and minimising the carrying out of dust generating work during adverse weather conditions. Dust generated from the project would generally be carried in a south-westerly direction during the mornings and a north-easterly direction during the afternoons. This is away from the majority of receivers, which are primarily located south of the study area near Gulgong.

Other sources of air emissions would likely be associated with the combustion of diesel fuel and petrol from heavy vehicles, mobile excavation machinery, and stationary combustion equipment as well as from the handling and/or onsite storage of fuel and other chemicals. More specifically, exhaust emission sources would include:

- vehicles travelling to and from the site (primarily during construction)
- vehicles traveling within the study area between the two array areas
- earthmoving machinery and equipment for site preparation
- cable trenching and laying equipment
- pile-driving equipment
- assisted material handling equipment (forklifts and cranes)
- machinery and equipment for connection infrastructure establishment and installation of the BESS
- water trucks for dust suppression.

Exhaust emissions would likely involve periodic localised emissions of carbon monoxide, particulate matter (PM_{10} and $PM_{2.5}$), oxides of nitrogen (including nitrogen dioxide), sulphur dioxide, volatile organic compounds, and polycyclic aromatic hydrocarbons associated with the combustion of diesel fuel and petrol. Combustion emissions have the potential to impact on human health as well as contribute to greenhouse emissions and leave residues on private properties. However, as the use of heavy vehicles, equipment and machinery would be largely limited to the construction phase of the project, any impacts from combustion emissions would be minimal and temporary in nature (approximately 24 month construction period).

Due to limited ground disturbance and requirements to operate heavy vehicles, equipment and machinery, the project is not anticipated to generate significant air quality impacts during operations.

Air quality emissions during decommissioning activities would likely be similar to those experienced during construction.

18.1.4 Environmental management and mitigation measures

Proposed measures to manage and/or mitigate air quality impacts from the project are detailed in **Table 18-1**.

Table 18-1: Management and mitigation measures – air quality

ID	Management/mitigation measure	Timing
AQ1	Protocols to minimise air quality impacts will be included in the CEMP	Prior to construction
AQ2	Water trucks will be used for dust suppression along internal, unsealed access roads and disturbed areas when required (i.e. if visible dust emissions are observed).	At all times
AQ3	The traffic management plan will include optimisation of vehicle movements onsite reducing wheel generated dust.	At all times
AQ4	Dust suppression measures will take into consideration weather, extended dry periods and Mid-Western Regional Council water restriction levels.	At all times

18.2 Climate change and greenhouse gas

18.2.1 Assessment methodology

The SEARs do not require an assessment of the project's potential climate change and greenhouse gas impacts. However, to address concerns raised by the neighbouring landholders, a qualitative assessment of the project's potential climate change and greenhouse gas impacts has been undertaken.

Assessment of climate change and greenhouse gas impacts was undertaken using a desktop assessment to understand the likely and potential issues for the project. This includes:

- identifying the climate change projections for the region
- understanding the strategic context for climate change and greenhouse gas policy in Australia
- undertaking a review of existing research and data for similar projects
- identification of the project activities and components that generate greenhouse gas emissions.

18.2.2 Existing environment

Climate change projections

Climate change refers to the warming temperatures and altered climatic conditions associated with the increased concentration of greenhouse gases in the atmosphere. Greenhouse gases include carbon dioxide, methane, nitrous oxide, ozone, water vapour and synthetic gases such as chlorofluorocarbons and hydrofluorocarbons. Climate change impacts can influence the environmental impacts of construction and decommissioning of the project. For example, hot, dry or windy conditions can exacerbate air quality impacts and prolonged rainfall can increase soil compaction impacts or cause flooding.

Climate change projections for Australia includes increases in sea and air temperatures, more frequent and hotter hot days and fewer cool extremes, decrease in rainfall across southern Australia and more intense rainfall throughout Australia, and more extreme events such as bushfires, heatwaves and flooding (CSIRO, 2018).

The Mid-Western Region is expected to experience up to 10 per cent less rainfall in the near future (2020-2039) whilst temperatures are predicted to increase by up to one degree (Department of Planning, Industry and Environment, 2014).

Strategic context

There are various State and Commonwealth initiatives aimed to increase the proportion of renewable energy within the Australian electricity market (refer to discussion in **Section 3.1**). These policies are primarily driven by the objectives to diversify the Australian market, ensure security of the network and to decrease greenhouse gas emissions generally associated with non-renewable energy sources in order to meet climate change agreements and targets such as the Paris Agreement and RET scheme.

Electricity generation and greenhouse gas emissions

Each year, Australian corporations that meet certain thresholds must report their emissions and energy information under the National Greenhouse and Energy Reporting (NGER) scheme. Each reporting year, the electricity sector has been the largest emitting industry in Australia, contributing 48.8 per cent of Australia's scope 1 emissions in the 2018-2019 reporting year (164,349,333 tCO_2-e) (**Figure 18-3**) (Clean Energy Council, 2018). Of this 48.8 per cent, approximately 63.7 per cent is from black coal fuel sources, 25.2 per cent is from brown coal and 9.9 per cent is from gas. Less than 1 per cent of reported scope 1 emissions were from solar fuel sources (Clean Energy Council, 2018).

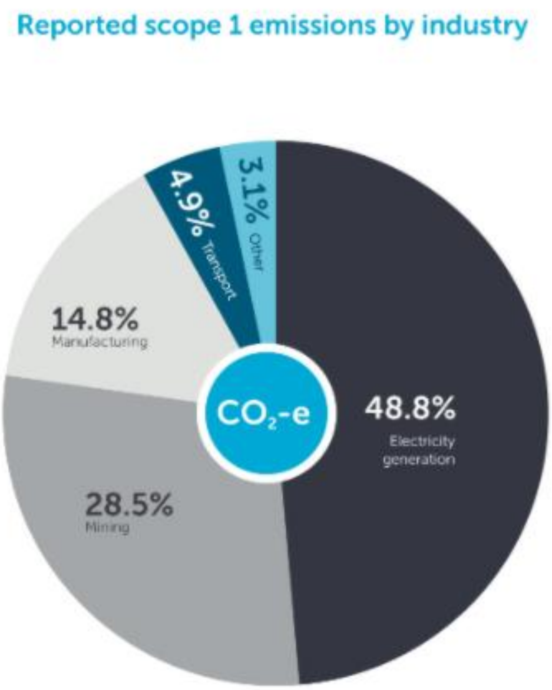


Figure 18-3: Reported scope 1 emissions by industry in Australia

Figure 18-4 shows the total reported scope 1 and 2 greenhouse gas emissions and average emissions intensities for major fuel types in 2018-19 (Clean Energy Council, 2018). The largest contributors to scope 1 and 2 greenhouse gas emissions in the 2018-19 reporting period were black coal fuel sources (total emissions 104,992,801 tCO_2-e) and brown coal fuel sources (total emissions 41,829,841 tCO_2-e). Solar fuel sources contributed only 3,300 tCO_2-e of scope 1 emissions and 6,938 tCO_2-e of scope 2 emissions in the reporting period (total emissions 10,238 tCO_2-e).

The average emissions intensity calculated for solar fuel sources is significantly lower (around 0.05 tCO_2-e per MWh) in comparison to conventional fuel sources such as black coal (around 0.89 tCO_2-e per MWh), (brown coal around 1.20 tCO_2-e per MWh) and gas (around 0.65 tCO_2-e per MWh).

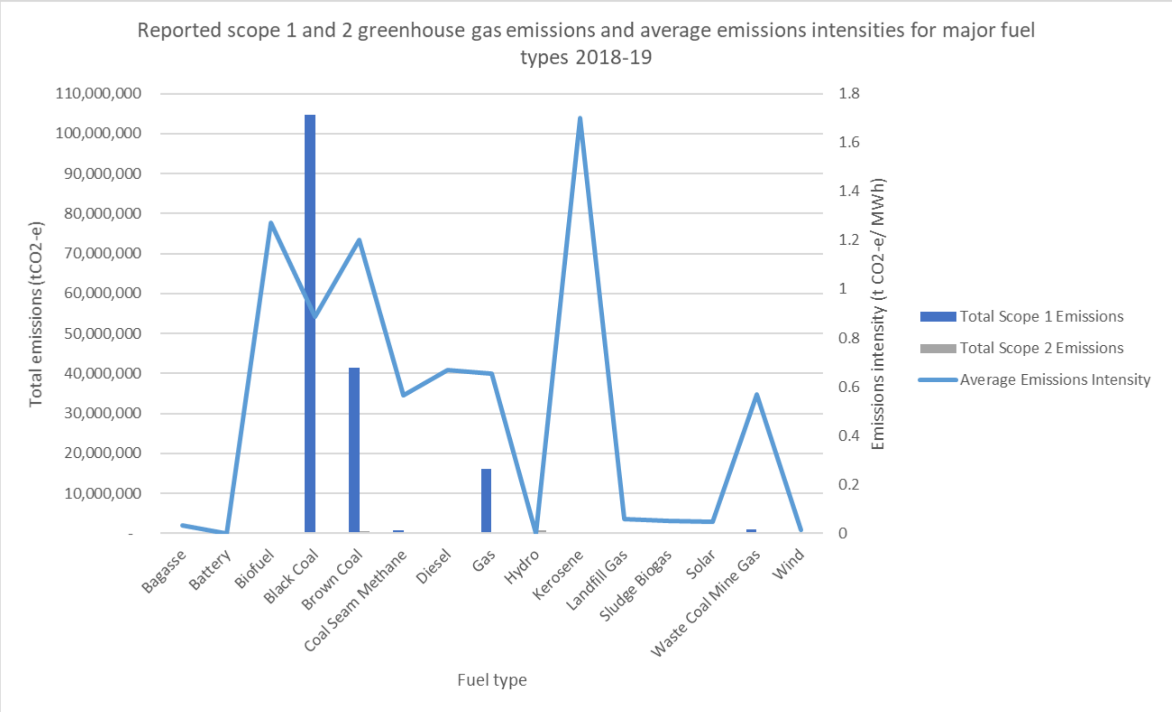


Figure 18-4: Reported scope 1 and 2 greenhouse gas emissions and average emissions intensities for major fuel types 2018-19

Lifecycle greenhouse gas emissions and solar projects

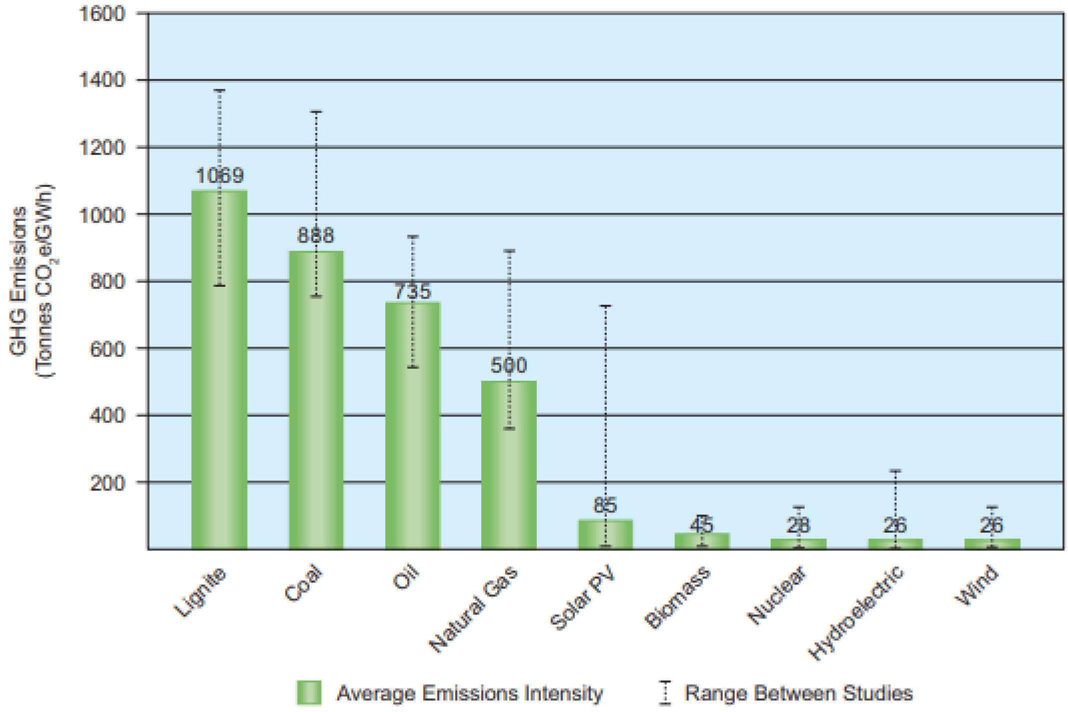
Both fossil-fuel and non-fossil-fuel power technologies generate greenhouse gas emissions over their lifecycle due to their energy requirements for:

- upstream processes – raw material extraction, material production, material transportation to site, and installation and construction
- operational processes – power generation and operational maintenance
- downstream processes – decommissioning and disposal.

The greenhouse gas emissions produced over a project's lifecycle are categorised into three different scopes:

- Scope 1 emissions – all direct emissions from an activity
- Scope 2 emissions – indirect emissions from electricity purchase and use
- Scope 3 emissions – all other indirect emissions not included in scope 2 due to upstream or downstream activities.

Lifecycle GHG emissions associated with solar energy projects are significantly lower on average than other conventional electricity generation methods such as lignite (brown coal), coal (black coal), oil and gas (refer to **Figure 18-5**). Solar projects release the majority of their emissions during construction and decommissioning, whereas in comparison, coal fired power plants release the majority of their emissions during operation (World Nuclear Association, 2011).



***Source**:* (World Nuclear Association, 2011)

Figure 18-5: Lifecycle greenhouse gas emissions intensities for electricity generation methods

18.2.3 Assessment of potential impacts

Upstream greenhouse gas emissions would be generated during the construction phase of the project including:

- embodied scope 3 emissions in the extraction and production of construction materials such as cement, steel and photovoltaic panels
- combustion of fuel in construction plant, equipment and vehicles resulting in the release of scope 1 emissions
- emissions from vegetation clearance or construction waste resulting in the release of scope 1 emissions
- electricity consumption for equipment and machinery resulting in the release of scope 2 emissions
- scope 2 emissions from general electricity consumption in construction compounds, administration buildings and for lighting.

Electricity production using photovoltaics emits no pollution, produces no greenhouse gases, and uses no finite fossil-fuel resources (World Nuclear Association, 2011). However, there will be minor scope 2 emissions generated by the use of electricity used at in the administration building for domestic purposes (e.g. lighting, computer use, kitchen appliances, security equipment). Therefore, greenhouse gas emissions during the operation phase will be minimal. During operations, the project would produce minimal greenhouse gas emissions when compared to conventional coal and gas fired powered stations based on the reported average greenhouse gas emissions under the NGER scheme in 2018-19 (refer to **Figure 18-4**).

Decommissioning activities would result in scope 1 emissions from the combustion of fuels and electricity consumption in plant, equipment and vehicles used to disassemble, remove and dispose of infrastructure.

Based on the average lifecycle emissions for solar photovoltaic projects (85 tCO_2e/GWh) (World Nuclear Association, 2011) (refer to **Figure 18-5**) the project would generate approximately 255 kilotonnes over its lifecycle. This is 814 kilotonnes less than the average lifecycle emissions from conventional brown coal projects and 633 kilotonnes less than the average lifecycle emissions from black coal projects. This approximation does not take into consideration the specific project activities and components and does not consider the advancement of solar panel technology since the publication of the source study in 2011. It does however provide a general comparison of the lifecycle greenhouse gas emissions released from conventional brown and black coal facilities to the project.

18.2.4 Environmental management and mitigation measures

The climate change and greenhouse gas impacts from the project are considered to be positive in comparison to other conventional fuel sources. For this reason, no environmental management and mitigation measures are proposed.

19. CUMULATIVE IMPACTS

This chapter presents an assessment of the potential cumulative impacts as a result of the project. This chapter has been prepared to address specific SEARs relating to cumulative impacts as presented in ***Section 1.5****.*

19.1 Assessment methodology

Adverse cumulative impacts occur when the infrastructure or activities at the study area exacerbate the impacts of other infrastructure or activities occurring nearby. Cumulative impacts can occur concurrently or sequentially.

Nearby projects with the potential to result in cumulative impacts with or as a result of the project were identified using the following sources:

- DPIE Major Projects website
- Google Maps
- Mid-Western Regional Council development application register
- Transport for NSW current projects register (relative to transport routes).

Projects were selected based on the following screening criteria:

- location – proximity to areas and activities assessed as part of each staged assessment.
- timeframe – whether the project occurs in the recent past or present or foreseeable future.
- scale – potential impacts of a scale that could cause cumulative impacts with each staged assessment.
- status – the stage of the project at the time of each staged assessment (including forecast timeframes for construction and operation). Stages includes approved projects, proposed projects and local strategic plans.

19.2 Existing environment

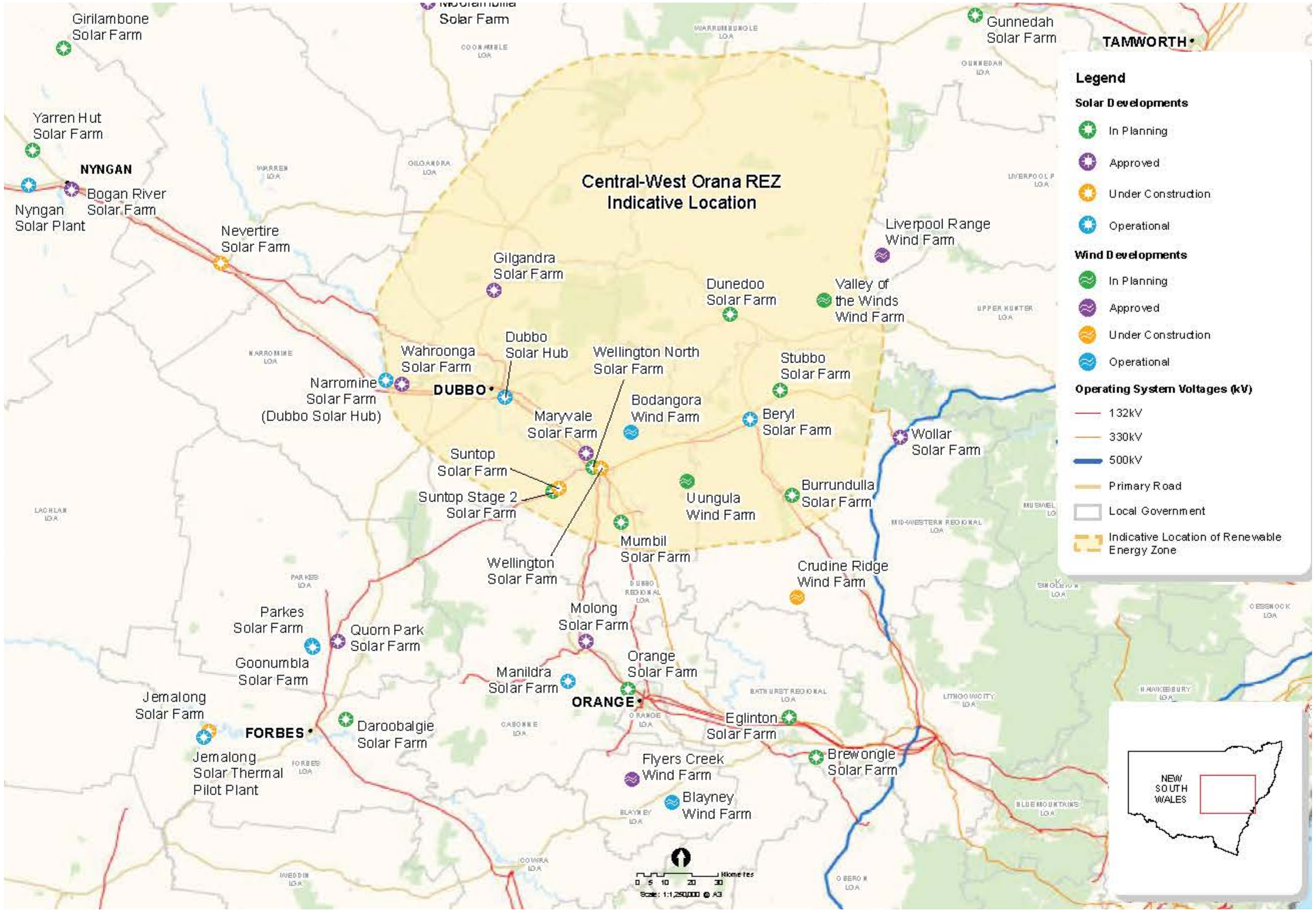
A summary of both planned and existing projects within the immediate region with the potential for cumulative impacts with the project is provided in **Table 19-1** with locations shown on **Figure 19-1**.

Table 19-1: Planned and existing projects within the immediate region

Project	Status	Proximity and location	Key project details
Beryl Solar Power Plant[1]	Operational	14 km south-west of study area	• Commenced operations in June 2019 • Capacity of up to 95 MW • 30-year operational project life • Development footprint of 225 ha • Peak workforce of approximately 150 jobs
Wollar Solar Farm[2]	Proposed	34 km south-east of study area	• Construction scheduled to commence in mid-late 2020 (approximate 22-month construction period) • Capacity of up to 290 MW • 30-year operational project life • Peak workforce of approximately 300 jobs

Project	Status	Proximity and location	Key project details
Dunedoo Solar Farm[3]	Proposed	30 km north-west of study area	• Construction scheduled to commence 2021 (12-month program) • Capacity of up to 66 MW • 30-year operational project life • Development footprint of 95 ha • Peak workforce of approximately 100 jobs
Valley of the Winds Wind Farm[4]	Proposed	20 km north of study area	• Construction scheduled to commence in early 2023 (approximate 24 to 42-month construction period) • Proposed 175 wind turbines • Capacity of up to 800 MW • Access to the site via Beryl Road from the Castlereagh Highway • Peak workforce of approximately 400 jobs
Ulan Mine[5]	Operational	10 km east of study area	• Open cut and underground mine • Mine life approved to 2033 • Production of up to 20 Mt of run-of-mine coal per annum • Peak workforce of 931 persons
Moolarben Mine[6]	Operational	14 km east of study area	• Open cut and underground mine • Mine life approved to 2038 • Production of up to 16 Mt of run-of-mine coal per annum • Peak workforce of 740 persons
Wilpinjong Mine[7]	Operational	24 km south-east of study area	• Open cut mine comprising seven mining areas • Production of up to 16 Mt of run-of-mine coal per annum • Mine life approved to 2033 • Peak workforce of 625 persons
Bowdens Silver Project[8]	Proposed	46 km south-east of study area	• Open cut silver, zinc and lead mine • Extraction of up to 29.9 Mt of run-of-mine ore per annum • Mine life of 23 years
Liverpool Range Wind Farm[9]	Approved (not yet constructed)	44 km north-east of study area	• Proposed 282 wind turbines • Capacity of up to 1000 MW • Peak workforce of approximately 800 jobs
Boral Quarries Beryl	Operational	15 km south-west of study area	• Construction material mining

Sources: [1] (Ngh Environmental; First Solar, April 2017); [2] (Wollar Solar Development Pty Ltd, 2019); [3] (Ngh Environmental; ib vogt, March 2020); [4] (Ramboll, May 2020) [5] (Glencore, March 2020); [6] (Yancoal, April 2020); [7] (Peabody Energy, 2016); [8] (R.W. Corkery & CO. Pty. Limited, June 2020); [9] (Epuron, May 2017)



***Source**:* (Department of Planning, Industry and Environment , 2020)

Figure 19-1: Planned and existing projects within the region

19.3 Assessment of potential impacts

Cumulative impacts may relate to:

- changes to land use
- traffic volumes and movements
- noise and vibration emissions
- air emissions including dust and vehicle emissions
- changes to the landscape character and visual amenity
- social impacts including workforce accommodation and availability
- resource use and availability including construction materials and labour force availability.

There may be cumulative impacts from the concurrent construction of the project and the Wollar Solar Farm and Dunedoo Solar Farm developments due to the size of the construction workforce and subsequent demand for short-term accommodation, local infrastructure and services and associated vehicle movements on the regional road network. These impacts would be dependent on the final timing and duration of construction activities associated with the two proposed developments and the project.

The construction access routes for Wollar Solar Farm that overlap with the project include Ulan Road, Golden Highway and Cope Road. Site access for Dunedoo Solar Farm (obtained from the Scoping Report (NGH, 2020) is via the Castlereagh Highway. The cumulative impact of the project when considering surrounding developments is anticipated to be negligible due to the low traffic volumes. In addition, the MRV/HRV and AV/B-double types of vehicles generated by the Wollar Solar Farm will avoid peak hours for delivery.

Cumulative impacts with neighbouring mining operations may include the generation of dust or noise emissions during construction activities and additional traffic impacts on the regional road network. These impacts are anticipated to be minimal due to the distance between the operations and the project.

No cumulative visual impacts with the existing Beryl solar farm and proposed Dunedoo and Wollar solar farms would occur as a result of the project as there are no opportunities to view any of these solar farms simultaneously with the project. Additionally, due to the relatively isolated location, the project is set back from major travel routes which prevents any opportunities to view solar farms in succession along travel routes.

Once the project has reached the end of its operational life, all project infrastructure would be decommissioned and removed, with the exception of underground cabling deeper than 1000 millimetres, which would remain in-situ following decommissioning. The land within the study area would then be returned to its pre-existing land use, suitable for grazing of sheep and/or cattle, or another land use as agreed by the project owner and the landholder at that time. As a result, cumulative impacts to agricultural land capability are not anticipated following decommissioning of the project.

19.4 Environmental management and mitigation measures

Proposed measures to manage and/or mitigate cumulative impacts from the project are detailed in **Table 19-2**.

Table 19-2: Management and mitigation measures – cumulative

ID	Management/mitigation measure	Timing
CU1	Develop and implement a community and stakeholder engagement plan that includes ongoing consultation with neighbouring operations to manage and cumulative impacts	Construction / operations

20. ENVIRONMENTAL MANAGEMENT AND MITIGATION MEASURES

This chapter presents a summary of the proposed environmental management measures that will be implemented throughout the life of the project.

20.1 Environmental management strategy

UPC\AC and its contractors will manage its environmental responsibilities and environmental performance through the implementation of an environmental management strategy and will ensure the commitments made in this EIS as well as any conditions of approval or legal requirements are fulfilled. The management of environmental impact during construction and operation will be documented in the CEMP and the OEMP, which form part of the environmental management strategy.

The environmental management measures set out in **Table 20-1** will be monitored during construction and operation of the project to confirm their effectiveness, and whether any additional measures are required.

The CEMP provides the system to manage and control the environmental aspects of the project during pre-construction and construction. It also provides the overall framework for the system and procedures to ensure environmental impact is minimised and legislative requirements are fulfilled. This includes the preparation of environmental sub-plans, which detail how environmental issues are managed through construction.

The OEMP documents the management and control of environmental aspects during the operating lifecycle of the project. The iterative design and environmental assessment process allow impacts on the environment to be avoided or minimised where possible. Where environmental controls are incorporated as part of the design development, there will be a program of monitoring and review to ensure the controls comply with stated objectives.

20.2 Construction and operation environmental management plans

The CEMP and OEMP will provide a structured approach to the management of environmental issues identified in this EIS during construction and operation of the project. Implementing the CEMP and OEMP will effectively ensure that the project meets regulatory and policy requirements in a systematic manner and continually improves its performance. The strategies defined in the CEMP and OEMP will be developed with consideration of the project approval requirements, and mitigation measures presented in this EIS. The management plans:

- assign responsibilities for planning, implementing, maintaining and monitoring environmental controls including the responsibilities of sub-contractors
- provide specific mitigation measures and controls that can be applied to avoid or minimise negative environmental impact
- provide specific mechanisms for compliance with applicable policies, approvals, licences, permits, consultation agreements and legislation
- state objectives and targets for issues that are important to the environmental performance of the project
- outline monitoring regimes to check the adequacy of controls as they are implemented during construction and operation. This includes monitoring to validate the impact predicted for the project, to measure the effectiveness of environmental controls and implementation of the CEMP and OEMP, and to address approval requirements. Where

non-conformances are detected further analysis will be carried out, identifying and implementing corrective actions to rectify and notify the non-conformance as required
- include the requirements of regular inspections to evaluate the effectiveness of controls and compliance with CEMP, OEMP and sub-plans. Any maintenance or deficiencies in controls will be recorded and provided to the contractor for corrective action
- provide details of communications within the project team and with government authorities and the community. This includes the requirement to prepare and implement a community communications strategy and a complaints and enquiries procedure
- include copies of approvals, licenses and permits
- include the provision of environmental sub-plans which detail how construction and operation activities will be managed to avoid or minimise impact including the type, location and timing of environmental controls.
- provide an emergency response procedure for mitigating environmental damage and procedures for planning restoration activities
- provide details of training and awareness programs for personnel working on the project. This includes a compulsory site induction that outlines the requirements of the CEMP and legislative requirements, regular toolbox talks on specific environmental issues, and daily pre-start meetings during construction
- provide for an environmental auditing program to verify compliance with the CEMP, OEMP and sub-plans, conditions of approval, relevant legislation.
- provide a mechanism for regular evaluation of environmental performance and continual improvement.

20.2.1 Construction Environmental Management Plan and Operational Environmental Management Plan sub-plans

Environmental management sub-plans support the CEMP and the OEMP. These documents will be prepared to identify requirements and processes applicable to specific impacts described in the EIS. They will address requirements of conditions of approval and other measures identified in the EIS to the satisfaction of the Secretary. The construction related sub-plans that will be prepared for the project are outlined in **Table 20-1** and include:

- biodiversity management plan
- traffic management plan
- cultural heritage management plan (including Aboriginal and non-Aboriginal heritage)
- soil and water management plan including:
  - erosion and sediment control plan
  - flood response plan.
- noise and vibration management plan
- air quality management plan
- waste and resource management plan.

20.2.2 Non-conformance and corrective action

If a non-conformance is identified, a corrective/preventative action (or actions) will be implemented. In addition, environmental management improvement opportunities can be initiated as a result of incidents or emergencies, monitoring and measurement, audit findings or other reviews. Improvement opportunities may also result in the implementation of corrective/preventative actions.

Corrective/preventative actions and improvement opportunities will be entered into the contractor's quality system database and include detail of the issue, action required and timing and responsibilities. The records will be updated with date of close out and any necessary notes. The database will be reviewed regularly to ensure actions are closed out as required.

Non-conforming activities may be stopped, if necessary, by personnel outlined in the CEMP. The work will not start until a corrective/preventative action was closed out.

Procedures for rectifying and where required, notifying any non-compliance identified during environmental auditing, review of compliance or incident management are also documented in a compliance tracking program. A compliance tracking program will be established to track compliance against the following for pre-construction and construction phases of the project:

- conditions of approval
- management measures identified in the EIS and submissions report
- legislative requirements
- licensing conditions
- contract specifications relating to environmental matters.

20.3 Decommissioning and rehabilitation management plan

Near completion of operation of the project, a decommissioning and rehabilitation plan will be prepared that outlines the rehabilitation objectives and strategies to return the study area to its pre-existing condition for agricultural land use. This will include:

- rehabilitation objectives and strategies
- describing the design criteria of the final land use and landform
- performance indicators to be used to guide the return of the land back to a condition suitable for agricultural production (i.e. sheep and cattle grazing)
- expected timeline for the rehabilitation program.

20.4 Summary of management measures

A summary of the environmental management measures that will be implemented during the construction and operation of the project is presented in **Table 20-1**.

Table 20-1: Summary of management and mitigation measures

ID	Management/mitigation measure	Timing
	Biodiversity	
B1	Clearing protocols will be developed that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance (e.g. removal of native vegetation by chainsaw instead of heavy machinery where only partial clearing is proposed). Fencing (or other barriers as required) and signage will be placed around those areas of vegetation to be maintained to prevent any accidental construction damage and provide a permanent barrier between the development footprint and retained areas. The type of fencing during construction may be of a temporary nature and scale that is robust enough to withstand damage during this stage of work. Use of appropriate machinery for vegetation removal adjacent to retained areas.	Prior to construction / construction
B2	Pre-clearance surveys will be undertaken prior to tree clearing. Active breeding or nesting identified during pre-clearance surveys will be avoided in August, September and October which is the breeding/nesting period for most fauna species. A qualified ecologist/licenced wildlife handler will supervise tree removal in accordance with best practise methods.	Prior to construction / construction
B3	A procedure will be developed for the relocation of habitat features (e.g. fallen timber, hollow logs) to adjacent retained habitat.	Prior to construction
B4	Monitoring will be undertaken within the environmental exclusion zones to ensure biodiversity values are not significantly affected by indirect impacts. This may include: • comparison against EIS baseline monitoring • consideration of natural seasonal variation • development of trigger values for the commencement of adaptive management actions • details of proposed adaptive management actions to reduce or eliminate recorded impacts.	Construction / decommissioning
B5	Appropriate controls will be implemented to manage exposed soil surfaces and stockpiles to prevent sediment discharge into waterways.	Prior to construction / construction

ID	Management/mitigation measure	Timing
	All works within proximity to the drainage lines will have adequate sediment and erosion controls (e.g. sediment barriers, sedimentation ponds). Revegetation will also commence as soon as is practicable to minimise risks of erosion.	
B6	Construction works will only be undertaken during daylight hours and night lights will not be used. Lights associated with operation will be directional to avoid unnecessarily shining light into adjacent retained vegetation where possible.	Construction / operation
B7	Dust suppression measures will be implemented to limit dust onsite. Revegetation will also be commenced as soon as practicable to minimise areas likely to create dust.	Construction
B8	All machinery will be cleaned prior to entering and exiting the study area to minimise the transport of weeds to vegetated areas to be retained. Weeds that are present within the study area that are listed under the *NSW Biosecurity Act 2015* will be managed.	Construction
B9	All personnel working on the project will undertake an environmental induction as part of their site familiarisation. This will include: • site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and noxious weeds) • what to do in case of environmental emergency (e.g. chemical spills, fire, injured fauna) • key contacts in the case of an environmental emergency.	Construction
B10	A Traffic Management Plan will be developed which includes speed limits and controls to reduce risk of fauna strike. Any vehicle strike incidents will be recorded.	Construction / operation
B11	A strategy will be developed and implemented to protect vegetation and habitat adjacent to the project. This will outline the following: • rubbish disposal guidance • prohibition of wood collection • prohibition of lighting of fires • no-go-zones for native vegetation outside the development footprint • speed limits on the surrounding road network	Construction
B12	Suitable species will be used as ground cover species in any revegetation areas.	Construction
B13	All waterway crossings will be designed in accordance with *Policy and Guidelines for Fish Friendly Waterway Crossing* (DPI, n.d.) where appropriate.	Detailed design

ID	Management/mitigation measure	Timing
	Aboriginal heritage	
AH1	The proponent will develop the ACHMP which is to be agreed to by the RAPs and DPIE. The ACHMP will also include an unanticipated finds protocol, unanticipated skeletal remains protocol and long-term management of any artefacts.	Prior to construction
AH2	The Aboriginal site (Rosevale IF-01) within the development footprint for the project will be salvaged by a surface collection of visible artefacts. The recommended methodology for the salvage will be finalised after the approvals process has been completed in the ACHMP but will include the measures outlined in Section 9.3.1 of the ACHAR (**Appendix D**). The salvage works will include the mapping, analysis and collection of the surface artefact at the affected site. Results will be included in a brief report to preserve the data in a useable form and an Aboriginal Site Impact Recording Form (ASIRF) will be submitted to AHIMS.	Prior to construction
AH3	All land-disturbing activities will be confined to within the development footprint and associated tracks and/or crossings. Should the parameters of the proposed work extend beyond this, then further archaeological assessment may be required.	Construction
	Historic heritage	
HH1	If items of historic heritage significance are uncovered during the project, then the Unanticipated Finds Protocol for Historic Heritage included in Appendix 5 of the Aboriginal cultural heritage and historic heritage assessment (**Appendix D**) will be enacted.	Construction
HH2	To avoid the potential for harm to historic objects on unassessed adjacent landforms, all ground surface disturbing activities will be confined to the development footprint.	Construction
HH3	An unanticipated finds protocol for historic heritage will be developed and implemented as required during construction.	Construction
	Soils	
S1	Disturbed areas will be progressively stabilised and rehabilitated as construction is completed to minimise the extent of bare soil.	Construction

ID	Management/mitigation measure	Timing
S2	The following measures will be implemented to manage the risk of contaminants and impacts on surrounding environments: • appropriate storage (including bunding) of all potential contaminants (i.e. chemicals and fuels) onsite to reduce risks of spills contaminating waterways and land • protocol for the discovery of contaminants in the study area during works, including requirements to stop work, remediate and dispose of contaminants as necessary • measures for mitigating soil contamination by fuels or other chemicals (including notification to EPA, emergency response requirements etc) • measures for the ongoing inspection and maintenance of machinery/vehicles to ensure that they remain in a clean condition free of fluid leaks.	Prior to construction / prior to operation
S3	The photovoltaic arrays will be designed to allow for enough space between rows of panels for establishment of groundcover and implementation of weed controls.	Detailed design
	Land use	
LU1	Land management within the study area will include measures to minimise impacts to surrounding agricultural land use with reference to DPI's publication *Infrastructure proposals on rural land* (Kovac, M and Briggs, G, 2013). These measures will also be implemented during operation of the project and will include strategies to minimise impacts of aerial spraying. The land management measures will aim to minimise impacts on: • land and soil capability within the development footprint • biosecurity both at a local and regional level • soil erosion • surface water runoff • agricultural activities on neighbouring properties.	At all times
LU2	Biosecurity management will include: • measures to manage the impacts of weeds, disease and pest animals during construction, operation, and decommissioning activities • biosecurity response measures where impacts are identified • contingency measures in the event that existing measures are inadequate in managing the risk/impact.	At all times

ID	Management/mitigation measure	Timing
LU3	Consultation will be undertaken with Mid-Western Regional Council, DPIE and other relevant stakeholders including mining and exploration licence holders, and native title claimants in order to identify potential impacts on surrounding land uses and develop measures to address concerns.	Detailed design / prior to construction
LU4	Consultation will continue to be undertaken with participating landholders to minimise disruption to agricultural activities during construction and operation.	Detailed design / prior to construction
LU5	Options will be further investigated to consider the feasibility of grazing within the study area throughout operation, in consultation with landholders.	Detailed design / prior to operation
LU6	A decommissioning and rehabilitation plan will be prepared that outlines the rehabilitation objectives and strategies to return the study area to its pre-existing condition for agricultural land use. This will include but not be limited to: • rehabilitation objectives and strategies • describing the design criteria of the final land use and landform • performance indicators to be used to guide the return of the land back to agricultural production • expected timeline for the rehabilitation program.	Prior to decommissioning
	Landscape character and visual	
LCV1	The design will retain the existing roadside planting where possible along the eastern boundary of the site to reduce the overall visual impact.	Detailed design
LCV2	Consideration will be given to the colours of the PCUs, the battery facility, O&M buildings and storage shed to ensure minimal contrast and to help blend into the surrounding landscape to the extent practicable.	Detailed design
LCV3	Existing vegetation within the environmental exclusion zones will be retained and protected to maintain the existing level of screening.	Construction / operation
	Noise and vibration	
NV1	Construction noise and vibration management measures will be implemented consistent with recommendations contained within the ICNG.	Construction

ID	Management/mitigation measure	Timing
	Traffic and Transport	
T1	UPC\AC will continue to consult with Mid-Western Regional Council to agree the appropriate treatment or upgrade requirements for the safe use of Blue Springs Road during construction and the process for undertaking any treatment or upgrade works in accordance with Development Consent conditions	Prior to construction

T2	A construction traffic management plan will be prepared in consultation with TfNSW and Mid-Western Regional Council. The plan will include:
	• details of the transport route to be used for all project-related traffic
	• details of any road upgrade works required by Development Consent
	• a protocol for undertaking independent dilapidation surveys to assess the existing condition of the proposed construction routes prior to construction, upgrading or decommissioning activities and the condition of the proposed construction routes following construction, upgrading or decommissioning activities
	• a protocol for the repair of the construction routes if dilapidation surveys identify these roads to be damaged during construction, upgrading or decommissioning works
	• details of the measures that will be implemented to minimise traffic impacts during construction, upgrading or decommissioning works, including:
	    • Temporary traffic controls, including detours and signage
	    • Notifying the local community about project-related traffic impacts
	    • Procedures for receiving and addressing complaints from the community about project-related traffic
	    • Minimising potential for conflict with school buses, other road users during peak hours and rail services as far as practicable (measures also required during operation of the project)
	    • Minimising dirt tracked onto the public road network from project-related traffic
	    • Scheduling of haulage vehicle movements to minimise convoy length or platoons
	    • Responding to local climate conditions that may affect road safety such as fog, dust and wet weather
	    • Responding to any emergency repair or maintenance requirements
	    • A traffic management system for managing over-dimensional vehicle trips to and from the project
	• a program to ensure drivers associated with the project receive suitable training on the Driver Code of Conduct and any other relevant obligations under the CTMP
		Prior to construction

ID	Management/mitigation measure	Timing
	• a flood response plan detailing procedures and options for safe access to and from the site in the event of flooding • controls for transport and use of dangerous goods in accordance with State Environmental Planning Policy No. 33 – Hazardous and Offensive Development, Australian Dangerous Goods Code and Australian Standard 4452 Storage and Handling of Toxic Substances.	
T3	The safe sight distance analysis undertaken at the Cope Road / Blue Springs Road intersection and at the proposed site access points from Blue Springs Road and Barneys Reef Road, will be ground-truthed to determine if vegetation trimming or speed limit reductions need to be applied to provide the required safe sight distance for all vehicle types expected to access the project.	Prior to construction
T4	Parking requirements for the project construction and operation workforce will be provide onsite and parking will not be provided on public roads adjacent to the site.	Prior to construction
T1	UPC\AC will continue to consult with Mid-Western Regional Council to agree the appropriate treatment or upgrade requirements for the safe use of Blue Springs Road during construction and the process for undertaking any treatment or upgrade works in accordance with Development Consent conditions	Prior to construction
	Water	
W1	Infrastructure with the potential to cause pollution to waterways in the event of flooding, such as inverters and battery storage will be located with a minimum 300 mm freeboard above the maximum 1% AEP flood level.	Detailed design
W2	Solar panels will be designed to provide a minimum of 300 mm freeboard for the lowest edge above the maximum 1% AEP flood level.	Detailed design
W3	The panel structure will be designed to withstand the flood velocities expected at the site.	Detailed design
W4	No infrastructure will be placed within 20 m of any Strahler 3 or above order streams.	Detailed design
W5	All waterway crossings will be designed and constructed in compliance with the Department of Primary Industries, Office of Water, Guidelines for riparian corridors on waterfront land and Guidelines for watercourse crossings on waterfront land.	Detailed design

ID	Management/mitigation measure	Timing
W6	Further flood investigations and hydrological and hydraulic modelling will be carried out where required during detailed design to ensure the flood immunity objectives and design criteria for the project are met. The modelling will be used to define the nature of both main stream flooding and major overland flow across the development footprint under pre- and post- project conditions and to define the full extent of any impact that the project will have on patterns of both main stream flooding and major overland flow.	Detailed design

W7	A construction soil and water management plan (CSWMP) will be prepared to outline measures to manage soil and water impacts associated with the construction works, including contaminated land. The CSWMP will provide:
	• measures to minimise/manage erosion and sediment transport both within the construction footprint and offsite including requirements for the preparation of erosion and sediment control plans (ESCP) for all progressive stages of construction Measures to manage waste including the classification and handling of spoil
	• procedures to manage unexpected contaminated finds
	• measures to manage stockpiles including locations, separation of waste types, sediment controls and stabilisation
	• measures to manage accidental spills including the requirement to maintain materials such as spill kits
	• controls for receiving waterways which may include:
	  ○ Designation of 'no go' zones for construction plant and equipment
	  ○ Creation of catch/diversion drains and sediment fences at the downstream boundary of construction activities where practicable to ensure containment of sediment-laden runoff
	• erosion and sediment control measures will be implemented and maintained at all work sites in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water 2008b), commonly referred to as the "Blue Book".
		Prior to construction

W8	The use of any farms dams during construction will be agreed with the landholder and the estimated maximum harvestable right dam capacity will not be exceeded.	Construction

ID	Management/mitigation measure	Timing
	Hazards and risks	
H1	A Construction Bushfire Management Plan (BMP) will be prepared in consultation with the Rural Fire Service, and to the satisfaction of the Secretary. The BMP will include the management and mitigation measures described in **Section 15.3.3**.	Prior to construction
H2	An Operation BMP will be prepared in consultation with the Rural Fire Service, and to the satisfaction of the Secretary. The BMP will include the management and mitigation measures described in **Section 15.3.3**.	Prior to operation
H3	A Bush Fire Emergency Management and Evacuation Plan will be prepared consistent with *'Development Planning A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan* (NSW RFS, 2014) and Australian Standard *AS3745 2010 'Planning for Emergencies in Facilities'*. A copy of the plan will be displayed and available for review in a prominent location directly adjacent to the site's main entry point/s	Prior to construction / prior to operation
H4	The operator will contact Mid-Western Local Emergency Management Committee (LEMC) to discuss how the site will be considered under the Mid-Western Local Disaster Plan (DISPLAN).	Prior to operation
	Socio-economic	
SIA1	An Accommodation and Employment Strategy will be developed and implemented for the project in consultation with Mid-Western Regional Council. This strategy will: • propose measures to manage workforce accommodation to minimise the effects of non-local hires during construction on short-term accommodation availability and the local housing market • include a code of conduct for the projects workforce, particularly to avoid anti-social behaviour at peak construction and align with Mid-Western Regional Council's existing industry agreements • to the extent possible and within UPC's control, consider the cumulative impacts associated with other State significant development projects in the area, including nearby mines • investigate options for prioritising the employment of local workers for the construction and operation of the project, where feasible • include a program to report measures undertaken or implemented in line with the strategy include a program to monitor and review the effectiveness of the strategy over the life of the project, including regular monitoring and review during construction.	Prior to construction

ID	Management/mitigation measure	Timing
SAI2	A community benefit share fund will be developed. Funding need will be identified and prioritised based on potential project impacts and in collaboration with Mid-Western Regional Council, the community, and the NSW Government. Opportunities may include sponsorship, grant assistance, strategic community partnerships or co-ownership schemes.	Prior to construction
SIA3	Investigation will be undertaken into the value of investment in local tertiary training institutions to address skills shortages where identified during the development of the Accommodation and Employment Strategy. Where value is identified and a strategy is defined, investment will be targeted through the community benefit share fund.	Prior to construction
SIA4	During development of the Accommodation and Employment Strategy, further consultation with local short-term accommodation providers will be undertaken to identify and where appropriate secure, accommodation for the non-local portion of the construction workforce.	Prior to construction
SIA5	During development of the Accommodation and Employment Strategy, further consultation with local employment service providers will be undertaken to identify and where appropriate secure, local hires.	Prior to construction
	Waste and resources	
WR1	A construction waste management plan will be prepared in consultation with Council. The waste management plan will include: • details of the quantities of each waste type and the proposed reuse, recycling and disposal locations • details on measures to reduce the types and volumes of waste • measures to maximise reuse and recycling	Prior to construction
WR2	All waste generated from the project will be assessed, classified and managed in accordance with the *Waste Classification Guidelines* (EPA, 2014)	At all times
WR3	Wastes will be disposed of at suitable facilities permitted to accept the waste	At all times
WR4	Management of wastes will follow the resource management hierarchy principles in accordance with the WARR Act (i.e. avoid > reduce > reuse > recycle > recover > disposal)	At all times
WR5	Skip bins will be made available onsite to enable waste separation for recycling (e.g. separate skip bins for cardboard recycling, plastics and timber collection)	Construction / operation

ID	Management/mitigation measure	Timing
WR6	General waste bins will be provided for disposal of materials that cannot be cost-effectively recycled	Construction / operation
WR7	The site septic system will be installed and operated in accordance with Council regulations	Construction / operation
WR8	All trucks transporting waste from the site will have covered loads to prevent spillage and other nuisances	Construction / operation
WR9	All materials will be removed from the site following decommissioning and the site will be left waste-free	Decommissioning
	Air quality	
AQ1	Protocols to minimise air quality impacts will be included in the CEMP	Prior to construction
AQ2	Water trucks will be used for dust suppression along internal, unsealed access roads and disturbed areas when required (i.e. if visible dust emissions are observed).	At all times
AQ3	The traffic management plan will include optimisation of vehicle movements onsite reducing wheel generated dust.	At all times
AQ4	Dust suppression measures will take into consideration weather, extended dry periods and Mid-Western Regional Council water restriction levels.	At all times
	Cumulative	
CU1	Develop and implement a community and stakeholder engagement plan that includes ongoing consultation with neighbouring operations to manage any cumulative impacts	Construction / operations

21. PROJECT JUSTIFICATION AND CONCLUSION

21.1 Project justification

The project would result in a number of benefits including:

- support and contribution to Commonwealth and State climate change commitments such as the Paris Agreement, RET Scheme, 2020 ISP, NSW *Net Zero Plan Stage 1: 2020-2030*, and NSW *Renewable Energy Action Plan 2013*
- supplying approximately 400 megawatts (0.4 gigawatts) to the NEM and contributing towards the targeted 3,000 megawatts for the CWO REZ as identified in the NES
- enhance reliability and security of electricity supply
- contribute to capacity gaps in the electricity market following the closure of major coal-fired power generators within the State by 2035 including Vales Power Station, Eraring Power Station, Bayswater Power Station and Mount Piper Power Station
- creation of local job opportunities
- support the diversification of the local economy.

The site, technology, layout and size of the project have been developed in consideration of a several alternatives to ensure the project would result in maximum benefits for the locality and region in the long term, whilst minimising impacts to the environment. The project is considered to be justified and in the public interest because:

- it is suitably located in a region with ideal climatic and physical conditions for large-scale solar energy generation
- it is within close proximity of existing infrastructure with adequate capacity to receive the energy proposed to be generated
- it is situated adjacent to agricultural land uses that are compatible with large-scale solar energy generation
- it would not result in significant biophysical, social or economic impacts
- it would create employment opportunities and benefits to the local and regional economy.

UPC\AC is committed to the long-term environmental management of the land within the development footprint. At the end of the project's investment and operational life, the development footprint would be returned to its pre-existing agricultural land use or another land use as agreed by the project owner and the landholder at that time.

The consequences of not proceeding with the project would result in:

- loss of opportunity to reduce greenhouse gas emissions and move towards cleaner electricity generation
- loss of a renewable energy supply that would assist in reaching the RET
- loss of additional electricity generation and supply into the NEM
- loss of social and economic benefits created through the provision of direct and indirect employment opportunities during the construction and operation of the project, as well as flow on social and economic benefits.

21.2 Ecologically sustainable development

ESD involves the effective integration of social, economic and environmental considerations in decision-making processes. In NSW, the principals of ESD have been incorporated into legislation including the EP&A Act and the EP&A Regulation. The principles used to define ESD are outlined in the Intergovernmental Agreement on the Environment (1992) and the NSW *Protection of the Environment Administration Act 1991* (NSW). These principles are presented in **Table 21-1** along with a description of how the project and this EIS have considered each principle.

Table 21-1: Principles of ESD and how they have been considered in the project and this EIS

Principle	Considerations
Precautionary Principle	
a) The precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and ii. an assessment of the risk-weighted consequences of various options.	The precautionary principle has been adopted in the assessment of environmental impacts (**Chapter 6** to **Chapter 19**). All potential impacts have been considered and management and mitigation measures have been included where a risk is present. These measures are summarised in **Chapter 20**. As described in **Section 3.4**, UPC\AC has considered a range of options in developing the project to avoid environmental constraints.
Inter-generational Equity Principle	
b) Inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.	The project would contribute to the sustainable transition of electricity generation in NSW to a more reliable, more affordable and cleaner energy future. Once decommissioned, the land within the development footprint can be rehabilitated to its current use if required thereby allowing for either continuation of renewable energy generation or a return to agricultural production, both of which would provide benefits for future generations.
Biodiversity Principle	
c) Conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.	The impacts of the project on biodiversity values has been assessed in the BDAR in **Appendix C** and are summarised in **Chapter 6**. The project has been designed to avoid areas of higher conservation value. This has included selecting the location of the study area with consideration of limiting the amount of intact vegetation to be removed. Additional environmental exclusion zones have been added to reduce impact to areas of greater biodiversity values, along with an expansion of the main environmental

Principle	Considerations
	exclusion zone after completion of the initial biodiversity assessment to further avoid and minimise impacts to environmental values. Management and mitigation measures have been prescribed to minimise and manage residual impacts (refer to **Chapter 20**).
Valuation Principle	
d) Improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as: i. polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, ii. the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, iii. environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.	There is currently no empirical evidence or detailed academic studies in an Australian setting (e.g. quantitative research or economic assessments) that considers whether an increase in large-scale solar photovoltaic developments in an area is associated with a decline or increase in surrounding property values. However, it is generally considered that impacts relating to visual amenity are the more driving concerns of loss of property value for neighbouring residential properties. A visual amenity impact assessment has been undertaken for the project (**Appendix F**) and is summarised in **Chapter 11**. The assessment concluded that project could be undertaken whilst maintaining the core landscape character of the area and would have a minimal visual impact on the surrounding visual landscape. It is therefore unlikely that a decline in neighbouring property values would occur as a result of the project. Pollution risks have been assessed with regards to land and water impacts and would place any cost of remediation solely upon the proponent.

21.3 Objectives of the Environmental Planning and Assessment Act 1979

The relevant objectives of the EP&A Act, under which the project is being assessed are:

> *(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,*
> *(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,*
> *(c) to promote the orderly and economic use and development of land,*
> *(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,*
> *(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),*
> *(g) to promote good design and amenity of the built environment,*
> *(j) to provide increased opportunity for community participation in environmental planning and assessment.*

The objects of the EP&A Act have been considered throughout this environmental assessment including consideration of socio-economic impacts (**Chapter 16**), natural resources and competing land uses (**Chapter 10**), conservation of threatened and other species and their habitats (**Chapter 6**), management of built and cultural heritage (**Chapter 7** and **8**), and amenity impacts (**Chapter 11**). Considerable consultation has also been undertaken with the local community to release community values and incorporate these into the project design (**Chapter 5**).

The project aims to promote the orderly and economic use of the land through the provision of utility services (power generation). The project has been designed and located to avoid native vegetation and sensitive environments (i.e. waterways) as much as possible and minimise the use of natural and artificial resources while considering the social and economic welfare of the local community.

For these reasons it is considered that the project is consistent with the objects of the EP&A Act.

21.4 UPC\AC project commitments

As a signatory to the Clean Energy Council's *Best Practice Charter for Renewable Energy Developments*, UPC\AC has demonstrated their intention to:

- engage respectfully with the communities in which they plan and operate projects;
- be sensitive to environmental and cultural values; and
- make a positive contribution to the regions in which they operate.

Stakeholder engagement on the Stubbo Solar Farm has been comprehensive to date and reflects the importance UPC\AC places on this aspect of its business. UPC\AC will continue to work with all stakeholders as the approval process for the project progresses and detailed design and approval schedule for the project is better defined.

The environmental management strategy will govern the avoidance, minimisation and management of impacts during the construction and ongoing operation of the project and will be set out to ensure the responsibilities and accountabilities for environmental performance are clear.

Throughout community engagement as part of the preparation of the EIS, UPC\AC has also demonstrated their intention to establish a positive, long-term connection with the local community. As part of this, UPC\AC has already committed to develop a community benefit sharing model with local community and stakeholders, including TAFE and local business groups.

21.5 Conclusion

The preferred option assessed in this EIS provides a balance between technological, energy and environmental aspects, while retaining the flexibility required in the final design stage. The environmental assessment undertaken for the project has determined that the project would not result in significant impacts to environmental, cultural, social and economic values and residual impacts can be managed with the mitigation measures summarised in **Chapter 20** in place. Furthermore, the project is consistent with the principles of ESD, and the objectives of the EP&A Act and therefore should be approved under the EP&A Act.

Throughout the project refinement process, UPC\AC has made considerable effort to avoid potential environmental impacts, where possible. In those instances where potential impacts cannot be avoided, UPC's design principles have sought to minimise environmental impacts and/or implement mitigation measures to manage the extent and severity of any residual environmental impacts. During detailed design and prior to the commencement of construction, the placement of infrastructure and extent of construction activities would be further refined to ensure avoidance and minimisation objectives are met.

The project forms an important part of Australia's transition to renewable energy generation and would positively contribute in meeting Commonwealth and State targets. The project would enhance the reliability and security of electricity supply by contributing to the anticipated capacity gaps in the electricity market following the closure of major coal-fired power generators within NSW.

Should the project not proceed, the potential project benefits described within the EIS would not be realised. In addition, it will be more difficult in the short-term for the Commonwealth and NSW Government to achieve their respective renewable energy and greenhouse gas emission reduction targets.

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