Tallawang Solar Farm Project

Transport Impact Assessment

July 2022

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1. Introduction

1.1 Project Background

RES Australia Pty Ltd (RES) is seeking to develop the proposed Tallawang Solar Farm ('the Project') in the Central West region of New South Wales (NSW), approximately 8 km north-west of Gulgong, within the Mid-Western Local Government Area (LGA) and the Central West Orana Renewable Energy Zone (CWO-REZ) – refer to *Figure 1.1* following.

The Project will involve the construction, operation and decommissioning of a 500-megawatt (MW) solar farm with a Battery Energy Storage System (BESS) of approximately 200 MW / 400 MW-hours, a 330 kilovolt (kV) overhead transmission line approximately 13 km long and associated infrastructure, which will connect the Project to the national electricity grid. The Project's conceptual layout is shown in *Figure 1.2* following.

One on-site switchyard and a 330 kV substation is proposed, at two possible locations within the solar farm and BESS development area (refer to the layout shown in *Figure 1.2* following). The final location of the on-site switchyard and substation will be determined during detailed design.

The Project will have one primary access from the Castlereagh Highway at a newly proposed access location via a local un-serviced road locally known as Jacksons Lane – refer to *Figure 1.2* following.

The Project will connect to the grid via the proposed CWO-REZ Transmission Project (including new 500 kV and 330 kV transmission lines, substations and related infrastructure) currently being developed by the NSW Government to support the growth of the CWO-REZ. The CWO-REZ Transmission Project is subject to a separate development application process.

It is anticipated that the grid connection point for the Project will be via a proposed switching station near the proposed Barneys Reef Wind Farm project area, directly north of the Tallawang Solar Farm site. The proposed Barneys Reef Wind Farm is also being developed by RES and subject to a separate development application process. The proposed switching station will support independent connections from both the Tallawang Solar Farm and Barneys Reef Wind Farm projects.

The final alignment of the Project's overhead transmission line is subject to the final placement of the switching station and the grid connection point, however a 60 m wide corridor of approximately 13 km long has been identified by RES to support access to the anticipated connection point. The final placement of the transmission line for the Project will be determined in coordination with the Barneys Reef Wind Farm project.

The Project is a State Significant Development (SSD) under the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) as the capital value is over $30 million. A development application (DA) for the Project is required to be submitted under *Part 4* of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

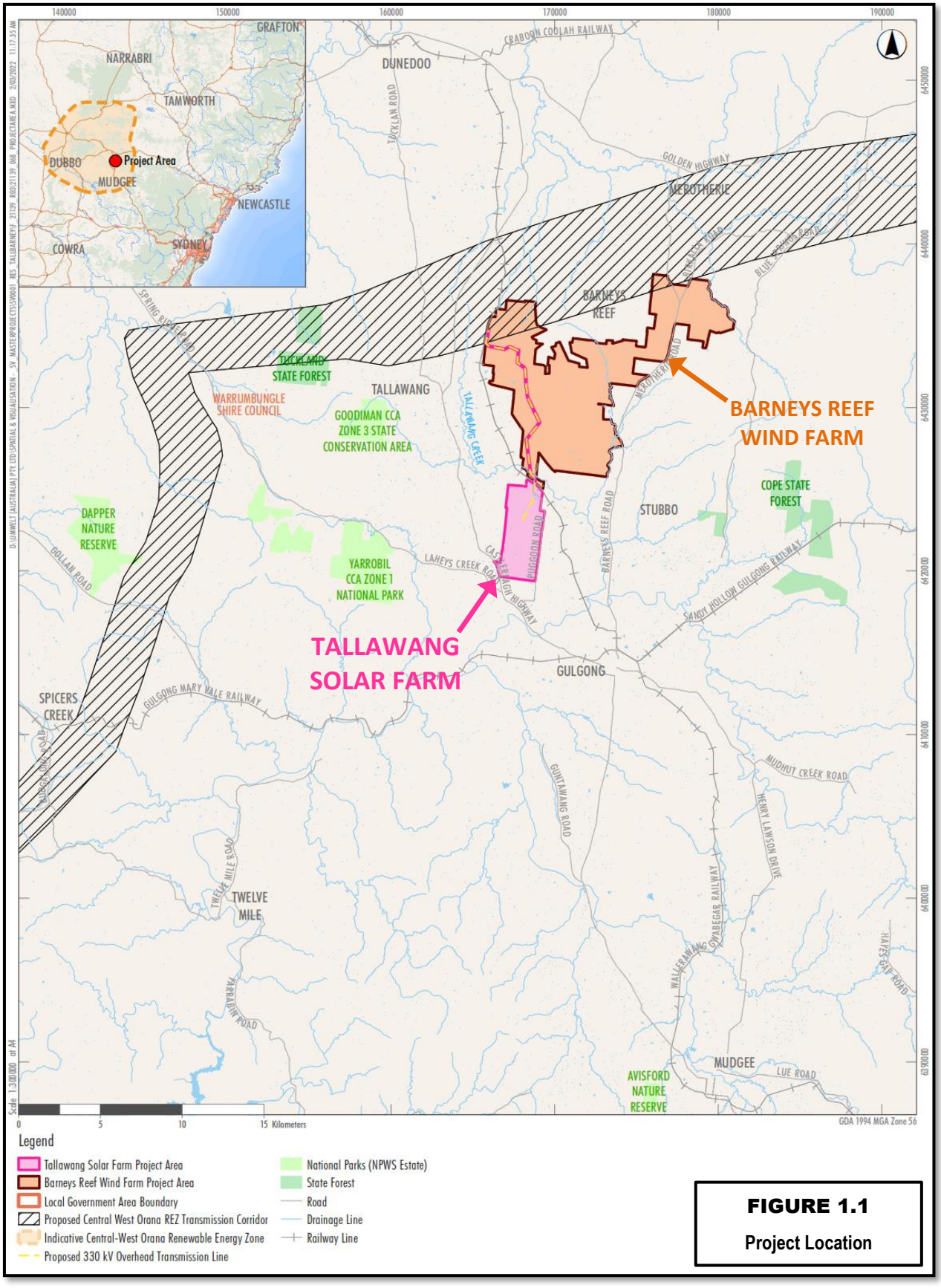
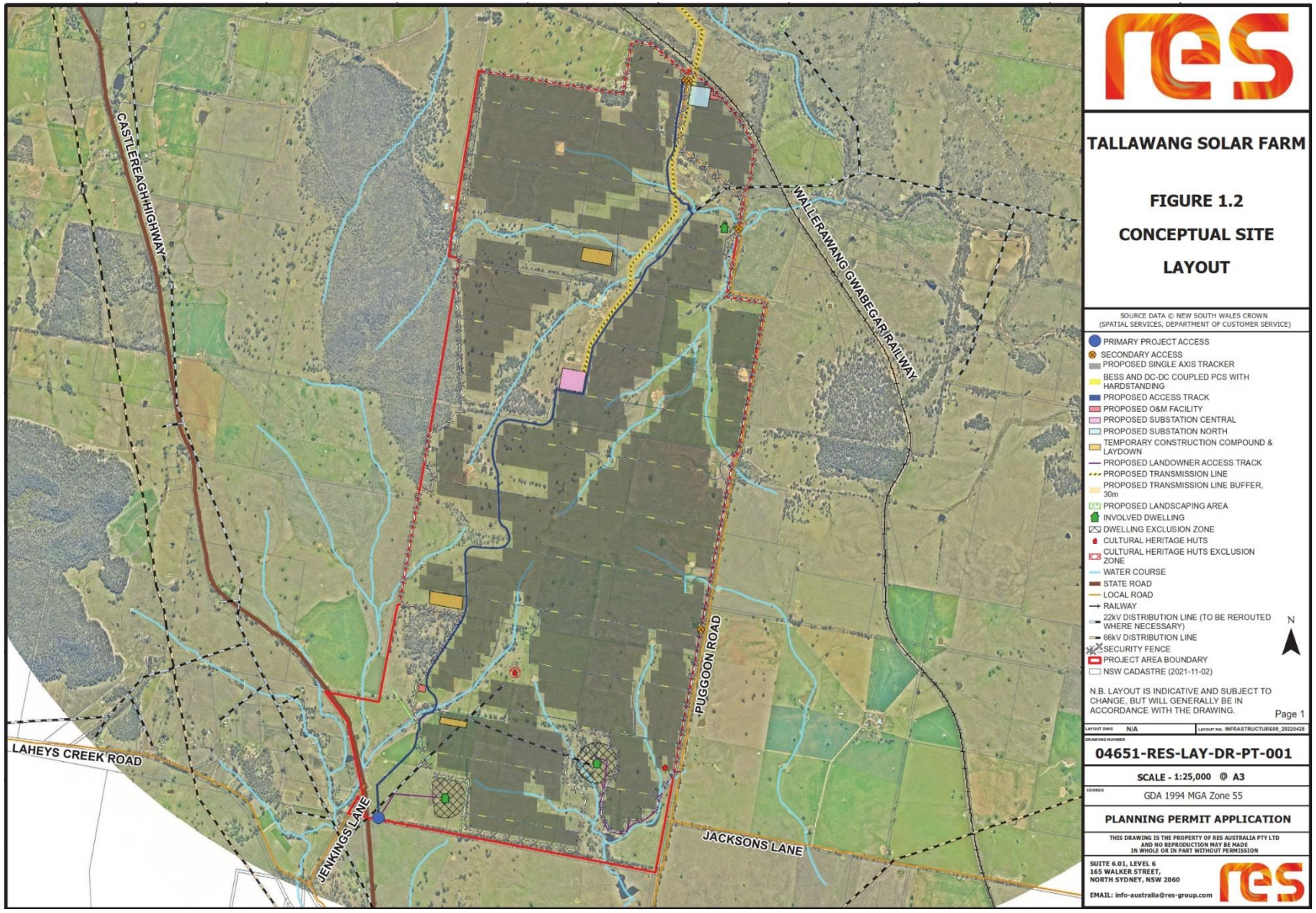


FIGURE 1.1

Project Location


CASTLEREAGH HIGHWAY
WALLERAWANG GWABEGAR RAILWAY
PUGGOON ROAD
LAHEYS CREEK ROAD
JENKINGS LANE
JACKSONS LANE
TALLAWANG SOLAR FARM
FIGURE 1.2
CONCEPTUAL SITE
LAYOUT
SOURCE DATA © NEW SOUTH WALES CROWN
(SPATIAL SERVICES, DEPARTMENT OF CUSTOMER SERVICE)
PRIMARY PROJECT ACCESS
SECONDARY ACCESS
PROPOSED SINGLE AXIS TRACKER
BESS AND DC-DC COUPLED PCS WITH HARDSTANDING
PROPOSED ACCESS TRACK
PROPOSED O&M FACILITY
PROPOSED SUBSTATION CENTRAL
PROPOSED SUBSTATION NORTH
TEMPORARY CONSTRUCTION COMPOUND & LAYDOWN
PROPOSED LANDOWNER ACCESS TRACK
PROPOSED TRANSMISSION LINE
PROPOSED TRANSMISSION LINE BUFFER, 30m
PROPOSED LANDSCAPING AREA
INVOLVED DWELLING
DWELLING EXCLUSION ZONE
CULTURAL HERITAGE HUTS
CULTURAL HERITAGE HUTS EXCLUSION ZONE
WATER COURSE
STATE ROAD
LOCAL ROAD
RAILWAY
22kV DISTRIBUTION LINE (TO BE REROUTED WHERE NECESSARY)
66kV DISTRIBUTION LINE
SECURITY FENCE
PROJECT AREA BOUNDARY
NSW CADASTRE (2021-11-02)
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N.B. LAYOUT IS INDICATIVE AND SUBJECT TO CHANGE, BUT WILL GENERALLY BE IN ACCORDANCE WITH THE DRAWING.
Page 1
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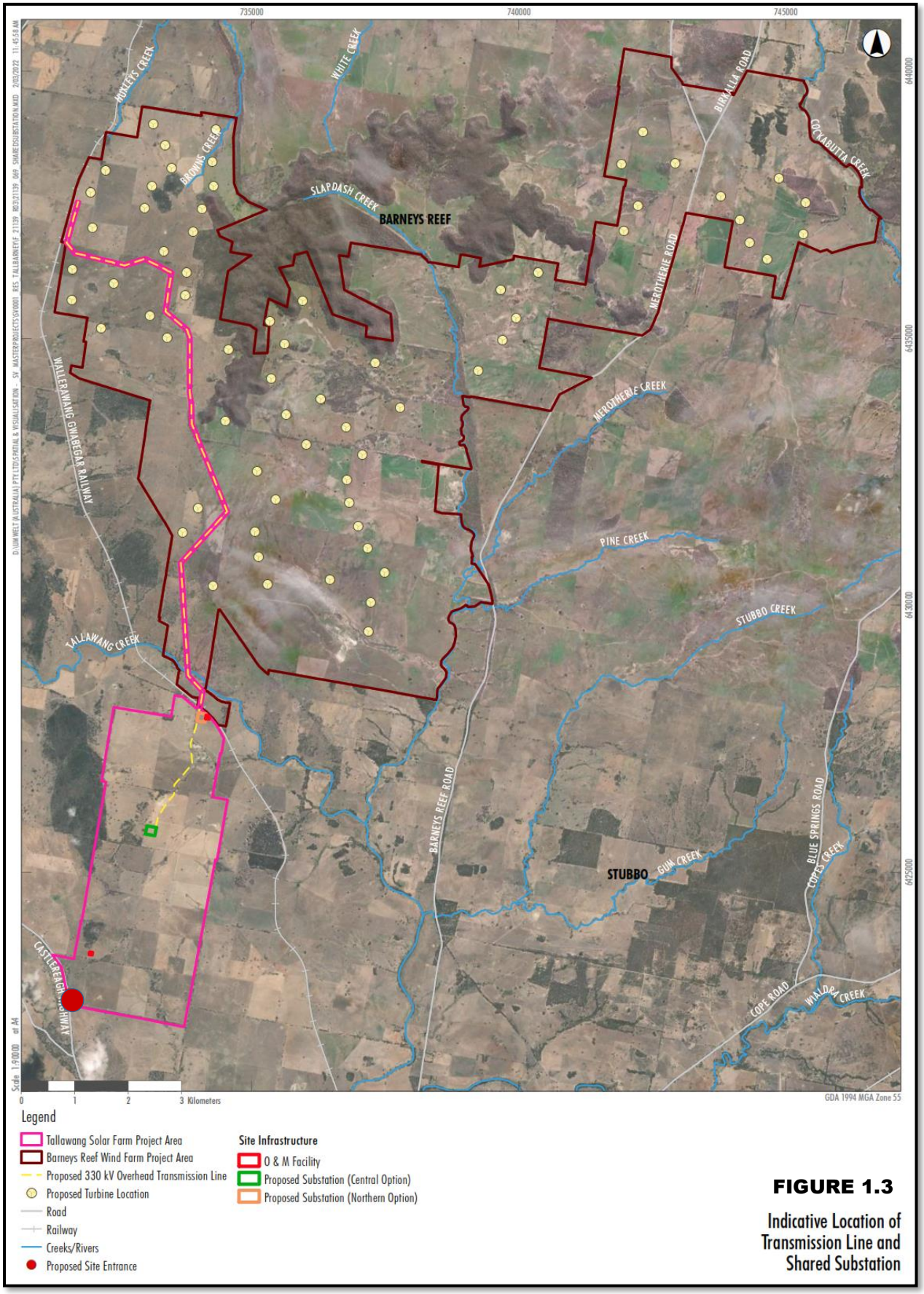

FIGURE 1.3

Indicative Location of Transmission Line and Shared Substation

1.2 Transport Assessment

This transport impact assessment (TIA) report has been prepared by *Samsa Consulting Pty Ltd*, Transport Planning & Traffic Engineering Consultants, in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning, Industry and Environment (DPIE) on 14 September 2021 and amended on 26 November 2021.

This assessment investigates transportation impacts associated with the construction, operation and decommissioning of the Project, and in particular component and equipment haulage as well as other construction transport considerations including staff transport. The report assesses preferred transportation routes to the proposed site access point. Prevailing transport constraints and impacts are identified and assessed. Appropriate site access locations from the public road network are also identified. The report will serve as a supporting background paper to the Project's Environmental Impact Statement (EIS).

1.3 Assessment Scope & Methodology

The scope of the assessment included the following tasks:

- Review of project background information.
- Project discussions with RES project team.
- Discussions with Mid-Western Regional Council, Warrumbungle Shire Council and Transport for NSW (TfNSW).
- Site inspections of the surrounding road network proposed to serve the Project site, including preferred transportation routes.
- Traffic generation during construction, operation and decommissioning phases of the Project.
- Traffic distribution onto the surrounding local and regional road network.
- Assessment of transport impacts on the surrounding road network including site access, road safety, road capacity and road conditions.
- Discussion of mitigation measures to address potential transport impacts identified.
- Preparation of this TIA report to be used to support the Project's EIS.

1.4 Environmental Assessment Requirements

NSW Department of Planning & Environment (DPIE) issued Secretary's Environmental Assessment Requirements (SEARs), which require the TIA to assess the construction and operational traffic impacts of the Project. This TIA has addressed the SEARs for the construction and operational impacts of the Project as outlined in *Table 1.1* following:

Table 1.1: Transport Related SEARs

Requirement	Where Addressed
Assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation.	*Sections 4.2* and *4.4* (specifically *Tables 4.2* and *4.3*)
Assessment of the likely transport impacts to the site access route, site access point(s), any Crown land, particularly in relation to the capacity and condition of the roads, road safety and intersection performance.	*Sections 4.3* and *4.5* (specifically *Table 4.5*)
Cumulative impact assessment of traffic from nearby developments including Barneys Reef Wind Farm.	*Section 4.6*
Provide details of measures to mitigate and/or manage potential impacts including a schedule of all required road upgrades (including resulting from heavy vehicle and over-mass / over-dimensional traffic haulage routes), road maintenance contributions, and any other traffic control measures, developed in consultation with the relevant road authority.	*Sections 5.1, 5.2* and *5.3*

1.5 Consultation With Road Infrastructure / Transport Authorities

Mid-Western Regional Council

Consultation undertaken with Mid-Western Regional Council during the preparation of the TIA included:

- Email correspondence on 11 August 2021: Council deferred any comments until after SEARs were issued.
- Subsequent email correspondence on 25 October 2021: no additional comments over and above the SEARs raised although it was acknowledged that Council's relevant Engineering staff would review the detailed information in relation to road upgrade requirements and traffic related matters.
- Meeting held with Council's Planning Directorate and Traffic Engineer. Council's principal transport-related issues were as follows:
  - Potential impacts to Council's infrastructure.
  - Traffic impacts on nearby residences / towns with a preference for minimal heavy vehicle traffic through Gulgong.
  - Infrastructure agreement (or similar) to manage any required road upgrades / maintenance during construction.

- Council indicated it would be in a position to undertake any relevant upgrades required, if necessary.

Warrumbungle Shire Council

Consultation undertaken with Warrumbungle Shire Council during the preparation of the TIA included:

- Email correspondence to inform Council and request feedback.
- Meeting held with Council's directors for Environment & Development and Technical Services. Council's principal transport-related issues were as follows:
  - Potential impacts to Council's infrastructure.
  - Traffic impacts on nearby residences / towns with a preference for minimal heavy vehicle traffic.
  - Infrastructure agreement (or similar) to manage any required road upgrades / maintenance during construction.

Transport for NSW (TfNSW)

Consultation was undertaken with TfNSW during the preparation of the TIA including a meeting held on 6 December 2021. The principal transport-related issues were as follows:

- Appropriate assessment of cumulative impacts from nearby developments especially Barneys Reef Wind Farm.
- Proposed transport routes for project components including site access locations.
- Need for improvements to the road network including proposed intersection treatments.
- Road safety assessment along the main transport routes.

A further meeting was held with TfNSW on 2 March 2022 to provide an update on the project and discuss the two site access options off Castlereagh Highway for the Project. The main feedback from TfNSW was as follows:

- The initial (existing) access location opposite Jenkings Lane is considered to be problematic and preference is to be given to the second access location known as Jacksons Lane.
- Concept designs are to be provided in the EIS for further review and feedback.

TfNSW also provided advice as part of the SEARs, which have been addressed in this TIA – refer to *Table 1.1* above. For a summary of the advice by TfNSW and where it has been addressed in the TIA, refer to *Appendix A*.

Australian Rail Track Corporation (ARTC)

Consultation has been undertaken with ARTC regarding the proposed overhead transmission line. The ARTC are aware of the project and RES has received design requirements for any crossing with high voltage lines to connect to the power grid as well as any requirements in regard to transporting components / equipment to site. RES has submitted an application with ARTC. There is ongoing engagement where the solar farm project and the location of the CWO-REZ grid project are being further developed and finalised.

1.6 Report Structure

The remainder of this assessment report is presented as follows:

Chapter 2 provides a project description including general details of the solar farm equipment and components.

Chapter 3 describes the existing transport conditions including proposed transport routes and traffic conditions.

Chapter 4 assesses the transportation impacts during the construction and operation phases of the Project.

Chapter 5 discusses mitigation measures to address potential transport impacts identified.

Chapter 6 provides a summary and conclusions to the assessment.

2. Project Description

The Project will include the construction, operation and decommissioning of a photovoltaic (PV) solar farm with a capacity of up to 500 MW (AC) that would supply electricity to the national electricity grid and will include a BESS with a proposed capacity of up to 200 MW / 400 MWh.

The solar farm and associated infrastructure are proposed to be located on existing cropping and grazing areas of up to 1,370 ha, with the PV modules and associated infrastructure likely to occupy around 864 ha of this area.

Project Components

The Project will include operations and maintenance buildings, civil works and electrical infrastructure required to connect to the electricity transmission network. The Project proposes to have a primary access at a newly proposed access point from the Castlereagh Highway and along a local road directly south of the Project area.

Subject to final design, the key components of the Project (shown previously in *Figure 1.2* and *Figure 1.3*) include the following:

- Approximately 1,136,400 bi-facial solar PV modules in an east-west, single-axis tracking arrangement with a maximum height of 5 m above ground level.
- BESS comprised of DC-coupled, containerised battery storage units adjacent to each inverter. The battery storage units will have the following specifications, subject to final design:
  - Approximately 93 power conversion systems (PCSs) typically comprised of two DC-coupled inverters and four battery storage units per skid.
  - Containerised battery storage units: subject to final procurement, the dimensions of each battery storage unit will be approximately 12.2 m long by 2.5 m wide and up to 3 m tall.
- Approximately 186 inverters and voltage step-up transformers.
- One on-site switchyard and 330 kV solar farm substation, with underground electrical conduits and cabling, at two possible locations within the solar farm and BESS development area. The final location of the on-site switchyard and substation will be determined during detailed design.
- An overhead 330 kV transmission line approximately 13 km long, connecting the Project to the grid via the proposed NSW Government switching station.
- Operational and maintenance ancillary infrastructure including the following:
  - Site office and amenities.
  - Car parking and internal access roads.
  - Workshop and associated infrastructure (storage facility).
  - Vegetation screening.
  - Drainage line crossings and access points.
  - Permanent security fencing.
- Temporary facilities required during the construction and decommissioning phases, such as the following:
  - 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.
- Single access point from the Castlereagh Highway via a road locally known as Jacksons Lane – refer to *Figure 1.2* above.
- Access to the north-eastern corner of the Project site will need to cross Puggoon Road.
- Vegetation screening, if and where required.
- Drainage line crossings, if and where required to manage existing surface water flows and access points for construction purposes.
- Perimeter security fencing, crossing gates, water tanks or dams, and potential alternate secondary access points to facilitate sheep grazing.

Construction compound areas (including laydown areas, security hut and temporary parking) are proposed on the solar farm site and close to the primary Project access point from the Castlereagh Highway via Jacksons Lane.

Internal access tracks for the construction phase will be approximately 6 m wide and constructed of compacted gravel.

Proposed Transport Route

Construction materials and equipment would be transported via road to Castlereagh Highway. Over-size / over-mass (OSOM) transport would travel from the Port of Newcastle via Golden Highway to Castlereagh Highway and the Project site – refer to *Section 3.2* and specifically *Figure 3.1*, for the Project's proposed transport route.

Construction Phase Details

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

- 7am to 6 pm, Monday to Friday.
- 8 am to 1 pm on Saturday.
- No work on Sunday or public holidays.

Exceptions to the above hours may be required, however these would be limited to low noise generation activities, where practicable.

The construction phase is expected to be undertaken over approximately 34 months from the commencement of site establishment works. It is anticipated that construction works would commence June 2023.

Following the construction phase, the Project is expected to operate for approximately 35 years. It is expected to generate up to 580 direct jobs during the peak construction period (approximately four months) and approximately seven direct jobs during the operations and ongoing maintenance phase.

After the initial 35-year operating period, the solar farm would either be decommissioned, removing all above-ground infrastructure and returning the site to its existing land capability, or re-purposed with new PV equipment, subject to technical feasibility, landowner discussions and planning consents.

3. Existing Conditions

3.1 Transport Mode

The assessment of transportation of the solar farm components to site involves the separate consideration of the transport mode between:

- Australian ports for imports and other local manufacturing plants located in Australia to the Project site;
- Transportation through any urban centres along the transport routes; and
- Site access off the public road network to the internal road network of the Project site.

The most likely port of entry for imported solar farm equipment has been assumed to be the Port of Newcastle. Therefore, this assessment evaluates the potential transport routes from the NSW Hunter Coast region.

Rail Transport

Rail as a transport option is potentially possible via the rail network that runs to Gulgong and/or Wellington. This could be accessed from the eastern seaboard via the Country Regional Network (CRN) and/or the ARTC rail networks. However, while specially designed flat-bed cars and support systems are available to transport large / heavy loads, the size of the larger solar farm components would not be able to be transported due to a lack of vertical and horizontal clearance within the electrified sections and at some structures along the route, such as bridges.

Problems of scheduling rail services and restriction on track capacity may also affect delivery and would require negotiation and confirmation with rail operators.

The problem also exists of handling and transporting solar farm components from the rail hub to site, requiring road transport regardless, most likely through urban centres. The extent of transportation handling is such that it is not considered feasible to use rail transport. Therefore, rail transport has not been pursued any further as an option.

Road Transport

The main road routes to Tallawang are primarily by either National Routes or State Highways and, subject to statutory permit conditions, can accommodate the proposed solar farm components generating the largest delivery vehicles, ie. OSOM vehicles.

A TfNSW permit would be required for road access for OSOM vehicles along the major road network (National Routes or State Highways) from areas of component manufacture or import to the Project site. The transport contractor would be responsible for obtaining all necessary transport permits, arranging escort services and any other third-party services as required by applicable regulations.

The road network has the flexibility to provide a single transportation mode from origin to the Project site without the need for additional loading and handling operations.

3.2 Proposed Road Transport Route

The primary Project site access is proposed from the Castlereagh Highway (State Highway B55) at a newly proposed access point along a local road known as Jacksons Lane, directly south of the Project area (refer to *Figure 1.2* above).

The primary access is proposed to be used for all heavy vehicle (including OSOM) deliveries to the Project site as well as light vehicle access. This will include the major solar and battery component deliveries.

Some components of the overhead transmission line will be delivered to site via the internal access track network on the solar farm site and within the transmission line corridor. Internal vehicular tracks throughout the Project site required for construction and operational vehicles will provide access to various parts of the site. The proposed road transport route from the Port of Newcastle (approximately 230 km to the south-east of the Project area) to the Project access is via Industrial Drive, Pacific Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway and Castlereagh Highway to the Project's primary access – refer to *Figure 3.1* following. The proposed road transport route will apply to all OSOM and other material / component delivery from the Hunter Coast area.

The proposed road transport route detailed above has previously been used for delivery of nearby wind farm project components and thus, would be suitable (more conducive) for delivering generally smaller and lighter solar farm components.

For other non-OSOM vehicle deliveries, the source of materials / resources for construction is a commercial procurement decision which will occur post-Development Consent. The transport routes through the surrounding towns and road network will be along the following major State Road or highway routes:

- North and north-west – via Newell Highway and Castlereagh Highway.
- West – via Golden Highway and Castlereagh Highway.
- South-west and south – via Mitchell Highway / Goolma Road and/or Castlereagh Highway.
- East and south-east – via Great Western Highway and Castlereagh Highway.

The above major road network provides a relatively high standard of road infrastructure, suitable for heavy vehicle transport. Generally, this road network has relatively wide carriageways and road formations, pavement linemarking, and controlled access to side roads with 100 km/h speed limits.

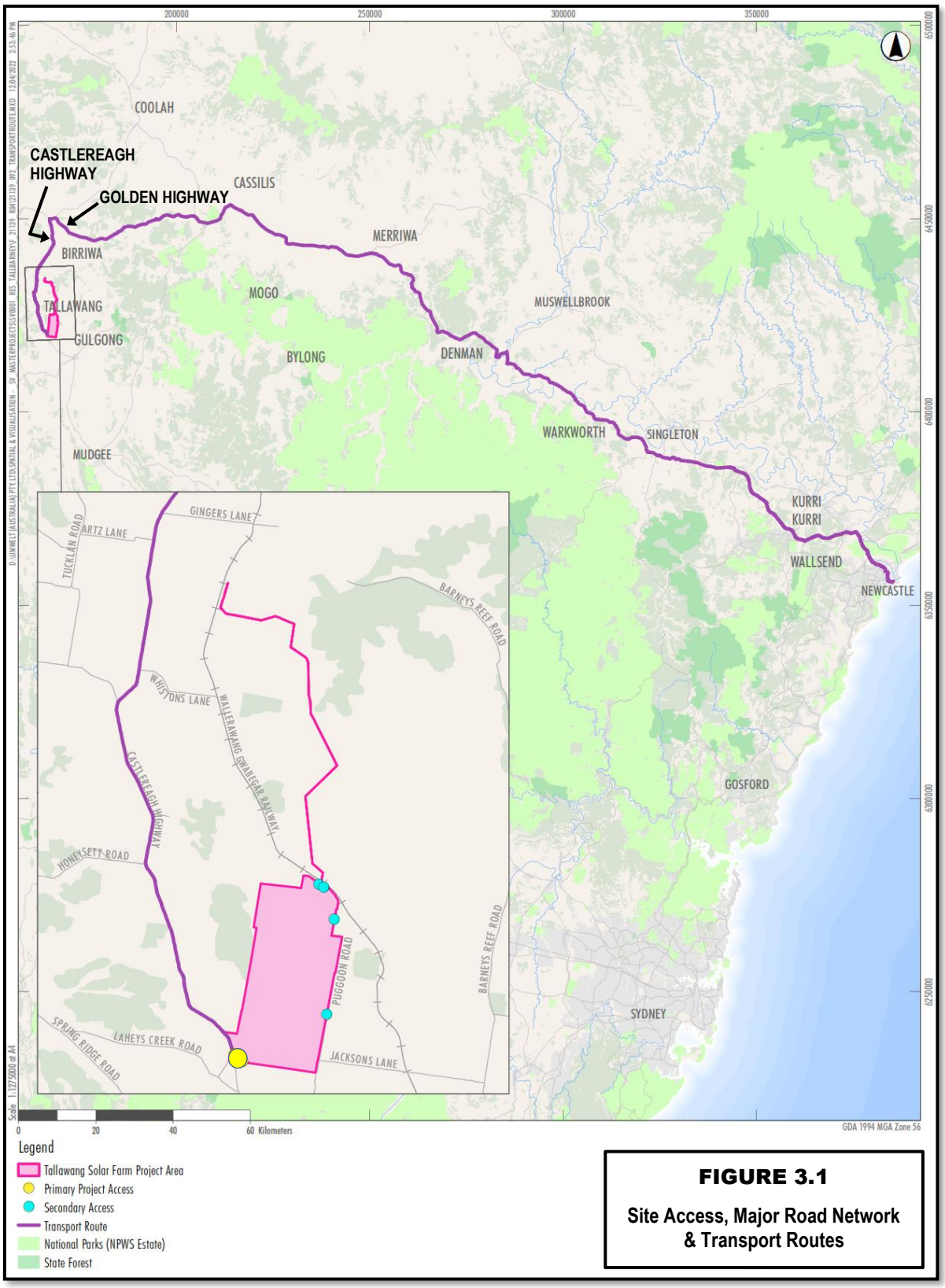

FIGURE 3.1

Site Access, Major Road Network & Transport Routes

3.2.1 Major Road Network

The major road network in the area surrounding the proposed Project site comprises the following highways – refer to *Figure 3.1* above.

Golden Highway

Golden Highway is a State Highway (B84) forming an arterial route from New England Highway between Branxton and Singleton to the Newell Highway at Dubbo, passing through Denman, Merriwa and Dunedoo. Golden Highway is generally a two-lane, undivided road with varying shoulder widths and formations. The pavement condition is generally good, commensurate with its status as a State Highway and its suitability as a route for larger heavy vehicles, eg. B-doubles.

The general road environment can be described as flat to gently rolling terrain with some moderate curved alignments requiring lower advisory speeds within the background 100 km/h speed zone. The road environment and alignment are generally conducive to OSOM and heavy vehicle transport. Any specific OSOM vehicle issues would be identified by the transport contractor and covered under the TfNSW permit system for OSOM transportation along the major road network.

Castlereagh Highway

Castlereagh Highway is a State Highway (B55) forming an arterial route from Great Western Highway near Lithgow in the south to Golden Highway (east of Dunedoo) in the north and extending through to the St George district in Queensland. It passes through Mudgee and Gulgong in its southern section.

Castlereagh Highway is generally a two-lane, undivided road with sections of overtaking lane and varying shoulder widths and formations. The pavement condition is generally good, commensurate with its status as a State Highway and its suitability as a route for larger heavy vehicles, eg. B-doubles.

The general road environment can be described as rolling / hilly terrain with some tighter curved alignments requiring lower advisory speeds within the background 100 km/h speed zone.

The road environment and alignment are generally conducive to OSOM and heavy vehicle transport. Any specific OSOM vehicle issues would be identified by the transport contractor and covered under the TfNSW permit system for OSOM transportation along the major road network.

3.2.2 Minor Road Network

The minor road network in the area surrounding the proposed Project site comprises Puggoon Road to the east, which would only be used as a crossing access between Lot 105 of DP 750762 and Lots 74, 96 and 105 of DP 750762 in the north-eastern corner of the Project site.

3.3 Public Transport

There is limited public transport in the vicinity of the Project area. An intermittent school bus service (operated by Eastend Bus Services at Gulgong) runs between Tucklan and Gulgong along Castlereagh Highway that passes the proposed primary site access location.

There is no rail station nearby that serves as public transport.

3.4 Rail Network

The rail network to the north of the Project site is part of the Wallerawang Gwabegar Railway line (owned by ARTC). It crosses Gingers Lane and Puggoon Road at level crossings.

There are no regular train services along the railway line and the principal traffic is currently coal trains with heritage (tourist) train services operating intermittently.

3.5 Parking Facilities

Given the rural nature of the area, there are no formal on-street or off-street parking facilities in the vicinity of the Project site.

3.6 Active Transport Infrastructure

There are no formal pedestrian or cyclist facilities (pedestrian footpaths, shared paths or on-road cycleways) in the vicinity of the Project site.

3.7 Current Traffic Volumes

Traffic volume data was obtained from the TfNSW '*Traffic Volume Viewer*' website where the most recent, relevant data along the major road network (ie. Golden Highway, Castlereagh Highway) was from 2009. This historical data was extrapolated to current traffic volumes by adopting a traffic growth of 25% over the 12-year period between 2009 and 2021, equivalent to an approximate 1.9% per annum (compounded) growth rate. The 25% growth is generally in line with traffic growth at various TfNSW data stations in the regional area and thus is considered to be a reasonable assumption.

Current (estimated) 2021 traffic volumes in vehicles per day (vpd) and vehicles per (peak) hour (vph) for the surrounding road network are shown in *Table 3.1* following. Note that peak hourly traffic flows have been assumed to be between 10% and 15% of daily traffic flows.

Table 3.1: Current (Estimated) 2021 Traffic Volumes

Road Section	Vehicles Per Day (vpd)	Vehicles Per Hour (vph)	Traffic Volume Source
Golden Highway	780	100	TfNSW traffic data (2009)
Castlereagh Highway (south)	1,540	200	TfNSW traffic data (2009)
Castlereagh Highway (north)	820	100	TfNSW traffic data (2009)

3.8 Road Safety

An evaluation of road safety has been undertaken based on the TfNSW Centre for Road Safety's crash statistics over the latest five-year recording period (2015 to 2019 inclusive). This encompassed Castlereagh Highway between Golden Highway in the north and the outskirts of the Gulgong urban area in the south. The data revealed the following pertinent issues:

- There was a total of 11 crashes recorded over the subject five-year period, which were spread relatively evenly over the recording period – a single incident in 2019, two in both 2016 and 2017 and three in both 2015 and 2018.
- There was one fatal crash, two serious injury crashes and three moderate injury crashes. The other incidents were a single minor injury crash and four non-casualty (tow-away) crashes.
- Ten of the crashes were vehicles travelling off the road (left or right) including all the significant injury crashes. The remaining incident involved a vehicle striking an animal on the road (non-casualty / tow-away crash).
- There were no crashes in the vicinity (say, within 250 m) of the proposed primary Project access along Castlereagh Highway. A single crash occurred in the vicinity of the Castlereagh Highway / Gingers Lane T-junction, however this was an off the road, non-casualty incident for travel along the highway, which would not likely have been affected by the intersection operations.
- The crash rate for the subject section of road network is approximately 5.7 per 100 million-vehicle-kilometres travelled (100 mvkt), which is considered to be low to average for a rural highway area.
- In summary, there is not considered to be any significant road safety risk or exposure for the surrounding road network based on the crash statistics.

4. Transport Impact Assessment

Construction of the Project includes all physical works to enable the solar farm operation including, but not limited to, the installation of solar PV modules, installation of the BESS, construction of ancillary Infrastructure including sub-station transformers, road upgrades carried out before the commencement of operation and establishment or construction of any temporary facilities, which were not already established as part of the pre-construction minor works.

It is anticipated that works will commence in June 2023. The timing of construction will principally be driven by additional permits and authorisations, post-Development Consent tender, contractor selection, detailed design and procurement processes and a final investment decision. An indicative Project timeline is presented in *Table 4.1* below.

Table 4.1: Indicative Project Timeline

Phase	Approximate Duration
Detailed design, contract development and pre-construction	6 months
Construction and commissioning	34 months
Operation	35 years
Maintenance	Annual and ongoing
Repowering or decommissioning	At completion of project life

4.1 Construction Vehicle Types

The type of construction vehicles proposed to access the Project site depends on the equipment and/or personnel being transported and their function on the site. Access to construction site offices and facilities buildings would generally be available for conventional two-wheel drive vehicles. Access to on-site locations via access tracks may be restricted to four-wheel drive or multiple wheel drive vehicles depending on the internal road network conditions.

Vehicles to be used in the transport of components and deliveries will be heavy vehicle delivery trucks, which will predominantly be 'truck'n'dog' type vehicles with a number of mixer trucks and articulated vehicles (AVs such as semi-trailers) also being used. The AVs will occasionally be used to transport larger components and plant such as the solar PV panels.

The largest vehicles to be used for the Project will be for transformer transport to the Project's sub-station site. These vehicles will be regarded as OSOM vehicles, resulting in restricted access and requiring special TfNSW operating permits to allow them to travel on public roads.

The OSOM vehicles will typically be Drake trailers consisting of 16 axles and approximately 30 m in length by 4.3 m in width. The total vehicle length would be almost 43 m. The multiple axle groups would ensure compliance with point load and overall load limits for the road surfaces along the transport route. In this regard, typical axle weights under such configurations are less than 2 tonnes per tyre, which is less than a typical semi-trailer loading of up to 2.75 tonnes per tyre.

Therefore, OSOM vehicles can typically incur less loading stress on the road surface, especially when run under escort with limited speed, than normal heavy vehicle traffic. Furthermore, 'over-size' and 'over-mass' vehicles may feature trailers with steering on some or all rear axles. This technology ensures improved manoeuvrability, minimises stress on the equipment and the load, and reduces or eliminates tyre scrubbing and the associated stresses on the road surface when cornering.

4.2 Construction Phase Traffic Generation

Traffic-generating tasks over the life of the Project would typically include:

- Initial site set-up and access construction during the pre-construction period.
- Construction staff movements, solar farm component deliveries (including OSOM transport), concrete material deliveries and other general deliveries during construction works.
- Operational staff movements during operation and maintenance.
- Decommissioning and reinstatement construction activities.

During the construction phase, several tasks would generate traffic. These are categorised as follows:

- Construction material delivery.
- Solar farm component delivery.
- Construction staff transport.

The construction phase of the Project will result in increased traffic movements by light vehicles transporting construction staff and light construction deliveries as well as heavy vehicles transporting the solar farm and BESS infrastructure equipment including OSOM vehicle transport of the sub-station transformers.

4.2.1 Heavy Vehicle Transport

The transport of solar farm components and construction materials would be undertaken by heavy vehicles including OSOM vehicles. The use of larger capacity B-triples and road trains may be considered by the transport contractor, which would reduce vehicle trip movements and improve transportation efficiency. If the use of these larger capacity vehicles is desired, approval would be sought from the relevant road authorities including Councils.

The anticipated vehicle transport to be used for the solar farm components would typically comprise the following:

- Solar PV modules: B-double (although type A road train or B-triple preferred) with typically 27 modules / pallet and 16 to 18 pallets / container.
- Battery storage: B-double (although type A road train or B-triple preferred) with one unit per trailer.
- Inverters: B-double (40-foot container) with 100-tonne mobile crane for offload and typically two skids, one truck.
- Cabling and steel strands for transmission lines: B-double (type A road train or B-triple preferred) dependent on local restrictions. Two drums per trailer for larger diameter cable, five to six drums per trailer for smaller cable diameter.

- Sub-station transformer: one OSOM beam set (likely) or platform trailer per transformer.
- Operations and maintenance building (two OSOM vehicles if delivered in two sections otherwise one OSOM vehicle) as well as a control room (one OSOM vehicle).
- Other associated infrastructure and construction materials such as gravel / road base for construction of site access tracks, culverts, concrete, water (up to seven water trucks per weekday from Gulgong) and other miscellaneous materials deliveries for site office operations and the like.

There are expected to be to up to two sub-station transformers as well as the operations and maintenance building and control room, delivered to the site via OSOM vehicles. These would be transported to site as single loads on designated days. Therefore, a maximum of four (4) OSOM vehicles are expected over the entire construction period.

For general (non-OSOM) heavy vehicle transport, the anticipated average daily traffic generated during the Project's construction phase is estimated at up to 85 heavy vehicles accessing the site per day, resulting in some 170 heavy vehicle trips generated daily. This heavy vehicle generation may increase to a maximum of approximately 135 heavy vehicles per day (270 heavy vehicle trips) during the peak construction periods (about four months out of the total 34-month construction phase).

Typically, the heavy vehicles would be split into approximately 25% articulated vehicles / low-loaders and 37.5% each rigid trucks and truck'n'dog vehicles.

General heavy vehicle transport could travel from any direction along the surrounding road network depending on origin of the deliveries, eg. from the south (Gulgong-Mudgee area), west (Dubbo area), north (Dunedoo area) and east (Merriwa area). As a worst-case scenario for the purposes of this assessment, it has been assumed that all heavy vehicle trips could travel from a single direction on any given day, resulting in a maximum of some 270 heavy vehicle trip movements per day from either direction along Castlereagh Highway to the primary Project access location.

4.2.2 Construction Staff Traffic

Construction staff numbers will fluctuate over the construction period dependent on the activities being undertaken. During the peak construction period (approximate duration of four months), it is anticipated that maximum construction staff numbers would be up to 580 staff.

Assuming there will be some shared journey-to-work trips by construction staff (resulting from car-pooling and similar initiatives), an average of 1.8 persons per car has been adopted for traffic generation purposes. Therefore, during the peak construction staff periods (four months), traffic generation would be up to approximately 300 light vehicles (cars) or 600 light vehicle trips per day.

It should be noted that this traffic generation is considered to be a conservative (high traffic generating) case scenario and that if car occupancy was able to be increased, staff traffic generation has the potential to be significantly less. Consequently, impacts from traffic on the surrounding road network would be reduced.

Moreover, there is the potential to transport construction staff by buses from off-site hubs, which if utilised, could reduce the peak staff traffic generation up to a maximum of say, 30 buses per day, equating to 60 bus trip movements daily. In this case, an additional allowance of up to 50 light vehicles (or 100 light vehicle trips) per day should also be assumed.

For the purposes of this assessment, the bus transport option for construction staff has been disregarded in order to consider a worst-case, traffic generating scenario.

It is assumed that construction staff trip distribution would be split equally between the south (Gulgong-Mudgee area), west (Dubbo area), north (Dunedoo area) and east (Merriwa area) resulting in approximately 300 construction staff vehicle trip movements per day from each direction along Golden Highway / Castlereagh Highway (north) and Castlereagh Highway (south) to the primary site access location.

4.2.3 Total Traffic Generation

The above sections provide the basis for estimating the peak traffic generation over the construction period. Traffic generation used in this transport assessment adopts the worst case for each of the heavy vehicle and light vehicle (construction staff) trip generation to provide a conservative (high) figure. The worst-case scenario traffic generation also assumes that peak heavy vehicle generation coincides with peak construction staff numbers.

It should be noted that typically, the peak traffic generation would apply for only some four months (less than 12%) out of the total 34-month construction period. This peak 4-month period would coincide with the installation of the solar panels, BESS, sub-stations and ancillary infrastructure. For the remaining 30 months (great majority of the construction phase), reduced traffic generation would occur.

Peak traffic generation is shown in *Table 4.2* below and has been classified into daily movement trips (ie. two-way trips), shown as vehicles per day (vpd) and peak hour trips (where applicable), shown as vehicles per hour (vph).

Table 4.2: Total Project Traffic Generation

Traffic Generating Activity		Golden Highway	Castlereagh Hwy (north)	Castlereagh Hwy (south)
Construction staff (light vehicles only)	vpd	300	300	300
	vph	150	150	150
OSOM vehicle transport	vpd	2	2	0
	vph	1	1	0
Standard heavy vehicle transport	vpd	270	270	270
	vph	30	30	30

In estimating the peak hour trips presented in *Table 4.2* above, the following assumptions were made:

- All the workforce travelling by private vehicles will arrive between 6 am and 7 am, before the background morning peak period of 7 am to 8 am, and depart between 6 pm and 7 pm, after the background afternoon peak period.
- 10% of the daily heavy vehicle trips are made in the peak hour periods.

4.3 Effect of Construction Phase Traffic Generation

4.3.1 Road Capacity

In order to assess the potential impacts on road capacity, the traffic generation of heavy vehicles and the staff traffic generation (refer to *Table 4.2* previously) have been added to current daily and peak hour traffic flows to obtain future traffic flows along the affected road network.

Future traffic volumes in vehicles per day and vehicles per hour for roads along the preferred access route are shown in *Table 4.3* following. The traffic volumes are broken up into light vehicles (LV) and heavy vehicles (HV) with the heavy vehicle proportion assumed to be between 10% and 15% of the total traffic volume.

Table 4.3: Future Traffic Volumes

Traffic Scenario		Golden Highway	Castlereagh Hwy (north)	Castlereagh Hwy (south)
Daily Traffic – vehicles per day				
Current traffic #	LV	700	720	1,400
	HV	80	100	140
Solar farm traffic generation	LV	300	300	300
	HV	272	272	272
Combined future traffic	LV	1,000	1,020	1,700
	HV	352	372	412
Hourly (Peak) Traffic – vehicles per hour				
Current traffic #	LV	85	85	180
	HV	15	15	20
Solar farm traffic generation	LV	150	150	150
	HV	31	31	31
Combined future traffic	LV	235	235	330
	HV	46	46	51

Current traffic derived from *Table 3.1*: HV % assumed to be between 10% and 15% of total traffic volume.

Road capacity can be expressed and qualified along a section of the rural road network as its 'level of service' (LoS). Typically, the LoS is based on road capacity analysis as described in Austroads' "*Guide to Traffic Engineering Practice, Part 2 – Roadway Capacity*". Road capacity can be expressed in total vehicles per day and/or vehicles per hour.

The level of service descriptions are as follows:

LOS A: Free flow conditions, high degree of freedom for drivers to select desired speed and manoeuvre within traffic stream. Individual drivers are virtually unaffected by the presence of others in the traffic stream.

LOS B: Zone of stable flow, reasonable freedom for drivers to select desired speed and

manoeuvre within traffic stream.

LOS C: Zone of stable flow, but restricted freedom for drivers to select desired speed and manoeuvre within traffic stream.

LOS D: Approaching unstable flow, severely restricted freedom for drivers to select desired speed and manoeuvre within traffic stream. Small increases in flow generally cause operational problems.

LOS E: Traffic volumes close to capacity, virtually no freedom to select desired speed or manoeuvre within traffic stream. Unstable flow and minor disturbances and/or small increases in flow would cause operational break-downs.

LOS F: Forced flow conditions where the amount of traffic approaching a point exceeds that which can pass it. Flow break-down occurs resulting in queuing and delays.

Road capacity for two-lane, two-way sections of a rural road network is largely based on a combination of design speed, travel lane and shoulder width, sight distance restrictions, traffic composition, directional traffic splits and terrain[1]. This provides a basic level of service and associated service flow rate under prevailing road and traffic conditions. Based on their road and traffic characteristics, the levels of service and flow rates for the affected sections of the rural road network along the preferred access route is shown in *Table 4.4* following.

Table 4.4: Rural Road Network Service Flow Rates

Road Section	Level of Service (LoS)				
	A	B	C	D	E
Golden Highway	240 vph 1,800 vpd	420 vph 3,500 vpd	660 vph 5,800 vpd	1,020 vph 9,900 vpd	1,760 vph 16,500 vpd
Castlereagh Highway (north / south)	250 vph 1,900 vpd	490 vph 3,700 vpd	800 vph 6,100 vpd	1,290 vph 10,400 vpd	2,310 vph 17,600 vpd

Based on the above service flow rates, the current traffic volumes and additional Project generated construction traffic volumes of the rural roads along the transport access routes (conservative scenario peak volumes used as a worst-case scenario), 'before and after' levels of service can be expected as shown in *Table 4.5* following.

Table 4.5: Rural Road Network – Current and Future Levels of Service

Road Section	Current LoS	Future LoS
Golden Highway	A	A / B
Castlereagh Highway (south)	A	B
Castlereagh Highway (north)	A	A / B

From the above table, it is clearly evident that operating conditions (levels of service) along the rural road network would only change marginally from existing conditions, even after the addition of the conservative scenario (maximum peak) solar farm generated construction

1 Austroads "*Guide to Traffic Engineering Practice: Part 2 – Roadway Capacity*", Section 3

traffic.

The majority of the rural road network under consideration has significant spare capacity and is operating at high levels of service (LoS A). At these enhanced levels of service with the significant spare capacity available along the road network, intersection performance at the rural intersections in the vicinity of the site can also be anticipated to be insignificantly impacted by the addition of the Project's traffic generation.

In summary, the addition of heavy vehicles and construction staff traffic during peak construction periods is able to be absorbed by the relevant road networks and intersections subject to appropriate road infrastructure upgrades and construction traffic management (discussed in *Section 5* below).

4.3.2 Site Access and Road Safety

Construction traffic is proposed to access various parts of the Project site via an internal site access network off the primary access at a newly proposed access point from the Castlereagh Highway and along Jacksons Lane.

In addition, the Project would require access from Lot 105 of DP 750762 across Puggoon Road to get access to Lots 74, 96 and 105 of DP 750762 in the north-eastern corner of the Project site. The crossing design and location will be finalised in consultation with Council during the detail design phase.

All OSOM vehicle transport will travel to the proposed primary Project access along Castlereagh Highway from the north. For non-OSOM vehicle transport, access would also be available from the south to allow local service and/or resource suppliers located south of the Project site the opportunity to participate in the Project.

Available sight distance to/from the proposed primary Project site access location along Castlereagh Highway is over 250 m in both directions, which is satisfactory for the 100 km/h speed limit along the highway.

Local intersection widening will be required at the primary Project access and the intersection will be designed to allow relevant construction vehicles (including OSOM vehicles) to safely exit from and re-enter the public road network (Castlereagh Highway) whilst minimising disruption to traffic and maintaining road safety. Thorough consultation will be undertaken with Council and TfNSW when developing the detailed designs for intersections with public roads and in the preparation of the CTMP for the Project.

During Project construction, the increased traffic generation and in particular, the higher turning movements to/from the highway at the Project's primary access location would warrant auxiliary and/or protected (channelised) turn lane intersection treatments.

The proposed intersection at Castlereagh Highway will consist of a three-way junction with a connecting access road along Jacksons Lane and extending onto the Project area. The proposed intersection upgrade would provide an auxiliary and/or protected (channelised) turn lane intersection treatment to accommodate the swept path turning movement by the largest types of trucks requiring access to the Project area – refer to *Figure 4.1* and *Figure 4.2* following for concept intersection layouts for the primary site access.

The proposed access intersection requirements have been discussed with the Mid-Western Regional Council and Transport for NSW and agreed in principle. Mid-Western Regional Council and Transport for NSW will be consulted further in relation to the detailed design requirements for the intersection works prior to construction and for the purposes of securing

approval under the Roads Act.

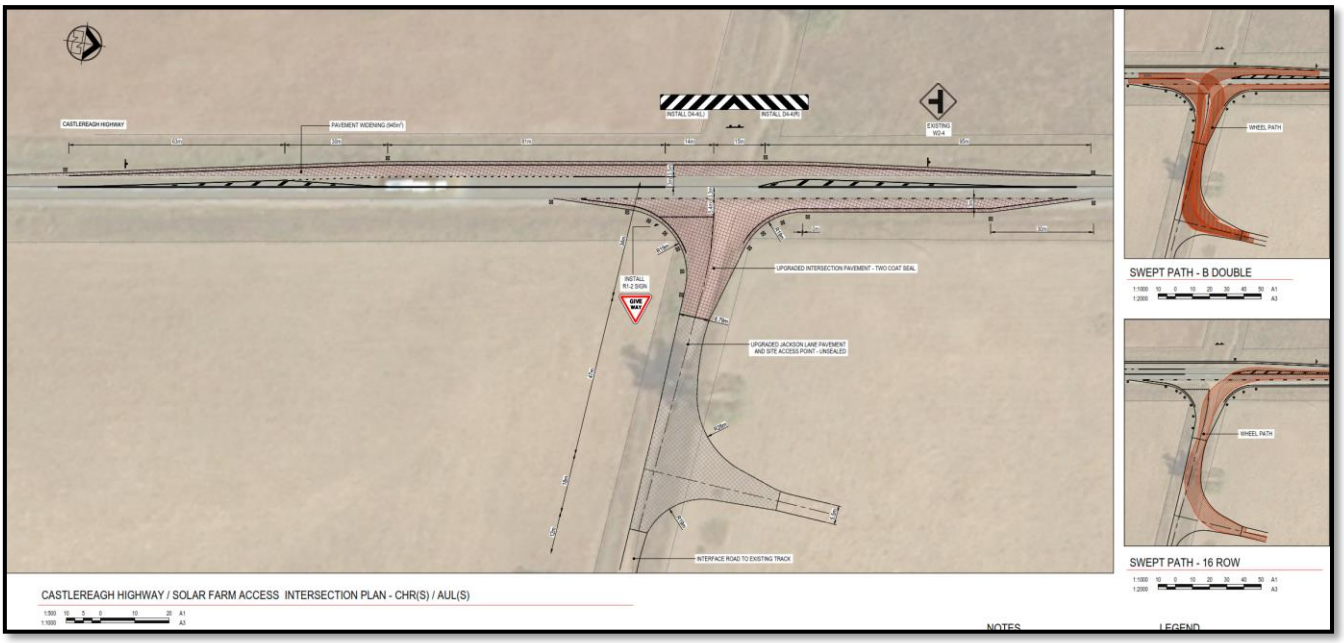

Figure 4.1: Jacksons Lane CHR / AUL Intersection Concept

Figure 4.2: Jacksons Lane BAR / BAL Intersection Concept

It is considered that no road network upgrades would be required along Puggoon Road because the road is only to be used as a crossing to get access from Lot 105 of DP 750762 to Lots 74, 96 and 105 of DP 750762 in the north-eastern corner of the Project site. The crossing design and location will be finalised in consultation with Council during the detail design phase.

4.3.3 *Internal Site Access and Parking*

Suitable on-site manoeuvring areas would be available so that larger vehicles are able to safely manoeuvre into the Project site off the public road network, around the Project site and exit the Project site onto the public road network. All vehicles would enter and exit the Project site to / from the public road network in a forward direction only. All vehicles generated by construction staff would be accommodated within on-site parking areas.

The standard design vehicle for swept path adequacy in the provision of intersections and the design of parking and turning areas would generally be (as a minimum) the Austroads single unit truck / bus of 12.2 m length. However, provision would be made, where possible, to allow for an articulated vehicle swept path, which requires a wider area allowing for manoeuvring by semi-trailers. The design of access roads and junctions would need to allow for widths of up to 4.5 m and weights complying with TfNSW maximum loading.

The construction and maintenance of the solar farm will require the construction of an internal site access network to reach all the solar panel and BESS locations as well as other infrastructure.

The internal site access network will consist of private access tracks and will not be accessible to the public, ie. access will be controlled by lockable gates. The internal site access network will generally be a minimum 6.0 m wide with regular passing bays and turning heads as required to accommodate construction vehicles. These areas would also provide turning / manoeuvring and passing opportunities for delivery vehicles.

The internal accesses will comprise an all-weather graded surface. Ongoing operational maintenance of on-site accesses would be undertaken by the solar farm operator.

4.3.4 *Rail Crossings*

Access over two railway level crossings along the Wallerawang Gwabegar Railway line (maintained by ARTC) will be required as part of the construction of the Project. The transport contractor would need to undertake a detailed assessment taking into account the transport methodology to be adopted including the size and weight of loads as well as the type of vehicles to be used. Any upgrade works across the rail crossings would then be developed and finalised in conjunction with and to the satisfaction of ARTC

4.4 Operational Phase Traffic Generation

The operational phase of the Project includes the general operation of the solar farm, with monitoring both by on-site staffing and via remote monitoring. Aspects of the Project operation to be dealt with by on-site staff would include safety management, environmental condition monitoring, landowner management, routine servicing, malfunction rectification and site inspections. Those functions to be overseen by remote monitoring include solar panel and BESS performance assessment, solar farm reporting, remote resetting and maintenance co-ordination. Pro-active computer control systems monitor the performance of the solar panels and BESS and ensure that any issues are dealt with by on-site staff or contractors, as appropriate.

Maintenance staff will be on-site throughout the year, making routine checks of the solar farm infrastructure on an ongoing basis. Major planned servicing would be carried out intermittently and involve a number of service vehicles (typically two technicians per vehicle) on-site.

Management of regrowth and existing vegetation will be necessary within the overhead

transmission line corridors to reduce the threat of fire and physical damage to the transmission line, and to allow access for maintenance vehicles. This will be carried out using mechanical, manual and chemical clearing methods prior to construction activities commencing and as part of ongoing maintenance activities for the duration of the Project.

Following construction of the overhead transmission line, maintenance will most likely be limited to yearly inspections in a 4WD vehicle to check the integrity of the transmission poles and other associated infrastructure. Occasionally, access by medium and heavy vehicles may be required to repair or maintain overhead transmission line components.

Traffic generation during operations would be relatively minor. There is proposed to be up to seven operational / maintenance staff servicing the solar farm infrastructure, likely to be based in the surrounding, local areas. Typically, this would comprise an estimated seven direct, permanent jobs with others engaged in employment on the site on a periodic basis.

It is understood operational traffic would consist of 4WD-type service vehicles travelling within the Project site's internal access track network after gaining access off the public road network from the Project access location. It is envisaged that with journey-to-work and home trips, this would amount to a maximum of 20 trips per day, which would occur during peak maintenance periods and on an intermittent basis. This maximum (peak) traffic generation would readily be absorbed into the spare capacity of the existing road network.

4.5 Effect of Operation Phase Traffic Generation

Based on the relatively minor traffic generation during operations described above, traffic and road network impacts would be negligible. The current road network has significant spare capacity and is used by 4WD-type vehicles, which are anticipated to be used for servicing the various sites.

All vehicles generated by operations staff would be accommodated within on-site parking areas.

4.6 Cumulative Impacts

The Project site is located within an REZ and therefore, there are a number of other existing and proposed renewable energy projects within the region including the proposed Barneys Reef Wind Farm project planned directly north of the Tallawang Solar Farm project site.

A cumulative impact assessment, presented in *Table 4.6* following, was conducted in relation to nearby developments that may overlap or interact with the Project, including the approved Stubbo and Dunedoo Solar Farms, the operational Beryl Solar Farm and the proposed (not yet approved) Barneys Reef Wind Farm, which were referenced in the SEARs.

For the purposes of the future combined (cumulative) traffic assessment, it has been conservatively assumed that the abovementioned approved and proposed developments would have some overlap of construction with the proposed Tallawang Solar Farm. This presents the worst-case scenario, as realistically the construction periods for these developments would be staggered and are not likely to occur concurrently.

Table 4.6: Renewable Energy Projects in Surrounding Region

Renewable Development	Status	Distance to the Project	Potential for Cumulative Impact
Beryl Solar Farm (Banpu Australia)	Operational	5 km south	Cumulative impacts would be limited as the solar farm is operational. This development's operational traffic has been allowed for and incorporated into the background traffic.
Stubbo Solar Farm (UPC\AC Renewables)	Approved	7 km east	The EIS for Stubbo Solar Farm states that construction is expected to commence early to mid-2022 and expected to last for 2 years. Should the development proceed to that timetable, construction activities would overlap with Tallawang Solar Farm's construction period. The construction transport route for Stubbo Solar Farm includes Golden Highway up to the Cope Road turn-off. Therefore, there is potential for cumulative transport impacts along Golden Highway.
Dunedoo Solar Farm (ib vogt)	Approved	30 km north to north-west	The EIS for Dunedoo Solar Farm states that construction is expected to commence late 2022. There would be some overlap with Tallawang Solar Farm construction activities should the development proceed as per that timetable. The construction transport route for Dunedoo Solar Farm includes Golden Highway to Dunedoo. Therefore, there is potential for cumulative transport impacts along Golden Highway.
Barneys Reef Wind Farm (RES Australia)	In planning	Directly north	Developed by the same proponent – it is proposed that construction for Barneys Reef Wind Farm is to commence Q4 2023. The construction period would be approximately 28 months with peak construction in months 7 to 14, overlapping with Tallawang Solar Farm peak construction. Barneys Reef Wind Farm will utilise a similar construction transport route along Golden Highway and Castlereagh Highway.

In addition to the above developments, several large, non-renewable projects are also located near the Project area, including the operational Ulan Coal Mine Complex (located approximately 25 km east of the Project site), Moolarben Coal Complex (36 km east of the Project site) and Wilpinjong Mine (30 km south east). Cumulative traffic from these currently operating mining ventures have been allowed for and incorporated into the existing background traffic.

With respect to a possible, worst-case scenario of cumulative traffic generation from proposed / approved developments, *Table 4.7* following, shows potential total daily traffic generated along the relevant, surrounding road network as well as a corresponding level of

service for each applicable road section (peak hourly traffic and corresponding LoS in brackets).

Table 4.7: Potential Total Cumulative Traffic Generation

Road Section	Current Traffic [1]	Tallawang Solar Farm	Barneys Reef WF [2]	Stubbo Solar Farm [3]	Dunedoo Solar Farm [3]	Total Traffic	Future LoS [4]
Golden Highway	780 (100)	572 (181)	506 (231)	562 (181)	562 (181)	2,982 (874)	B (D)
Castlereagh Hwy (sth)	1,540 (200)	572 (181)	0	0	0	2,112 (381)	B
Castlereagh Hwy (nth)	820 (100)	572 (181)	290 (145)	0	0	1,682 (426)	A (B)

1 Current traffic derived from *Table 3.1,* shown as vehicles per day (peak vehicles per hour).
2 Based on traffic generation estimates from Barneys Reef Wind Farm assessment.
3 Based on traffic generation from Tallawang Solar Farm assessment.
4 Future level of service (LoS) based on rural road network service flow rates in *Table 4.4* and totalling the current traffic with traffic generation from all projects. Shown as LoS for daily traffic (peak hourly traffic).

The total cumulative traffic flows shown in *Table 4.7* above, indicate that operating conditions (levels of service) along the rural road network would generally be adequate, even after the addition of total cumulative traffic generation from a number of surrounding proposed / approved developments.

It should be noted that the above total cumulative traffic suggests the potential for the total cumulative traffic to occur. However, it is considered that this worst-case scenario is unlikely to occur due to a number of factors including staff / material resourcing and component manufacture as well as collaboration between projects to avoid transport scheduling conflicts.

Once the construction dates / timetables are finalised for the Tallawang Solar Farm Project (currently anticipated to start in June 2023 for a period of approximately 34 months) as well as for the above projects, the cumulative impact of all concurrent projects (including any other potential future projects) would need to be considered with respect to transport and traffic operations.

Generally, any transport-related impacts would initially need to be considered as part of a CTMP to minimise cumulative construction impacts. This is particularly relevant for wind farm projects such as Barneys Reef, which generate the great majority of their transport impacts during the construction phase.

Typical mitigation measures would include:

- Independent scheduling of construction activities and deliveries for each project so that they do not overlap in order to minimise road transport movements.
- Region-wide traffic management.
- Shared road infrastructure upgrade works.
- Targeted dilapidation and reinstatement programs.
- Collective community consultation programs.

4.7 Decommissioning Phase

At the end of the operational life of the Project, should the Project be decommissioned, all infrastructure will be dismantled and removed from the Project site. This may not include the connection infrastructure which may be essential to be retained.

Internal roads, if not required for ongoing farming purposes or fire access, would be removed and the Project site reinstated as close as possible to its original condition and use. Access gates, if not required for farming purposes, would also be removed. Individual landowners will be involved in any discussion regarding the removal or hand-over of infrastructure on their property.

All decommissioning work would be the responsibility of the Proponent and provision for this will be included in the lease arrangements agreed with the landowners.

Traffic generation during decommissioning is estimated to be approximately 30% less than the peak traffic generation during construction – refer to the traffic generation volumes shown in *Table 4.2* above.

Based on the assessment of the road capacity during the construction phase (detailed above in *Section 4.3.1*), traffic and road network impacts would be minimal with only marginal changes from existing conditions. Although the road network conditions at the end of the Project's life in 35 years are unknown, it is considered that based on current conditions, the road network would have significant spare capacity and be able to accommodate the necessary heavy vehicles to be used during the decommissioning.

As per the construction phase, a comprehensive CTMP would be prepared prior to the decommissioning phase in conjunction with the relevant road authorities. This would aim to ensure adequate road safety and road network operations are maintained.

5. Mitigation Measures

5.1 General Management of Potential Impacts

The management of potential impacts caused by the proposed Tallawang solar farm would cover the construction, operation and decommissioning phases of the Project. With respect to the potential traffic impacts during the decommissioning phase, these essentially mirror the construction phase impacts, although would occur over a shorter time period.

For management of potential impacts during the construction phase, the following general measures would need to be undertaken:

- Engage a licensed and experienced transport contractor with experience in transporting solar farm component loads. The contractor would be responsible for obtaining all required approvals and permits from TfNSW and local Councils and for complying with conditions specified in the approvals.
- Dilapidation surveys would be conducted for detailed pavement and infrastructure inspections (eg. bridge loading adequacy) to ensure all access routes are suitable prior to carrying out the transport tasks.
- To ensure adequate road safety is maintained, a comprehensive CTMP would be prepared by the Proponent in conjunction with the transport contractor and relevant road authorities. The CTMP would detail appropriate construction traffic controls and management measures and all aspects would be implemented in co-ordination with Councils and TfNSW. The CTMP would include, but not be limited to, provisions for the following typical issues:
  - Details of all transport routes and traffic types to be used for development-related traffic.
  - Protocol for undertaking dilapidation surveys in consultation with the relevant road authorities.
  - Protocol for the repair of any roads identified in the dilapidation surveys to have been damaged during construction or decommissioning works.
  - Details of the measures that would be implemented to minimise traffic safety issues and disruption to local users of the transport route(s) during construction or decommissioning works, including, but not limited to, the following:
    - consideration of potential interaction with other State Significant Development in the local area in consultation with the applicant(s) of those projects;
    - temporary traffic controls, including detours and signage;
    - notifying the local community about project-related traffic impacts;
    - minimising potential for conflict with school buses, stock movements and rail services;
    - implement measures to minimise development-related traffic on the public road network outside of standard construction hours;
    - implement measures to minimise dirt tracked onto the sealed public road network from Project-related traffic;
    - ensuring loaded vehicles entering or leaving the site have their loads covered or contained;
    - providing sufficient parking on-site for all Project-related traffic;

  - responding to any emergency repair or maintenance requirements during construction and/or decommissioning;
  - traffic management system for managing OSOM vehicles; and
  - comply with the traffic conditions in the Development Consent.
- Drivers' code of conduct that typically addresses, but is not limited to, the following:
  - travel speeds;
  - fatigue management;
  - procedures to ensure that drivers adhere to the designated transport routes;
  - procedures to ensure that drivers implement safe driving practices; and
  - include a detailed program to monitor and report on the effectiveness of these measures and the code of conduct.

- Prepare road dilapidation reports covering pavement, drainage and bridge structures in consultation with TfNSW and the local Councils for the proposed transport routes before and after construction. Regular inspection regimes undertaken in consultation between local Councils and the Proponent would be developed. Any damage resulting from construction traffic, except that resulting from normal wear and tear, would be repaired to pre-existing conditions.
- Speed reduction along Castlereagh Highway at Birriwa to mitigate potential noise impacts.
- Consider establishing a 'car pool' initiative or providing bus services for construction staff from nearby centres to minimise the impact of vehicle movements.
- For decommissioning, similar general measures would be necessary as those detailed for construction. However, the CTMP for decommissioning would need to be revised to address traffic operation and volume changes in the future years during the decommissioning phase.

For management of potential impacts during the operations phase, the following general measures would need to be undertaken:

- Establish a procedure to ensure the ongoing maintenance of the internal on-site access network during the operation phase. This maintenance would include sedimentation and erosion control structures, where necessary.

5.2 Road Authority Approvals

The use of licensed and experienced contractors for transporting solar farm equipment and components is essential to ensure the minimisation of any impacts to the road network and traffic operations. There are a number of transport contractors who are experienced in the specialised transport of OSOM vehicle loads. These contractors operate closely with road authorities and are able to arrange all required permits for undertaking the transport tasks. They would also carry out detailed transport route assessments and confirm the requirement for any road infrastructure upgrades and/or bridge strengthening works.

In obtaining approval and permits for OSOM transport, the following documents are pertinent:

- NSW RMS "*Additional Access Conditions: Oversize and overmass heavy vehicles and loads*" November 2017

- NSW RTA "*Road Transport (General) Act 2005: General Class 1 Oversize (Load-Carrying Vehicle) Notice 2007 under Division 3 of Part 2 of the Road Transport (Mass, Loading and Access) Regulation 2005*" August 2007
- NSW RTA "*Road Transport (General) Act 2005: General Class 1 Oversize (Special Purpose Vehicle) Notice 2007 under Division 3 of Part 2 of the Road Transport (Mass, Loading and Access) Regulation 2005*" August 2007

Consultation with TfNSW regarding their requirements for transporting OSOM vehicle loads resulted in the following pertinent issues:

- Generally, the wider and longer OSOM transport will require two pilot vehicles and contact with NSW Police for further guidance (pilot vehicles).
- OSOM permits are required to be 'specific' permits for each vehicle if they will be travelling along designated roads or locations. Additional and specific OSOM permits may be required for loads with greater dimensions than covered by a General Class 1 Oversize Notice.
- A specific permit:
  - prescribes the travel conditions that apply to a particular vehicle;
  - identifies the vehicle to which the permit applies; and
  - identifies the registered operator of the vehicle.
- The permit may also specify conditions to secure payment for:
  - damage caused to roads, bridges or other property by the OSOM vehicle;
  - road work that must be conducted before the vehicle can travel on a particular route; or
  - costs incurred by TfNSW to evaluate the proposed route or provide any special escort services.
- Transport of over-size (length) components will most likely utilise a rear-end steering system on a trailer or low loader.
- An over-mass permit will be required for the sub-station transformer unit.
- Night transport is generally available along the major road network (between 1 am and sunrise or 6 am, whichever is earlier).
- Transport through the any urban areas must generally occur during daylight periods. It is recommended that if the transport routes pass through any school zones or adjacent to any schools, transport also be restricted to outside school drop-off and pick-up times (8:00 am to 9:30 am and 2:30 pm to 4:00 pm) to prevent conflicts with these activities.

5.3 Potential Road Infrastructure Upgrades

As well as the construction of an internal on-site access network that connects the various parts of the solar farm site and associated infrastructure, local intersection widening works to accommodate the increased heavy vehicle volumes and OSOM transport vehicles would be required at the primary Project access at the Jacksons Lane / Castlereagh Highway intersection.

The proposed intersection will consist of a three-way junction with a connecting access road extending onto the Project area. The proposed intersection upgrade would provide an auxiliary and/or protected (channelised) turn lane intersection treatment to accommodate the swept path turning movement by the largest types of trucks requiring access to the Project area – refer to *Figure 4.1* and *Figure 4.2* for concept intersection layouts for the primary Project access.

The intersection upgrade works described above would be developed and implemented in consultation with and to the satisfaction of the local Council(s) and TfNSW and designed to their satisfaction and approval.

6. Summary & Conclusions

The following pertinent issues summarise the transport assessment for the proposed Tallawang Solar Farm project:

- The solar farm would be located in the Central West region of NSW, approximately 8 km north-west of Gulgong, within the Mid-Western LGA and the Central West Orana Renewable Energy Zone.
- The Project will involve the construction, operation and decommissioning of a 500-MW solar farm with a BESS of approximately 200 MW / 400 MW-hours, a 330 kV overhead transmission line approximately 13 km long and associated infrastructure connecting to the national electricity grid.
- Road transport is the preferred method of transport. Rail is not feasible due to larger solar farm components not being able to be accommodated by the rail system, lack of vertical and horizontal clearance in some sections, double handling, problems of scheduling rail services and potential restriction on track capacity.
- The primary Project access provides a newly proposed access location from the Castlereagh Highway along a local road directly south of the Project area (known as Jacksons Lane) for all transportation including OSOM vehicles and standard light and heavy vehicles.
- The preferred transport route for OSOM vehicles is via Golden Highway and Castlereagh Highway to the Project's primary site access.
- The major road network and standard heavy vehicle road network provides transport routes directly to the Project's primary access.
- The source of resources for construction is a commercial procurement decision which will occur post-Development Consent. The routes used to move the resources through the surrounding towns and road network will be along the major road network and standard heavy vehicle road network, or alternatively along routes permitted by the resource suppliers' permitting and approvals process.
- The major and minor road networks in the vicinity of the proposed solar farm project all have significant spare capacity.
- All solar farm component locations and ancillary infrastructure would be able to be accessed from the primary Project access point via an internal project site road network.
- During the construction phase, several tasks would generate traffic including solar farm component delivery, construction material delivery and construction staff transport. During peak construction activities, the maximum daily traffic generation would be up to 600 light vehicle trips and up to 270 heavy vehicle trips. There would be a total maximum of four (4) OSOM vehicle trips during the entire duration of the Project's construction period.
- During peak construction activities, all affected roads on the road network would maintain satisfactory levels of service and adequately absorb construction-generated traffic.

- Traffic generation during operations would be minimal resulting in a maximum of up to 20 trips per day. Consequently, traffic and road network impacts would be negligible during the operational phase.
- During Project construction, the increased traffic generation and in particular, the higher turning movements to/from the highway at the Project's primary access location would warrant auxiliary and/or protected (channelised) turn lane intersection treatments.
- A comprehensive CTMP would be prepared by the Proponent in conjunction with the transport contractor and relevant road authorities and all aspects would be implemented in co-ordination with the local Council and TfNSW.
- The use of licensed and experienced contractors for transporting solar farm equipment and components would ensure a minimisation of transport-related impacts. They would operate closely with road authorities and arrange all required permits for undertaking the transport tasks, as well as carry out detailed transport route assessments and confirm the requirement for any road infrastructure upgrades.
- Traffic generation during decommissioning is estimated to be approximately 30% less than the peak traffic generation during construction. Traffic and road network impacts are anticipated to be minimal with only marginal changes from existing conditions. A comprehensive CTMP would be prepared prior to the decommissioning phase in conjunction with the relevant road authorities to ensure adequate road safety and road network operations are maintained.
- While there are a number of nearby major projects that may result in cumulative impacts, once the construction dates / timetables are finalised for the Tallawang Solar Farm Project, the cumulative impact of all concurrent projects (and potentially other future projects) would need to be considered with respect to transport and traffic operations.

In conclusion, it is considered that with the appropriate intersection upgrade at the primary site access point and suitable construction traffic management, the proposed Tallawang Solar Farm Project would not create any significant adverse impacts with respect to transport issues such as traffic operations, road capacity on the surrounding road network, site access and road safety. The management of heavy vehicle movements during construction would be appropriately covered by a CTMP to be prepared prior to construction starts, while the use of a specialised and licensed transport contractor would ensure that the transport tasks would be undertaken in an appropriate manner.

Appendix A

Transport for NSW Advice / Issues

Requirement	Where Addressed
Consideration of the cumulative traffic volumes from the proposed Tallawang Solar Farm and the Barney's Reef Wind Farm, in this respect the following matters should be addressed: – Will both projects have overlap in terms of the scheduling of commencement and completion? – If this is the case, the TIA should be prepared in a manner that addresses the overlapping timeframes and how the cumulative traffic impacts will be managed and should be assessed collectively in relation to traffic volumes for construction workforce, light vehicles, heavy vehicles and the relationship with the over-size and over-mass (OSOM) movements for the Barneys Reef Wind Farm. – Will the workforce be shared between the two developments? – Will the workforce have coinciding hours of operation? What will the cumulative implications be for the traffic generation? – The peak traffic generation should be assessed collectively for both projects in relation to the AM and PM peaks for the construction workforce and heavy vehicles. How will this be managed? Will the hours of operation and shifts be staged for each project? – Consideration should be given within the TIA if the projects will be overlapping to the key access points with the classified road and the traffic volumes that will be accessing those intersections. – The TIA should also address the haulage routes and the construction workforce routes collectively and the timeframes for the movements of heavy vehicles, light vehicles and OSOMs for both projects. – Austroads warrant assessment as per *Part 6* of *Austroads Guide to Road Design* should be based on the cumulative peak traffic generation if both projects are to have coinciding timeframes and workforces. In this regard, the concept design for any intersection treatments with the classified road network are to form part of the documentation referred to TfNSW.	Refer to *Section 4.6* for general cumulative impact measures – once the construction dates / timetables are finalised for the Tallawang Solar Farm Project and other nearby projects that may create cumulative impacts, any impacts would be considered as part of a Construction Traffic Management Plan (CTMP) to minimise cumulative construction impacts.
Project schedule: – Hours and days of work, number of shifts and start and end times. – Phases and stages of the project, including construction, operation and decommissioning.	Some general information has been provided in *Section 2* and *Section 4* – further information will be provided in the CTMP once a more detailed construction methodology is developed
Traffic volumes: – Existing background traffic. – Project-related traffic for each phase or stage of the project. – Projected cumulative traffic at commencement of operation, and a 10-year horizon post-commencement.	Refer to *Sections 3.3*, *4.2* and *4.4* – cumulative traffic will be detailed in the CTMP once a more detailed construction methodology is developed and construction dates / timetables are finalised.

Requirement	Where Addressed
Traffic characteristics: – Number and ratio of heavy vehicles to light vehicles. – Peak times for existing traffic. – Peak times for project-related traffic including commuter periods. – Proposed hours for transportation and haulage. – Interactions between existing and project-related traffic.	Refer to *Sections 3.3*, *4.2, 4.3* and *4.4* – further details on timing will be provided in the CTMP and as part of the NHVR OSOM permit process once a more detailed construction methodology is developed.
Description of all OSOM vehicles and the materials to be transported.	Refer to *Sections 4.1* and *4.2.1*
Origins, destinations and routes for: – Commuter (employee and contractor) light vehicles and pool vehicles. – Heavy (haulage) vehicles. – OSOM vehicles.	Refer to *Sections 3.2* and *4.2.2*
Road safety assessment of key haulage route/s.	Refer to *Section 3.4*
Impact of traffic generation on the public road network and measures employed to ensure traffic efficiency and road safety during construction, operation and decommissioning of the project.	Refer to *Sections 3.4, 4.3* and *4.5*
Need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and mitigate the impact of project-related traffic.	Refer to *Sections 4.3.2, 4.3.4* and *5.3* – further details on specific roadworks / road network upgrades will be detailed in the CTMP once a detailed construction methodology is developed.
Proposed road facilities, access and intersection treatments are to be identified and be in accordance with Austroads Guide to Road Design including provision of safe intersection sight distance (SISD).	Refer to *Section 4.3.2*
Local climate conditions that may affect road safety during the life of the project, eg. fog, wet and dry weather, icy road conditions, etc.	To be specifically covered within a downstream CTMP document inclusive of a '*Driver's Code of Conduct*'.
Layout of the internal road network, parking facilities and infrastructure.	Refer to *Figure 1.2: Conceptual Solar Farm Layout*.
Impact on rail corridors and level crossings detailing any proposed interface treatments.	Refer to *Section 3* and *Section 4*
Impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling.	Refer to *Section 5.1* and to be specifically covered within a downstream CTMP document.

Requirement	Where Addressed
It is noted that there are a significant number of renewable energy projects occurring within the locality and consideration of the traffic implications from coinciding timeframes for the construction of these projects should form part of the TIA.	Refer to *Section 4.6* for general cumulative impact measures – once the construction dates / timetables are finalised for the Tallawang Solar Farm and other nearby projects, any cumulative impacts would be considered as part of a CTMP to minimise construction impacts.
TIA is to consider the timing of TfNSW projects that are likely to be coinciding with the development in relation to the proposed haulage routes to be utilised for the development.	To be specifically covered within a downstream CTMP document once the timing of the Project is finalised.
Inclusion of the traffic generation from the construction of ancillary aspects such as the transmission line will need to form part of the TIA. It is noted the transmission line will be an overhead line and will cross the railway line to the north of the project.	Refer to *Section 4.2*
Consultation with ARTC (as the rail authority) should occur regarding the proposed overhead transmission line.	Refer to *Section 1.4*.