

APPENDIX K TRAFFIC IMPACT ASSESSMENT



Wellington North Solar Farm Limited

Wellington North Solar Project Development Traffic Impact Assessment

May 2018

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1. Introduction

1.1 Overview

GHD has been engaged by Wellington North Solar Farm Pty Limited to undertake a review of the traffic impact assessment to assist with construction and operation of the proposed Wellington North Solar Plant (WNSP).

The Wellington North Solar Plant (Project) in central western NSW is currently being developed by Wellington North Solar Farm Pty Limited (WNSF), a wholly owned subsidiary of AGL Energy Limited. The project is located approximately seven kilometres northeast of Wellington town centre, off Goolma Road, in the Dubbo Regional Council Local Government Area.

This Traffic and Parking Impact assessment report discusses the following:

- Existing Conditions – a review of existing road features and access, adjacent developments, traffic volumes and crash data;
- Proposed Development – a review of additional traffic generated as a result of the proposed solar plan during construction and operation;
- Development Impact – assessment of the performance of the existing intersections resulting from the proposed solar plant development; and
- Parking and Access Review – a review of the parking provision in relation to relevant, and a summary of the transportation routes for access and egress arrangements.

1.2 Study area

1.2.1 Site location

The subject site is located within the Dubbo Regional Council Local Government Area (LGA), seven kilometres northeast of Wellington town centre between Cobbora Road and Goolma Road. The site shown in Figure 1-1 is located to the west of Goolma Road and consists of approximately 970 hectares of land that is currently used for agricultural purposes..

Three vehicular access points to the development site are proposed:

- **Access Point 1:** The primary access point will be via Campbells Lane along the northern boundary of the site. This access will be used for light and heavy vehicles.
- **Access Point 2:** The existing driveway off Goolma Road that leads to the Soil Conservation Service facilities. The access point may continue to be utilised by Soil Conservation Service staff in addition to light vehicle access to the solar plant. By exception only, the access point may be required for some heavy vehicle movements, such as the delivery high voltage transformers.
- **Access Point 3:** The existing driveway off Goolma Road that leads to the residential dwelling on the property. This access point will be utilised by light vehicles only.

The location of the proposed WNSP in relation to the surrounding road network is shown in Figure 1-2.



Figure 1-1 Site location

Source: AGL Limited – Modified by GHD

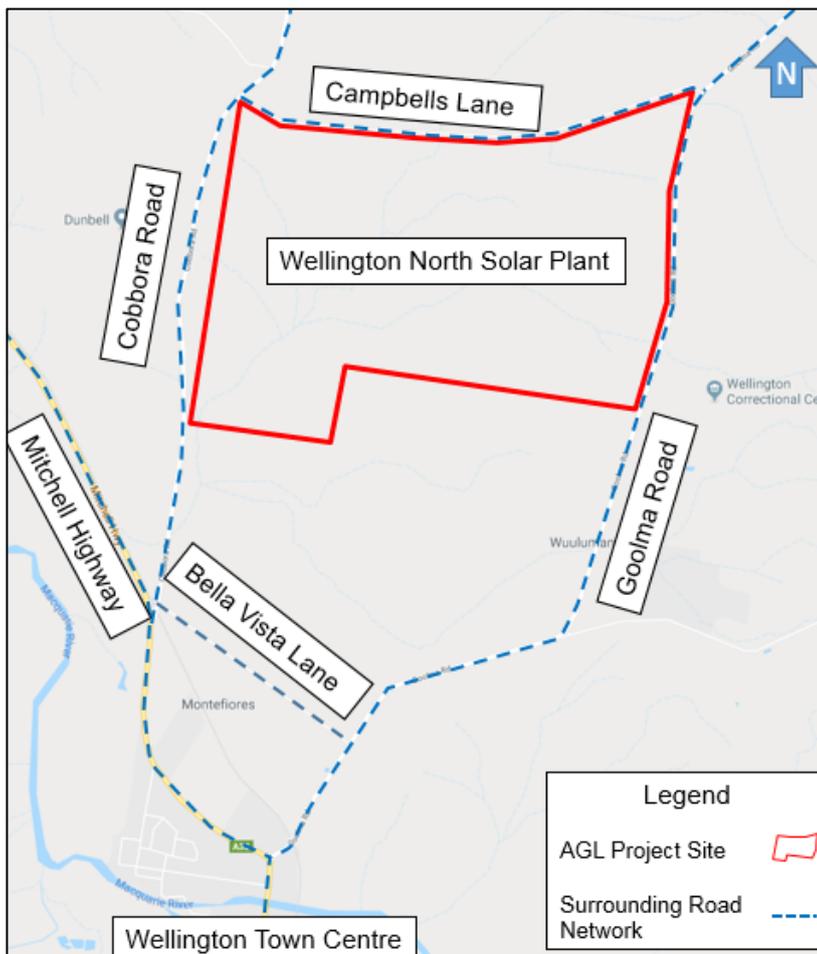


Figure 1-2 Road network near subject site

Source: Six maps – Modified by GHD

1.3 Study assumptions and limitations

This report and assessment for the proposed WNSP are based on the following assumption and limitations:

- The information provided by AGL in relation to expected truck and vehicle generation and arrival-departure locations for the construction and staff personnel is accurate.
- Traffic count survey data based on automatic tube count conducted between 28 February 2018 and 6 March 2018 by Matrix Traffic and Data Solutions is accurate.
- The analysis is a desktop study and no site visits have been undertaken.
- The conditions of the surrounding network are based on information either supplied by the traffic surveys and Google Maps / Streetview.

1.4 Report structure

The report is structured as follows:

- Section 2 Existing conditions;
- Section 3 Traffic impact and assessment;
- Section 4 Parking provision;
- Section 5 Mitigation measures; and
- Section 6 Summary and conclusions.

2. Existing conditions

2.1 The site

The proposed WNSP is located within Dubbo Regional Council LGA on the western side of Goolma Road, south-west of its intersection with Campbells Lane.

As indicated in Figure 2-1, the site is located in a RU1 (Primary Production) zone with the Wellington and Macquarie Correctional Centre to the east of the site zoned as SP2 (Infrastructure). The land south of the site, at the intersection of Mitchell Highway and Goolma Road is zoned as R5 (Large Lot Residential).

The site currently consists predominately of greenfield area with the land used for agricultural purposes.

Primary access to the proposed WNSP will be off Campbells Lane via Cobbora Road, which currently consists of a give way priority controlled intersection located to the west of the site. South of the site is a local road network (Bela Vista Lane) providing access to the residential dwellings located within the residential zone.

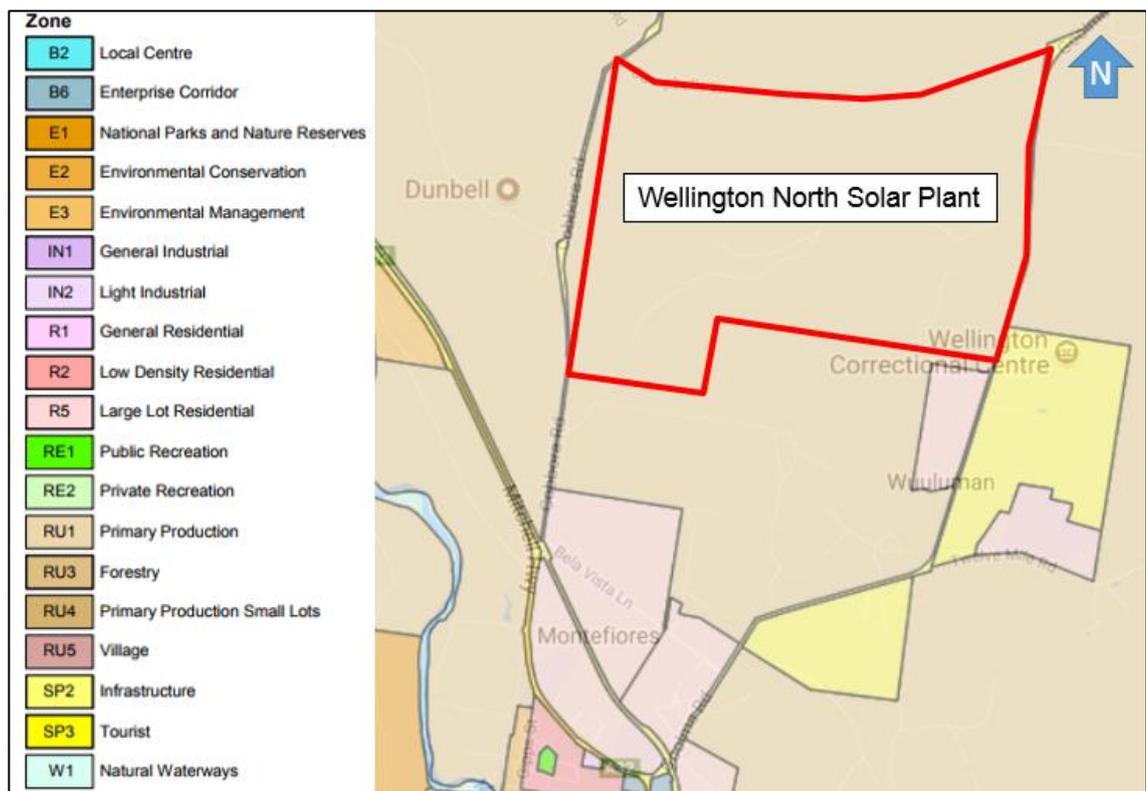


Figure 2-1 Land zoning

Source: www.planningportal.nsw.gov.au – Modified by GHD

2.2 Existing road network characteristics

This section provides an understanding of the existing road network surrounding the site.

2.2.1 Road hierarchy

Roads within NSW are categorised in following two ways:

- By Classification (ownership); and
- By the function that they perform.

Road Classification

Roads are classified (as defined by the *Roads Act 1993*) based on their importance to the movement of people and goods within NSW (as a primary means of communication).

The classification of a road allows Roads and Maritime Services (Roads and Maritime) to exercise authority of all or part of the road. Classified roads include Main Roads, State Highways, Tourist Roads, Secondary Roads, Tollways, Freeways and Transitways.

For management purposes, Roads and Maritime has three administrative classes of roads. These are:

- **State Roads** – Major arterial links through NSW and within major urban areas. They are the principle traffic carrying roads and fully controlled by Roads and Maritime with maintenance fully funded by Roads and Maritime. State Roads include all Tollways, Freeways and Transitways; and all or part of a Main Road, Tourist Road or State Highway.
- **Regional Roads** – Roads of secondary importance between State Roads and Local Roads which, with State Roads provide the main connections to and between smaller towns and perform a sub arterial function in major urban areas. Regional roads are the responsibility of councils for maintenance funding, though Roads and Maritime funds some maintenance based on traffic and infrastructure. Traffic management on Regional Roads is controlled under the delegations to local government from Roads and Maritime. Regional Roads may own all part of all or part of a Main Road, Secondary Road, Tourist Road or State Highway; or other roads as determined by Roads and Maritime.
- **Local Roads** – The remainder of the council controlled roads. Local Roads are the responsibility of councils for maintenance funding. Roads and Maritime may fund some maintenance and improvements based on specific programs (e.g. urban bus routes, road safety programs). Traffic management on Local Roads is controlled under the delegations to local government from Roads and Maritime.

Functional Hierarchy

Functional road classification involves the relative balance of the mobility and access functions. Roads and Maritime define four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility, to high accessibility and low mobility. These road classes are:

- **Arterial Roads** – generally controlled by Roads and Maritime, typically no limit in flow and designed to carry vehicles long distance between regional centres.
- **Sub-Arterial Roads** – can be managed by either Roads and Maritime or local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub region, or provide connectivity from arterial road routes (regional links).

- **Collector Roads** – provide connectivity between local roads and the arterial road network and typically carry between 2,000 and 10,000 vehicles per day.
- **Local Roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day.

The surrounding road network is shown in Figure 2-2.

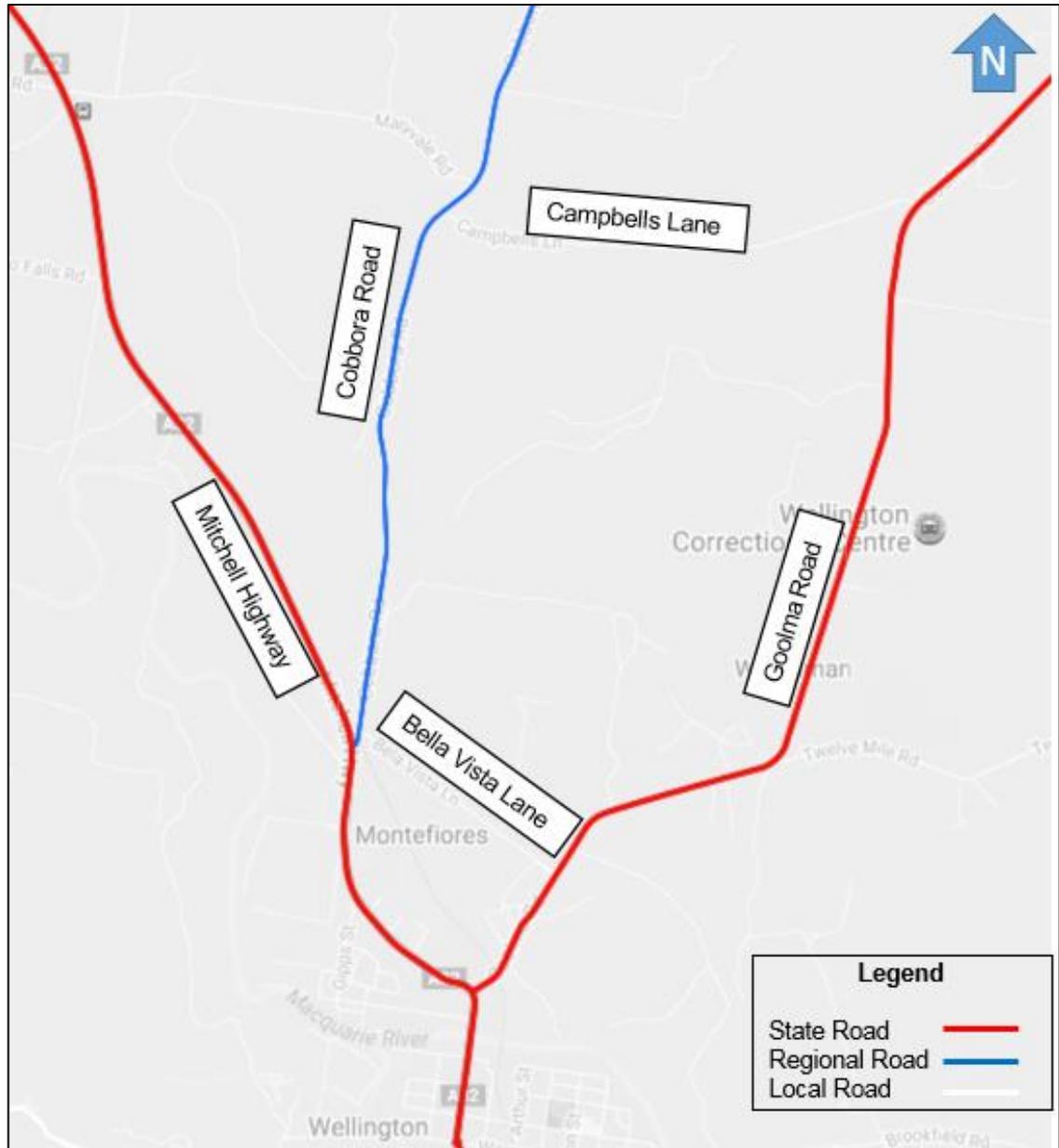


Figure 2-2 Surrounding road network

Source: Transport for NSW maps – Modified by GHD

2.2.2 Cobbora Road

Cobbora Road acts as a regional road in the vicinity of the WNSP running in a north-south alignment. Cobbora Road connects to Mitchell Highway to the south and Golden Highway to the north with priority controlled intersections at both locations. Access to the WNSP from Cobbora Road is via its intersection with Campbells Lane at a give-way priority controlled intersection.

Cobbora Road has the following key features within proximity of site as outlined in Table 2-1
Cobbora Road key features and shown in Figure 2-4.

Table 2-1 Cobbora Road key features

Feature	Description
Carriageway	There is typically 1 travel lane in each direction with an undivided carriageway.
Parking	Unrestricted
Speed Limit	No sign posted speed limit (100 km/h)
Pedestrian Facilities	No dedicated pedestrian facilities
Bicycle Facilities	No dedicated bicycle facilities
Public Transport	No dedicated public transport facilities, however a level crossing exists across Cobbora Road approximately 80 m north of the Mitchell Highway



Figure 2-3 Cobbora Road west of the site (looking south)

Source: Google maps Streetview

2.2.3 Goolma Road

Goolma Road functions as a sub-arterial road with a north-south alignment. Goolma Road runs between Gulgong in the north and Wellington in the south, forming priority controlled intersections at Mitchell Highway and Campbells Lane.

Goolma Road has the following key features within proximity of site as outlined in Table 2-3 and Figure 2-4.

Table 2-2 Goolma Road key features

Feature	Description
Carriageway	There is a single travel lane in each direction; with an undivided carriageway. A right turn lane is provided northbound on Goolma Road to access the Wellington and Macquarie Correctional Centre.
Parking	Unrestricted
Speed Limit	100 km/h
Pedestrian Facilities	No dedicated pedestrian facilities
Bicycle Facilities	No dedicated bicycle facilities
Public Transport	No dedicated public transport facilities



Figure 2-4 Goolma Road east of the site (looking south)

Source: Google maps Streetview

2.2.4 Campbells Lane

Campbells Lane is located along the northern boundary of the WNSP and will act as the primary access to the solar plant. Campbells Lane is a local road running in an east-west alignment from Goolma Road, east of the site, to Cobborra Road in the west. Campbells Lane forms part of a priority controlled intersection at both these locations.

Campbells Lane has the following key features within proximity of site as outlined in Table 2-3 and shown in Figure 2-5.

Table 2-3 Campbells Lane key features

Feature	Description
Carriageway	There are 1 travel lanes in each direction; with an undivided carriageway
Parking	Unrestricted
Speed Limit	No sign posted speed limit (100 km/h)
Pedestrian Facilities	No dedicated pedestrian facilities
Bicycle Facilities	No dedicated bicycle facilities
Public Transport	No dedicated public transport facilities



Figure 2-5 Campbells Lane north of the site (looking west)

Source: Google maps Streetview

2.2.5 Bela Vista Lane

Bela Vista Lane is located south of the WNSP. Bela Vista Lane is a local road running in an east-west alignment from Goolma Road, east of the site, to Cobbora Road in the west. Bela Vista Lane forms part of a priority controlled intersection at both these locations.

Bela Vista Lane has the following key features within proximity of site as outlined in Table 2-3 and shown in Figure 2-6.

Table 2-4 Bela Vista Lane key features

Feature	Description
Carriageway	There is 1 travel lane in each direction; with an undivided carriageway with a gross load limit of 20 tonne.
Parking	Unrestricted
Speed Limit	No sign posted speed limit (100 km/h)
Pedestrian Facilities	No dedicated pedestrian facilities
Bicycle Facilities	No dedicated bicycle facilities
Public Transport	No dedicated public transport facilities



Figure 2-6 Bela Vista Lane north of the site (looking west)

Source: Google maps Streetview

2.2.6 Mitchell Highway

Mitchell Highway forms part of the arterial road network and runs from Dubbo in the north to Bathurst to the south. In the vicinity of the WNSP, Mitchell Highway has a north-south alignment and forms priority controlled intersections at Goolma Road and Cobbora Road.

Mitchell Highway is a state road providing access from the WNSP to Wellington town centre. Access to the WNSP via Mitchell Highway is provided through its intersection with Cobbora Road south-west of the site and its intersection with Goolma Road south of the site.

Mitchell Highway has the following key features within proximity of site as outlined in Table 2-5 and shown in Figure 2-7.

Table 2-5 Mitchell Highway key features

Feature	Description
Carriageway	There is typically 1 travel lane in each direction with an undivided carriageway. An additional turning lane is provided in both directions on the approach to Cobbora Road and a right turn lane from Mitchell Highway northbound into Goolma Road.
Parking	Unrestricted
Speed Limit	110 km/h with 80 km/h in the southbound direction near its intersection with Cobbora Road and Goolma Road.
Pedestrian Facilities	No dedicated pedestrian facilities
Bicycle Facilities	No dedicated bicycle facilities
Public Transport	No dedicated public transport facilities within the vicinity of the site. Nearest bus stops are located on Mitchell Highway near Gobolion Street, on both sides of the road.



Figure 2-7 Mitchell Highway west of the site (looking west)

Source: Google maps Streetview

2.3 Existing road network performance

This section provides an understanding of the current traffic volumes on the key roads in proximity to the subject site.

2.3.1 Existing traffic volumes

In order to identify the existing traffic volumes in proximity to the site, seven-day tube count data was undertaken by Matrix Traffic and Transport Data between 28 February and 6 March 2018 at the following three locations and shown in Figure 2-8.

- Cobbora Road (approximately 500 m north of Bela Vista Lane);
- Goolma Road (approximately 300 m south of the access point to the Wellington and Macquarie Correction Centres);
- Campbells Lane (approximately 400 m west of Goolma Road – approximately mid-way between property access and 90 degree curve in the road).

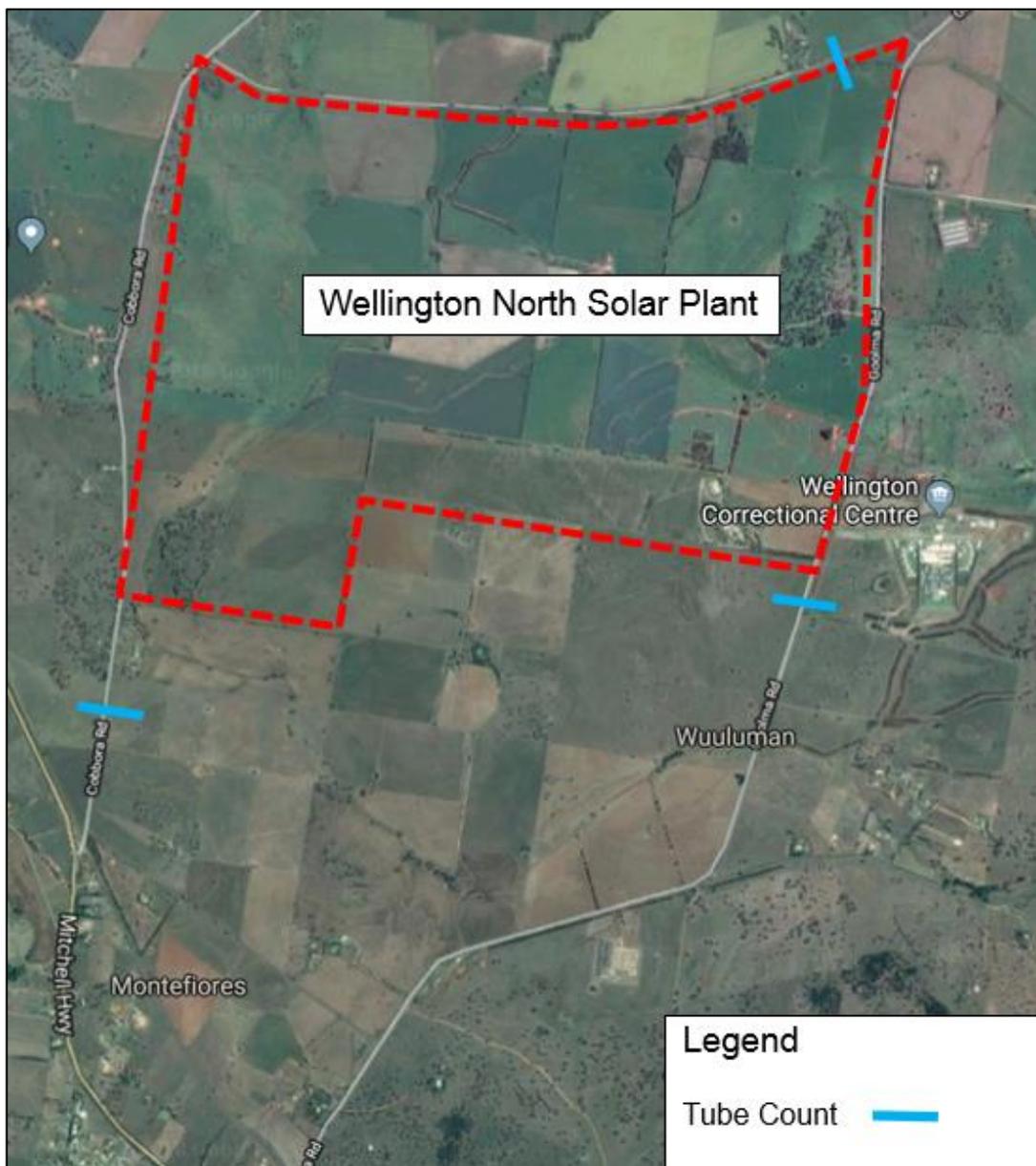


Figure 2-8 Traffic survey locations

Source: Google maps – Modified by GHD

2.3.1.1 Cobbora Road traffic volumes

The identified daily traffic volumes on Cobbora Road is shown in Figure 2-9 with the surveyed weekday average and seven day average (weekday and weekend) in Figure 2-10 .

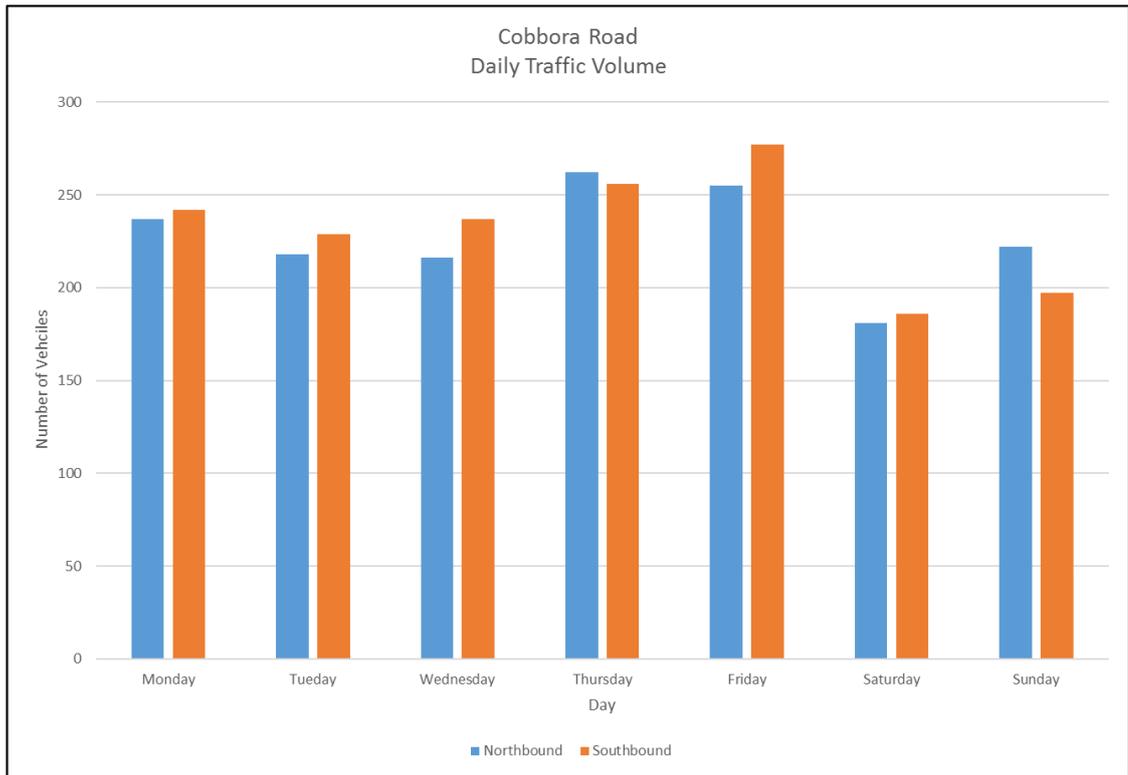


Figure 2-9 Daily traffic volumes on Cobbora Road

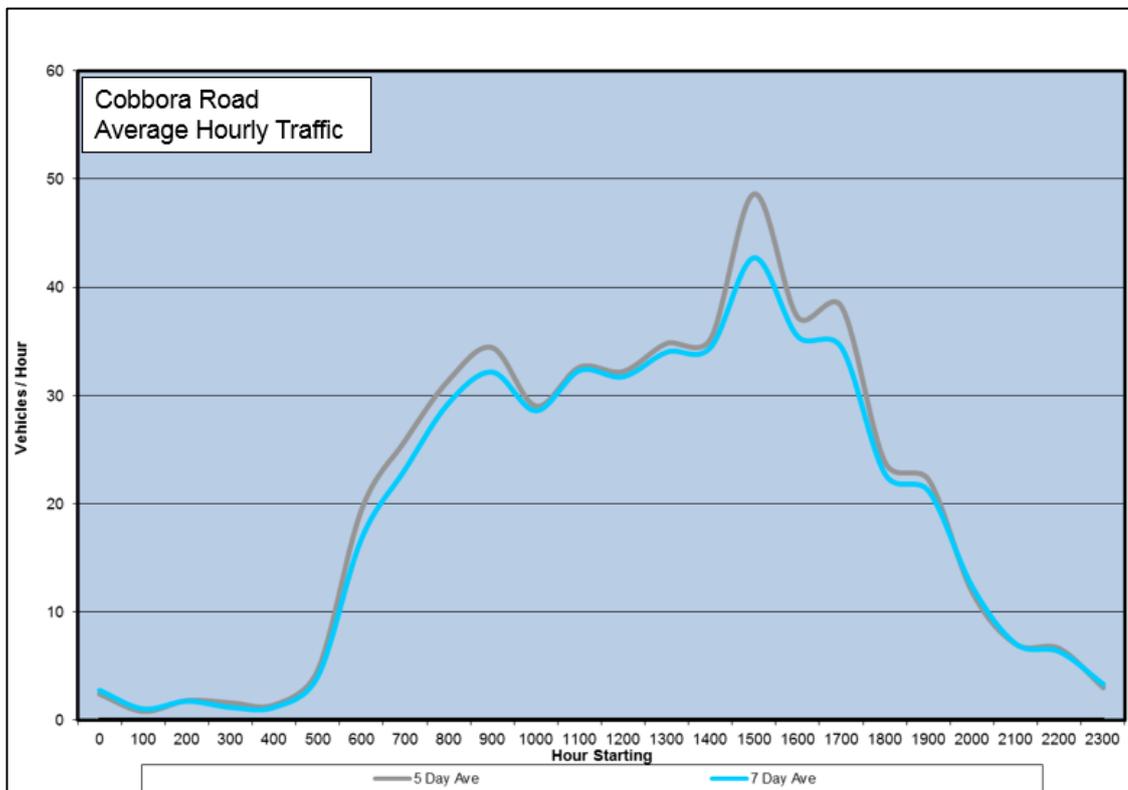


Figure 2-10 Weekday and seven day average hourly traffic profile on Cobbora Road (two-way)

Table 2-6 outlines the highest recorded vehicle movements within an hour period during the AM and PM periods, while Table 2-7 surmises 85 percentile traffic speeds and the percentage of heavy vehicles on Cobbora Road.

Table 2-6 Peak hour average surveyed traffic volume on Cobbora Road

Cobbora Road	Average Weekday AM Peak Hour (veh/h)*	Average Weekday PM Peak Hour (veh/h)*	Saturday Peak Hour (veh/h)*
Northbound	20	19	16
Southbound	14	29	20
Total	34	49	36

Notes:

(*) veh/h = vehicles per hour

Table 2-7 Key traffic data summary on Cobbora Road

Key Data Description	Amount
Weekday % Heavy Vehicles	25 %
Weekend % Heavy Vehicles	12 %
85 percentile speed	98.1 km/h

2.3.1.2 Goolma Road traffic volumes

The identified daily traffic volumes on Goolma Road is shown in Figure 2-11 with the surveyed weekday average and seven day average (weekday and weekend) in Figure 2-12.

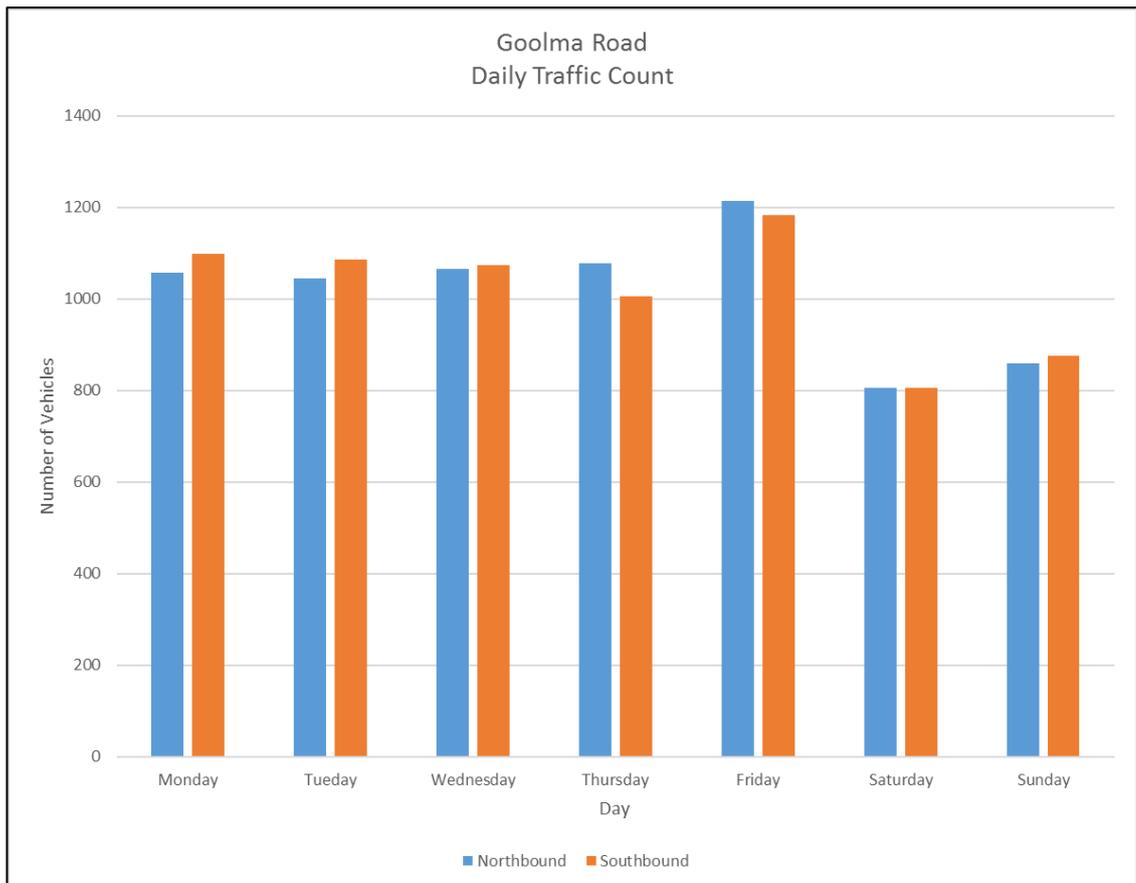


Figure 2-11 Daily traffic volumes on Goolma Road

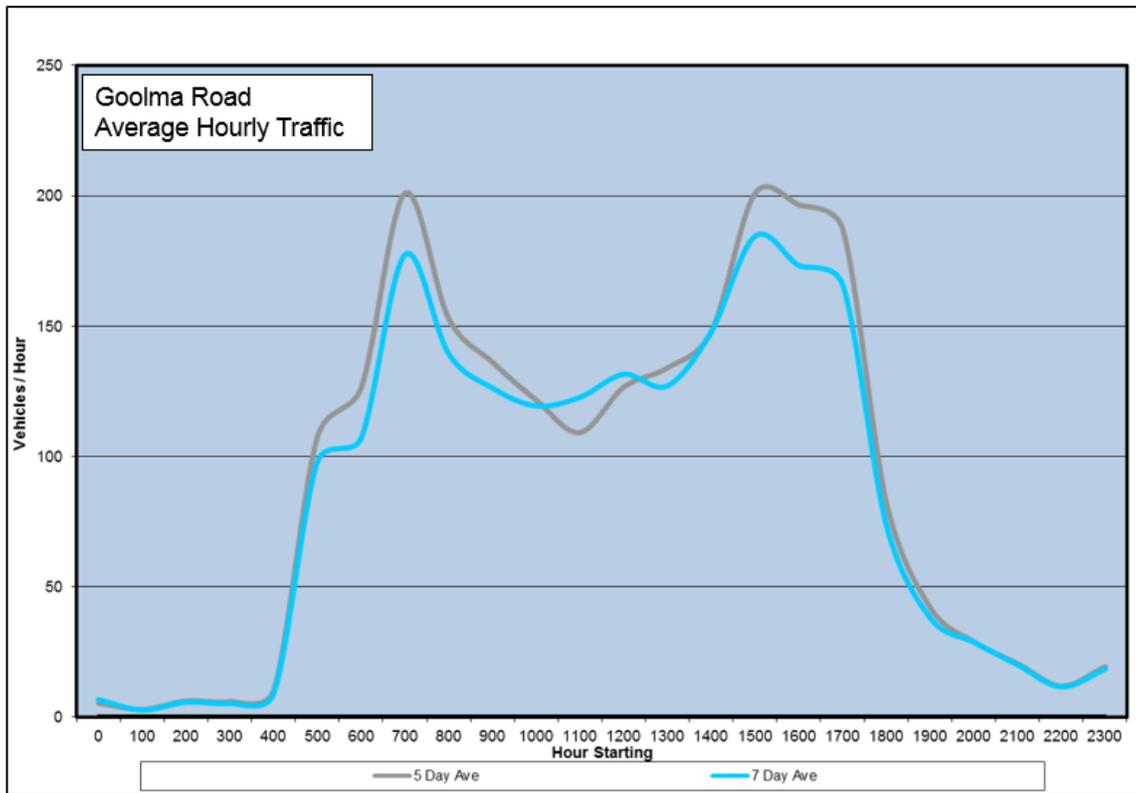


Figure 2-12 Weekday and seven day average hourly traffic profile on Goolma Road (two-way)

Table 2-8 outlines the highest recorded vehicle movements within an hour period during the AM and PM periods, while Table 2-9 surmises 85 percentile traffic speeds and the percentage of heavy vehicles on Goolma Road.

Table 2-8 Peak hour average surveyed traffic volume on Goolma Road

Goolma Road	Average Weekday AM Peak Hour (veh/h)*	Average Weekday PM Peak Hour (veh/h)*	Saturday Peak Hour (veh/h)*
Northbound	157	66	57
Southbound	44	135	94
Total	201	201	151

Notes:

(*) veh/h = vehicles per hour

Table 2-9 Key traffic data summary on Goolma Road

Key Data Description	Amount
Weekday % Heavy Vehicles	18 %
Weekend % Heavy Vehicles	11 %
85 percentile speed	104.7 km/h

2.3.1.3 Campbells Lane traffic volumes

The identified daily traffic volumes on Campbells Lane is shown in Figure 2-13 with the surveyed weekday average and seven day average (weekday and weekend) in Figure 2-14 .

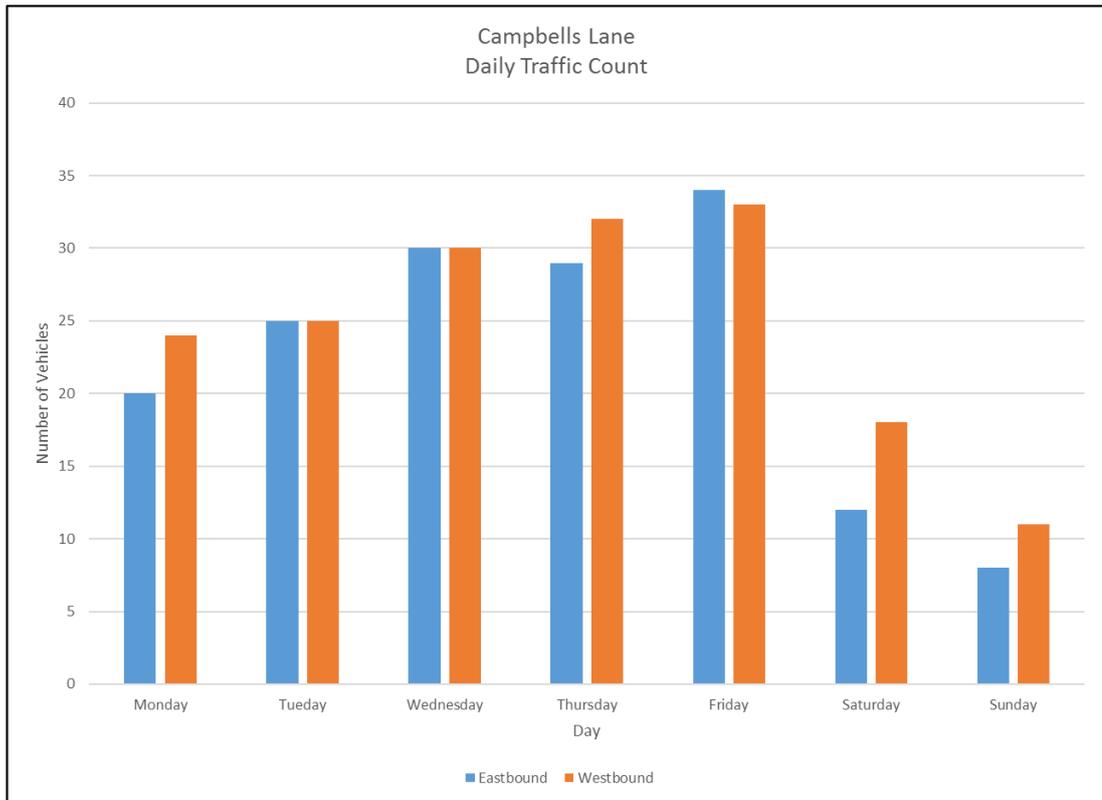


Figure 2-13 Daily traffic volumes on Campbells Lane

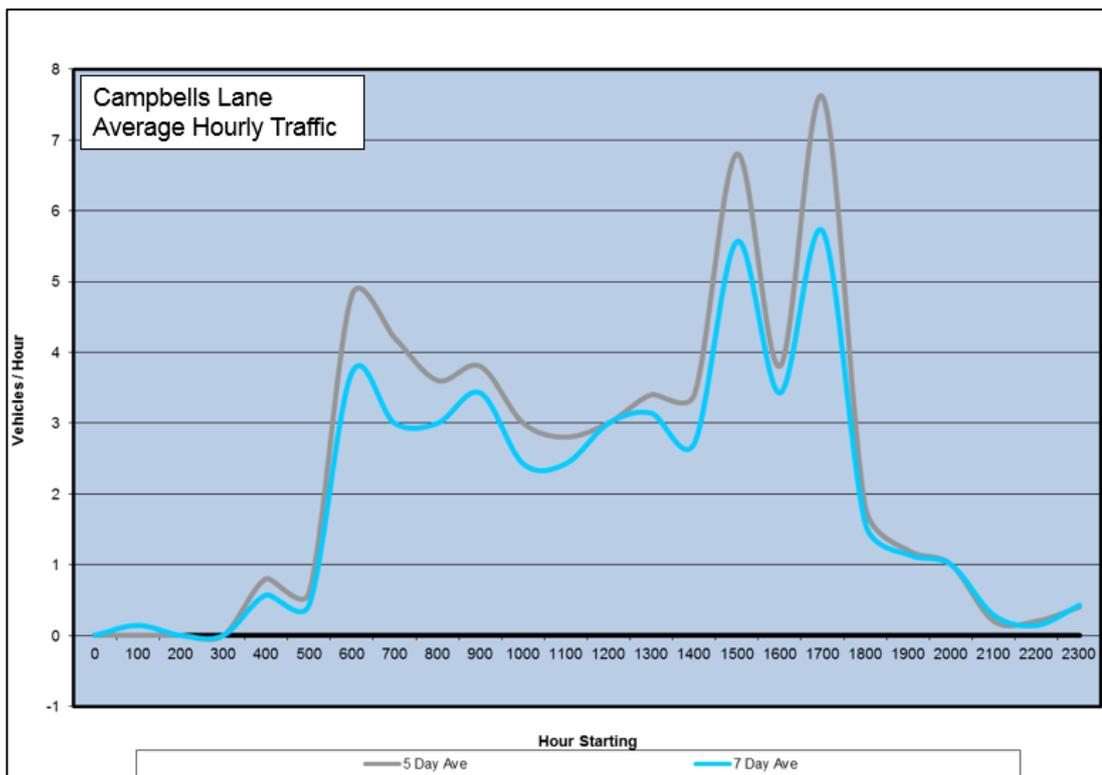


Figure 2-14 Weekday and seven day average hourly traffic profile on Campbells Lane (two-way)

Table 2-10 outlines the highest recorded vehicle movements within an hour period during the AM and PM periods, while Table 2-11 surmises 85 percentile traffic speeds and the percentage of heavy vehicles on Campbells Lane.

Table 2-10 Peak hour average surveyed traffic volume on Campbells Lane

Campbells Lane	Average Weekday AM Peak Hour (veh/h)*	Average Weekday PM Peak Hour (veh/h)*	Saturday Peak Hour (veh/h)*
Eastbound	4	3	1
Westbound	1	5	4
Total	5	8	5

Notes:

(*) veh/h = vehicles per hour

Table 2-11 Key traffic data summary on Campbells Lane

Key Data Description	Amount
Weekday % Heavy Vehicles	12 %
Weekend % Heavy Vehicles	7 %
85 percentile speed	91.9 km/h

2.4 Crash data review

GHD utilised the Transport for NSW Centre for Road safety website to review the crash statistics for a five-year period (2012-2016) for roads within proximity of the proposed WNSP.

Crash locations on Goolma Road and Cobbora Road near the proposed WNSP are shown in Figure 2-15



Figure 2-15 Study area crash data

Source: Transport for NSW Centre for Road Safety – Modified by GHD

A summary of the findings is outlined as follows:

There were a total of four (4) crashes recorded within proximity to the WNSP over the five year period between 2012 – 2016. Of the four crashes, three (3) were recorded on Goolma Road and one (1) was located on Cobbora Road. The recorded crashes resulted in two (2) moderate injuries.

- Two (2) of the crashes were a result of vehicles striking an animal (one crash on Cobbora Road and one crash on Goolma Road).
- One (1) crash was a result of a vehicle colliding with another vehicle emerging from an adjacent driveway (Goolma Road).
- One (1) crash occurred when a vehicle steered off road to the left and struck an object (Goolma Road).

2.5 Public and active transport

Given the rural nature of the location, there are no formalised pedestrian or cycle facilities on the road network surrounding the site.

Wellington Railway Station, located approximately 7 km south of the site, is serviced by regular train services to Dubbo, Orange, Bathurst, Lithgow and Sydney. Charter coach services also operate between Wellington and major centres.

A local bus service (TLDW – Wellington to Dubbo) operates around the town of Wellington, operates four daily services Monday to Friday.

There are no public transport services that run along Goolma Road or Cobbora Road to the site. Accordingly, the vast majority of trips generated by the construction activity and workers are expected to occur using private vehicles.

There is no designated school bus route within proximity of the site.

3. Traffic impact assessment

This section of the report provides details and assessment of the estimated traffic generation during the construction of the WNSP, based upon estimated staffing numbers and heavy vehicle movements. Vehicle movements were estimated by GHD in conjunction AGL.

Construction activity is proposed to operate 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday. No construction activity will occur on Sunday and public holidays without prior approval.

The internal access and parking arrangement for the proposal are currently unknown and have therefore has not been assessed as part of the traffic study.

3.1 Wellington North Solar Plant life cycle overview

The WNSP is expected to proceed through mobilisation, construction, commissioning, operation and decommissioning stages typical of Photovoltaic (PV) generation facilities.

Mobilisation would be expected to occur for the first 1-3 months of the project delivery timeframe and traffic movements might include:

- light vehicles to mobilise workers (daily) to and from site;
- delivery of infrastructure including temporary offices and associated equipment, power generation equipment, ablutions;
- delivery of equipment and machinery for civil construction, clearing (if required) and general site establishment; and
- delivery of structural components and some PV equipment.

More intense construction would be expected to follow during months 3-14 to achieve mechanical completion with the following traffic movements:

- light vehicles to mobilise workers (daily) to and from site – numbers ramping up from mobilisation;
- delivery of equipment and machinery for structural , electrical and civil construction activities;
- ongoing delivery of PV and electrical equipment including deliveries of major equipment such as inverters, switchgear, transformer etc; and
- trucks for removal of waste.

Following mechanical completion the site will move into a commissioning phase estimated from months 15-18 where equipment deliveries are significantly reduced and the workforce is also reduced. During commissioning the majority of traffic would be expected to be light vehicles for personnel movement.

Following commissioning the site will move to operations phase which would be expected to extend for the life of the asset with very limited light vehicle movements predominately for routine operations and maintenance personnel and activities.

At the end of the useful life of the asset it is envisaged that decommissioning would take place which would involve mobilisation of a workforce and additional temporary facilities then move to removal of equipment and infrastructure. At this time it is expected that significant movements of light vehicles and trucks for transporting waste will occur. The decommissioning phase would be expected to last less than 8 months.

3.2 Construction traffic generation

3.2.1 Daily traffic

Two separated options are being considered for the construction of WNSP:

- 2MW block 420W modules; and
- 5MW block 340W modules.

Based on the information estimated by the client in consultation with GHD, the daily vehicle two-way trips outlined for each project month are shown in the graphs below Figure 3-1 and Figure 3-2.

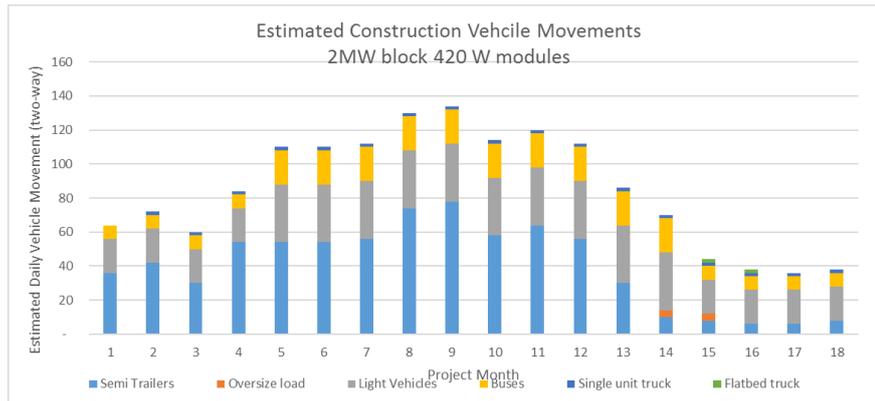


Figure 3-1 2MW block 420W module estimated daily vehicle movements

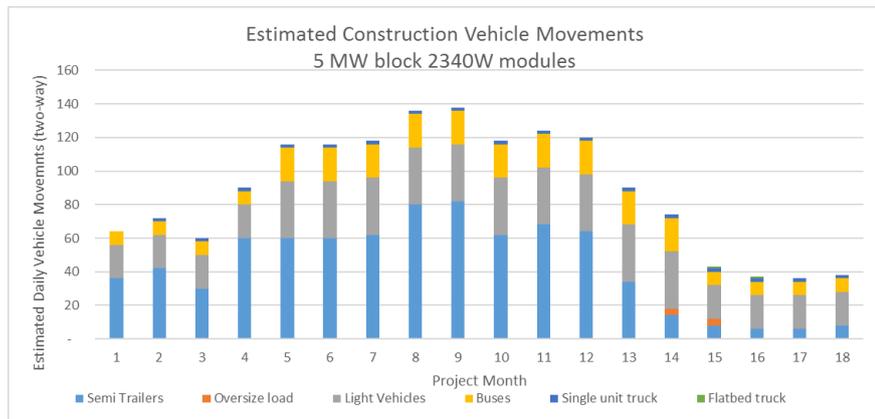


Figure 3-2 5MW block 340W module estimated daily vehicle movements

A review on the impacts to the road network utilising the 5MW block 340W module configuration was adopted, as this construction configuration generated the worst case peak daily trip generation of 138 two-way vehicle movements.

The peak daily two-way traffic generation for this configuration consisted of the following trip generation (based on month 9 of the construction program) as per Table 3-1.

Table 3-1 Peak daily trip generation (two-way)

Vehicle Type	Number of Trips (two-way)
Semi Trailers	82
Light Vehicles	34
Buses	20
Single-unit truck	2
Total	138

The client has advised that at the peak of the construction it is anticipated that up to 200 site personnel will be required to undertake the works. They have advised that a shuttle bus system may be in place to transport workers to the site consisting of a 20 seater bus. This would generate up to 20 vehicle movements (10 in and 10 out) during a peak hour period, equating to 40 vehicle movements daily. Additionally, an extra allowance has also been made for up to thirty people to travel in light vehicles (assuming approximately 2 people per vehicle) to access the site, generating up to 17 one way trips (inbound in the AM and outbound in the PM peak periods).

Based on information outlined in Table 3-1 within the peak construction period it is estimated daily there would be up to 34 light vehicle and 102 heavy vehicle movements. This results in approximately 75 % of the construction traffic activity will be heavy vehicles.

3.2.2 Peak hourly traffic generation and distribution

For a worst-case scenario for the impacts of the road network, it has been assumed that the peak traffic associated with construction activity would be during the arrival and departures of the site workers and occur within the road network AM and PM peak hour period.

It is expected that the remaining vehicle movements (84 two way trips) generated by the construction activity would be spread throughout the day with up to 10 (approx. 10%) two-way trips occurring within the same peak hour of the workers arrival and departure period.

AGL has advised that construction traffic will arrive via The Golden Highway (45 km north of the site) along Cobbora Road and turn left into Campbells Lane before accessing the site. Egress will be via the same route. For the assessment it has been assumed that workers will arrive from the south (the town of Wellington), utilising Mitchell Highway, Cobbora Road and Campbell Lane and then via the site access. This route is proposed to utilise the regional road network with lower traffic volumes to minimise road network impacts.

The peak hour AM and PM movements and approach routes within the vicinity of the site are outlined in Figure 3-3 and Figure 3-4 respectively. The AM and PM peak hour has been reviewed for a worst-case scenario.

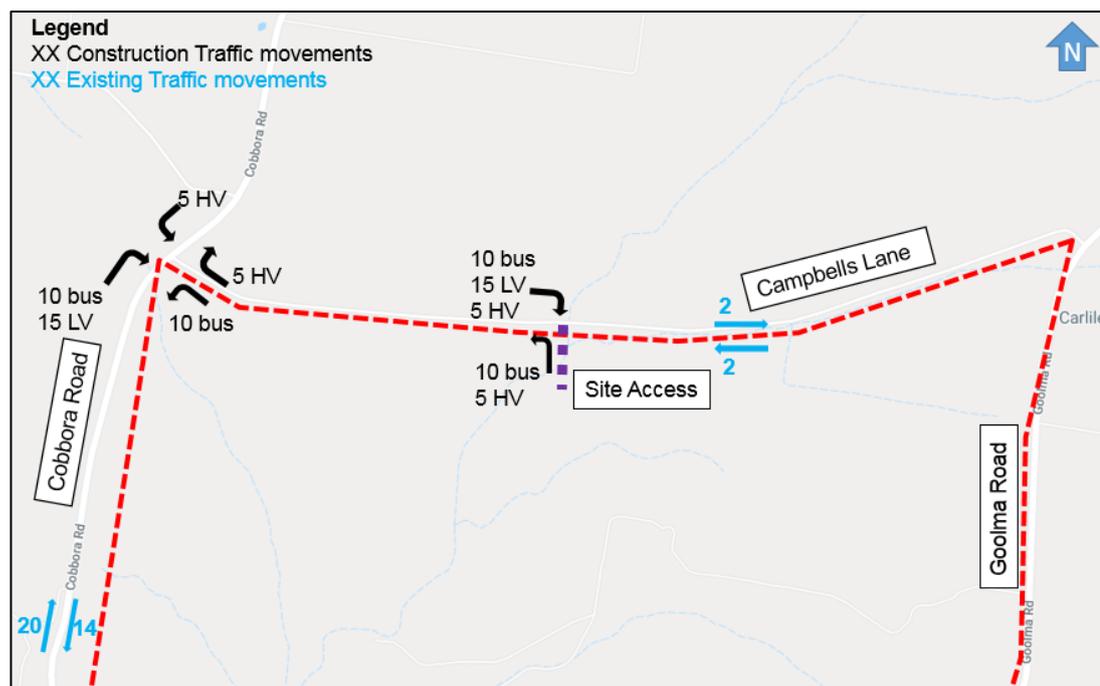


Figure 3-3 AM peak hour construction vehicle movements

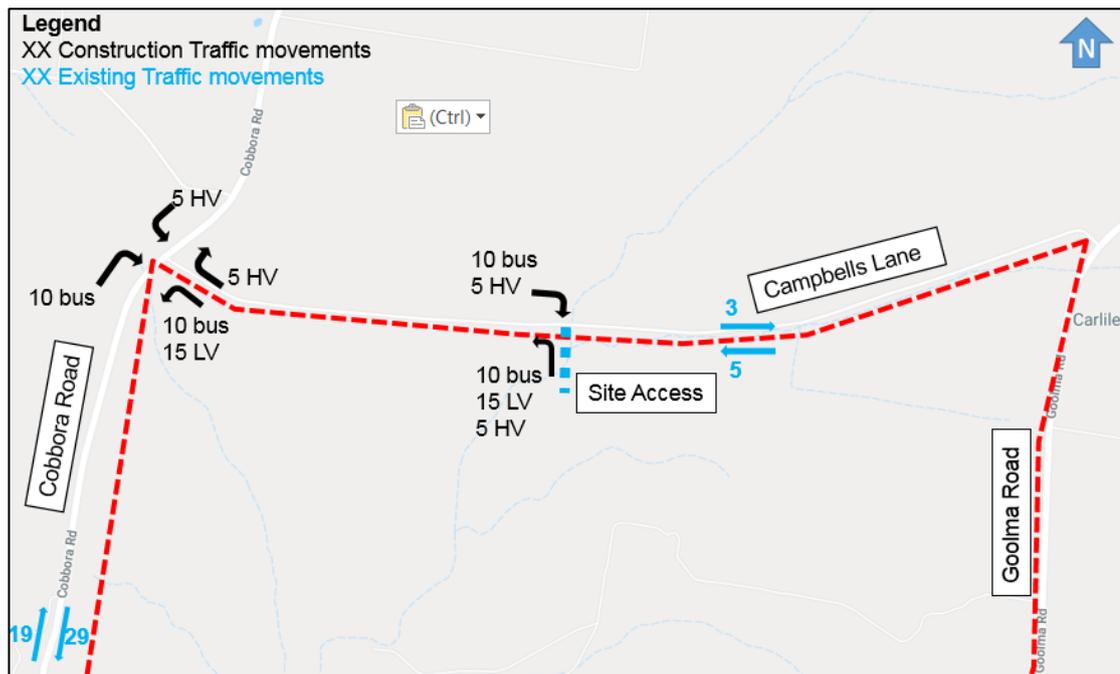


Figure 3-4 PM peak hour construction vehicle movements

3.3 Mid-block assessment

Based on the above information summary of estimated construction vehicle movements, a review of the existing peak traffic and combined construction movement was undertaken with reference to Roads and Maritime Services Guide to Traffic Generating Developments (2002). This outlines mid-block road capacity Levels of Service based on traffic flows per direction per lane to guide road capacity Level of Service as outlined in Table 3-2.

Table 3-2 Mid-block level of service (peak flows per direction)

Level of Service	Peak Hour Volume (veh/h*) One Lane	Peak Hour Volume (veh/h*) Two Lane
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: Guide to Traffic Generating Developments (Roads and Maritime Services 2002)

*Note veh/h = vehicles per hour

Table 3-3 outlines the Level of Service of the road network with respect to the mid-block level of service.

Table 3-3 Peak hour mid-block level of service

Location	Existing vehicles (two-way)	Additional vehicles (two-way)	Total Vehicles (two-way)	Level of Service
AM peak hour				
Cobbora Road (North of Campbell Lane)	34	10	44	A
Cobbora Road (south of Campbells Lane)	34	35	69	A
Campbells Lane	4	45	49	A
PM peak				
Cobbora Road (North of Campbell Lane)	49	10	59	A
Cobbora Road (south of Campbells Lane)	49	35	84	A
Campbells Lane	8	45	53	A

The above review shows that the mid-block level of service is good (LoS A). However, it is recommended that the existing road environment pavement conditions be reviewed within proximity of the site. A bituminous paved surface should be provided on Campbells Lane between Cobbora Road and site access prior to the commencement of construction activity to reduce pavement degradation and improved driver safety.

3.4 Intersection treatment

3.4.1 Turn treatment

The *Austrroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* provides warrants that apply to major road turn treatments with respect to the provision of basic, auxiliary and channelised lanes along the major road. For the purpose of this assessment, the graph for a speed of greater or equal to 100 km/h has been applied, which is appropriate for both Cobbora Road and Campbells Lane.

A review was undertaken at the intersection of Cobbora Road and Campbells Lane and Campbells Lane and the site access as shown in Figure 3-5, based upon the existing and future traffic volumes, notably for the right turn movement on the major road (considered as the worst turn movement).

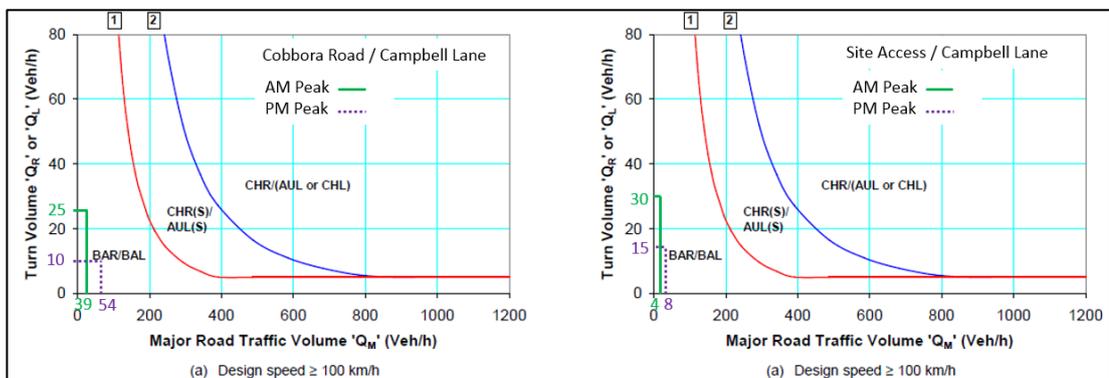


Figure 3-5 Intersection turn treatment review

Source: *Austrroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections* – modified by GHD -

Based on the warrants, it is considered that a Basic Right and Left Turn Treatment (BAR/BAL) is suitable for both the Cobbora Road and Campbells Lane and Campbells Lane and site access intersections. Currently, neither intersections provide this type of treatment, with no shoulder or road widening provided on the major road. It is considered that shoulder widening be provided on the western and eastern road alignment on Cobbora Road at Campbells Lane and a new intersection at site access be constructed in line with a BAR/BAL treatment as shown in Figure 3-6.

The turn treatment should be designed to accommodate articulated vehicles up to 19 m in length. Larger vehicles will require special permit and traffic management when required.

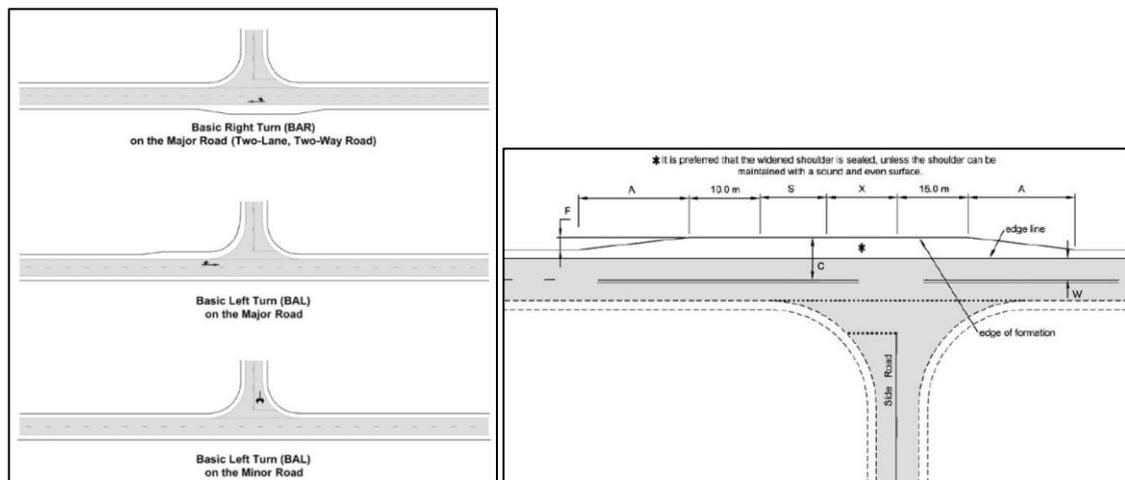


Figure 3-6 BAR/BAL turn treatments

Source: Austroads Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections -

3.4.2 Sight lines

The Austroads *Guide to Road Design Part 3: Geometric Design* (Table 5.5: Truck stopping sight distances) specifies that (accounting for a reaction time of two seconds) for roads with an operating speed of 100 km/h, a minimum sight distance of 191 metres should be provided. A desktop review using Google imagery indicates that these sight lines can be achieved. This would be subject to further assessment when developing a concept and detail intersection plan and review of current on-site conditions (e.g. vegetation growth).

3.5 Oversize vehicles

The number of oversized vehicles is low within the construction of the WNSP with up to eight two-way movements within the later months of the construction period (month 14 and 15). Oversized vehicles will be utilised to transport transformers to the site during the construction phase, which is anticipated to be arranging from the Port of Newcastle located approximately 370 km west of Wellington.

Oversize vehicles will require permits from Roads and Maritime Services and suitable traffic management on the transportation of the type of oversized vehicles that will need to be used. Oversize vehicle routes are to be carried out where possible on designated heavy vehicle routes or routes approved by Roads and Maritime Services. It is proposed that such routes will be via the Golden Highway (north of the site), Cobbora Road and the site access off Campbells Lane.

Additionally, oversized traffic movements should be carried out, where possible, outside peak road network periods where possible minimising the impacts on the road network.

An example of the potential oversized vehicle that would be required to transport the transformers is a flatbed trailer as shown in Figure 3-7. The vessel type and size is to be coordinate to be suitable for transportation of the plant and agreed with the governing authority.

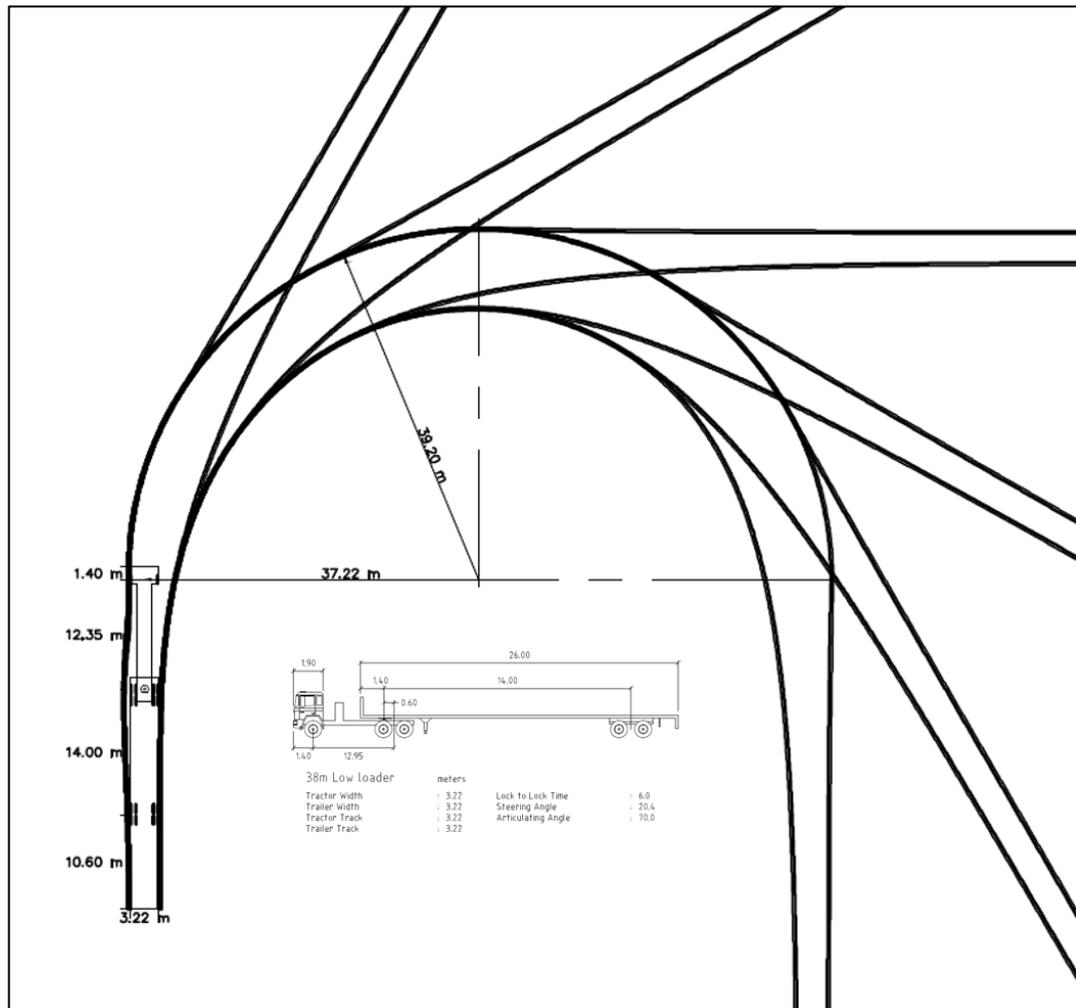


Figure 3-7 Oversized vehicle example

Source: AutoTurn computer aided program

3.6 Cumulative construction traffic impacts

The following projects are either in operation, construction or planned for construction within the proximity of the WNSP.

- Bodangora Wind Farm;
- Macquarie and Wellington Correctional Centres; and
- Maryvale and Wellington Solar Farms.

The existing traffic surveys volumes on the adjoining road network to the WNSP carried out in February/March 2018 would have included the operation and construction of the existing Macquarie and Wellington Correctional Centres and the current construction activity of the Bodangora Wind Farm.

Based upon the intersection turn treatment review and mid-block assessment of the road network and of the project traffic generation and the WNSP, the background traffic along the major road network has additional capacity to cater for additional traffic flow as a result of surrounding projects or fluctuations in traffic volumes.

3.7 Operational phase traffic movements

It is considered that the traffic generated during operation will consist of minor traffic movements in association with maintenance of the WNSP. Although no specific details of onsite vehicle movements have been provided by the client, it is anticipated that traffic movement required maintenance and monitoring of the WNSP would be less than construction traffic. Therefore, the road network would continue to operate satisfactorily post construction subject to the recommendations outlined in the construction traffic generation assessment has been carried out.

3.8 Decommissioning phase traffic movements

If the WNSP is decommissioned by the client in the future, it is considered that the construction traffic generated during decommissioning will consist of less daily vehicular movements than the construction of the WNSP. Although no specific details of on-site vehicle movements have been provide by the client for decommissioning of the solar plant, a preliminary estimate has been undertaken based upon the 5 MW block 340W modules system (which created the higher vehicular movement). This estimate was based on the estimated required materials to be decommissioned with decommissioning occurring over a ten month period. As shown in Figure 3-8, the peak daily vehicular movement of construction traffic is 117 two-way trips, which is less than the peak construction traffic movement of 138 two-way trips. Thereby the traffic analysis undertaken for the construction of the WNSP is a worst-case scenario of traffic movements.

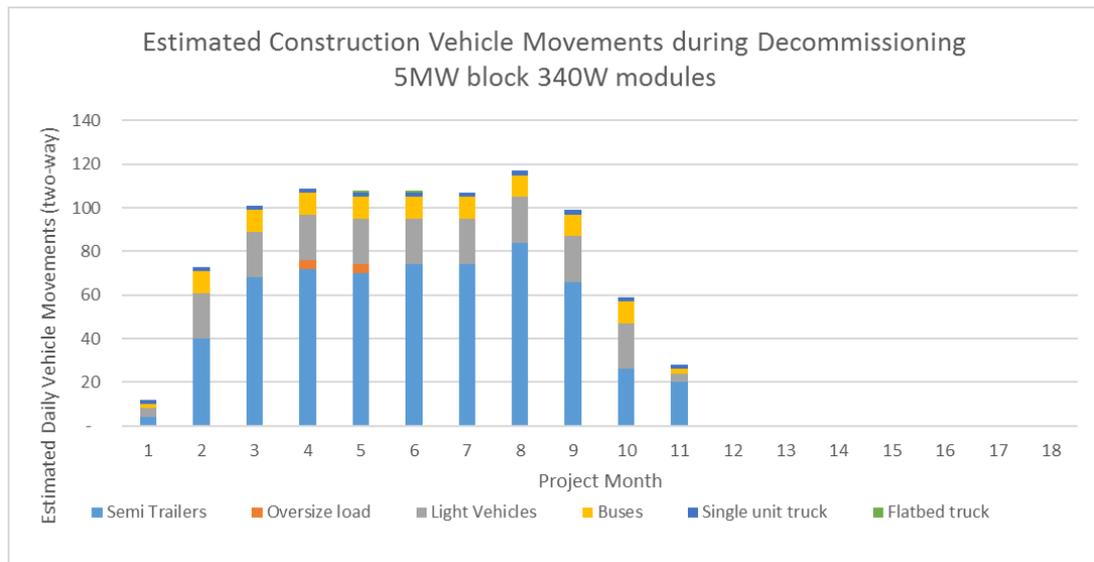


Figure 3-8 5MW block 340W module estimated daily vehicle movements during decommissioning

4. Parking provision

The internal access and parking arrangement for the proposal are currently unknown at this stage of the application and therefore have not been assessed as part of this traffic study. However the following outlines the items for consideration during the development the site arrangement and associated parking.

4.1 Parking provision

The Council DCP nor Roads and Maritime Services Guide to Traffic Generating Developments do not outline recommended parking provisions for solar plant developments. Therefore, the parking required should be based on a first principles approach dependent upon site personnel required, to carry out the construction works and ongoing maintenance required post-construction.

Given the rural nature of the site, it should be assumed that all site personnel during the operational phase will arrive by private vehicle on an individual basis, with the parking provision to be accommodated on site near the main administration/office/maintenance area.

Construction parking should be allocated within close proximity to the site office, suitable to accommodate the estimate peak light vehicles (minimum 30 vehicles based upon the information provided) on site and the number of shuttle buses utilised.

4.2 Parking layout

In line with *AS2890.1 – Off Street Car Parking*, the parking area should be designed to accommodate the specific design vehicle. For light vehicles, the parking space dimensions and associated aisle widths for a Class 2 (generally medium-term parking) facility classification are presented in AS2890.1 include:

- Spaces: 2.5 m x 5.4 m; and
- Aisle Width: 5.8 m

Additionally, allowance should be made to accommodate larger design vehicles such as a truck, should it be required for the use of maintenance vehicles.

5. Mitigation measures

5.1 Construction activity traffic management

5.1.1 Construction traffic management objective

A Construction Traffic Management Plan (CTMP) will need to be prepared prior to the commencement of works with site induction for construction personnel being undertaken to outline the requirements of the CTMP. The aim of the CTMP is to maintain the safety of all workers and road users within the vicinity site and the following are the primary objectives:

- To minimise the impact of the construction vehicle traffic on the overall operation of the road network.
- To provide continuous, safe and efficient movement of traffic for both the general public and construction workers.
- Installation of appropriate advance warning signs to inform users of the changed traffic condition.
- To provide a description of the construction vehicles and the volume of these construction vehicles accessing the construction site.
- To provide information regarding the changed access arrangement and also a description of the proposed external routes for vehicles including the construction vehicles accessing the site.
- Establishment of a safe pedestrian environment in the vicinity of the site.

5.1.2 Traffic management

Public access to the site is to be maintained on the surrounding road network. Vehicles will be permitted to travel past the work site with traffic signage in accordance with a Traffic Control Plan (TCP) to be developed in accordance with *RMS Traffic Control at Works Sites and AS1742.3 – Traffic Control for Works on Roads*. This is to advise motorists of changes in road network or vehicle movements to/from the site including “Truck turning” activity.

It is not anticipated to implement road closures within the public road network as part of the construction activity.

Traffic Control Plans will need to be developed as part of the CTMP prior to commencing of construction activity on the site.

5.1.3 Traffic activity and parking provisions

It is anticipated that access and egress for site personnel may occur during the AM and PM peak hour periods of the surrounding road network. For a worst-case perspective the intersection review has been based on peak hour traffic volumes.

Encouraging carpooling between workers will decrease traffic activity and parking demand in conjunction with the shuttle bus system proposed.

Parking for construction personnel is to be accommodated within site. The area is to be allocated to accommodate the peak site personnel. Parking within the public road network should not be permitted. Details of the proposed parking were not available at the time of this assessment, however given the large greenfield site, it is anticipated adequate parking area can be provided to facilitate the parking of workers and visitors to the site.

5.1.4 Pedestrian management

Site access is to be restricted to authorised personnel only and existing employees on site. Pedestrian access to and around the site is to be maintained at all times. It is anticipated the pedestrian activity in public areas surrounding the site will be low due to the rural nature of the surrounding properties and no formalised pedestrian facilities.

Within the site pedestrian travel paths are to be maintained to key areas such as building entrances and be free from trip hazards.

5.1.5 Road hazards

The CTMP should identify specific road hazards associated with the area including but not limited to:

- fog;
- wet weather;
- frost; and
- wildlife.

5.2 Road improvements

5.2.1 Intersection treatments

The following intersections treatments are recommended:

- The intersection of Cobbora Road / Campbells Lane should be upgraded to provide a BAR/BAL turn type treatment including shoulder widening on Cobbora Road (major road);
- The proposed site access on Campbells Lane should be designed to provide BAR/BAL turn type treatment; and
- Intersection treatments should be designed to accommodate articulated vehicles of 19 m in length.

5.2.2 Pavement treatment

It is recommended that a pavement review be undertaken within proximity of the site. A bituminous surface be applied to Campbell Lane between Cobbora Road and the site access prior to construction to reduce pavement degradation and improve driver safety.

6. Summary and recommendations

6.1 Traffic impact

The construction of the project is estimated to generate at peak periods 138 two-way movements daily and up to 45 two-way movements during the peak hour during the peak construction period. It is estimated that the operational phase traffic generation would be less than the peak construction period.

The construction, operational and decommissioning traffic generation can be accommodated within the existing road network within the vicinity of the site subject to the recommended intersection treatments at Cobborra Road / Campbells Lane and the site access outlined in the mitigation measures.

Based upon the intersection turn treatment review and mid-block assessment of the road network and of the project traffic generation and the WNSP, the background traffic along the major road network has additional capacity to cater for additional traffic flow as a result of surrounding projects or fluctuations in traffic volumes.

6.2 Parking

The internal access and parking arrangement for the proposal are currently unknown at this stage of the application and therefore have not been assessed as part of this traffic study, however the following outlines the items for considerations during the development the site arrangement and parking.

- Parking provision to be provided on a first principles approach, with parking provided within the site boundary assuming all personnel post construction will travel individually by private vehicles to the site.
- Recommended parking dimensions
 - Spaces: 2.5 m x 5.4 m; and
 - Aisle Width: 5.8 m
- Additional allowance should be made to accommodate larger design vehicles such as a truck, should it be required for the use of maintenance vehicles
- Construction parking to be provided within the site suitable to accommodate peak light vehicles provision, shuttle bus parking and heavy vehicle waiting areas.
- Given the greenfield site, it is assumed such provisions can be accommodated within the site boundary

6.3 Mitigation measures

6.3.1 Construction traffic management plan

A Construction Traffic Management Plan (CTMP) will need to be prepared prior to the commencement of works with site induction for construction personnel being undertaken to outline the requirements of the CTMP. The aim of the CTMP is to maintain the safety of all workers and road users within the vicinity site. The plan can include such items as:

- Vehicle approach routes
- Traffic management and traffic control plans
- Workers transportation (shuttle bus)

- Pedestrian management
- Oversize vehicle permit requirements
- Road hazards (including fog, wet weather, frost, wildlife etc.)

The CTMP will be developed in consultation with Dubbo Regional Council and Roads and Maritime Services.

6.3.2 Road improvements

The following road improvements are recommended to facilitate construction and post-construction traffic movements:

- The intersection of Cobbora Road / Campbells Lane should be upgraded to provide a BAR/BAL turn type treatment including should widening on Cobbora Road (major road)
- The proposed site access on Campbells Lane should be designed to provide BAR/BAL turn type treatment.
- Intersection treatments should be designed to accommodate articulated vehicles of 19 m in length.
- Campbell Lane should be reviewed to provide a bituminous surface between Cobbora Road and the site access to reduce pavement degradation and improve driver safety.

6.4 Conclusion

Based on the investigations undertaken by GHD, the proposed development does not have an adverse impact on the road system subject to the recommended mitigation measures being applied.

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