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Wollar Solar Farm

Traffic Impact Assessment

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1. Introduction

1.1 Background

Ontoit was engaged by NGH Environmental (NGH) to undertake a comprehensive review of the existing and future transport conditions as part of a Traffic Impact Assessment (TIA). Ontoit understands the TIA will assist with the completion of an Environmental Impact Assessment for the proposed Solar Farm at Wollar, NSW, and form part of the approval documentation to the State and Local Government Agencies.

The purpose of the study is to examine the operation of the existing traffic network and to assess the traffic and parking impacts that may arise from both the construction and operational activities generated by the proposed Solar Farm. In addition, this report builds upon the work undertaken by NGH in producing the '*Preliminary Environmental Assessment (2018)*' and the resulting agency comments and Secretary's Environmental Assessment (SEARs) Requirements.

This report presents the analysis and results that have been undertaken as part of the TIA and will support the broader Environmental Impact Assessment for the proposed Solar Farm. The assessment of traffic and parking impacts generated by the proposed development is based on the following information and guidelines:

- Proposed development plans and designs provided by NGH;
- The NSW Roads and Maritime (RMS) *Guide to Traffic Generating Developments* (Version 2.2, October 2002);
- The Mid Western Regional Council Development Control Plan (DCP) 213 (Amendment No.2, Dec 2014); and
- Review of existing traffic and parking conditions in the surrounding road network.

1.2 Site Context

Ontoit understands the proposed Solar Farm site is located 7km south of Wollar Village and is situated to the west of Barigan Road (see **Figure 1** red circle). The Village of Wollar is located within the Mid-Western Regional Local Government Area (LGA) and is approximately 54km north-east of Mudgee (38kms as the crow flies). Primary access to the village is via Wollar Road from the east and west and Ulan-Wollar Road from the north which connects to the Golden Highway via Ulan Road.

The land immediately surrounding the proposal site is a mix of grazed and Crown Land. We understand that the grazed land is currently occupied by approximately 500 head of cattle and forms one of the primary industries of the area. Coal mining is another predominant industry and employer within the area and the nearest mine is located at Wilpinjong, which is approximately 11km north west of the proposed Solar Farm site.

The village of Wollar is the nearest inhabited area which had a recorded population of 69 people in 2016. The town boasts a number of facilities including a general store (including Post Office and fuel), community hall, Rural Fire Services and a public primary school. We understand the predominant industry for local residents is farming which includes cattle and cropping for feed. In addition, the Wilpinjong Mine is located approximately 5km north east of the village and was established in 2006. Since establishment, the operator Peabody Energy has received further approval (April 2017) for expansion of the facility to the north east of the existing site.

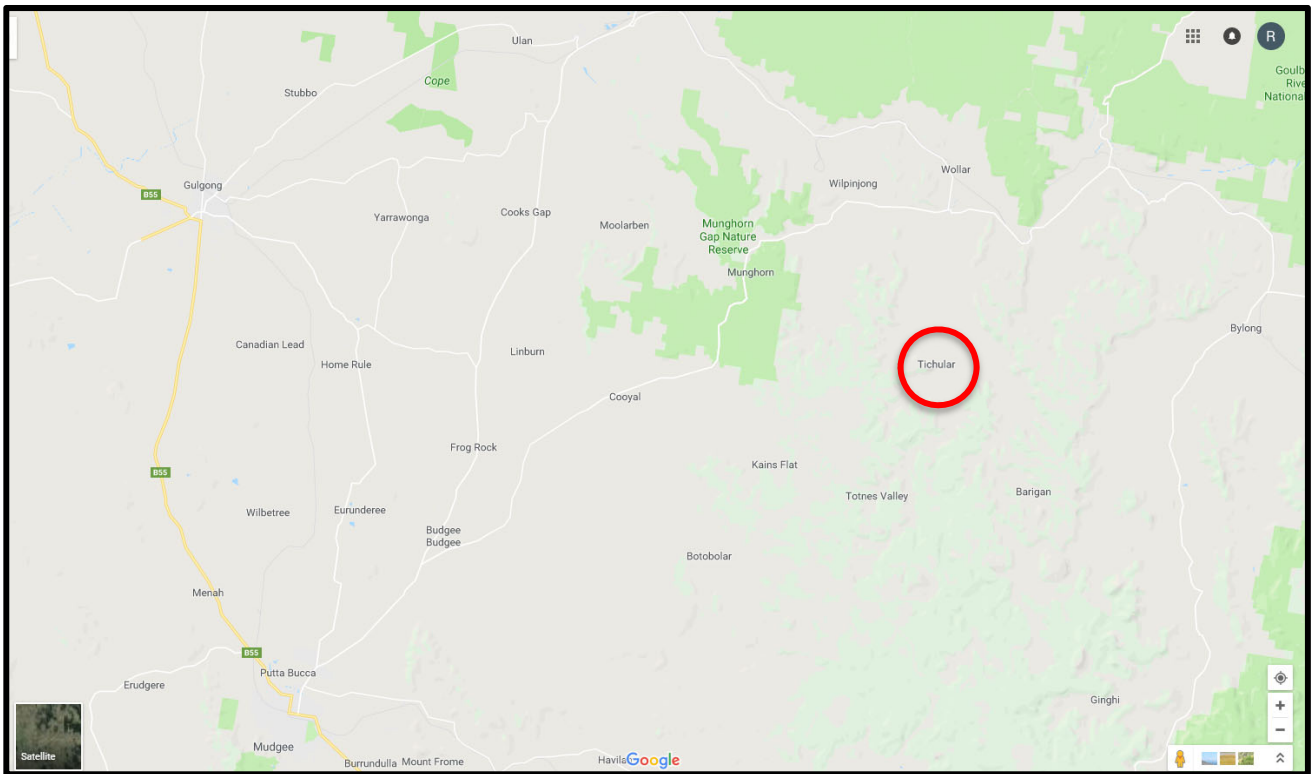


Figure 1 Proposed Solar Farm location in Mid-Western Regional Council

The area of Wollar is further serviced through the regional centre of Mudgee located approximately 38km south west of the proposed Solar Farm site. Wollar residents have access to all the major services including banks, supermarkets, accommodation, post office, medical centres and a hospital at Mudgee. Based on the 2016 Census, Mudgee currently has a population of 10,923 which is an increase of 9.7% since 2006 and currently makes up 44.4% of the Mid-Western Regional LGA. Access to Mudgee from Wollar is via Wollar Road and Ulan Road which provide direct access into the Town Centre of Mudgee.

1.3 Report Structure

This report provides advice and analysis on the potential future traffic and transport conditions that will result from the proposed Solar Farm. The report has been structured as follows:

- Chapter 2 – Existing Situation – this section provides an overview of the current traffic and transport conditions in the vicinity of the proposed development site;
- Chapter 3 – The Development Proposal – this section provides an overview of the development proposal and associated transport and traffic infrastructure;
- Chapter 4 – Future Traffic Conditions – this section provides an overview of the likely impacts to the transport and traffic network as a result of the development; through both the construction and operational phases; and
- Chapter 5 – Summary and Conclusion – this section summarises the analysis and key conclusions / recommendations of the study.

2. Existing Conditions

A comprehensive review of the transport and traffic network in the vicinity has been undertaken to establish a baseline of conditions. This section outlines and summarises the findings from this review.

2.1 Road Network

The area of Wollar is located within the Mid-Western Regional LGA and is accessed via three primary road corridors:

- Wollar Road from the west which connects to Ulan Road to access the Regional Centre of Mudgee;
- Wollar Road from the east which connects to Ringwood Road to access the Golden Highway or alternatively continues to access the Bylong Valley Way to access Bylong and Murrumbo; and
- Ulan-Wollar Road from the north that connects to Ulan Road and the Golden Highway to the north or alternatively to Gulgong via Cope Road in the west.

Figure 2 illustrates the location of Wollar noting the major regional towns of Mudgee and Gulgong to the west.

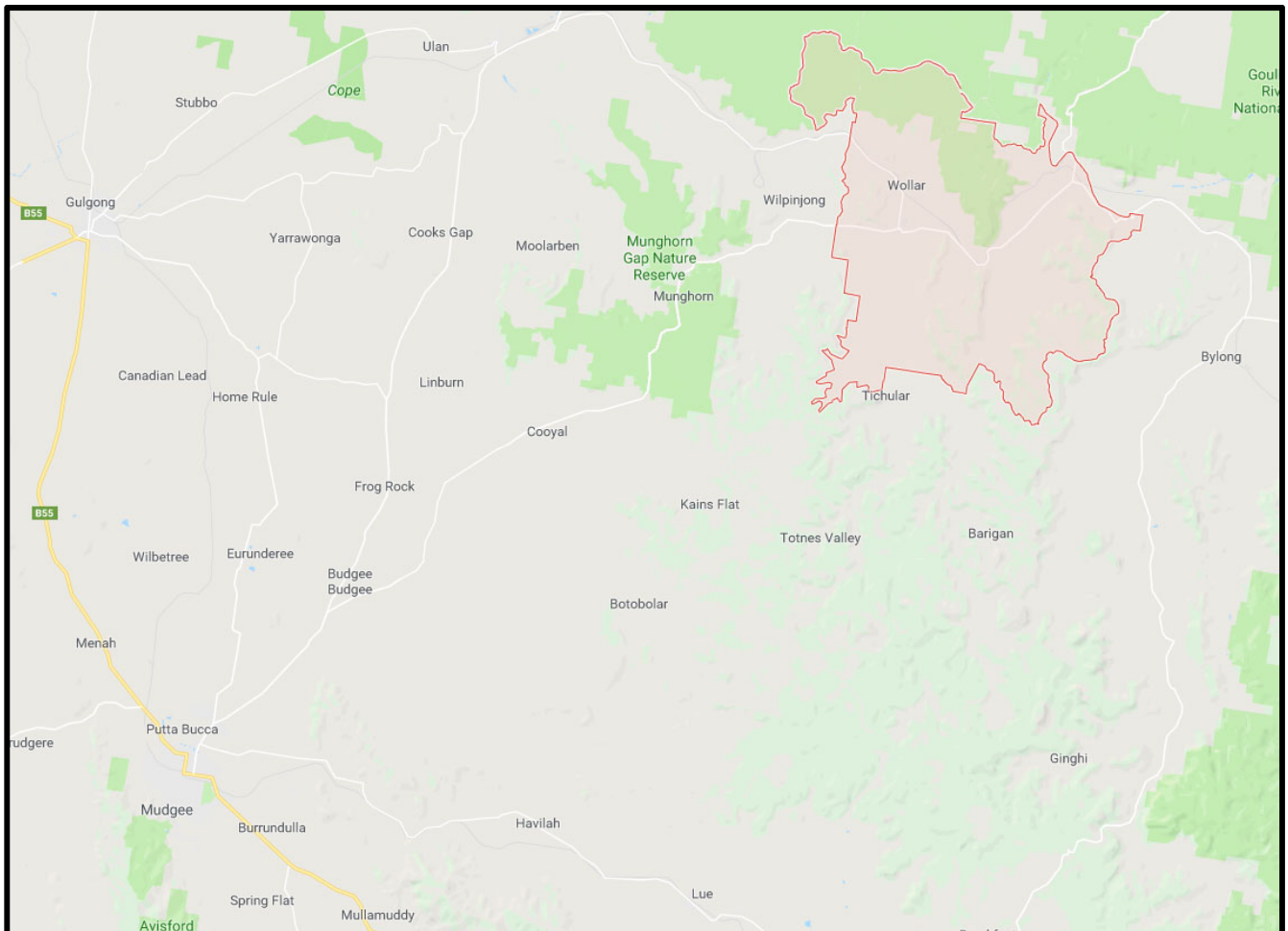


Figure 2 The area of Wollar obtained via Google Maps

The area of Wollar is centred around Wollar Village which is the closest inhabited area to the proposed Solar Farm. The proposed Solar Farm site under investigation is located approximately 7km south of Wollar Village and is accessed via Barigan Road. **Figure 3** illustrates the location of the proposed Solar Farm and key access corridors.

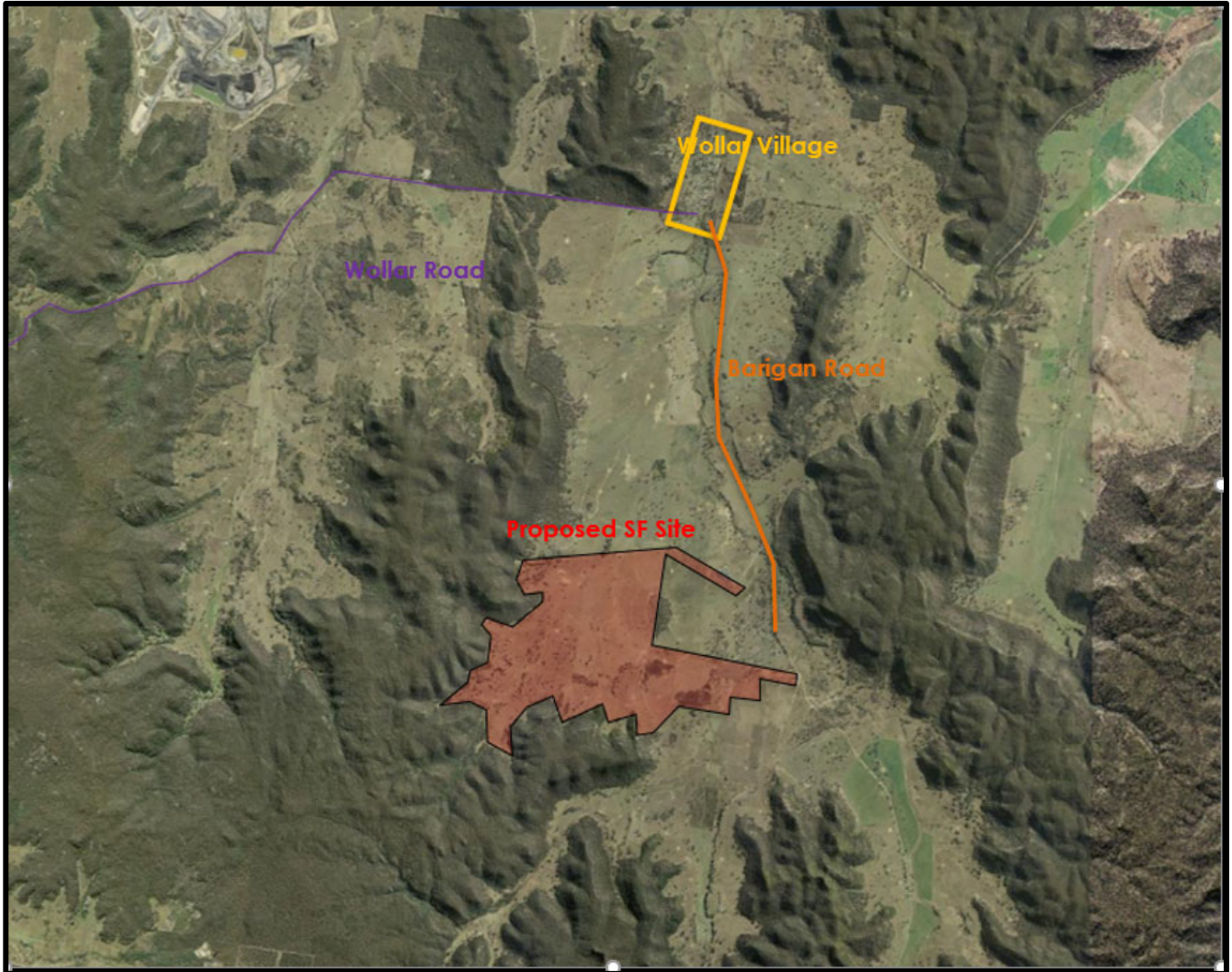


Figure 3 Proposed Solar Farm site and key access corridors sourced from NSW Six Maps

Access to the proposed Solar Farm site is via the three primary access corridors that connect to Wollar Village. From the village access to the site is via Barigan Road which links to the proposed access roads to the site. Characteristics for each of these roads are different and are briefly described below:

- Wollar Road (east and west of Wollar Village) is classified as a Regional Road in the RMS Road Classification Hierarchy and consists of:
 - > Sealed bitumen road with approximate carriageway width of 7m (see **Figure 4** and **Figure 5**);
 - > Single traffic lane in each direction;
 - > Line marking in the form of centre lines and in some cases road edges;
 - > Regular property and commercial development accesses directly off the roads;
 - > Posted speeds on open road and in built up areas;
 - > Regular unsignalised priority-controlled intersections with local roads; and
 - > An existing roadway capacity of approximately 600-900 vehicles per hour, per lane.



Figure 4 Wollar Road between Ulan Road and Hayes Gap Road

Figure 5 Wollar Road between Mahons Road and O'Brien's Lane

- Ulan-Wollar Road is not a classified road within the RMS Road Classification Hierarchy and is therefore a local council access road, key characteristics include:
 - > Sealed bitumen road with approximate carriageway width of 7m;
 - > Single traffic lane in each direction;
 - > No regular Line marking in the form of centre lines and in some cases road edges;
 - > Regular property and commercial development accesses directly off the roads;
 - > A number of rail crossings;
 - > Posted speeds 100kph on open road and 50kph in built up areas;
 - > Regular unsignalised priority-controlled intersections with local roads; and
 - > An estimated existing roadway capacity of approximately 300-500 vehicles per hour, per lane.
- Barigan Road is not a classified road within the RMS Road Classification Hierarchy and is therefore a local council access road, key characteristics include:
 - > Unsealed road with approximate carriageway width of 6-7m (see **Figure 6** and **Figure 7**);
 - > Single carriageway road with no formal line marking, requires vehicle to slow and move to one side to enable safe passing;
 - > Regular property and commercial development accesses directly off the roads;
 - > Regular unsignalised priority-controlled intersections with local roads; and
 - > An existing roadway capacity of approximately 300-500 vehicles per hour.



Figure 6 Barigan Road immediately after Wollar Village



Figure 7 Barigan Road 2-3km south of Wollar Village

The proposed Solar Farm is accessed via Barigan Road which connects the proposed development site to Wollar Village. Barigan Road is accessible via a number of RMS State and Regional Roads as illustrated in Figure 8.



Figure 8 RMS NSW Regional Road Map (red dot denotes approximate location of proposed Solar Farm)

From a broader regional perspective, the proposed Solar Farm site is easily accessible via the regional road network that connects to the regional centres of Mudgee and Gulgong. Both Mudgee and Gulgong are accessible via Wollar Road and Ulan Road. Further to this, Ulan Road provides direct connections to both the Castlereagh Highway, which provides a direct connection to Sydney; Port Botany, and the Golden Highway, which provides direct access to Newcastle and the Port of Newcastle. These regional connections will likely play a critical role during the establishment of the Solar Farm which is discussed further in **Section 4**.

2.1.1 Vehicle Volumes

Local area traffic data was sourced from two locations:

- The 2015 Wilpinjong Extension Project – Road Transport Assessment (GTA Consultants); and
- A site visit conducted on Tuesday 7th of August 2018.

Figure 9 illustrates the location of survey traffic data that was collected during the 2015 counts and from the recent site visit.

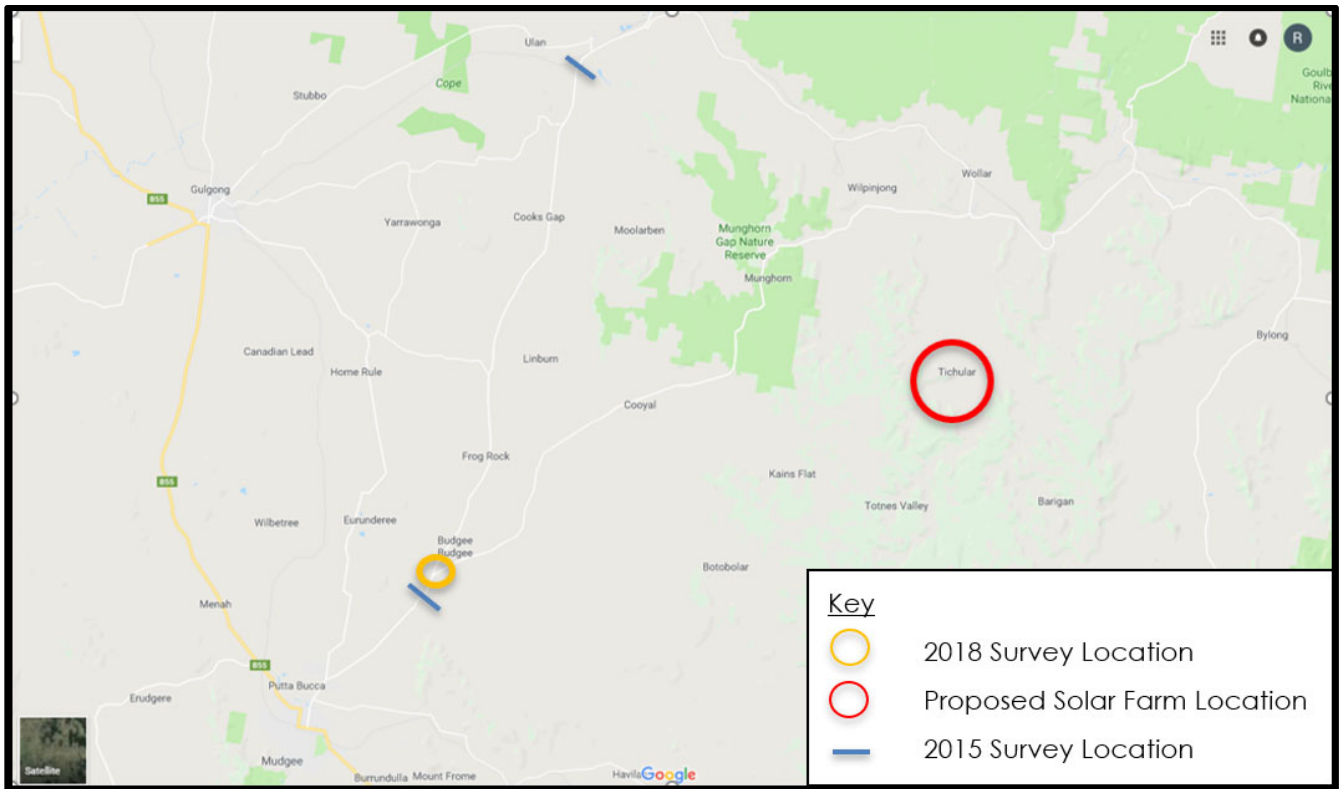


Figure 9 Traffic survey data collection

Traffic surveys were focussed to capture traffic flows along primary access corridors, as advised by the client, which are anticipated to be to the west of the proposed Solar Farm location. Ontoit was advised that:

- Equipment and materials will largely be imported and therefore arrive at either Port Botany, Sydney or the Port of Newcastle. Key access roads from these locations include:
 - > The Castlereagh Highway linking to Mudgee then onto Ulan Road and Wollar Road for goods arriving from Port Botany; and
 - > From the Port of Newcastle, multiple routes are available however the Golden Highway will form the primary access corridor. Access to Wollar can be gained via Bylong Valley Way and Wollar Road, Ringwood Road and Wollar Road or alternatively Ulan Road, which all connect to the Golden Highway.
- Workers and staff are likely to come from local regional towns, key access corridors include:
 - > From Mudgee – Ulan Road onto Wollar Road, which connects to Barigan Road;
 - > From Gulgong – Multiple routes are available; however, two routes are considered to provide the most direct access, these include:
 - / Cope Road to connect to Ulan Road, then onto Ulan-Wollar Road, which connects to Barigan Road; and
 - / Henry Lawson Drive – Mudhut Creek Road – Ulan Road – Linburn Lane, which connects to Wollar Road and provides access to Barigan Road.

Given the above information, traffic survey data was collected to establish a robust baseline for the primary road corridors; Ulan Road and Wollar Road. In addition, comprehensive 24-hour, 7-day data was collected in 2015 (see **Attachment A.1**) which was utilised to determine the location and timing of the 2018 surveys. As such, the 2018 surveys were focused at the Ulan Road / Wollar Road intersection; to enable a comparison between the existing 2015 data and to obtain recent movement and turning data for the Ulan Road – Wollar Road corridor. The 2018 surveys were focused on:

- The AM Peak Period – determined to be 5am-6am consistently from the 2015 traffic counts; and
- A PM Count – the 2015 traffic surveys had varying PM peak periods which were dependent on location. Therefore, the 2018 count was undertaken between 3pm and 4pm to obtain a typical weekday PM traffic volume count (*this was also consistent with the southbound Ulan Road, south of Wollar Road 2015 count PM peak Period*).

The results of the 2018 traffic surveys are illustrated in **Figure 10**.

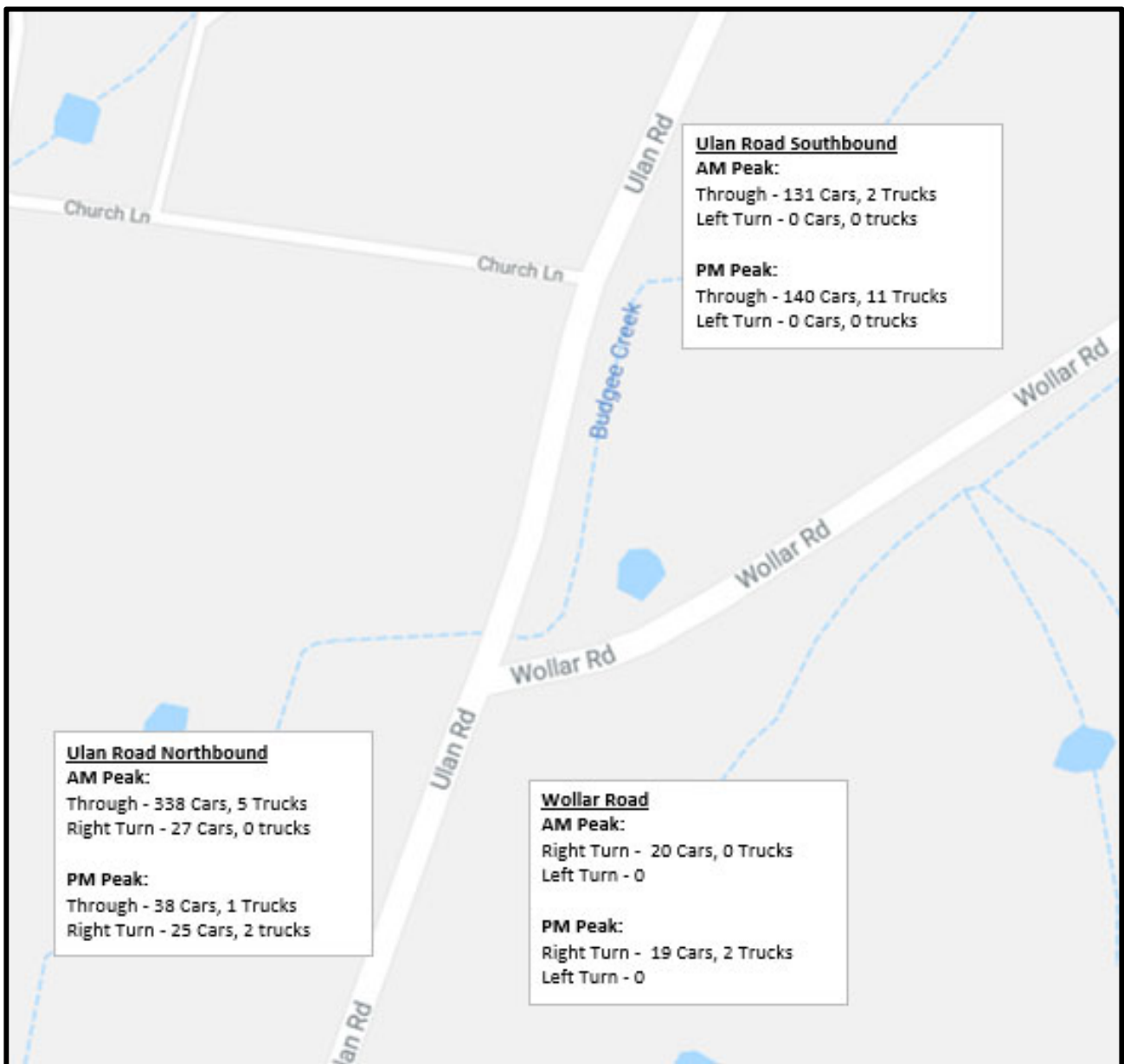


Figure 10 Summary of the 2018 traffic survey counts for AM and PM peak periods

2.1.2 2015 vs 2018 Traffic Volume Observations

A comparison on the 2018 vs 2015 traffic surveys was undertaken for Ulan Road to assist in establishing a robust baseline in traffic activity in the region over the past three years. In addition, the comparison was undertaken to identify any impacts associated with adjacent development / land uses such as the Wilpinjong Mine Extension.

In 2015, the 'Wilpinjong Extension Project – Road Transport Assessment' (WEP RTA), see Table 6.1, identified an increase of 200 vehicles in the AM peak hour along Ulan Road south of the intersection with Wollar Road by 2017. The 2018 count identified a growth of 135 vehicles, approximately 40% increase, in northbound traffic and a further 66 additional vehicles southbound, approximately 100% increase. This equates to a total growth of 201 vehicles along Ulan Road in the AM Peak period which is consistent with the forecasts presented in the WEP RTA. It is therefore a reasonable conclusion that all the growth along Ulan Road can be attributed to the expansion of the Wilpinjong Mine.

In the PM peak the WEP RTA identified an additional 163 vehicles. The 2018 surveys indicated a decrease of 83 vehicles northbound, approximately 60% decrease and an increase of 17 vehicles southbound, approximately 11% increase. Whilst the 2018 counts are not consistent with the WEP RTA forecasted traffic growth, it should be noted that this could be explained by our PM traffic count focusing on 3-4pm as opposed to the 6-7pm noted in the RTA. Overall, we can conclude that the primary impact of the expansion of the mine has been on the AM peak period.

2.1.3 Historic Origin and Destination Data

The 2015 Road Transport Assessment for the Wilpinjong Extension Project undertook analysis of the existing distribution of visitor, delivery and workers for the existing mine operations. Whilst the proposed Solar Farm does not have an existing operation, the trip distribution for the Wilpinjong Mine operation provides a good indicator of the potential trip distributions for the Solar Farm. In 2015, the existing mine operations had a trip distribution of:

- 89% to/from Mudgee utilising Ulan Road and Ulan – Wollar Road;
- 9% to/from Newcastle utilising the Golden Highway and Ulan – Wollar Road; and
- 2% to/from Orange, utilising Mitchell Highway to Wellington and Gulgong, then Cope Road to Ulan Road (GTA, 2015).

This trip distribution data will be utilised to assist in determining the trip distribution for the proposed Solar Farm in **Section 4**.

2.2 Access

Existing accesses in the vicinity of the proposed Solar Farm are all off Barigan Road. There are a number of potential accesses to the site including:

- The unnamed access to the existing substation (see **Figure 11**, **Figure 12** and **Figure 13**), this is currently an unsealed road approximately 4-5m in width; and
- Maree Road is an existing unsealed road approximately 4-5m in width (see **Figure 14** and **Figure 15**).



Figure 11 Existing substation access road aerial (Credit: Google Maps)



Figure 12 Existing Substation access road



Figure 13 Existing substation access road intersection with Barigan Road



Figure 14 Existing Maree Road access



Figure 15 Maree Road

2.3 Crash Data

Existing road crash data was sourced from the Transport for NSW road safety website, available from: http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tblga=4. A review of historic crash data (between 2011 and 2016) was undertaken focussing on the primary corridors to and from the proposed Solar Farm site at Wollar. Crash data was analysed for:

- Ulan Road between Mudgee and Golden Highway;
- Wollar Road between Ulan Road and Barigan Road; and
- Ulan-Wollar Road between Ulan Road and Wollar Village.

No crashes have been recorded on Ulan-Wollar Road therefore analysis focused on Ulan Road and Wollar road. **Figure 16** illustrates a summary of the road crashes between 2013 and 2017 within the Mid-Western Region of NSW.

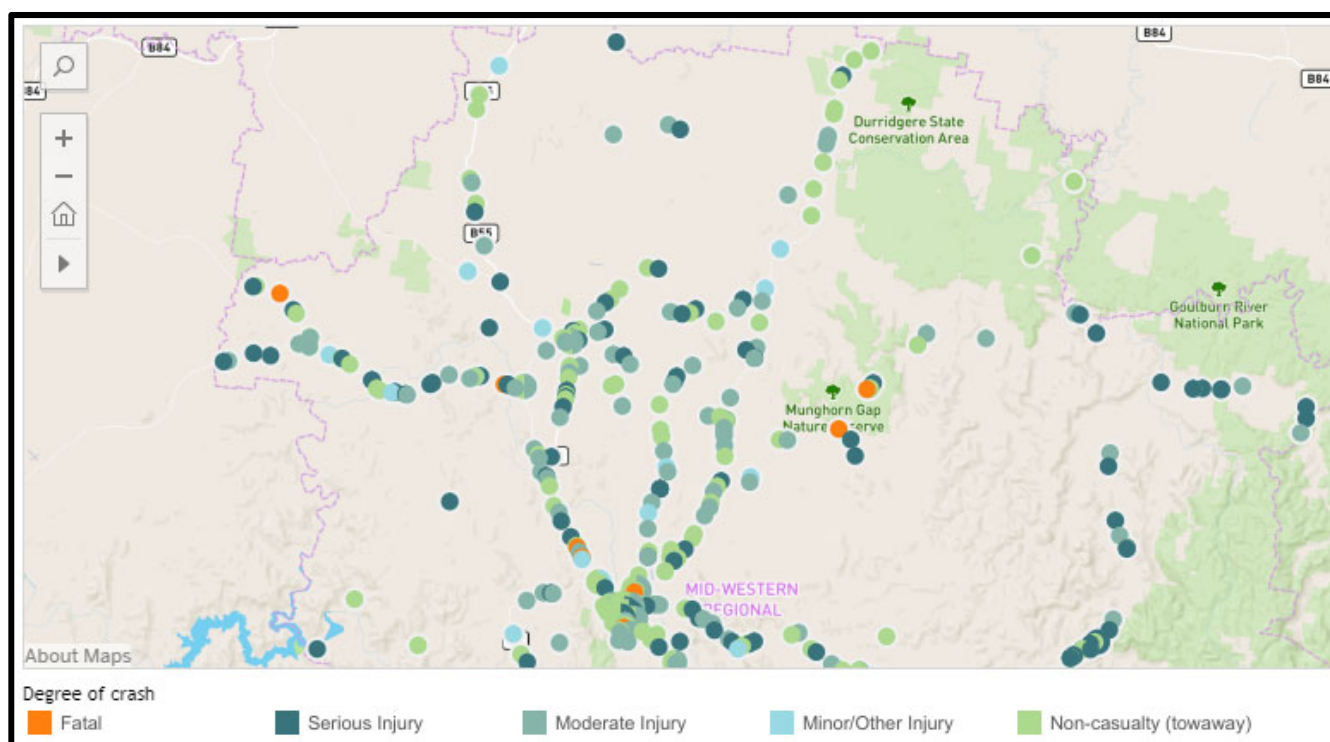


Figure 16 Summary of road crashes by severity between 2013 and 2017 for the Mid-Western Region

Figure 16 illustrates that there are a number of crashes along the key corridors to the proposed Solar Farm Site. Of particular interest is the number of Serious and Fatal crashes recorded on Ulan Road and Wollar Road. Subsequently, the crash data was further refined by road corridor, severity and year. For Ulan Road, **Table 1** provides a summary of the crashes along Ulan Road between Mudgee and the Golden Highway between 2013 and 2017.

Table 1 Detailed crash data for Ulan Road

Severity	2013	2014	2015	2016	2017	TOTAL
Fatal	0	2	0	0	0	2
Serious Injury	2	1	0	1	1	5
Moderate Injury	4	6	2	4	3	20
Minor Injury	1	0	1	0	0	2
Non-Casualty	7	7	4	4	0	22
TOTAL	14	16	7	9	4	51

Further analysis of the fatal and serious injury crashes concluded:

- 2 serious incidents occurred in 2013. One was caused by a collision with an object after drifting off the road after a 'S' bend, resulting in one serious injury. The other was due to one car being rear ended during the night, this also resulted in one serious injury. Both incidents occurred during the night;
- 2 Fatal incidents occurred in 2014. One was due to a loss of control by the driver, resulting in the loss of one life. The other was due to one car being rear ended, also resulting in the loss of one life. Both of these incidents occurred during the day;

- 1 serious incident occurred in 2016, due to drifting off the road after a sharp left bend, this resulted in one injury and occurred during the day; and
- 1 serious incident occurred in 2017, due to collision with a pedestrian. This resulted in one injury and occurred during the day.

We can conclude from the above analysis that the majority of serious and fatal crashes occurred due to driver error or drivers not driving to the conditions of the road carriageway. Despite the number of crashes over the last five years along Ulan Road the overarching trend is declining year on year.

For Wollar Road, **Table 2** provides a summary of the crashes between Ulan Road and Wollar Village between 2013 and 2017.

Table 2 Detailed crash data for Wollar Road

Severity	2013	2014	2015	2016	2017	TOTAL
Fatal	0	0	0	2	0	2
Serious Injury	1	0	0	0	2	3
Moderate Injury	1	0	1	2	0	4
Minor Injury	0	1	0	0	1	2
Non-Casualty	0	3	0	0	0	3
TOTAL	2	4	1	4	3	14

Further analysis of the fatal and serious injury crashes concluded:

- 2 Fatal incidents occurred in 2016, with 3 casualties. One was caused by collision with an object after drifting off the road during an 'S' bend occurring in the day, resulting in one fatality. The other crash was due to an animal collision during the night, which resulted in 2 fatalities;
- 1 serious incident occurred in 2013 due to collision with an object after drifting off the road during a sharp right bend occurring during the day, resulting in two people being injured; and
- 2 serious incidents occurred in 2017 due to collisions with objects after drifting off the road after 'S' bends, these occurred in very close proximity to each other. These crashes resulted in 3 injuries

We can conclude from the above analysis that the majority of serious and fatal crashes occurred due to driver error or drivers not driving to the conditions of the road carriageway. There is no overarching trend for Wollar Road based on the total yearly crashes as they have remained fairly consistent over the last five years.

2.4 Rail Crossings

There are no existing rail crossings in along the primary approach route which includes Ulan Road, Wollar Road and Barigan Road.

Whilst there are a number of rail crossings along Ulan-Wollar Road, the volumes of traffic expected to approach from this approach route is minimal and will therefore have a negligible impact on their operation. In 2015, GTA consultants undertook a comprehensive assessment of the rail crossing capacity along Ulan-Wollar Road corridor. They also estimated the probability of vehicles encountering a train at a crossing point and therefore the probability of delays. In all cases apart from one crossing which measured just over 2%, the probability was measured to be less than 1%. This result indicates that the chances of a vehicle encountering a train along this corridor is very low.

The current train timetable for the corridor is understood to be 1 train every 30 minutes or up to 3 trains an hour. Given the low volume of train activity on the line, as well as the low traffic volume increase along the Ulan-Wollar Road corridor, we envisage minimal impact on vehicular traffic using this corridor to access the Solar Farm.

2.5 Parking

No existing formal parking facilities at the proposed Solar Farm location were identified during the August 2018 site visit.

2.6 Active Travel

During the August 2018 site visit, no active travel infrastructure or use was observed. No formal facilities exist on the primary approaches or at the proposed Solar Farm location.

2.7 Public Transport

No regular public transport routes have been identified linking to the Village of Wollar. However, there is an existing School Rote that provides a service for Wollar Village children to access Mudgee School. The existing route is illustrated in **Figure 17**. This service is currently provided once during the AM commencing at 7:30am on Araluen Road and one in the PM returning to Wollar Village at 4:45pm.

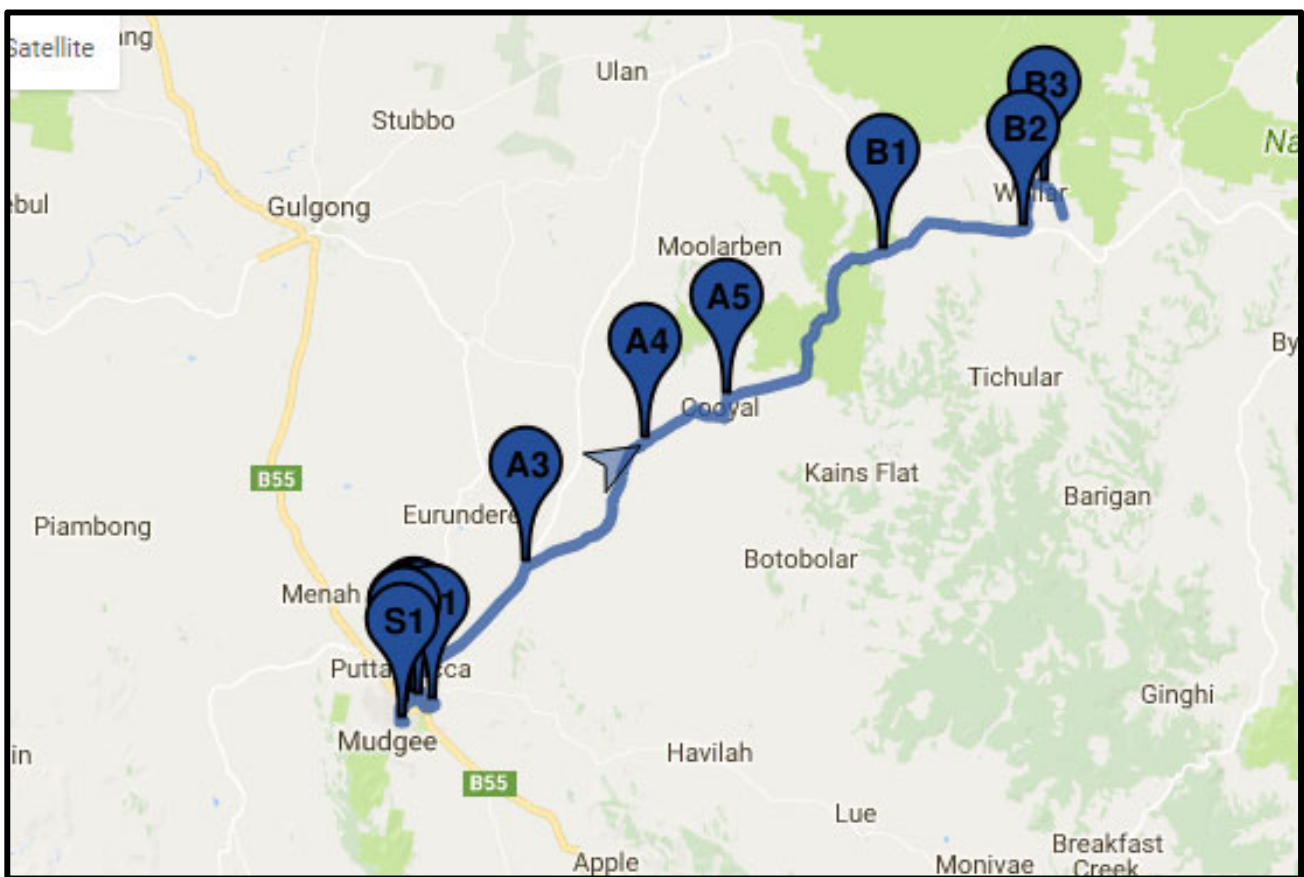


Figure 17 Existing school bus route between Wollar Village and Mudgee

3. Proposed Development

OntoIt has been advised the proposed Solar Farm involves the construction, operation and decommissioning of a ground-mounted PV solar array. Up to 290 MW (AC) of renewable energy would be generated and supplied directly to the national electricity grid. The proposal area is approximately 878 ha and would consist of associated infrastructure occupying around 458 ha. This section of the report outlines the detailed infrastructure items and works that will occur with the construction, operation and decommissioning of the new facility.

3.1 Solar Farm Infrastructure

OntoIt understands that the proposed Solar Farm could provide enough clean, renewable energy for about 144,726 average NSW homes while displacing approximately 711,123 metric tons of carbon dioxide annually.

The proposed Solar Farm comprises the following key items of infrastructure:

- Approximately 938,336 photovoltaic solar panels mounted on either fixed or tracking systems, both of which are considered feasible:
 - > Fixed-tilted structures in a north orientation at an angle of 32 degrees; or
 - > East-west horizontal tracking systems.
- Approximately 59 power conversion units (PCU) composed of two inverters, a transformer and associated control equipment to convert DC electricity generated in the solar panels to 33 kV AC electricity;
- Steel mounting frames with piled foundations;
- An onsite 330kV substation containing 2 transformers and associated switch gear to facilitate connection to the national electricity grid;
- Underground power cabling to connect solar panels, combiner box and PCU's;
- Underground auxiliary cabling for power supplies, data services and communications;
- Buildings to accommodate a site office, 33 kV switch gear, protection and control facilities, maintenance facilities and staff amenities;
- Up to 2km of access track off Barigan Road to the site via:
 - > The existing TransGrid substation access road, which would require construction of an access road between the Wollar substation and the proposed onsite substation – this will form the primary site access; and
 - > Maree Road – this will form an operational / maintenance access and will only be utilised occasionally post construction of the proposed Solar Farm.
- Internal access tracks and upgrades to existing access roads, for construction and maintenance activities;
- Space for future energy storage facility with a capacity of up to 30MWh and comprising lithium ion batteries with inverters;
- Perimeter security fencing up to 2.3 m height; and
- Native vegetation planting to provide visual screening for specific viewers, if any are required.

During the construction phase, temporary ancillary facilities would be established on the site and may include:

- Laydown areas;
- Construction site offices and amenities; and
- Car and bus parking areas for construction staff.

3.2 Indicative Site Layout

OntoIt was provided with an indicative site layout for the proposed Solar Farm. **Figure 18** illustrates the proposed layout of the Solar Farm which includes:

- Proposed layout of Solar PV Panels;
- Location of transmission lines and easements;
- Laydown areas;
- Substation area; and
- Key environmental constraints across the site.

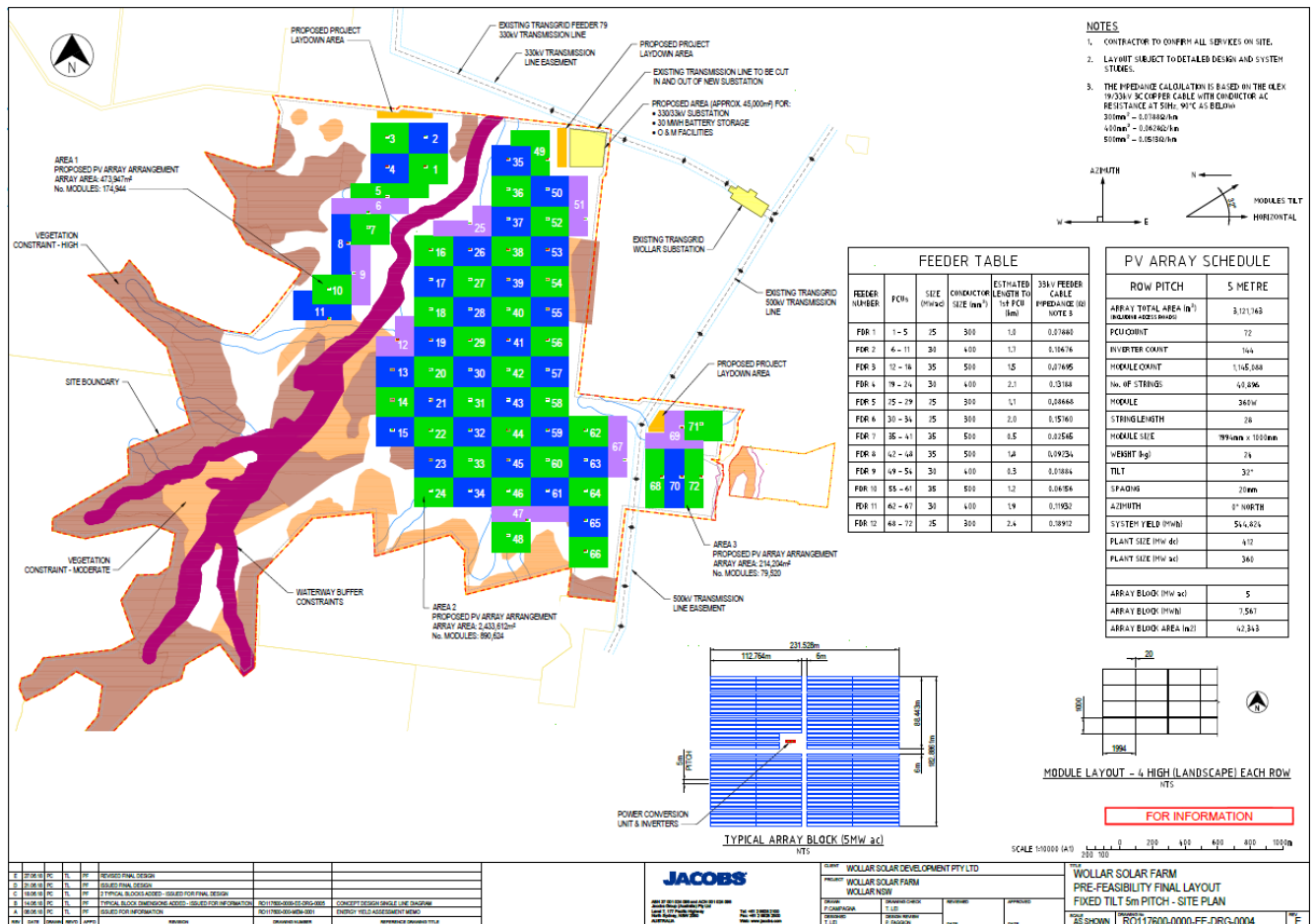


Figure 18 Indicative Solar Farm Layout

In addition, OntoIt was provided with a development footprint which is illustrated in **Figure 19**.

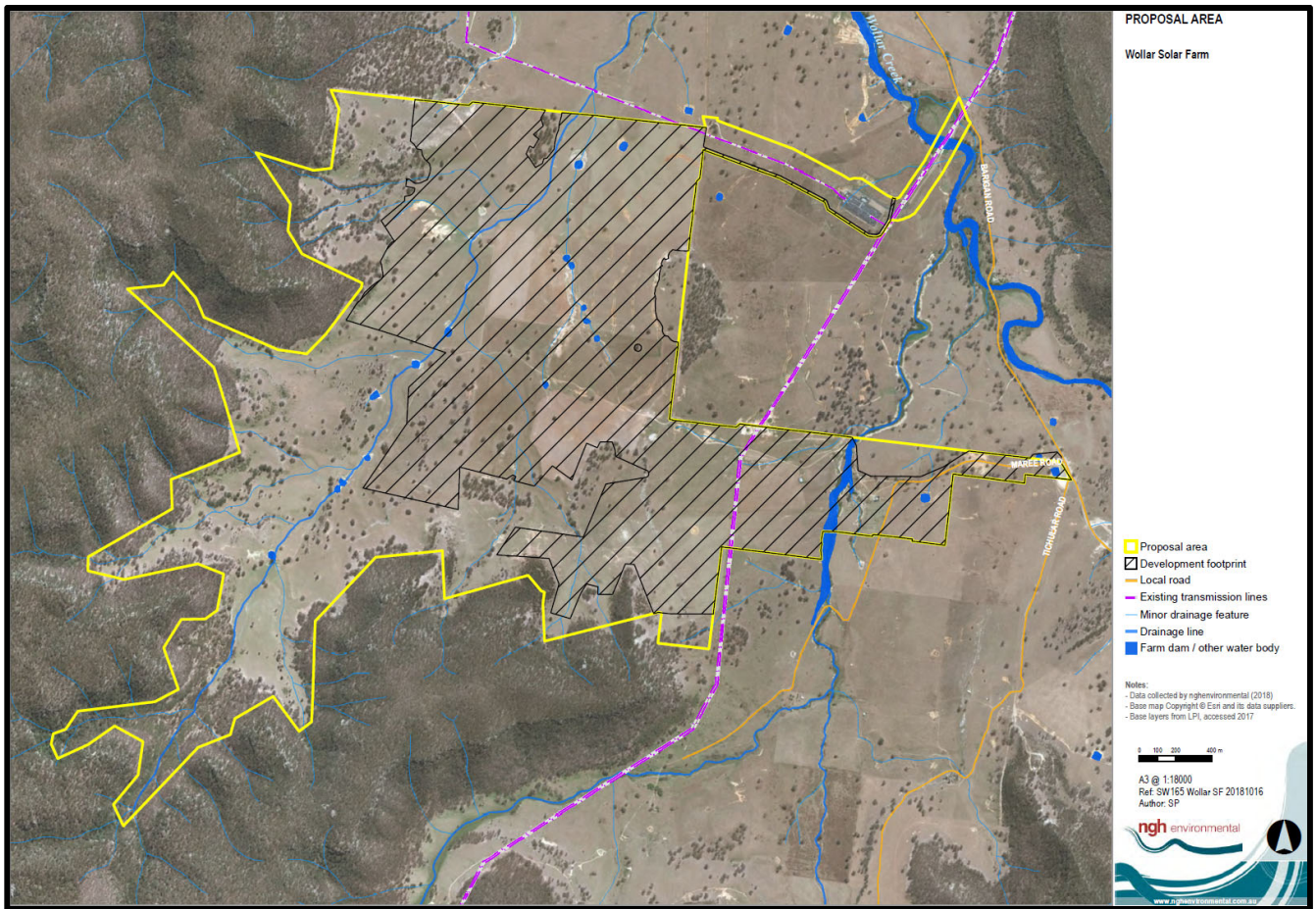


Figure 19 Development footprint for the proposed Wollar Solar Farm

3.3 Employees and Workforce

3.3.1 Construction Phase

OntoIt was advised by the proponent that the construction phase for the proposed Solar Farm will take approximately twelve months. It is anticipated that the greatest travel demand will be during the construction phase due to:

- Peak workforce of 500 people;
- Up to 82 heavy goods vehicles deliveries a day (plus an additional eight movements at commencement and end of the construction phase);
- Up to two oversized vehicle movement a day;
- Up to 40 buses a day to transport the workforce to and from the site; and
- A further 60 private vehicles are expected as a result of the workforce.

3.3.2 Operational Phase

OntoIt was advised that once construction is complete the Solar Farm trip demand will significantly decrease. It is anticipated that once established the Solar Farm will:

- have five full time employees; and
- A number of operational and maintenance light vehicles accessing each day.

3.3.3 Decommissioning Phase

Ontoït was advised that during the decommissioning phase the majority of plant at the Solar Farm will be scrapped, as it has reached end of life. Subsequently, this will result in a reduction of 30% traffic density from the numbers illustrated under **Section 3.3.1** . The reduction in traffic can be primarily achieved as a result of only transporting scrap (glass, steel, copper etc...) from the site which will result in a higher packing density and therefore less vehicles will be required.

4. Traffic and Parking Generation

4.1 Traffic Generation

The Roads and Maritime Services 'Guide to Traffic Generating Development' does not outline specific trip generation rates for the construction and operation of a Solar Farm. As such, traffic generation demand has been determined through the analysis of the forecasted employee, workforce and goods and service vehicle deliveries provided by the proponent. This section of the report summarises the analysis undertaken to determine the traffic generation rates during both the construction and operational phases for the proposed Solar Farm.

4.1.1 Construction Traffic Demand

The construction phase of the Solar Farm is expected to generate the peak travel demand for the site which will result from the:

- Construction trade workforce;
- Large equipment deliveries; and
- Goods and Service vehicle deliveries and visitors.

Onto it was advised that during the peak of the construction phase:

- The peak workforce demand will be 500 personnel;
- There will be two oversized vehicle movement a day;
- There will be 82 heavy goods vehicle movements every day;
- There will be a further eight heavy goods vehicle movements at the commencement and conclusion of the construction period (dropping off and picking up equipment); and
- There will be eleven buses a day transporting workforce to and from the site.

Based on the information provided by the proponent, Onto it estimated the peak vehicle demand for the AM peak period which is anticipated to have the largest single hour demand. **Table 3** outlines the estimated peak hour vehicle demand for the proposed Solar Farm construction phase.

Table 3 Estimate 'worst case' peak hour vehicle demand for the construction phase

Mode	Daily Trip Generation	Estimated Peak Hour Trips
Shuttle Bus (25 seats)	40	20
Private Vehicles	60	60
Heavy Vehicles (at commencement and conclusion only)	8	2
Heavy Goods Vehicles	82	16
Oversized Vehicles	2	0
TOTAL	192	98

In estimating the peak hour trips presented above a number of assumptions were made:

- There will be 10 inbound and 10 outbound bus movements in the peak period;
- All the workforce travelling by private vehicles will arrive during the peak period; and
- 10% of the daily estimated heavy goods vehicle trips are made in the peak hour (inbound and outbound movement).

Based on the above analysis, it is anticipated that the peak travel demand, 'worst case' during the construction phase, is estimated to be 98 vehicles. It is not anticipated that these peak figures would be a consistent daily demand throughout the twelve-month construction phase. However, to analyse a 'worst case scenario' the peak vehicle demand has been estimated; to ensure sufficient capacity in the surrounding transport infrastructure is in place to support the additional vehicle demand resulting during the construction phase.

4.1.2 Operation Phase

The travel demand during the operational phase of the proposed Solar Farm is anticipated to be significantly less than the construction phase. In estimating the operational phase vehicle demands for the Solar Farm, OntoIt has considered the total workforce and the light goods and vehicle deliveries as advised by the proponent. **Table 4** outlines the estimated peak hour vehicle demand for the proposed Solar Farm operational phase.

Table 4 Estimated peak hour vehicle demands for the operational phase

Mode	Total Workforce / Deliveries	Percentage of Peak Hour Trips	Estimated Peak Hour Trips
Private Vehicles	5	100%	5
Light Goods and Service Vehicles	15	20%	3
TOTAL	N/A	N/A	8

Based on the above analysis it is anticipated that the daily peak travel demand for the operational phase of the Solar Farm is estimated to be eight vehicles. Given the estimated, very low, volume of traffic demand during the operational phase, no further analysis has been undertaken. The transport capacity and distribution analysis presented in **Section 5** therefore focusses on the estimated peak construction phase vehicle volumes.

4.2 Parking Generation

Whilst the Mid-Western Regional Council DCP does not specify parking rates specifically for Solar Farm Developments, the proposed Solar Farm will need to provide sufficient capacity for a temporary parking facility during construction and a permanent facility for operational and maintenance vehicle parking once complete. Parking generation rates were therefore determined and based on the peak vehicular demand during the construction and operational phases. Subsequently the parking demands are as follows:

- Construction phase:
 - > Temporary parking facility for up to 100 vehicles;
 - > A designated bus pick-up and drop-off location and storage / waiting facility; and
 - > Loading and unloading spaces for light goods and service deliveries.
- Operational Phase:
 - > Five permanent employee parking spaces;
 - > Two permanent visitor parking spaces; and
 - > Two loading and unloading spaces.

It is proposed that all parking, during both construction and operational phases, is contained on-site and no off-site vehicle parking is allowed.

5. Transport and Traffic Impact Assessment

This section summarises the analysis of the potential impacts associated with the development related traffic. The analysis has focussed on the traffic generated during the construction phase of the project which will produce the largest volume of additional traffic on the network.

5.1 Development Related Traffic Network Distribution

As noted in **Section 4.1**, the estimated peak traffic volume during the construction phase is an additional 92 vehicles. OntoIt has distributed this demand across the transport network to understand and identify any impacts and mitigation measures that may be required to support the proposal. The distribution of the additional traffic onto the existing transport network was based on consultation with the proponent and the historic origin and destination data outlined in **Section 2.1.3**.

Table 5 Predicted origin and destination of the additional traffic during the construction phase of the proposed Solar Farm

Origin / Destination	Inbound / Outbound	Trip Distribution Share (%)	Estimated Additional Traffic Volume
Mudgee	Inbound	90%	86
Mudgee	Outbound	90%	23
Newcastle	Inbound	8%	7
Newcastle	Outbound	8%	2
Other	Inbound	2%	2
Other	Outbound	2%	0
TOTAL	N/A	100%	120*

*95 inbound trips and 25 outbound trips. It assumes only the bus and heavy goods vehicles movements will be both inbound and outbound movements during the peak period.

Table 5 illustrates that the largest increase in traffic volumes are anticipated to start and end at Mudgee, which is the largest regional town within the Mid-Western Regional LGA. In comparison, all other origins and destinations are expected to experience a minor increase in traffic relative to this corridor. Given the anticipated low volume increases from Newcastle and other areas, the traffic impact analysis focussed on the Mudgee to Wollar road corridor which consists of:

- Ulan Road;
- Wollar Road; and
- Barigan Road.

5.2 Future Road Capacity

As identified in **Section 5.1** the primary access corridor for vehicular traffic to the proposed Solar Farm site is expected to be Ulan Road - Wollar Road – Barigan Road. As noted in **Section 2.1**, given the rural nature of Ulan Road and Wollar Road, their existing estimated capacity would be between 600-1000 vehicles per hour (300-500 per lane). Barigan Road would be slightly lower due to being narrower width, unsealed and a lower posted speed limit, but would still be capable of carrying 300-500 vehicles per hour.

Table 6 compares the existing capacity v's existing and future estimated traffic volumes.

Table 6 Existing capacity vs Existing AM Peak Hour Traffic Volume vs Estimated AM Peak Hour Traffic Volume

Road	Capacity	Existing AM Peak Volume	Estimated Future AM Peak Volume (during construction of Solar Farm)
Ulan Road (south of Wollar Road) Northbound	300-600	370	456
Ulan Road (south of Wollar Road) Southbound	300-600	154	177
Wollar Road Eastbound	250-450	27	113
Wollar Road Westbound	250-450	20	43
Barigan Road Southbound	300-500*	n/a	95
Barigan Road Northbound		n/a	25

* Due to the width of Barigan Road being less than the desired 3.6m lane width in each direction, we have considered the capacity of Barigan Road as a single traffic lane.

The RMS 'Guide to Traffic Generating Developments' and Austroads 'Guide to Traffic Management Part 3: Traffic Studies and Analysis' provide guidance on the acceptable Level of Service (LoS) for road corridors and major intersections. The Highway Capacity Manual (HCM) defines LoS as "the quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to manoeuvre, traffic interruptions, and comfort and convenience".

As defined within Austroads, typical single lane traffic capacities are dependent on a number of factors and characteristics; however generally accepted as approximately 1800 passenger car units per hour. The capacities defined in **Table 6** have taken the rural road conditions/characteristics into consideration which aligns with the capacities displayed in Table 4.5 of the RMS 'Guide to Traffic Management Part 3: Traffic Studies and Analysis'.

Based on the information presented in **Table 6** and comparison to Table 4.5 in the RMS guide, we can summarise the future traffic conditions along the primary corridors as follows:

- Ulan Road (south of Wollar Road) Northbound – during the construction phase (12-months only) and based on the estimate traffic generated the road corridor between Mudgee and Wollar Road will operate above a satisfactory level;
- Ulan Road (South of Wollar Road) Southbound – during the construction phase (12-months only) the road will continue to operate above a satisfactory level;
- Wollar Road Eastbound– during the construction phase (12-months only) the road will continue to operate above a satisfactory level;
- Wollar Road Westbound– during the construction phase (12-months only) the road will continue to operate above a satisfactory level;

- Barigan Road – based on the analysis above, it is likely that Barigan Road will continue to operate within capacity for the construction phase (12-months only). It should, however, be noted that given the nature of the vehicles that will be travelling along the corridor there may be minor delays if no mitigation measures are implemented to accommodate bi-directional traffic or passing lanes.

5.3 Intersection Capacity / Operation

There are two intersections along the primary access corridor that will experience a growth in traffic use during the twelve-month construction period:

- Ulan Road – Wollar Road – a priority-controlled intersection which has a right turn storage for vehicles travelling northbound on Ulan Road (see **Figure 20 and 21**); and
- Wollar Road – Barigan Road – a priority-controlled intersection.



Figure 20 Ulan Road / Wollar Road Intersection looking north



Figure 21 Ulan Road / Wollar Road intersection looking south

The recent site visit observed minimal traffic travelling through the Wollar Road / Barigan Road intersection with the predominant movement from between Wollar Road east and west of the intersection. A single vehicle was observed using Barigan Road and therefore existing traffic levels are extremely low. These observations are consistent with the traffic assessment undertaken for the Wilpinjong mine expansion. As such, it is anticipated that the increase in traffic through this intersection will not impact on the operation and if any delays are experienced; they will be minimal and only during the 12-month construction period.

Additionally, the recent site visit also observed that the Ulan Road / Wollar Road intersection has recently been modified / upgraded to include a right turn pocket, with significant storage capacity 8-10 car lengths. This modification will assist in maintaining an acceptable LoS during construction phase. The estimated future traffic flows through the intersection during the twelve-month construction phase are illustrated in **Figure 22**.



Figure 22 Estimated future traffic distribution at the Ulan Road / Wollar Road priority intersection

Whilst no Sidra analysis was undertaken, based on the traffic flows estimated in **Figure 22** the intersection is expected to continue to operate within capacity.

5.4 Access Arrangements

Onto it understands that access to the proposed Solar Farm will be as follows:

- The unnamed access to the existing substation, this is currently an unsealed road approximately 4-5m in width, this will form the primary access to the Solar Farm; and
- Maree Road which is an existing unsealed road with varied width ranging from 3-5m which is located further south along Barigan Road, this road will be used during the operational phase only for access for maintenance and operational purposes.

Both options were considered as the primary access corridor to the site. However, in considering the forecast volume of traffic during the construction phase and the existing condition of the carriageway, OntoIt has recommended to the proponent that the primary access to the site be via the existing TransGrid substation access road; with Maree Road used only for Maintenance and Operational Activities to gain access to the Solar Farm at the southern end.

The proposed access arrangements for the site are illustrated in **Figure 23**.

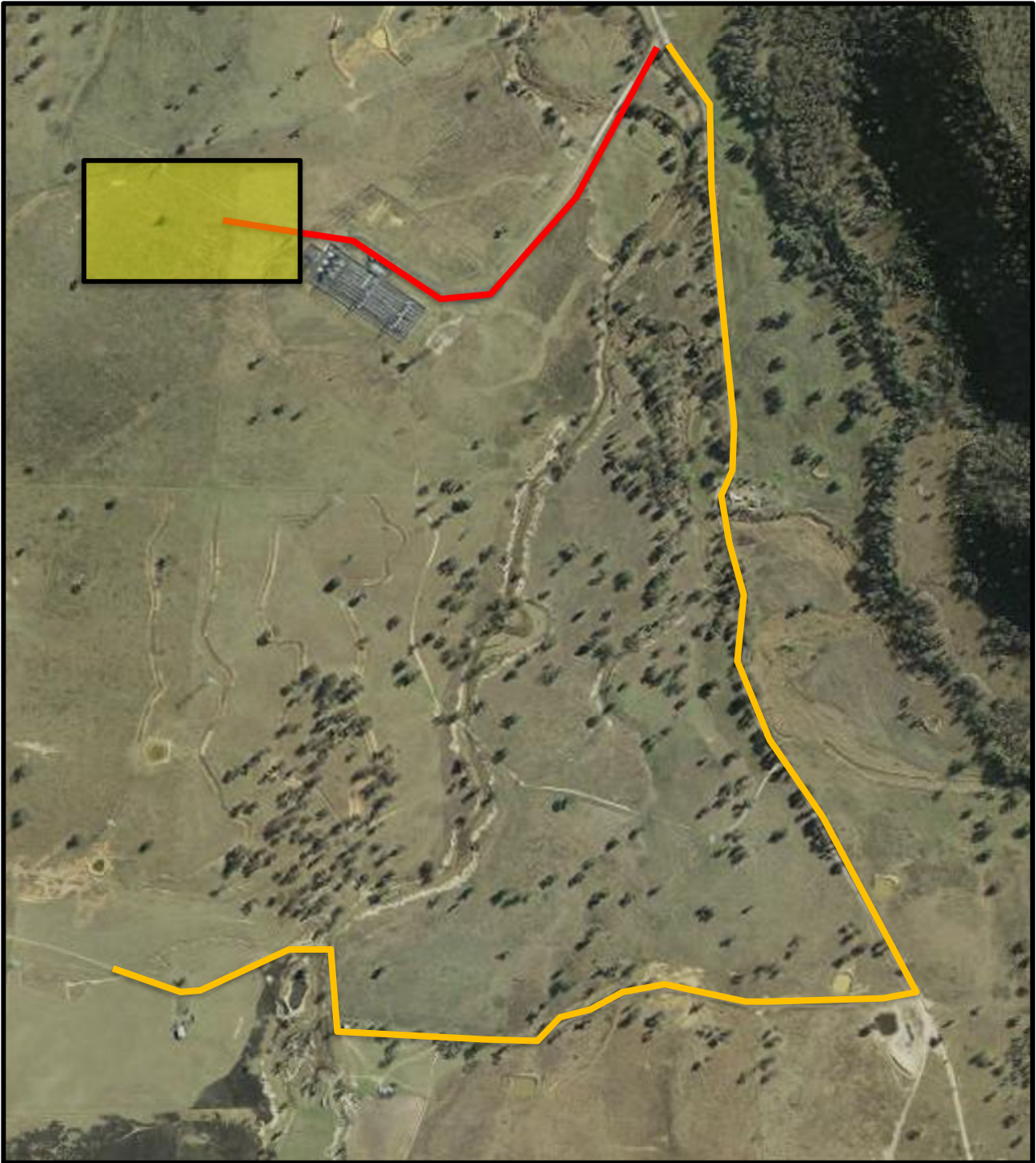


Figure 23 Proposed site access arrangements for construction and operation (red – proposed primary access, orange – operational and maintenance only access)

5.5 Parking Impacts

5.5.1 Construction

Temporary parking facilities will be required during the construction of the proposed Solar Farm. The temporary parking vehicles will need to accommodate a minimum of 180 vehicles and designated pick-up / drop-off and loading / unloading areas. In addition, adequate provision should be made within the site for the turning of large goods vehicles. Ideally this would be located in close proximity to the loading and unloading zone.

The yellow box illustrated on Figure 23 is the recommended area for the temporary parking facility. Further consideration will need to be given to this facility during the detailed design process.

5.5.2 Operation

Onto it was advised that there will be five full time employees post construction. Provision for five parking spaces should be made next to the proposed site office. In addition, a further 5-10 spaces are recommended to allow for parking of maintenance and delivery vehicles.

5.6 Public Transport Impacts

Given there is no existing public transport linkages servicing the proposed Solar Farm site, no impact on public transport routes or provisions is anticipated.

5.7 Pedestrian and Cycle Impacts

No impacts are anticipated on pedestrian and cycle access to the proposed Solar Farm.

5.8 Cumulative Traffic Impacts

There are a number of industrial activities in the vicinity of the Village of Wollar, particularly relating to agriculture and mining activities. Onto it has reviewed the Peabody Energy Road Transport Assessment (RTA) Wilpinjong Extension Project to understand the cumulative impact of traffic on the road network leading to the various existing and proposed facilities.

The recent traffic surveys indicated a rise in traffic volumes on Ulan Road in particular since the 2015 data presented in the Wilpinjong Expansion RTA. There is a direct correlation between the observed traffic flows on Ulan Road and the forecasted traffic flows contained within the RTA. As such, the growth in traffic observed on Ulan Road is directly attributable to the mine expansion.

The peak workforce for the Wilpinjong Expansion was predicted to be in 2024, however, this figure was only 24 additional staff on the 2018 figure. It is therefore a reasonable assumption that the 2018 existing road conditions are a reflection of the peak traffic demand from the mining activity. As such, no further increase in traffic is predicted and the numbers presented within **Section 5.1** and **5.2** of this report would be reflective of the cumulative traffic growth in the region.

6. Summary and Recommendations

6.1 Summary

The primary impacts of the proposed Solar Farm will be the result of the 12-month construction period. It is likely that the additional construction traffic will result in short journey time delays and possible localised minor congestion particularly on Ulan Road and Wollar Road and at the intersection between these two corridors. Once fully operational, the facility will have a negligible impact on the road traffic conditions due to the small amount (5) of full time employees.

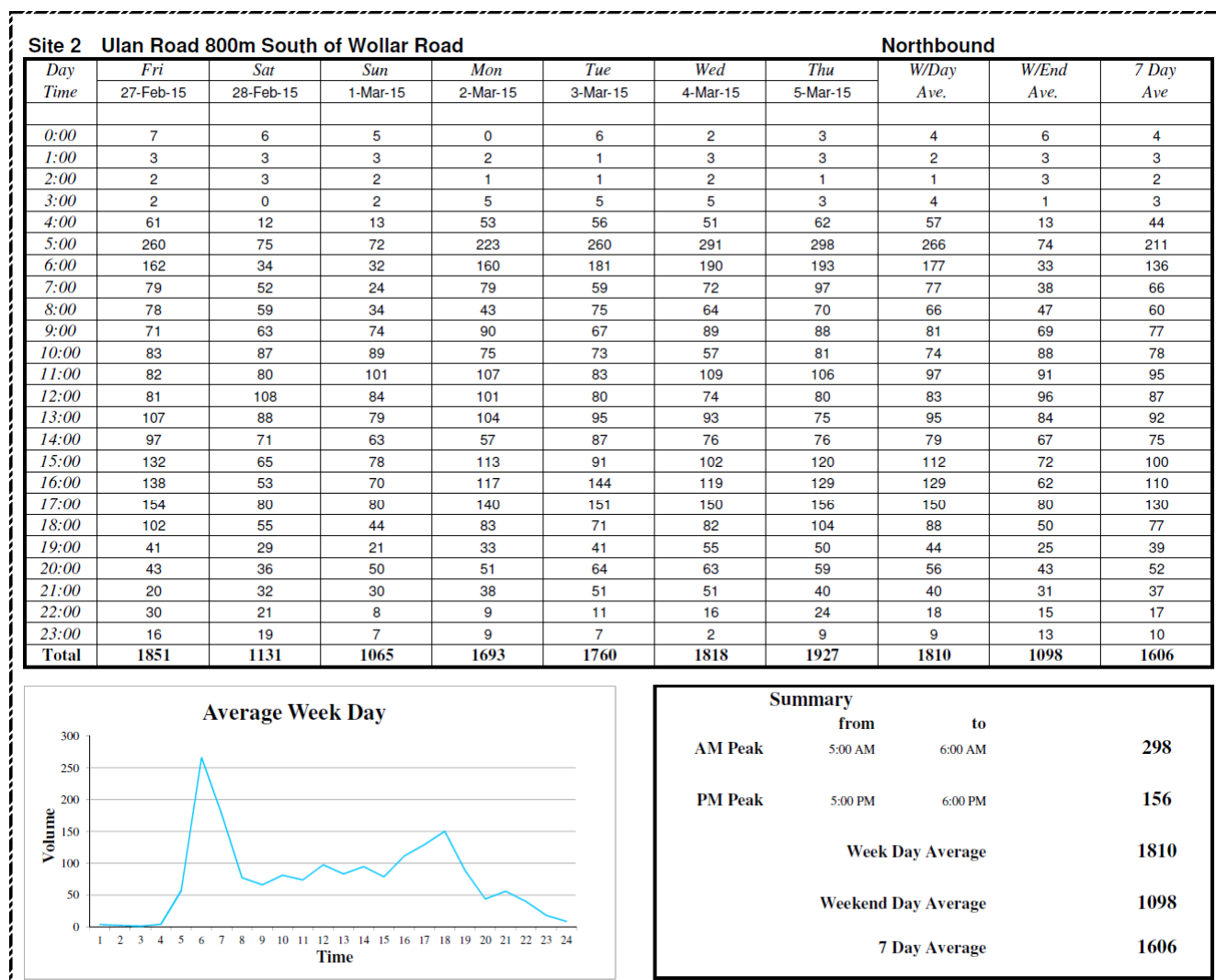
A number of temporary measures could be considered to assist in minimising the temporary impact brought about by the construction activities and these are included below.

6.2 Recommendations

To minimise localised congestion and traffic impact on the local road network, the following measures should be considered:

- A priority consideration should be the enhancement of Barigan Road; there are a number of possible measures to improve access to the site that should be considered:
 - > Passing facilities – the implementation of passing facilities such as pull in bays at strategic locations between the Village of Wollar and the site primary entrance (TransGrid access road) would enable vehicles to pass in a controlled and safe manner and improve the flow of vehicles along the corridor – this will be particularly important for larger heavy goods vehicles;
 - > Re-grading and widening – there is potential to re-grade and widen the whole road corridor between the intersection with Wollar Road and the primary entrance to the site. This option would enable free flowing traffic in both directions during the construction period, minimising delays and allowing larger vehicles to pass safely; and
 - > Upgrade and seal the road – widening and sealing Barigan Road could also be considered; however, this option is likely to be costly and could take significant time due to the length of corridor. It would however provide the best form of access to the facility and would be able to accommodate higher volumes of traffic and be suitable for the larger heavy goods vehicles.
- It is recommended that the proponent undertakes a road dilapidation survey and report prior and post construction activity;
- A Traffic Management Plan should be produced and approved prior to the commencement of any activity at the site;
- Any impacts or deterioration to the existing road network in the vicinity of the proposed Solar Farm will need to be returned to the same standard as pre-construction;
- Consideration of a temporary car park facility should be given to allow construction staff and vehicles to be accommodated and managed effectively on site;
- An allowance of two buses was made in the traffic analysis to carry employees to and from the site during construction. Consideration should be given to having additional buses which would reduce private vehicular demand access to/from the site.

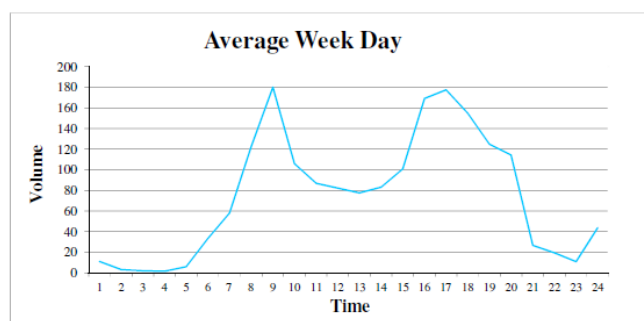
A.1 Traffic Surveys – extracted from the Wilpinjong Extension Project, Wilpinjong, NSW, Road Transport Assessment (GTA, 2015)



Site 2 Ulan Road 800m South of Wollar Road

Southbound

Day Time	Fri 27-Feb-15	Sat 28-Feb-15	Sun 1-Mar-15	Mon 2-Mar-15	Tue 3-Mar-15	Wed 4-Mar-15	Thu 5-Mar-15	W/Day Ave.	W/End Ave.	7 Day Ave
0:00	11	10	6	7	11	14	12	11	8	10
1:00	3	4	5	4	0	5	4	3	5	4
2:00	7	3	1	0	1	0	2	2	2	2
3:00	2	1	2	1	1	0	4	2	2	2
4:00	3	15	11	11	9	4	3	6	13	8
5:00	37	25	26	29	26	29	45	33	26	31
6:00	56	26	14	51	65	58	60	58	20	47
7:00	125	69	35	122	125	114	125	122	52	102
8:00	174	76	55	176	180	190	180	180	66	147
9:00	113	85	89	93	114	100	110	106	87	101
10:00	94	117	78	91	72	95	82	87	98	90
11:00	83	95	75	84	78	75	91	82	85	83
12:00	90	60	86	80	55	66	97	78	73	76
13:00	114	63	48	78	62	76	86	83	56	75
14:00	110	64	88	83	90	102	119	101	76	94
15:00	229	45	75	156	168	129	164	169	60	138
16:00	149	61	84	198	159	190	192	178	73	148
17:00	110	72	60	174	165	162	164	155	66	130
18:00	112	80	61	121	135	130	126	125	71	109
19:00	92	73	81	105	112	166	96	114	77	104
20:00	26	16	18	23	21	33	30	27	17	24
21:00	29	17	16	16	19	17	16	19	17	19
22:00	14	6	3	13	8	13	6	11	5	9
23:00	42	20	22	50	41	46	39	44	21	37
Total	1825	1103	1039	1766	1717	1814	1853	1795	1071	1588



Summary			
	from	to	
AM Peak	8:00 AM	9:00 AM	190
PM Peak	3:00 PM	4:00 PM	229
Week Day Average			1795
Weekend Day Average			1071
7 Day Average			1588

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