APPENDIX L

Traffic impact assessment

AMPYR

Shell ENERGY

EMM creating opportunities

Wellington South Battery Energy Storage System

Traffic Impact Assessment

Prepared for AMPYR Energy Pty Ltd

October 2022

Wellington South Battery Energy Storage System

Traffic Impact Assessment

AMPYR Energy Pty Ltd

J210534 RP1

October 2022

Version	Date	Prepared by	Approved by	Comments
1	29 July 2022	Baqir Husain	Abdullah Uddin	With cumulative impact of all developments
2	25 August 2022	Baqir Husain	Abdullah Uddin	Without Ungula wind farm development traffic
3	6 September 2022	Baqir Husain	Abdullah Uddin	Without Ungula wind farm development traffic
4	18 October 2022	Baqir Husain	Abdullah Uddin	TfNSW comments incorporated

Approved by

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Executive Summary

EMM Consulting (EMM) has been engaged by AMPYR Australia Pty Ltd (AMPYR) and Shell Energy (Shell) to prepare a Traffic Impact Assessment (TIA) for the proposed Wellington Battery Energy Storage System (BESS) located at 6773 Goolma Road, Wuuluman. The project involves the development of a BESS with a discharge capacity of 500 megawatts (MW) and a storage capacity of 1,000 megawatt hours (MWh). The project also incorporates an on-site substation and connection infrastructure to facilitate the transfer of energy to and from the electrical grid and ancillary infrastructure.

This report undertakes the traffic assessment, primarily for the construction of the project which will be undertaken in a single stage over a period of 12 to 18 months, or over two stages each of between 12 to 18 months. The assessment has considered the worst case construction traffic scenario, which is associated with a single stage construction for the proposed project. At peak, there will be 100 construction personnel working on site. There will be maximum of 100 light and 60 heavy vehicles per day during peak construction. There will likely be other infrastructure projects concurrently under construction in the area. Therefore, cumulative traffic impact assessments have been undertaken to determine the traffic impacts on the adjoining road network for the worst case cumulative scenario. A cumulative traffic impact assessment has been undertaken ie including the nearby Uungula wind farm and Wellington North Solar Farm developments (refer Section 4), with the cumulative scenario including the worst case construction traffic (single stage) scenario for the project.

The Goolma Road/Twelve Mile Road intersection will be upgraded as part of the Uungula wind farm development (Section 2.9).

In preparation of this TIA, consultation has taken place with Transport for NSW (TfNSW) and Dubbo Regional Council (council) regarding site access intersection upgrade. Council has provided in principal support on the concept (Appendix B). Consultation with TfNSW is ongoing, including further consideration of access options via Twelve Mile Road and construction timing for Uungula Wind Farm committed road upgrade works. The traffic related Secretary's Environmental Assessment Requirements (SEARs) and responses are documented in Section 1.3 of this report.

There will be 20 Oversize Over Mass (OSOM) deliveries for the construction of this BESS. The OSOM vehicles will be escorted to the site from the nearest port. Prior approval will be required from the National Heavy Vehicle Regular (NHVR) for OSOM vehicular access.

In summary, the key findings of this TIA are:

- A mid-block capacity analysis shows that on Goolma Road, the Level of Service (LOS) will deteriorate from B to D (with concurrent Uungula Wind Farm and Wellington North Solar Farm construction traffic). This is considered acceptable given that this LOS will occur during the AM and PM peak hours only which are a relatively small construction window (Section 4.1.1).

- The site access intersection upgrade (Appendix B) will be undertaken in accordance with Austroads requirements (Section 4.1.4) and will be as shown in the event that the Goolma Road/Twelve Mile Road intersection is upgraded as part of Uungula Wind Farm development.

The increase in traffic volumes will be marginal during operational stage. The project life is approximately 20 years, which may be extended. It is anticipated that the traffic generation during the decommissioning stage will be lower, compared to construction period and any cumulative traffic impact assessment for that time is unknown at present stage. Therefore, any separate traffic assessment for the decommissioning stage is not considered necessary.

The safety assessment for the proposed site access is undertaken in Section 5.1. To improve visibility, some street trees are recommended for removal prior to construction.

The mitigation measures are described in Section 6.

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1 Introduction

1.1 Overview

AMPYR Australia Pty Ltd (AMPYR) and Shell Energy (Shell) propose to develop the Wellington Battery Energy Storage System (the project). The project involves the development of a large-scale battery energy storage system (BESS) with a discharge capacity of 500 megawatts (MW) and a storage capacity of 1,000 megawatt hours (MWh). The project also incorporates an on-site substation and connection infrastructure to facilitate transfer of energy to and from the electrical grid, and ancillary infrastructure.

The project will be developed within privately owned land (Lot 32 DP 622471) and will incorporate either an overhead or underground transmission line and upgrade works to Wellington Substation in the adjoining TransGrid owned landholding (Lot 1 DP 1226751). Physical infrastructure associated with the BESS will occupy an area of approximately 13 ha, however during construction, the project will require a disturbance area of approximately 19 ha.

The site is located within the New South Wales (NSW) Government declared Central-West Orana Renewable Energy Zone and will complement nearby existing and proposed renewable energy generation assets in the region by smoothing out fluctuations in electricity supply from these new intermittent power sources, providing system security and other network services. In operation, the project will be one of the largest battery storage projects in NSW and will contribute to the overall storage capacity and reliability of the National Electricity Market.

This Traffic Impact Assessment (TIA) considers construction and operational traffic associated with the project. Construction traffic generation associated with other projects in the vicinity of the project with potential for overlapping or concurrent construction periods have been considered as part of a cumulative construction traffic impact assessment.

1.2 Location and context

The site is located within the Dubbo Regional Council local government area (LGA) at 6773 Goolma Road at Wuuluman. It will be located directly adjacent to the TransGrid owned Wellington Substation and is approximately 2.2 km north-east of the township of Wellington and 44 km south-east of the township of Dubbo.

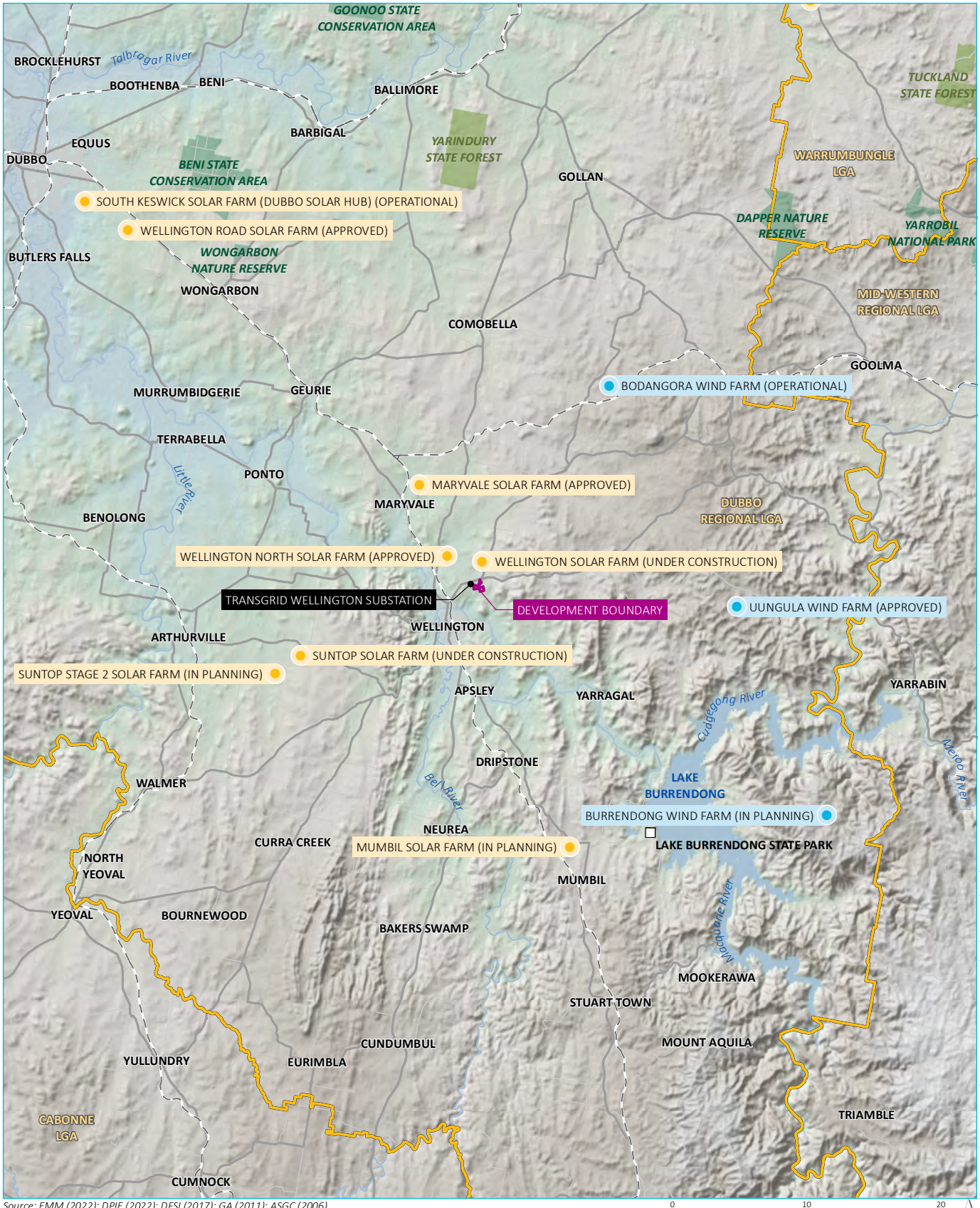
The regional setting is presented in Figure 1.1 and the site and its surrounding local context is shown in Figure 1.2.

The locality surrounding the project contains a variety of landscapes within an agricultural setting. Most of the local and sub-regional setting has been cleared for grazing and/or cultivation. There are no major National Parks, nature reserves, conservation areas or State forests close to the project. Key land uses surrounding the site include:

- cropping and grazing activities;
- correctional centres including the Macquarie Correctional Centre and Wellington Correctional Centre north of the site;
- renewable energy generating facilities including the Wellington Solar Farm immediately north of the site;
- electricity infrastructure including the TransGrid Wellington Substation and associated transmission lines; and
- residences along Goolma Road, Twelve Mile Road, Cadonia Drive, and Cadia Place.

Land surrounding the project is relatively flat, apart from a hill approximately 600 m east of the project, which rises about 100 m above the majority of the site. The project is directly south of the Wellington Solar Farm and adjacent and east of the TransGrid Wellington substation.

The site is within the Macquarie River catchment and Macquarie River is approximately 2 km south east of the site.



Source: EMM (2022); DPIE (2022); DFSI (2017); GA (2011); ASGC (2006)

0 10 20 km

GDA 1994 MGA Zone 55

N

KEY

- Development boundary
- Lake Burrendong State Park
- Rail line
- Major road
- Minor road
- River
- Named waterbody
- Local government area
- NPWS reserve
- State forest

Renewable energy project

- Solar farm
- Wind farm

Regional setting

Wellington Battery Energy Storage System
Traffic impact assessment
Figure 1.1

EMM creating opportunities

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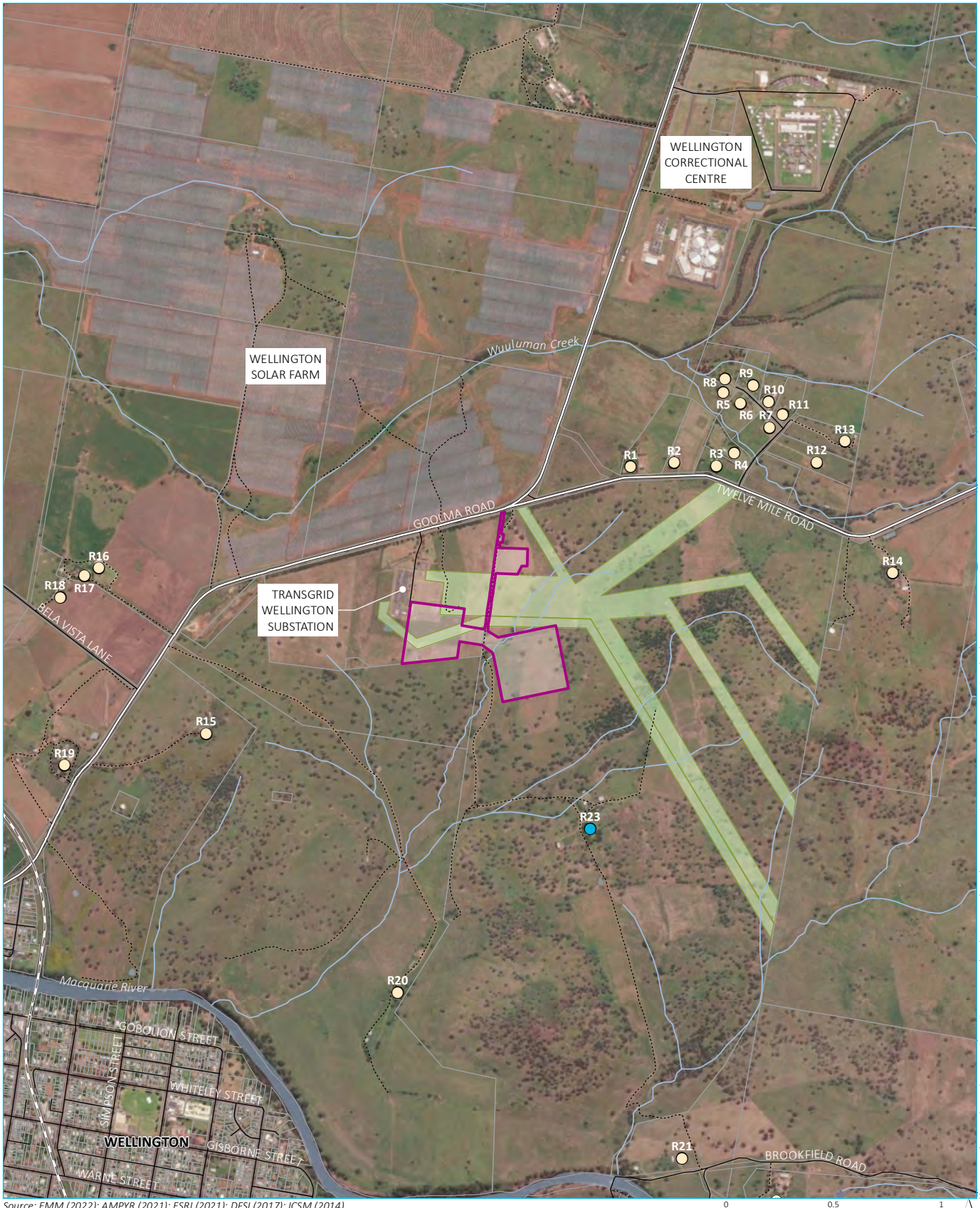

Source: EMM (2022); AMPYR (2021); ESRI (2021); DFSI (2017); ICSM (2014)

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KEY

- Development boundary
- Rail line
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line
- Waterbody
- Cadastral boundary
- Freehold easement

Receivers

- Non-project residential receivers
- Project participating landowner

Local context

Wellington Battery Energy Storage System
Traffic impact assessment
Figure 1.2

EMM creating opportunities

1.3 Assessment framework

The project is State significant development (SSD) pursuant to Schedule 1 of the *State Environmental Planning Policy* (Planning Systems) 2021 (Planning Systems SEPP). Accordingly, approval for the project is required under Part 4 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

The assessment was prepared in accordance with the requirements of the NSW Department of Planning and Environment (DPE), which are set out in the *Secretary's Environmental Assessment Requirements* (SEARs) for the project, issued on 1 October 2021. The SEARs identify matters which must be addressed in the project Environmental Impact Statement (EIS). This report responds to SEARs relating to transport issues. Table 1.1 lists requirements for the project relevant to this assessment and references where they are addressed in this report or in the EIS.

Table 1.1 SEARs for the assessment of transport

Requirement	Section addressed
Transport	
An assessment of the peak and average traffic generation, including over-dimensional vehicles, construction worker transportation and transport of materials by rail.	Section 3.2.1 for daily and peak hour traffic generation; and Section 3.4 for over-dimensional vehicles. Over dimensional vehicle permits will be acquired from the National Heavy Vehicle Regulator for the project prior to mobilisation. No transport via rail is proposed.
An assessment of the likely transport impacts to the site access route (including, but not limited to, Goolma Road, Twelve Mile Road and Mitchell Highway) and site access point(s), particularly in relation to the capacity and condition of the roads.	Section 4 for traffic impact assessment.
A cumulative impact assessment of traffic from nearby developments.	Section 4 for traffic impact assessment, including cumulative traffic impacts.
Provide details of measures to mitigate and/or manage potential impacts including a schedule of all required road upgrades (including resulting from heavy vehicle and over mass/over dimensional traffic haulage routes), road maintenance contributions, and any other traffic control measures, developed in consultation with the relevant road authority.	Section 5 for mitigation and management of traffic impacts due to the proposed development.

In addition to above SEARs, Transport for NSW (TfNSW), in its letter dated 21 September 2021, raised additional comments. TfNSW comments and EMM responses are provided in Table 1.2.

Table 1.2 TfNSW comments as part of the SEARs submission and report references

TfNSW comments	Response/section addressed
TfNSW requests that the Environmental Impact Statement be supported by a Traffic Impact Assessment (TIA) prepared by a suitably qualified person in accordance with the Austroads *Guide to Traffic Management* Part 12, the *Roads and Maritime Supplements to Austroad*s and the RTA *Guide to Traffic Generating Developments*.	This TIA has been prepared by Baqir Husain who has five years' experience as a Traffic Engineer in NSW. This TIA has been prepared in accordance with Austroads *Guide to Traffic Management* Part 12, the *Roads and Maritime Supplements to Austroads* and the RTA *Guide to Traffic Generating Developments*.
The TIA is to address the following:	
Project schedule: • hours and days of work, number of shifts and start and end times; and • phases and stages of the project, including construction, operation and decommissioning.	Section 3.2 for project schedule details. Section 3.2 for construction, Section 3.3 for operation and Section 6.3 for decommissioning phase.
Traffic volumes: • existing background traffic; • project-related traffic for each phase or stage of the project; and • projected cumulative traffic at commencement of operation, and a 10-year horizon post-commencement.	Section 2.4 for existing traffic conditions. Section 3.2 for project construction traffic. Section 3.3 for project operational traffic. Section 3.7 for cumulative traffic. Section 4.4 discusses about traffic assessment in 10-year horizon, post development.
Traffic characteristics: • number and ratio of heavy vehicles to light vehicles; • peak times for existing traffic, peak times for project-related traffic including commuter periods; • proposed hours for transportation and haulage; and • interactions between existing and project-related traffic.	Section 3.2.6 for light and heavy vehicle volumes. Section 2.4 for peak times for existing traffic and Table 3.2 for peak times for project related traffic. Section 3.2.3 for construction hours.
A description of all over size and over mass vehicles and the materials to be transported.	Section 3.4 for over size and over mass vehicles.
The origins, destinations and routes for: • commuter (employee and contractor) light vehicles and pool vehicles, Heavy (haulage) vehicles, Over size and over mass vehicles.	Section 3.5 for traffic distribution.
Road safety assessment of key haulage route/s.	Section 2.6 for crash analysis along the haulage route in close proximity to the site and Section 5 for road safety at sight entrance.
The impact of traffic generation on the public road network and measures employed to ensure traffic efficiency and road safety during construction, operation and decommissioning of the project.	Section 4 for impact assessment of construction traffic. Section 6.3 for decommissioning phase of the project.
The need for improvements to the road network, and the improvements proposed such as road widening and intersection treatments, to cater for and mitigate the impact of project related traffic.	Section 2.9 for road widening. Section 4.3 for intersection turn treatment with the development of Uungula wind farm.
Proposed road facilities, access and intersection treatments are to be identified and be in accordance with Austroads *Guide to Road Design* including provision of Safe Intersection Sight Distance (SISD).	Section 5 for SISD assessment.

Table 1.2 TfNSW comments as part of the SEARs submission and report references

TfNSW comments	Response/section addressed
Local climate conditions that may affect road safety during the life of the project (eg fog, wet and dry weather, icy road conditions).	Due the location of the site (mid north NSW), the road safety issues due to climatic conditions are expected to be minimal.
The layout of the internal road network, parking facilities and infrastructure.	The layout of the project and internal access driveway is shown in Figure 3.1. Parking will be provided at the control and office building and to be confirmed in detailed design.
Impact on rail corridors and level crossings detailing any proposed interface treatments.	No level crossings are present along the haulage route. The closest rail corridor is the Main Western line which intersects Goolma Road near the township of Wellington (approximately 2.3 km south-west of the project). The intersection of Goolma Road and the railway corridor is grade separated. Impacts to the rail corridor are not anticipated given the setback distance between the rail corridor and project.
Impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling.	Section 2.7.
Identification and assessment of potential impacts of the project, such as blasting, lighting, visual, noise, dust and drainage on the function and integrity of all affected public roads.	The project will not involve blasting. Lighting would be confined to the substation and BESS compound, which is setback from the public road, and will only be used during emergency maintenance. The potential for visual, noise, dust and drainage impacts are addressed in Chapter 6 of the EIS.
As a part of the Traffic Impact Assessment consideration must be given to the realignment of Twelve Mile Road and Goolma Road in terms of the existing, cumulative traffic from Uungula Wind Farm and the traffic generated from the proposed Wellington South BESS and the timing of the Uungula Wind Farm and Wellington South BESS. As the realigned Twelve Mile Road intersection with Goolma Road has only been designed to accommodate existing traffic on Goolma and Twelve Mile Roads and projected Uungula Wind Farm construction traffic. If the timing of the construction of the Wellington South BESS and Uungula Wind Farm overlap then the realignment of the Twelve Mile Road and Goolma Road, further work will potentially be required to the intersection design to accommodate the additional traffic. Discussions should occur with Uungula Wind Farm regarding construction schedules.	Section 3.6 considered nearby developments traffic. The cumulative impact assessment has considered potential construction traffic associated with Uungula Wind Farm and Wellington North Solar Farm. Section 4 considers the worst case cumulative impact scenario associated with construction of the project concurrently with construction of the nearby Wellington North Solar Farm and Uungula Wind Farm. A concept design for the site access intersection has been prepared, which assumes the realignment of Goolma Road/Twelve Mile Road (to be completed as part of the Uungula Wind Farm construction) has been completed prior to commencement of construction of this project (refer Appendix B).
The Twelve Mile Road and Goolma Road intersection timing is an important consideration as a part of the Traffic Impact Assessment as the timing of the intersection will have potential impacts on access during construction for the development given the proximity to the Twelve Mile Road and Goolma Road intersection.	Consultation with CWP, as the proponent of Uungula Wind Farm and associated Twelve Mile Road/Goolma Road realignment work, has been undertaken during preparation of this TIA and up to the submission date for exhibition, which indicates that the committed road upgrade works for that project will commence construction prior to the end of 2022. Consultation will continue during subsequent phases of design/assessment to ensure construction of the project can be managed effectively in consideration of proposed timing for Uungula intersection works.

Table 1.2 TfNSW comments as part of the SEARs submission and report references

TfNSW comments	Response/section addressed
It is noted that the primary access will be via the Twelve Mile Road (local Road) and should be continued to be pursued as the primary access to the development as per the requirements of Clause 101 of the State Environmental Planning Policy (Infrastructure) 2007.	Options to include a primary access off Twelve Mile Road were considered during development of the concept design. However, any site access near the Goolma Road/ Twelve Mile Road intersection is not considered feasible due to geometric constraints. As such, the site access is located further to the west along Goolma Road, approximately 100 m west of the existing intersection (Appendix B). The State Environmental Planning Policy (Transport and Infrastructure) 2021 is considered in Chapter 4 of the EIS.

1.4 Consultation with TfNSW on intersection design

Consultation with TfNSW has been undertaken during preparation of the TIA. Specifically, the assessed scenarios, site access and intersection upgrade options were presented and discussed with TfNSW in October 2022. Consultation with TfNSW is ongoing and will continue through subsequent phases of the assessment and design process in relation to potential access options and issues, outcomes of which will form part of the Response to Submission phase of the assessment and approval process following EIS exhibition.

1.5 Consultation with Dubbo Regional Council

Consultation with Dubbo Regional Council (DRC) has been undertaken during preparation of the EIS. Specifically, the assessed scenarios, site access and intersection upgrade options were presented and discussed with DRC representatives on 8 August 2022, at which time Council provided in principle support on the proposed concept plans (Appendix B). Consultation with DRC will continue through subsequent phases of the assessment and design process as required.

1.6 Scope of this report

This TIA has been prepared generally in accordance with the requirements of the NSW Government's (RTA) *Guide to Traffic Generating Developments* (2002) and incorporated the following investigations and analysis:

- a description of the existing traffic and transport environment in the locality;
- an assessment of the traffic volumes at the adjoining road network;
- an assessment of the forecast traffic generation during various stages of construction and operation of the BESS;
- an assessment of the potential impacts of the project on the external road network and site access intersection; and
- recommendations on minimising and managing potential traffic impact.

2 Existing conditions

2.1 Site location and access

The site is located at 6773 Goolma Road at Wuuluman, immediately east of the Wellington substation. The operational footprint associated with the project will be located in close proximity to existing infrastructure associated with the Wellington substation (setback approximately 650 m from the public road) and will require connection to the substation by way of an overhead or underground transmission line that will extend for approximately 500 m, along with upgrade works at the Wellington substation site. The disturbance footprint for construction is slightly larger than the operational footprint and includes a dedicated laydown area for the delivery and temporary storage of plant, infrastructure, and equipment prior to installation at the BESS compound and on-site substation. The laydown area will be maintained during construction only.

The current access to the site is provided at the intersection between Goolma Road and Twelve Mile Road. The intersection is give-way controlled along Twelve Mile Road. The access traverses a sealed section of Twelve Mile Road (Plate 2.1). The existing driveway is approximately 2 m wide and connects to an internal gravelled road that extends to the landowner's residence (Plate 2.2). The internal gravelled road runs generally along the western boundary of the property and bypasses the proposed location for the temporary laydown area, the BESS compound and on-site substation.

The intersection of Goolma Road and Twelve Mile Road is to be upgraded and realigned as part of CWP Renewable's (CWP) Uungula Wind Farm project. As part of that project, Twelve Mile Road will be realigned and connected to Goolma Road approximately 400 m north-east of the existing intersection. The extant portion of Twelve Mile Road between the existing intersection and realigned section of Twelve Mile Road will be retained and closed off by bollards. Further information regarding the proposed upgrade is provided in Section 2.9.

In order to provide for the safe access of trucks and Oversize Overmass (OSOM) vehicles for the project, it is proposed to establish a new access to Goolma Road closer to the western boundary of the landholding (approximately 50 m to the west of the existing driveway access location). The access and internal road will be sufficiently sized to accommodate the turning of vehicles into and out of the site. Further information regarding the proposed improvements to site access and internal road is provided in Section 2.9.

2.2 Road network

The NSW administrative road hierarchy comprises the following road classifications, which align with the generic road hierarchy as follows:

- state roads – freeways and primary arterials (TfNSW managed);
- regional roads – secondary or sub arterials (council managed and part funded by the State); and
- local roads – collector and local access roads (council managed).

An overview of the surrounding road network and traffic characteristics is presented in Figure 2.1.

Plate 2.1 **Goolma Road (looking east) and section of Twelve Mile Road before site access**

Plate 2.2 **Existing site access and gate (looking south)**

Source: EMM (2022); AMPYR (2021); ESRI (2022); TfNSW (2022); DFSI (2017); ICSM (2014)

0 1 2 km

GDA 1994 MGA Zone 55

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KEY

- Development boundary
- Train station
- Rail line
- Watercourse/drainage line
- Waterbody
- Key intersection

Degree of crash

- Fatal
- Serious Injury
- Moderate Injury
- Minor/Other Injury

Bus routes

- Route S106
- Route S110

NSW classified road

- State road
- Regional road
- Local road

Road network and traffic characteristics

Wellington Battery Energy Storage System
Traffic impact assessment
Figure 2.1

EMM creating opportunities

Table 2.1 Mitchell Highway

Aspect	Description
Road classification and connectivity	State Road which crosses the NSW border north of Bourke, and towards its southern end forms a junction with the Great Western Highway and Mid-Western Highway at Bathurst.
Alignment	North-south
Number of lanes	One lane each way, excluding near the intersections
Carriageway type	Sealed road
Carriageway width	Approximately 11 m with 3.5 m travel lane each way (measured from MetroMap scale)
Posted speed limit	60 kilometres per hour (km/h) in Wellington (near Goolma Road intersection) 110 km/h in rural sections of the highway
Heavy vehicle access	Yes
Traffic function	Carries regional traffic
Additional comments	Approximately 40% of heavy vehicles associated with the construction of the project are expected to use a portion of the Mitchell Highway (and Goolma Road) to deliver plant, equipment and materials to the site. A bisect of the road is provided in Plate 2.3.

Plate 2.3 Mitchell Highway (looking east towards Goolma Road intersection)

Table 2.2 Goolma Road

Aspect	Description
Road classification and connectivity	State Road between Mitchell Highway (west) and Gulgong (east)
Alignment	Generally east-west
Number of lanes	One lane each way
Carriageway type	Sealed road
Carriageway width	Approximately 9 m with 3.5 m travel lane each way and 1 m shoulders
Posted speed limit	Typically 100 km/h, reduced sped near the bends and townships
Heavy vehicle access	Yes
Traffic function	Carries regional and local traffic
Additional comments	Heavy vehicles will use Goolma Road to deliver plant, equipment and materials to the site. Approximately 60% of heavy vehicles will approach the site from the north/east and the remainder 40% of heavy vehicles are anticipated to approach the site from the west. Bisects of Goolma Road in proximity to the site are presented in Plate 2.4 and Plate 2.5.

Plate 2.4 Goolma Road (looking west from Goolma Road/Twelve Mile Road intersection)

Plate 2.5 Goolma Road (looking east to Goolma Road/Twelve Mile Road intersection)

Table 2.3 Twelve Mile Road

Aspect	Description
Road classification and connectivity	Local Road between Goolma Road at Macquarie Correctional Centre (west) and Goolma Road at Cudgegong River (east)
Alignment	East-west
Number of lanes	One lane each way
Carriageway type	Sealed road in the vicinity of site
Carriageway width	Approximately 8 m with 4 m travel lane each way (measured from MetroMap scale)
Posted speed limit	100 km/h
Heavy vehicle access	Yes, daylight hours only with a maximum speed limit of 80 km/h
Traffic function	Carries regional and local traffic
Additional comments	Heavy vehicles will not utilise Twelve Mile Road

Plate 2.2 Twelve Mile Road (looking west towards Goolma Road/Twelve Mile Road intersection)

2.3 Key intersection

The key intersection of relevance to the project is the Goolma Road/Twelve Mile Road intersection. The intersection is located immediately adjacent to the current site access. The location of the intersection is presented in Figure 2.1, intersection geometry is presented in Table 2.4, and the intersection is shown in Figure 2.2.

Table 2.4 Goolma Road/Twelve Mile Road intersection

Aspect	Description
Location from the site	700 m north of the site, however, the existing site access is located at the current intersection
Intersection control	Priority controlled Y type intersection, traffic on Twelve Mile Road has to give-way on approach to Goolma Road
Major Road	Goolma Road
West Approach	One approach and departure lane
North-East Approach	One approach and departure lane
East Approach	One approach and departure lane
Pedestrian Connectivity	No pedestrian connectivity in any of the approaches
Traffic function	Predominantly carries regional and local traffic
Speed limit	100 km/hour on all approaches
Additional comments	The existing intersection will be closed off and a new intersection will be developed approximately 400 m north of the existing intersection. The new intersection will be developed as committed in the development consent for the Uungula Wind Farm.

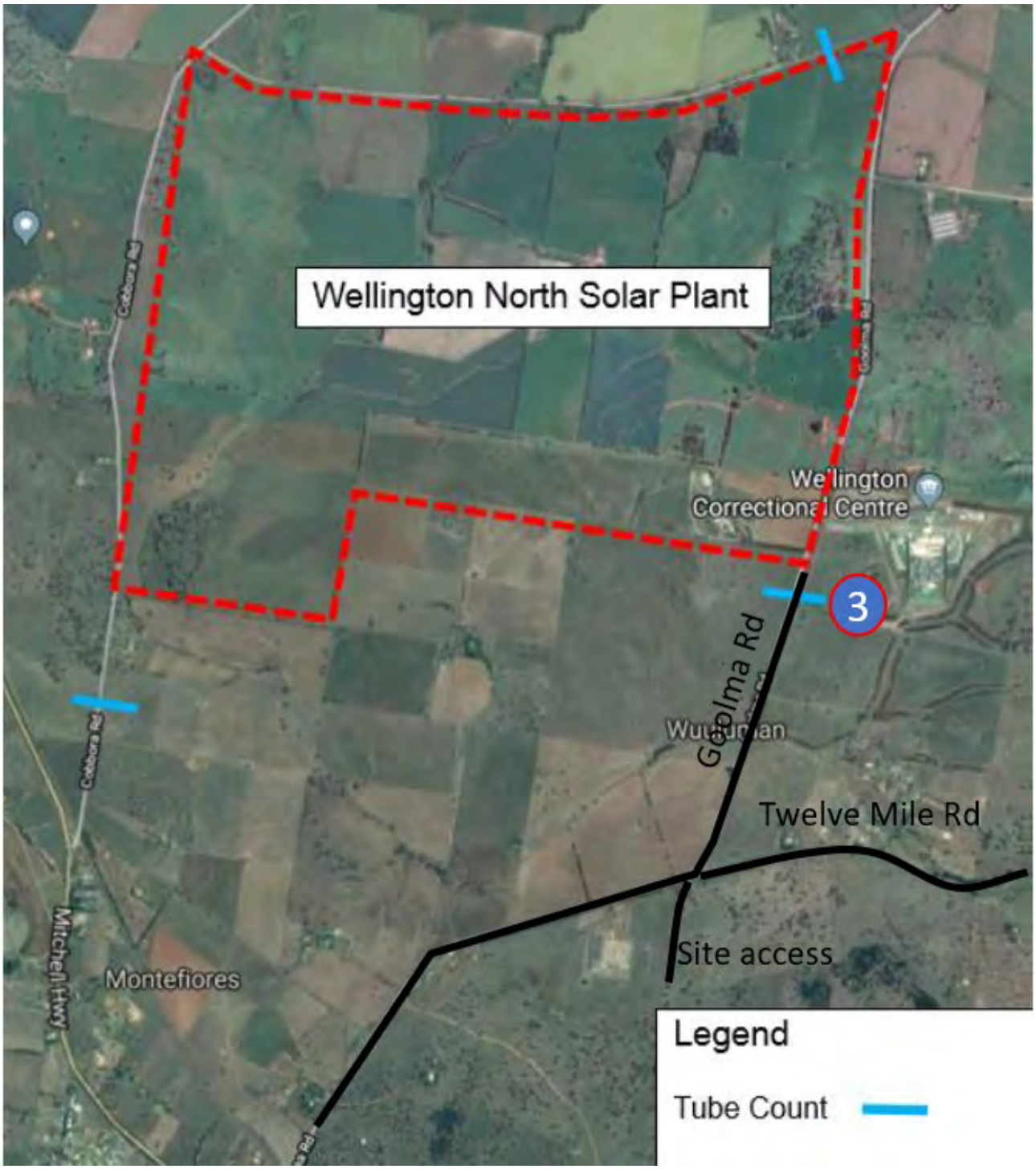
Figure 2.2 Goolma Road/Twelve Mile Road intersection

2.4 Existing traffic volumes

Traffic counts near the intersection of Goolma Road and Twelve Mile Road were obtained from Dubbo Regional Council (DRC). Tube counters were placed near the intersection, as shown in red lines in Figure 2.2. The count on Goolma Road (count 1) was undertaken between the period 13 October to 19 November 2020 and the count on Twelve Mile Road (count 2) was undertaken between 13 October to 26 November 2020. As per DRC traffic counts, Goolma Road AM peak hour was from 7.00 am to 8.00 am and PM peak hour was from 3.00 pm to 4.00 pm. Twelve Mile Road AM peak hour was from 8.00 am to 9.00 am and PM peak hour was from 4.00 pm to 5.00 pm.

Traffic counts for Goolma Road were also obtained from Wellington North Solar Farm (WNSF) Traffic Impact Assessment (GHD, 2021). Tube counters were placed in positions shown in Figure 2.3. The seven-day tube count was conducted on Goolma Road between 28 February and 6 March 2018 (count 3 in Figure 2.3). As per WNSF traffic counts, Goolma Road AM peak hour was from 7.00 am to 8.00 am and PM peak hour was from 4.00 pm to 5.00 pm.

Traffic count data from DRC and GHD (2021) are presented in Table 2.5. DRC traffic counts are attached in Section 7.



Source: (GHD, 2021)

Figure 2.3 Wellington north solar farm traffic survey locations

Table 2.5 DRC Council and GHD traffic volumes

Description		DRC Council traffic volumes		GHD traffic volumes	
		Goolma Road	Twelve Mile Road	Goolma Road	Twelve Mile Road
Survey year		2020	2020	2018	2018
Average AM Peak volume	Northbound/ eastbound	170	16	157	-
	Southbound/ westbound			44	-
Average PM Peak volume	Northbound/ eastbound	184	19	66	-
	Southbound/ westbound			135	-
Daily volume		1,939	189	2,140	-
HV %		25%	46%	18%	-

The traffic data in the above table shows that the traffic volumes on Goolma Road were approximately 10% higher in 2018 GHD count, compared to 2020 council count, possibly due to Covid-19 impact. The daily traffic in Goolma Road was over 2,000 vehicles per day where the peak hour traffic was recorded to 157 vehicles (approximately 7% of the daily total). The PM peak volumes were slightly higher than the AM peak for council counts but AM and PM peak volumes were similar for GHD count.

In Twelve Mile Road, the daily volumes were less than 200 vehicles. In summary, Twelve Mile Road carried approximately one tenth of traffic to that on Goolma Road.

2.5 Baseline traffic volumes

No intersection count has been undertaken as part of this study as DRC and GHD traffic data is considered to be sufficient to undertake the traffic impact assessment.

A growth factor of 1% per annum has been applied to the 2018 traffic volumes to estimate 2023 start of construction traffic volumes.

For the purposes of this assessment, (GHD, 2021) traffic count data has been used as DRC 2020 data may have been affected by the Covid travel restrictions throughout NSW. A per annum 1% liner growth has been applied in Goolma Road to GHD 2018 volumes to bring the traffic volumes from 2018 to 2023 which equates to 5% linear growth for five years. For Twelve Mile Road, the following correction factor is applied to bring the volumes to 2023:

- estimate 2020 WNSF traffic volume for Goolma Road using 1% per annum growth rate;
- estimate a correction factor between 2020 DRC and 2018 WNSF Goolma Road traffic volumes;
- apply correction factor to 2020 Twelve Mile Road traffic volume; and
- apply a 1% per annum growth rate to bring the Twelve Mile Road volumes from 2020 to 2023.

The directional split on Twelve Mile Road has been assumed to be the same as Goolma Road.

Baseline traffic volumes are presented in Table 2.6.

Table 2.6 2023 baseline traffic volumes

Description		Goolma Road	Twelve Mile Road
Average AM Peak volume	Northbound/eastbound	165	16
	Southbound/westbound	46	4
Average PM Peak volume	Northbound/eastbound	69	7
	Southbound/westbound	142	15
Daily volume		2,247	219
HV %		18%	46%

2.6 Crash analysis

Crash data from TfNSW Centre for Road Safety interactive history database for the last five years between 2016 and 2020 has been studied in the vicinity of the site. The crash data is presented in Figure 2.1.

The crashes are categorised based on the severity of the crashes as follows:

- fatal;
- serious injury;
- moderate injury;
- minor/other injury; or
- non-casualty (eg towaway).

Overall, there were five crashes on Goolma Road and Twelve Mile Road and one crash at Mitchell Highway and Goolma Road intersection. These crashes involved the following severity:

- one fatal;
- one serious injury;
- three moderate injury; and
- one minor/other injury.

The fatal crash took place in 2019 and was due to the vehicle running off-road towards left and crashing into an object. The majority of the other crashes were off road on bends, one rear end and one U-turn crash. The overall crash rate of six crashes is considered low over the 5-year period, which indicates that there are no significant road safety issues at the locality.

2.7 Public transport

Regional trains travelling to/from Dubbo-Sydney Central stop at Wellington which is approximately 5 km south-west of the site.

There are no public transport buses travelling along Goolma and Twelve Mile Road. There are bus services operating on Mitchell Highway linking Dubbo to Wellington operated by Odgen's Coaches and TfNSW.

There are school bus routes operating along Goolma Road and Twelve Mile Road. S106 operates between Mt Bodangora and Wellington Schools and travels along Goolma Road. S110 operates between Umagarlee and Wellington Schools and travels on both Goolma Road and Twelve Mile Road. School bus routes are shown in Figure 2.1.

2.8 Active transport

There is no walking or cycling infrastructure in the vicinity of the site due to its rural location.

2.9 Future road improvements

As part of the conditions of consent for the Uungula Wind Farm (SSD 6687), CWP is committed to undertake the following road upgrades in support of the use of Goolma Road and Twelve Mile Road for the transport of plant and equipment during construction of that project:

- the closure of the existing intersection at Goolma Road and Twelve Mile Road;
- the construction of a new intersection 400 m to the north and realignment of Twelve Mile Road to connect to the new intersection; and
- upgrades to Twelve Mile Road along the transport route.

The indicative design for the intersection upgrade is reproduced in Figure 2.4 and Figure 2.5. At the time of this study, the detailed design was being considered by DRC and TfNSW. It is understood that the extant section of Twelve Mile Road will ultimately be closed.

It is important to note that the project will not contribute to higher turn movements at the realigned Goolma Road/Twelve Mile Road intersection, as heavy vehicles associated with the project will primarily use Goolma Road to/from the Mitchell Highway. This means any traffic to/from the west will travel straight through the realigned intersection.

The access road from Twelve Mile Road to the Uungula Wind Farm site will be improved to facilitate the access and egress of larger trucks during construction of that project. Improvements would include gravel coverage, widening to 8 m and additional drainage, as required. The road will be maintained by CWP during operation to allow for the access and egress of maintenance and operational vehicles.

Minutes of the Uungula Wind Farm Community Consultative Committee meeting held 5 November 2021 were relied upon to determine when the road upgrades would likely commence. The minutes noted:

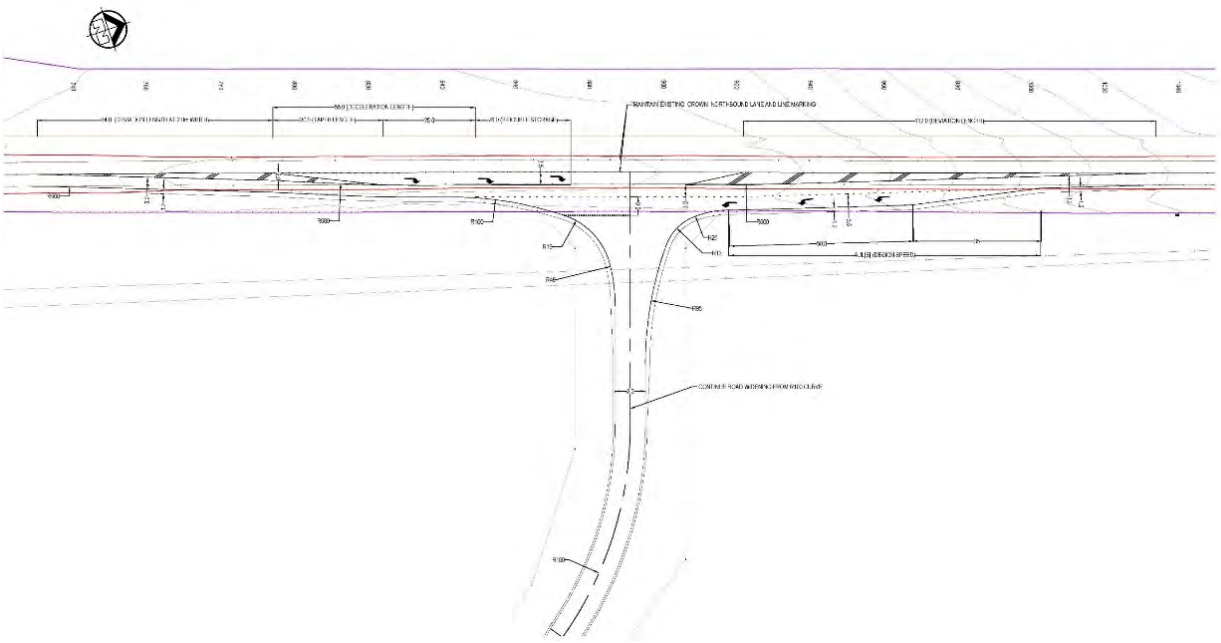
- that the road design for Twelve Mile Road and the Twelve Mile Road/Goolma Road intersection were being drafted but not completed yet, but noted that it will be as previously described;
- that the Twelve Mile Upgrade will take approximately 5–6 months to construct and will be completed first; and
- construction commencement is planned for April 2022.

At the time of writing this assessment, construction of the intersection upgrade works was yet to commence as per CWP's previously indicated schedule. In August 2022, immediately prior to finalisation of this TIA and EIS for exhibition, consultation with CWP indicated that their current schedule for Uungula Wind Farm is targeting project construction commencement later in 2022, with the road upgrade works to be undertaken in advance of construction commencement. Based on this, it is anticipated that the proposed upgrades to the intersection will be completed prior to commencement of construction of the Wellington BESS project which is earmarked to commence in May 2023.

It should be noted that the relocated intersection further north will improve site access and traffic safety for proposed site access for this project.

Source: DPIE - SSD 6687 Development Consent

Figure 2.4 Proposed location of Goolma Road/ Twelve Mile Road intersection



Source: DPIE - SSD 6687 Development Consent

Figure 2.5 CWP proposed intersection design for new Goolma Road/Twelve Mile Road intersection

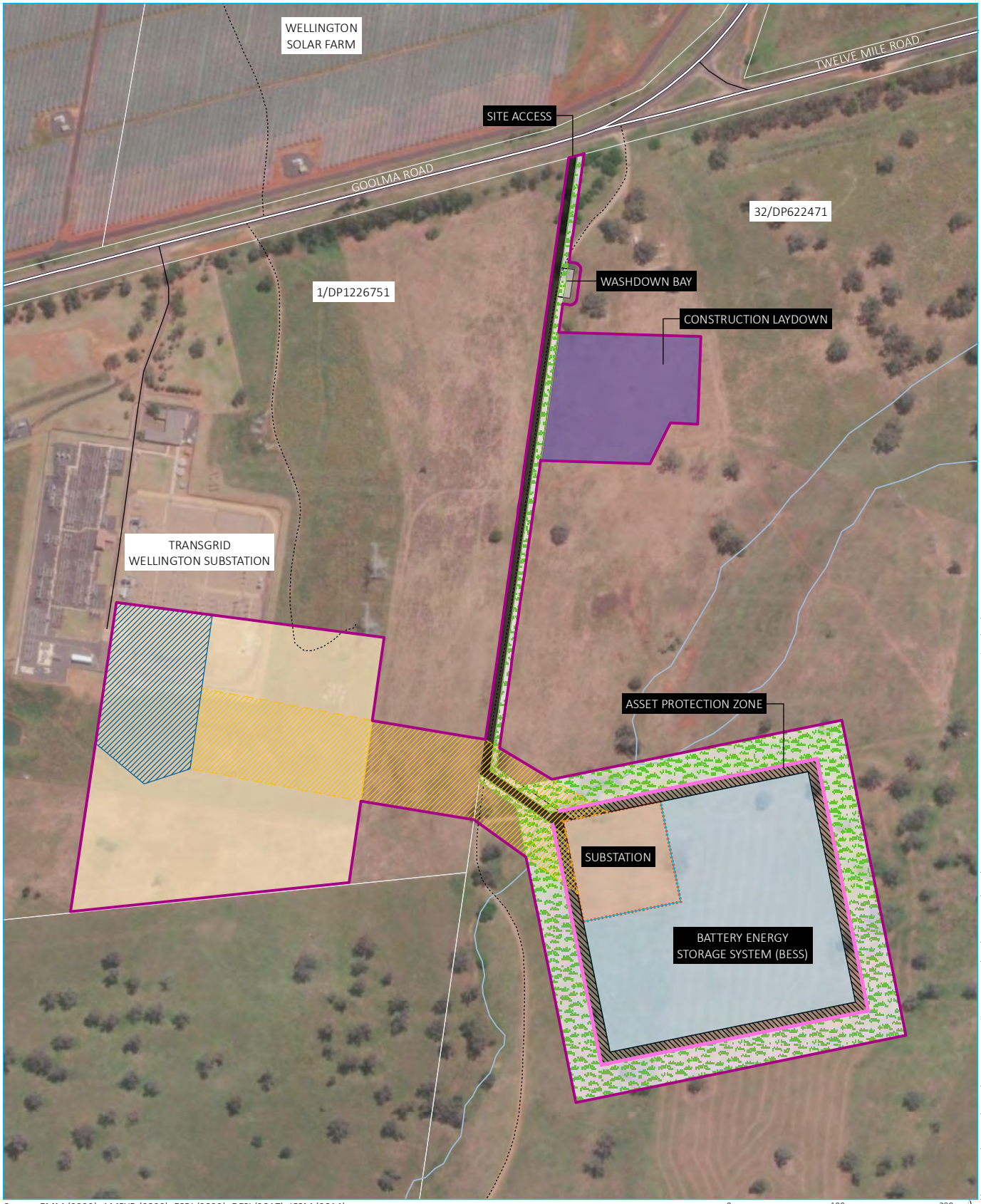
3 Project description

3.1 Description

The project consists of the construction and operation of a major grid-scale battery project immediately adjacent to the Wellington substation. The project will have a power output of 500 MW and an energy storage capacity of 1,000 MWh. The project will comprise:

- lithium-ion (Li-ion) batteries inside battery enclosures;
- power conversion systems (PCS) incorporating inverters and transformers;
- an aboveground or underground transmission line to the Wellington Substation;
- upgrade of the Wellington substation with an additional 330 kV switch bay with power transformers, including switchyard bench extension to the south of the existing bench and relocation of security fencing;
- an on-site substation comprising two 330 kilovolt (kV) transformer bays and ancillary infrastructure;
- cabling and collector units;
- ancillary infrastructure (eg control and office building, washdown bay, lighting and fencing); and
- an Asset Protection Zone (APZ).

A full description of the project is provided in Chapter 3 of the EIS. Relevant information concerning the construction and operation of the project is reproduced in this section. The layout of the project is presented in Figure 3.1.



Source: EMM (2022); AMPYR (2022); ESRI (2022); DFSI (2017); ICSM (2014)

0 100 200 m

GDA 1994 MGA Zone 55

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KEY

- Development boundary

Project components

- Indicative asset protection zone (10 m)
- Indicative transmission connection corridor
- Indicative TransGrid substation upgrade core infrastructure area
- Indicative TransGrid substation upgrade disturbance area
- Battery Energy Storage System (BESS) (battery rows offset at 6 m spacing and setback from substation)
- Substation
- Washdown bay
- Construction laydown
- Indicative landscaping (post construction)
- Access road
- Indicative location of noise bund

Existing environment

- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line
- Cadastral boundary

Project overview

Wellington Battery Energy Storage System
Traffic impact assessment
Figure 3.1

EMM creating opportunities

3.2 Construction

3.2.1 Construction activities

Key construction activities that will be undertaken as a part of the proposed BESS will comprise:

- installation and maintenance of environmental controls including drainage and sediment controls;
- mobilisation and establishment of temporary construction facilities and temporary laydown area;
- improvements to existing access and internal track;
- vegetation clearing to accommodate BESS compound infrastructure, the transmission line easement and asset protections zones;
- cut, fill, and compaction activities to desired design levels;
- installation of drainage including a consideration of diverting the tributary waterway beneath a section of the project access way;
- construction of concrete pads to support batteries, PCSs, and substation;
- delivery and installation of battery modules and enclosures, power conversion systems, cabling, and transformers;
- installation of tower structures including foundation piles;
- installation of overhead or underground cabling from the BESS substation to the TransGrid substation switchyard;
- connection works to connect to the TransGrid substation;
- upgrade of the Wellington substation, which may include an additional 330 kV switch bay with power transformers, including switchyard bench extension to the south of the existing bench, relocation of security fencing, construction of new gantry, busbar supports and other associated electrical infrastructure as required;
- landscaping;
- testing and commissioning; and
- removal of construction equipment and rehabilitation of disturbance areas.

3.2.2 Construction program

Construction is expected to commence in May 2023 (subject to approval). The project will be constructed and commissioned in line with battery supply availability, labour and equipment availability and increasing demand in the network. This may occur in a single stage over a period of 12–18 months. Alternatively, it is considered likely that it may occur over two stages as follows:

- Stage 1 – commencement of construction May 2023 and operations May 2024; and
- Stage 2 – commencement of construction November 2024 and operation November 2025.

Construction of the project, or each stage of it, would be undertaken in four phases, as follows:

- enabling works (eg site establishment) – approximately 2–4 months;
- construction works (civil works, structural works, and electrical works) – approximately 5–8 months;
- commissioning – approximately 4–5 months; and
- demobilisation – approximately 1 month.

For the staged construction scenario, Stage 1 would likely include 300 MW installed discharge capacity, all civil and enabling works, installation of batteries, one transformer and switchgear and associated structural, mechanical and electrical works, and connection to the substation. Stage 2 would consist of 200 MW, including installation of a second transformer and associated switchgear and batteries.

Both the single and staged construction scenarios have been considered in undertaking this assessment for the project, which identified the worst case construction traffic scenario as the single stage option. Section 3.2.7 outlines the construction traffic generation associated with that scenario.

3.2.3 Construction hours

Construction hours for the project will be consistent with the *Interim Construction Noise Guideline* (DECC 2009) recommended standard construction hours for normal construction and the and *Draft Construction Noise Guideline* (EPA 2021) being, namely:

- Monday to Friday: 7.00 am to 6.00 pm;
- Saturday: 8.00 am to 1.00 pm; and
- no works of Sunday and public holidays.

Certain activities may be required outside of the standard construction hours. These activities potentially include:

- delivery of plant and equipment for safety reasons (eg oversize overmass vehicles);
- commissioning and testing activities that must align with demands on the grid; and
- situations where agreement is reached with nearby affected receivers and local council.

3.2.4 Construction workforce

The construction phase of the project is expected to generate up to 100 construction personnel, the majority of which are expected to be generated in the Dubbo/Wellington region. Preference will be made for contractors utilising a regional workforce.

3.2.5 Plant and equipment

The typical plant and equipment required for construction will include items listed in Table 3.1.

The majority of the plant and equipment will be delivered to site on rigid and semi-trailer low-loaders. Construction materials will be delivered on rigid concrete agitators, truck and dog, and semi-trailer dump trucks.

Table 3.1 Typical construction plant and equipment

Construction phase	Plant type	
Enabling works	• Front end loaders • Dump trucks • Road trucks • Water trucks • Excavators	• Graders • Compactors and rollers • Light vehicles • Scissor lifts • Franna cranes
Construction and commissioning works	• Front end loaders • Dump trucks • Road trucks • Water trucks • Concrete trucks and pumps • Excavators • Graders • Compactors and rollers • Scrapers	• Backhoe • Concrete saws and grinders • Light vehicles • Scissor lifts • Franna cranes • Mobile cranes • Generators • Welding equipment • Compressors
Commissioning	-	-
Demobilisation	• Road trucks • Water trucks • Concrete saws and grinders • Excavators	• Franna cranes • Backhoes • Compactors and rollers

3.2.6 TransGrid Wellington substation upgrade

As part of the project, the Wellington substation will be upgraded by TransGrid with an additional 330 kV switch bay and associated infrastructure, which may be installed in stages to coincide with the staged construction of the BESS should a staged approach be adopted.

The site access to the Wellington substation is approximately 360 m west of the proposed new access to the project on Goolma Road (Figure 3.1). The traffic generation due to the substation upgrade will be relatively minor, estimated at approximately 3 to 5 vehicles per day to/from the Mitchell Highway (west), which has been included as part of this traffic assessment.

3.2.7 Construction traffic

The worst case construction traffic scenario is associated with a single stage construction approach for the BESS and Wellington substation upgrade works, as daily and peak hour traffic generation associated with a staged approach would be a percentage of that generated under the single stage scenario. Estimated construction traffic associated with the single stage construction scenario is as follows:

i Daily traffic generation

The following daily construction vehicle movements are anticipated:

- an average of up to 100 light vehicle trips per day (100 in and 100 out) during the construction works phase; and
- an average of up to 60 heavy vehicle trips per day (60 in and 60 out) during the construction works phase.

ii Peak hour traffic generation

The following assumptions have been made to anticipate peak hour construction vehicle movements:

- a maximum of 80 light vehicle trips during the morning and evening peak hour (80 in and 80 out); and
- a maximum of 30 heavy vehicle trips during the peak hour (30 in and 30 out).

Passenger vehicles are expected to arrive at the site prior commencement of construction shifts. Peak heavy vehicle trips are expected to occur during civil and structural works, associated with the delivery of materials, plant and equipment. Deliveries of batteries and enclosures are anticipated to occur in batches.

Construction traffic movements associated with the project are presented in Table 3.2.

Table 3.2 Construction traffic movements

Description		Goolma Road	
		Light vehicles	Heavy vehicles
AM peak (7.00 am to 8.00 am) movements	Eastbound	48	30
	Westbound	32	30
PM peak (4.00 pm to 5.00 pm) movements	Eastbound	32	30
	Westbound	48	30
Average daily movements		320	

3.3 Operational traffic

The operation of the project is expected to commence from 2024 for a period of approximately 20 years. The project will contribute to the employment of two employees during operation, primarily for scheduled maintenance. There would be up to 4 trips per day (4 in-bound and 4 out-bound), compromising:

- staff vehicles up to 3 per day (3 in-bound and 3 out-bound); and
- up to one heavy vehicle per day for transporting replacement parts and equipment, as need basis.

The BESS would be operated remotely 24 hours a day, 7 days a week.

Operation of the upgraded Wellington substation will not result in any additional traffic movements at that facility.

Operational traffic volumes will be significantly less than the project's construction traffic. Therefore, this assessment has focused on construction traffic only.

3.4 Over size over mass vehicles

There will be up to 20 Oversize Overmass (OSOM)[1] vehicles during the construction works phase. Relevant permits from the National Heavy Vehicle Regulator will be acquired for the project prior to mobilization.

OSOM vehicles movements will occur outside of standard construction hours and are anticipated to be wholly via Sydney/Newcastle and are anticipated to travel to site via the Castlereagh Highway and Goolma Road (east) route.

3.5 Traffic distribution

Passenger vehicles are expected to arrive at the site prior to commencement of construction shifts. Construction vehicles are anticipated to be primarily via regional centres including Dubbo/Wellington (60%) and Gulgong (40%) and are anticipated to travel to the site via the Mitchell Highway and Goolma Road (west) and Goolma Road (east), respectively.

Heavy vehicle movements, particularly those associated with the delivery of materials and equipment will generally be evenly spread throughout construction hours. Most heavy vehicles are anticipated to be via Sydney/Newcastle and surrounding regional centres (60%). Some heavy vehicles will also originate from Dubbo, Orange, and Parkes (40%). Vehicles travelling from Sydney and Newcastle are anticipated to travel to site via the Castlereagh Highway and Goolma Road (east), an approved B-double route. Other vehicles are anticipated to access the site via the Mitchell Highway and Goolma Road (west).

Traffic transport routes are presented in Figure 3.2.

3.6 Nearby development traffic

Development in vicinity of the project, has the potential to generate cumulative traffic impacts with the project. The status of surrounding projects has been considered in Chapter 7 of the EIS.

The greatest potential for cumulative impacts of future projects and the project in relation to traffic are associated with the following two projects, which have the potential to have construction periods that overlap with the project:

- construction of the Wellington North Solar Farm (SSD 8895); and
- Uungula Wind Farm (SSD 6687), including associated upgrades to the Goolma Road/Twelve Mile Road intersection and Twelve Mile Road.

Correspondence with Lightsource bp (LSbp) during preparation of this study confirmed that construction of the Wellington Solar Farm (SSD 8573) is complete and that the project is currently in its commissioning phase, therefore potential cumulative impacts associated with that project are not anticipated.

The locations of each of these developments are illustrated in Figure 3.3.

[1] *An oversize or overmass vehicle is a heavy vehicle or combination which alone, or together with its load, exceeds prescribed mass or dimension requirements, and is a heavy vehicle carrying, or designed for the purpose of carrying, a large indivisible item (HVNL s116 (1) (c)). This does not include road trains or B-doubles, or vehicles carrying a freight container designed for multimodal transport. Examples include a prime mover and extendable trailer or a prime mover and low loader combination.*

3.6.1 Wellington North Solar Farm

LSbp responded to EMM's request for information regarding its forecast traffic movements for the Wellington North Solar Farm, which is summarised in Table 3.3. The construction period for WNSF is expected to be 18 months, currently anticipated to commence later this year. The WNSF will utilise Goolma Road to access the site and the main vehicular access route is south via the Mitchell Highway and Goolma Road (GHD, 2021).

The GHD report states that there will be two OSOM vehicles during the construction period. Heavy vehicles will include vehicles related to construction activity and shuttle buses transporting staff. The remaining staff will be commuting via light vehicles. All construction traffic is expected to travel to the Goolma Road site access via the Mitchell Highway located to the south.

Based on the above consideration, Wellington North Solar Farm's traffic distribution is summarised below:

- *OSOM vehicle* (2 movements): 100% to from the east affecting the BESS site access.
- *Heavy vehicle* (19 movements): This includes 3 construction heavy vehicles and 16 shuttle buses. 100% to from the east affecting the BESS site access.
- *Light vehicle* (66 movements): 100% to and from the east affecting the BESS site access.

OSOM vehicles movements are low and have not been considered in the cumulative traffic impact assessment. The 85 movements would pass through the BESS site access area. It is reasonable to assume that during the AM peak all light vehicle movements will occur eastbound (towards the solar farm construction site) and vice versa during the PM peak.

Table 3.3 Wellington North Solar Farm traffic movements

Description		Goolma Road	
		Light vehicles	Heavy vehicles
Average AM peak movements	Eastbound	66	19
	Westbound	0	19
Average PM peak movements	Eastbound	0	19
	Westbound	66	19
Average daily movements		267	

3.6.2 Uungula Wind Farm

EMM approached CWP with a request for its recent forecast traffic movements for the Uungula Wind Farm (UWF). CWP referred to information contained in the publicly available EIS and supporting Uungula Wind Farm Project Transport Assessment (Samsa Consulting 2020). Construction activity for UWF is likely to occur over approximately 24 to 30 months with peak traffic generation for six months out of the total 24 to 30-month construction period. Traffic movements for the wind farm are presented in Table 3.4.

Table 3.4 Uungula Wind Farm traffic movements

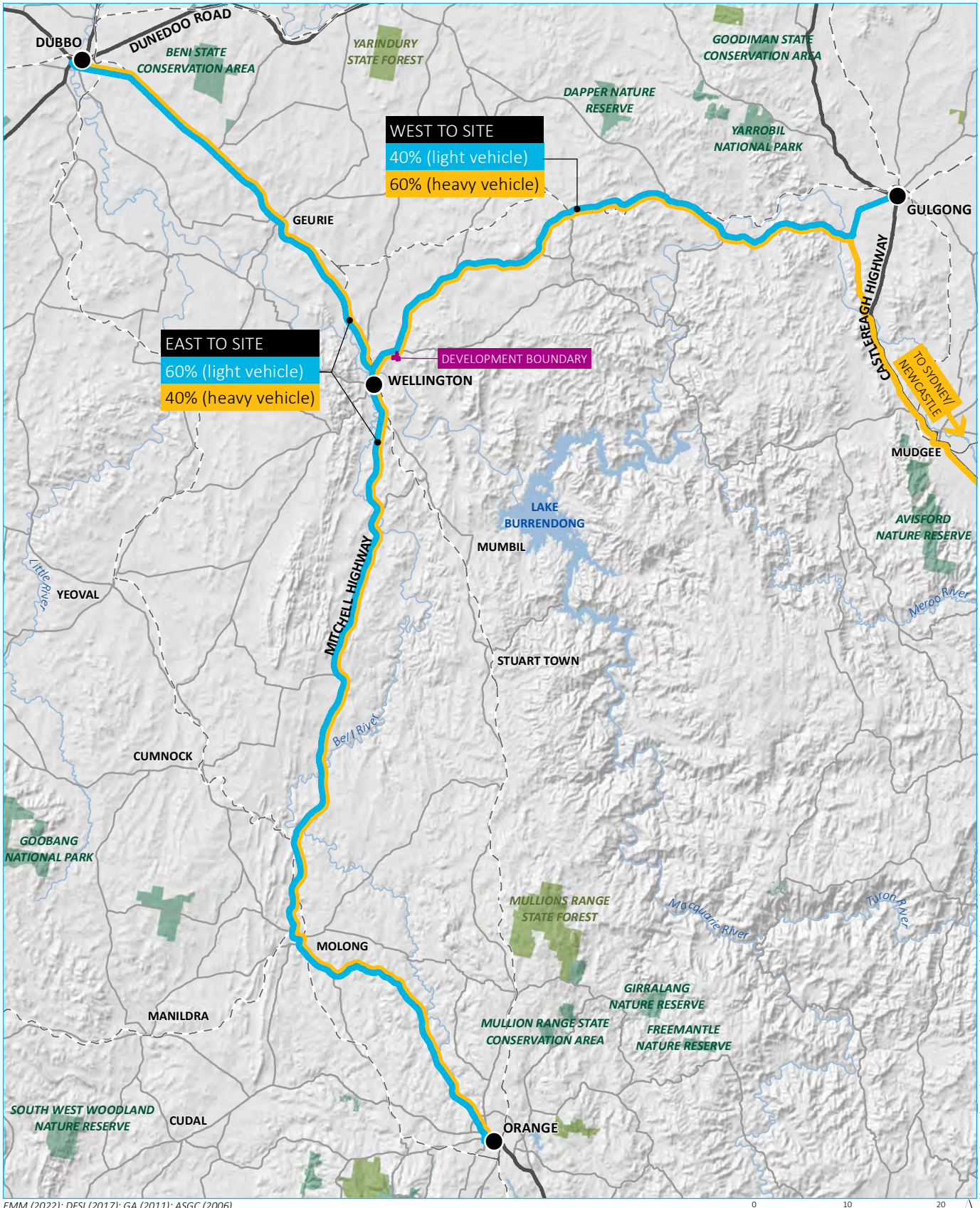
Description		Goolma Road	
		Light vehicles	Heavy vehicles
Average AM peak movements	Eastbound	100	11
	Westbound	100	10
Average PM peak movements	Eastbound	100	10
	Westbound	100	11
Average daily movements		506	

The report states OSOM vehicles will use the Goolma/Twelve Mile Road intersection to/from the west (eg Dubbo) passing through the subject site. Heavy vehicles and light vehicles (construction workers) will have 50%/50% split east and west.

Based on the above consideration, Uungula Wind Farm's traffic distribution is summarised below:

- **OSOM vehicle** (4 movements): 100% to from the west affecting the BESS site access.
- **Heavy vehicle** (21 movements): only 50% of the traffic generation eg 11 movements will affect the BESS site access as they will arrive from the west (eg Dubbo) and the remaining 50% (10 vehicles) will not affect the site access as they will arrive from the east and use the realigned Goolma and Twelve Mile Road intersection.
- **Light vehicle** (200 movements): only 50% of the traffic generation eg 100 movements will affect the BESS site access as they will arrive from the west (eg Dubbo) and the remaining 50% (100 vehicles) will not affect the site access as they will arrive from the east and use the realigned Goolma and Twelve Mile Road intersection.

As the OSOM vehicles will be escorted, these trip generation have not been considered in the cumulative traffic impact assessment. The 111 heavy and light vehicle movements would pass via the BESS site access. It is reasonable to assume that during the AM peak all light vehicle movements will occur eastbound (towards the windfarm construction site) and vice versa during the PM peak.



EMM (2022); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Development boundary
- Rail line
- Motorway/primary road
- Arterial/subarterial road
- River
- Named waterbody
- NPWS reserve
- State forest

Transport route

- Light vehicle
- Heavy vehicle

Transport routes

Wellington Battery Energy Storage System
Traffic impact assessment
Figure 3.2

EMM creating opportunities

3.7 Cumulative traffic

The cumulative traffic, which is the summation of baseline traffic volumes (Table 2.6); and construction traffic movements for the project (Table 3.2), Welling North Solar Farm (Table 3.3) and Uungula Wind Farm (Table 3.4) is presented in Table 3.5.

The location of the nearby developments is illustrated in Figure 3.3.

Table 3.5 Cumulative traffic movements

Description		Goolma Road				
		Baseline	Project Construction	Wellington North	Ungula Wind Farm	Total
AM peak movements	Eastbound	165 (16)	48 (30)	66 (19)	100 (11)	379 (76)
	Westbound	46 (4)	32 (30)	0 (19)	100 (10)	178 (63)
PM peak movements	Eastbound	69 (7)	32 (30)	0 (19)	100 (10)	201 (66)
	Westbound	142 (15)	48 (30)	66 (19)	100 (11)	356 (75)

Note: Values in brackets are heavy vehicle movements and values outside brackets are light vehicle movements.

The cumulative traffic movements in this section present a worst-case scenario where peak construction stages of nearby developments are assumed to overlap with the peak construction period of the project. The above table shows that there will be highest eastbound traffic generation during the AM peak and vice versa during the PM peak, should all the projects occur simultaneously.

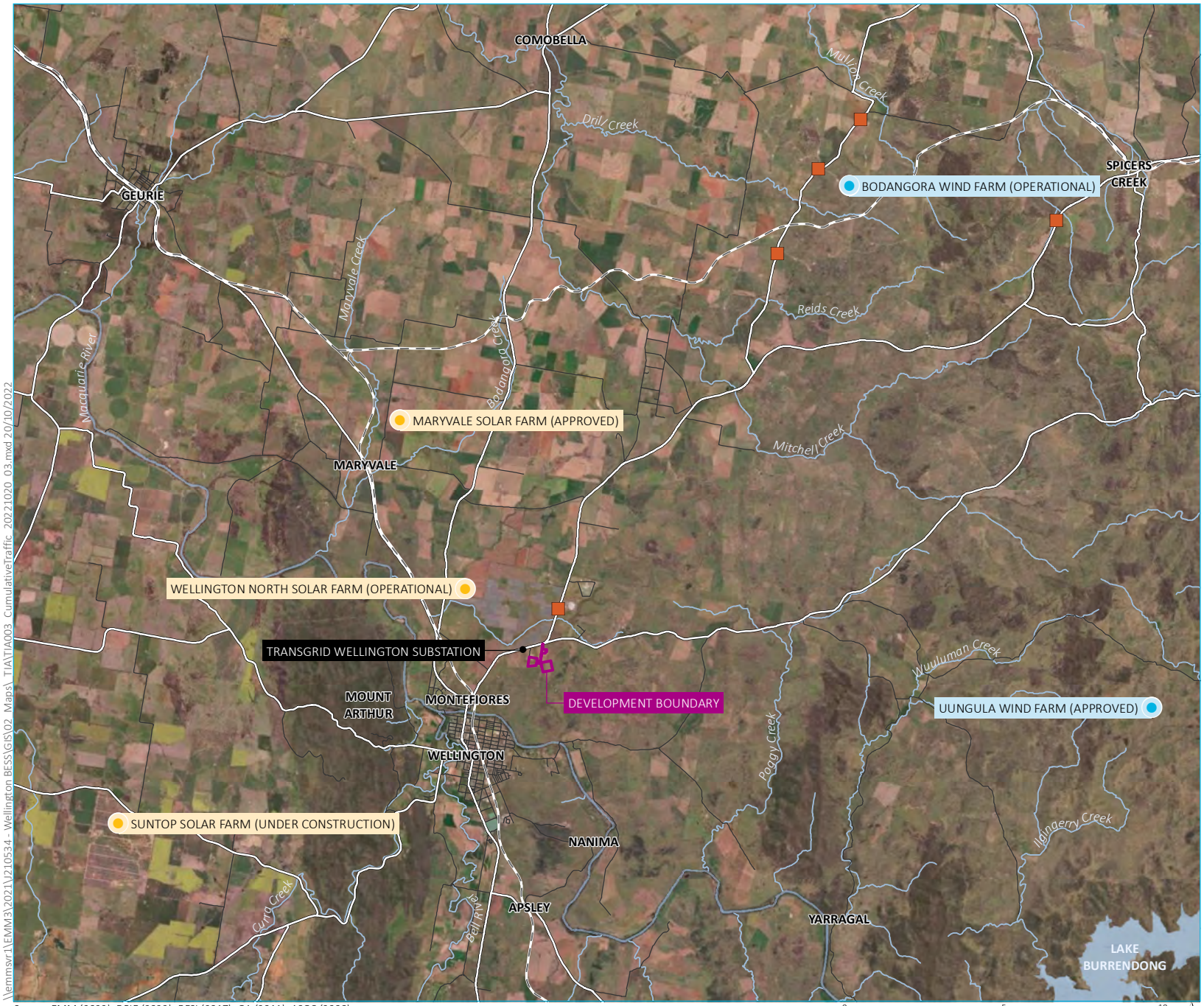
The traffic and transport assessments for WNSF (GHD, 2021) and UWF (Samsa Consulting, 2020) do not mention the construction start and end months/year of their respective developments. In October 2022, immediately prior to finalisation of this TIA and EIS for exhibition, LSbp (2022) announced commencement of construction early works at WNSF, indicating construction completion in 2024. Similarly, in August 2022, consultation with CWP indicated that their current schedule for Uungula Wind Farm is targeting project construction commencement later in 2022, with the road upgrade works to be undertaken in advance of construction commencement.

Based on the most recent information regarding both WNSF and UWF construction timing, it is likely that both projects will have commenced construction before the end of 2022.

3.8 Car parking

During construction, worker vehicles will either park at the temporary laydown area (where a construction compound will be located) or at the BESS compound. No cars will park along Goolma Road.

A car park will be established in the vicinity of the control and office building for the parking of vehicles during operation. In accordance with Section H2 of the *Wellington Development control plan 2013*, a minimum of three spaces will be provided, one of which will be an accessible parking space. The siting of the carpark will be confirmed within the detailed design.



KEY

- Development boundary
- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest (refer to inset)
- Access point for operational developments

Renewable energy project

- Solar farm
- Wind farm

Source: EMM (2022); DPIE (2022); DFSI (2017); GA (2011); ASGC (2006)

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Nearby developments

Wellington Battery Energy Storage System
Traffic impact assessment
Figure 3.3

EMM creating opportunities

4 Impact assessment

This chapter presents the worst case traffic impact assessment scenario considered for the project in which cumulative traffic generation associated with construction of the Wellington North Solar Farm and Uungula Wind Farm developments (Section 3.6) occurs concurrently with construction of this project. This allows for a conservative assessment to determine the worst possible scenario in terms of traffic impacts due to the projects.

In addition, the worst case construction traffic scenario has been considered for the project, which is represented by a single stage construction scenario (as opposed to a staged construction scenario, whereby daily and peak hourly construction traffic generation would be a smaller percentage of the single stage construction scenario traffic generation).

4.1 Mid-block capacity analysis

Capacity, as defined in (HCM, 2016), is the maximum sustainable hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under the prevailing roadway, environmental, traffic and control conditions. When capacity is estimated at a mid-block section of a lane or roadway, it is referred to as mid-block capacity.

The mid-block Level of Service (LOS) on rural and urban roads is assessed based on a vehicle's average travel speed. At low traffic volumes and under ideal conditions, drivers are able to travel at their desired speed without interference. As traffic volumes increase, and as roadway, terrain and traffic conditions become less than ideal, drivers are affected by the presence of other vehicles on the road and this forms bunches in the traffic stream.

There are six levels of service, as described below in Table 4.1, from *Guide to Traffic Generating Developments* (RTA, 2002).

Table 4.1 Mid-block level of service descriptions

Level of service	Level of service description
Level of Service A	This, the top level is a condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.
Level of Service B	This level is in the zone of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is little less than that of the level of Service A.
Level of Service C	This service level is also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.
Level of Service D	This level is close to the limit of stable flow but is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.
Level of Service E	This occurs when traffic volumes are at or close to capacity and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause a traffic-jam.
Level of Service F	This service level is in the zone of forced flow. With it, the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow break-down occurs and queuing and delays result.

4.2 Rural road capacity

Table 4.5 of *Guide to Traffic Generating Developments* (RTA, 2002) provides the two-way hourly traffic capacities (eg number of vehicles per hour) for two-lane roads for different LOS with a design speed of 100 km/h based on different terrain types. The capacities assume 60% of traffic is travelling in one direction and 40% is travelling in the other direction.

The capacities for each LOS transition (eg the combined number of vehicles travelling in both directions at where the LOS decreases) are provided in Table 4.2 for Goolma Road, assessed for rolling terrain.

Table 4.2 Roadway hourly capacity for a two-lane two-way rural road (100 km/h speed limit)

Terrain	Level of service transition	Effect of percentage of heavy vehicles (in traffic flow)						
		0%	5%	10%	15%	20%	25%	30%
Rolling	A/B*	250	210	180	155	135	120	110
	B/C	500	420	360	310	270	240	220
	C/D	920	760	650	570	510	470	450
	D/E	1370	1140	970	700	630	580	550
	E/F	2420	2000	1720	1510	1,360	1,260	1,210

Notes: *Assumed to be 50% of upper limit of B/C LOS.

Columns 20% to 30% have been extrapolated from the preceding columns.

The column for 20% heavy vehicles has been used to determine baseline Goolma Road mid-block capacity LOS in Table 4.3. Cumulative traffic mid-block capacity has been determined from 35% heavy vehicles, extrapolated from previous columns.

4.3 Rural road compliance

The mid-block capacity (LOS) assessment for Goolma Road west of the site access is provided in Table 4.3 for the baseline and cumulative traffic scenarios. The baseline traffic volumes are extracted from Section 2.5 and the cumulative traffic volumes are extracted from Section 3.7.

Table 4.3 Goolma Road mid-block capacity (including Ungula Wind Farm construction traffic)

Scenario	Peak hour volume	Heavy vehicle percentage	Level of Service
Baseline traffic	211 (AM)/211 (PM)	18% (AM)/18% (PM)	B/B
Cumulative traffic	510 (AM)/510 (PM)	35% (AM)/35% (PM)	D/D

The Goolma Road LOS has been determined from further extrapolations of the values presented in Table 4.2. Goolma Road is expected to operate at LOS B in the baseline traffic scenario and at LOS D in the cumulative traffic scenario.

The reduction in the LOS (by two levels) is only for the duration of the assessed period which corresponds to the period of peak construction activity. When the project construction work has been completed, the LOS will return to the baseline traffic conditions.

Further, this assessment has been carried out for a worst-case scenario where it is assumed that traffic from nearby developments, project construction traffic and road network traffic would all overlap in the same morning and evening peak hours. This is considered highly unlikely, and arrival and departure patterns of traffic may not necessarily coincide.

The LOS D is considered close to the limit of stable traffic flow but is expected to be experienced during construction period only during the AM and PM peak hours. At other times of the day, the LOS would be better than D.

4.4 Warrants for BA, AU and CH Turn Movements

Intersection operations are also assessed from the combination of the peak hourly through and turning traffic movements that occur at each intersection. This determines the need for additional intersection turning lanes (eg basic, auxiliary lane and channelised) in accordance with the current intersection design standards (Austroads 2017b) *Guide to Road Design Part 4, Intersections and Crossings General* (Figure 4.1), where:

- Curve 1 (red line) represents the boundary between a basic right turn (BAR) and a channelised short right turn (CHR(S)) turn treatment and between a basic left turn (BAL) and an auxiliary short left turn (AUL(S)) turn treatment.
- Curve 2 (blue line) represents the boundary between a CHR(S) and a full length CHR treatment and between an AUL(S) and a full length AUL or CHL treatment. The choice of CHL over an AUL will depend on factors such as the need to change the give way rule in favour of other manoeuvres at the intersection and the need to define more appropriately the driving path by reducing the area of bitumen surfacing.

Figure 4.1 below contains the graphs for the selection of turn treatments on roads with a design speed greater than or equal to 100 km/h which is appropriate for high-speed rural roads.

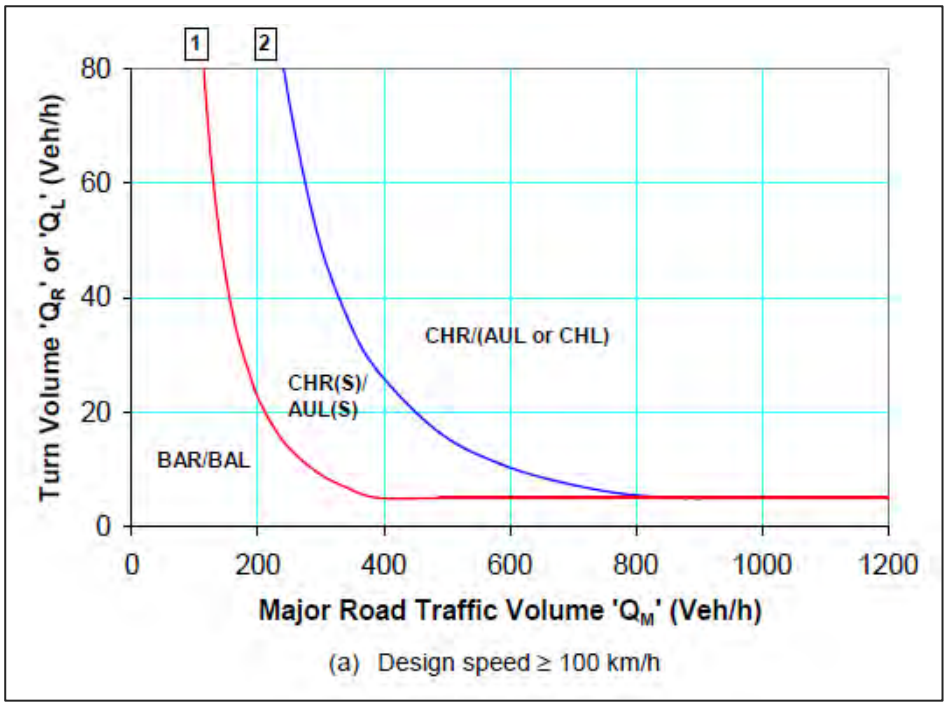

Figure 4.1 Austroads warrant design charts for rural intersection turning lanes

TfNSW recommends that intersections should be designed for a travel speed 10 km/h greater than the posted speed limit. As Goolma Road has posted speed limit of 100 km/h, the intersection (including any requirements for turning bays) should be designed for 110 km/h.

For a design speed of 100 km/h or greater, the requirements for additional left or right turn traffic lanes are measured from Figure 4.3.

The existing site access intersection is off Twelve Mile Road and will be closed off (Figure 4.2).

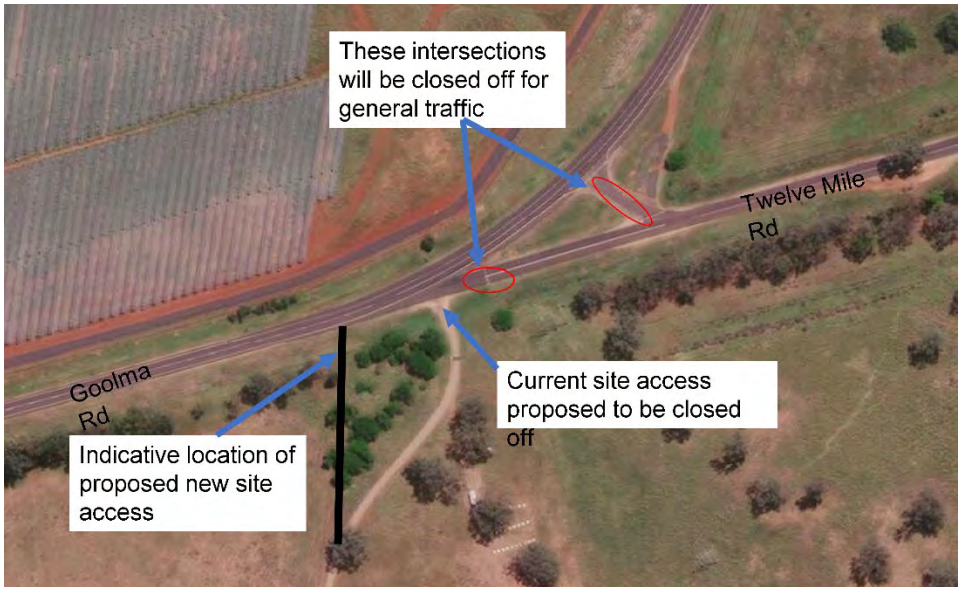

Figure 4.2 Existing site access and indicative new site access

The intersection peak hourly turning traffic volumes for the warrant assessment for the cumulative traffic is summarised in Table 4.4. Due to minimal existing turning traffic no change is required for the existing intersection traffic.

Table 4.4 Intersection turn treatment warrant for Goolma Road/Site Access Road intersection (including Ungula Wind Farm construction traffic)

Movement	Peak hour	Major road traffic volume	Turning traffic volume	Turn treatment required
Left turn from major road	AM	71	44	BAL
	PM	338	12	AUL(S)
Right turn from major road	AM	470	66	CHR
	PM	438	18	CHR(S)

Based on the cumulative traffic volumes for the Goolma Road/Site Access Road intersection, the following turn treatments will be required for the project construction traffic access:

- an auxiliary short left turn treatment (AUL(S)) will be required for left turning traffic from Goolma Road southbound to site access road; and
- a channelized right turn treatment (Austroads Type CHR) will be required for right turning traffic from Goolma Road northbound to site access road.

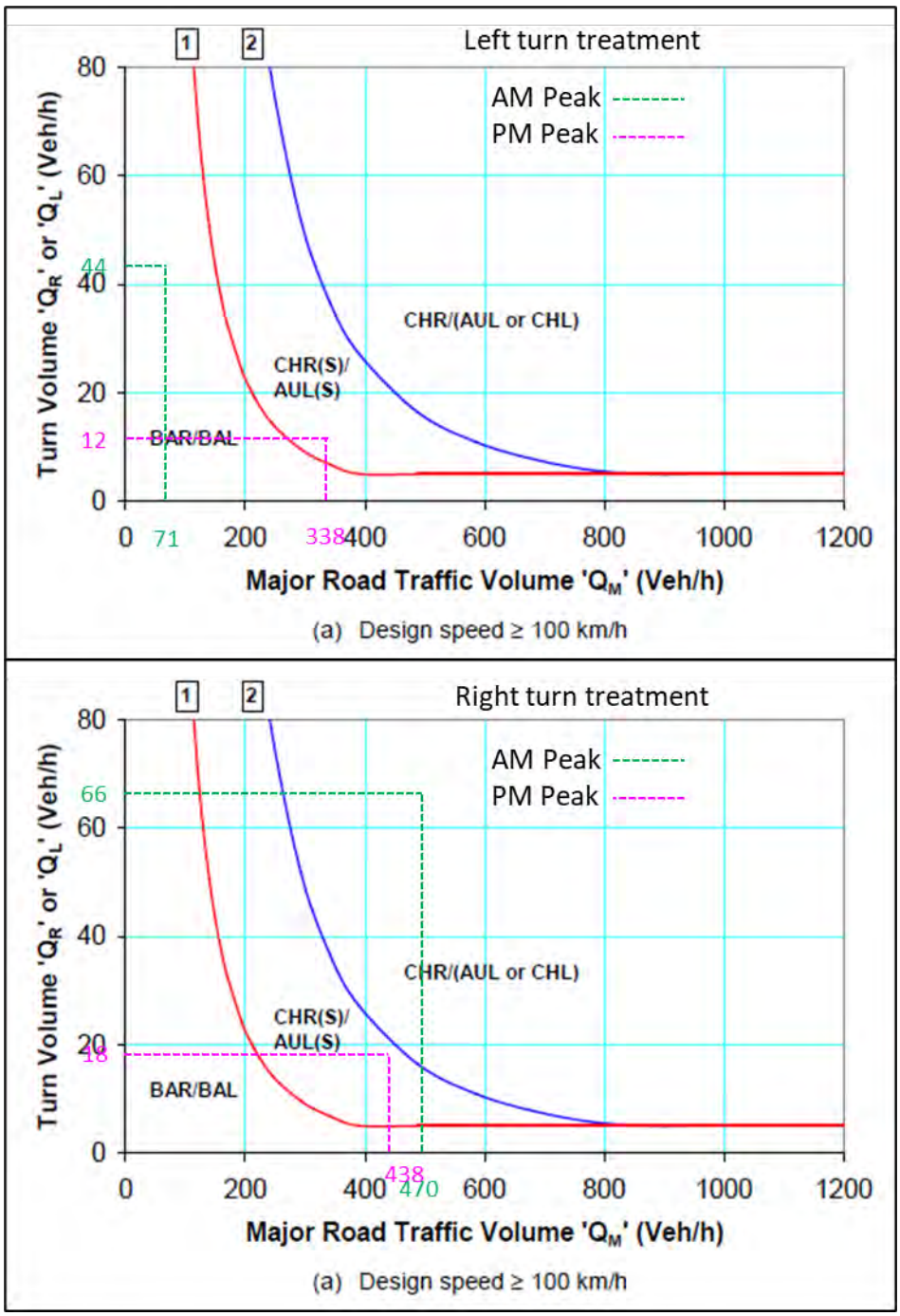

Figure 4.3 Austroads turn treatment warrant assessment for Goolma Road/Site Access intersection (including Ungula Wind Farm construction traffic)

Based on the above analysis, an auxiliary short left turn bay (AUL(S)) and a channelised right turn bay (CHR) will be required on Goolma Road at the site access intersection.

4.5 Operation traffic impact assessment

There will be four daily trips during the operation stage of the development (three light and one heavy vehicles). These volumes are significantly lower than the construction traffic generation and unlikely to have any noticeable impact to the adjoining road network. Therefore, traffic impact for 10-year horizon is not required.

4.6 Staged construction impact assessment

As discussed in Section 3.2.2, there is a likelihood of construction of the project occurring in two stages. This may result in Stage 1 operational traffic coinciding with Stage 2 construction traffic for the duration of the Stage 2 construction.

Stage 1 operational traffic would consist of up to two staff vehicles and one heavy vehicle for maintenance activities. Stage 2 construction traffic would be reduced in comparison to Stage 1 construction, as some construction activities such as site establishment works, intersection upgrade works, and parts of construction works (civil works, structural works, and electrical works) would already be completed during Stage 1 construction.

The staged construction works would reduce the peak construction traffic movements in comparison to single stage construction scenario and is not expected to generate significant traffic impacts if coinciding with nearby development traffic.

The overlap of Stage 1 operational and Stage 2 construction traffic is unlikely to result in significant traffic impacts. However, an operational traffic management plan may be required to ensure that operational traffic and construction traffic does not compromise any traffic or pedestrian safety within the project site.

4.7 Site access intersection concept design

In consultation with DRC and TfNSW, a concept design for the site access intersection has been prepared as illustrated in Appendix B. The concept plan shows that short left and right turn bays are provided from Goolma Road to the site. The intersection geometry is determined by the swept path assessments by a 26 m B-double truck which is the longest construction vehicle accessing the site.

It should be noted that despite the Austroads turn warrant requiring a full right turn bay during the AM peak hour (Table 4.4), a short right turn bay CHR (S) is provided due to the following reasons:

- This intersection is designed in line with the already approved realigned Goolma Road/Twelve Mile Road intersection (Figure 2.5).
- The site access off Goolma Road is not a public road. As stated in Section 4.1.5, during operation, there will be maximum four vehicles per day. Therefore, a short right turn bay should be sufficient to cater for the traffic demand for the right turning vehicles onto the site during operation.
- The right turn bay would accommodate two 26 m long B-double trucks. This is sufficient storage without impacting eastbound traffic on Goolma Road. The traffic generation data (Table 3.2) shows that during the AM peak hour, there will be 48 light and 30 heavy vehicles turning right from Goolma Road onto the site. This equates to 1.3 vehicles in every minute.

Based on the above considerations, a short right turn bay is justifiable. However, during construction, necessary traffic management may need to be in place to minimise any traffic impact on Goolma Road.

It should be noted that the concept plan at the site access intersection has been prepared based on the single stage project whereby the maximum construction traffic generation will occur at the site. This is a conservative assessment. If the project proceeds in two separate stages, this concept plan will be updated based on the revised traffic volumes and submitted to DPE/TfNSW/Council for consideration and approval, prior to commencement of detailed design.

The concept plan was presented to DRC as part of consultation activities in August 2022, with DRC providing in principle support of the concept subject to detailed design. In addition, the concept design plan has been provided to TfNSW for consideration and comment in advance of exhibition of the EIS for the project. Consultation with TfNSW is ongoing and will continue during the EIS exhibition and response to submissions phase of the project, including further consideration of access options via Twelve Mile Road and construction timing for Uungula Wind Farm committed road upgrade works as additional information becomes available. The concept design will be refined in consideration of feedback received from TfNSW.

5 Safety assessment

5.1 Road safety assessment at the project site entrance

In accordance with *Austroads Guide to Road Design Part 4A (Unsignalised and Signalised Intersections)* (Austroads, 2017), all unsignalised T-intersections must provide adequate visibility for turning traffic safety. This is assessed in further detail below, in terms of the safe intersection sight distance (SISD) at each intersection, which varies according to the design speed of the road. Normally a design speed 10 km/h higher than the posted speed limit is used to calculate the SISD.

Goolma Road has a speed limit of 100 km/h near the intersection. In accordance with *Austroads Guide to Road Design Part 4A (Unsignalised and Signalised Intersections)* (Austroads, 2017), for a road with design speed of 110 km/h (design speed is generally 10 km/h higher than the speed limit), the minimum SISD required for a general minimum 2 second driver reaction time is 285 m.

The sight distances on Goolma Road at the site access have been estimated based on the line of sight and observation, as shown in Plate 5.1. Based on the estimated sight distance analysis, the sight distance to the left is in excess of 800 m and therefore meets the minimum requirement (285 m) as stipulated in the *Austroads Guide to Road Design*.

Sight distance to the right is limited due to an existing roadside tree and the moderate bend on Goolma Road. This has restricted the sight distance to approximately 220 m to the right. It should be noted that there are warning signs on both approaches of Goolma Road (Photograph 5.1), warning motorists to reduce speed to 85 km/h before the bend. To improve sight distance, it is recommended that the tree, as identified in Plate 5.1, be removed.

The removal of roadside vegetation and presence of speed reduction warning signs will adequately address the existing sight distance issues to the right from the site access.

Sight distance to the left (>800 m)

Sight distance to the right (220 m)

Plate 5.1 Sight distance at new site access

Photograph 5.1 **Speed reduction warning sign on Goolma Road**

6 Management of impacts

6.1 Construction phase

The proposed traffic management mitigation measures for the construction phase are outlined in Table 6.1.

Table 6.1 Proposed mitigation measures during construction phase

Requirement	Mitigation measure	Responsibility	Timing
Need for intersection upgrades	• Following Uungula Wind Farm project's upgrade of Goolma Road/Twelve Mile Road intersection, install an auxiliary short left turn bay (AUL(S)) and a channelised short right turn bay (CHR(S)) at the Goolma Road/Site Access Road intersection, as shown in Appendix B.	AMPYR Australia Pty Ltd (AMPYR) and Shell Energy (Shell)	Pre-construction
Worksite traffic control and confirmation of other management measures	A detailed construction traffic management plan (CTMP) will be developed by the construction contractor in consultation with Dubbo Regional Council prior to the commencement of works. The CTMP will include a Driver Code of Conduct addressing: • informing drivers about the school bus routes along Goolma Road and Twelve Mile Road; and • truck drivers would be instructed take extra care if the construction trucks operate during the school run, typically 8.00 to 9.30 am and 2.30 to 4.00 pm; school days only in NSW. During construction, necessary traffic management may need to be in place to minimise any traffic impact on Goolma Road.	Contractor	Pre-construction
Access by oversize vehicles	Obtain a permit from NHVR to allow OSOM vehicles to use the road network as part of construction.	Contractor	Pre-construction
To address restricted sight distance to the right of site access along Goolma Road	Consider removal of the existing tree on the opposite side of Goolma Road as identified in Plate 5.2 to facilitate greater visibility. Construction stage traffic management measures such as warning signs for trucks entering (sign no. t2–25, to be confirmed in the CTMP). 	Contractor	Pre-construction

6.2 Operation phase

No material traffic impacts are expected during the operations phase. Accordingly, no mitigation measure is proposed for the operations phase.

6.3 Decommissioning phase

Works undertaken during decommissioning will not exceed the intensity associated with construction works and is expected to take up to 8 months. Traffic generation associated with decommissioning activities would therefore be a proportion of that estimated for the construction scenario considered herein and limited traffic impacts are expected during the decommissioning phase as all mitigation measures proposed during construction stage will have been implemented. Accordingly, no mitigation measures are proposed for the decommissioning phase.

7 Summary and conclusion

This TIA has reviewed and assessed project-related construction daily and peak hour traffic volumes in consideration of the potential for staged or single phase construction, along with cumulative traffic volumes along the existing road network to determine whether there is sufficient road network capacity and to ensure the existing road network will be adequate to accommodate the additional traffic movements generated by the project.

Vehicle movements will take place primarily on Goolma Road. Construction of the project will occur in a single stage over a period of 12–18 months, or over two stages each between 12–18 months, commencing from 2023. The worst case construction traffic scenario is associated with the single stage construction, which at its peak is expected to generate up to 100 construction personnel.

Construction traffic includes passenger vehicles transporting constructions workers and heavy vehicles transporting project equipment. There will be an average of up to 100 passenger vehicles and 60 heavy vehicles per day, and a maximum of 80 passenger vehicles and 30 heavy vehicles during the peak hour, in the construction phase. There will be up to 20 OSOM vehicles during the construction phase and relevant permits will be acquired from NHVR for the project prior to mobilize.

The cumulative impact assessment has considered potential construction traffic associated with Uungula Wind Farm and Wellington North Solar Farm (constructed in a single stage). The impact of project-related vehicles on Goolma Road capacity has been assessed. Due to the construction activities, the peak hour vehicle movements will increase traffic on Goolma Road. For the cumulative traffic impact assessment scenario including Uungula Wind Farm and Wellington North Solar Farm construction traffic, the mid-block capacity of the Goolma Road section west of the site access would deteriorate from LOS B to LOS D. However, this will only be during the scenario where peak construction activity overlaps with the nearby development traffic. The level of service will return to the baseline traffic conditions once peak construction period is over.

Sight distance to the right of the site access does not meet the minimum requirement as stipulated in the *Austroads Guide to Road Design*. Recommended mitigation measures include removing the existing roadside vegetation (a single tree) which currently restricts the sight distance along with implementation of construction stage traffic management measures such as warning signs. These would be beneficial to not only the site related traffic, but also general traffic passing through this section of Goolma Road.

As part of the Uungula Wind Farm development, the existing Goolma Road/Twelve Mile Road intersection will be relocated approximately 400 m to the north which will improve traffic safety for all motorists.

Austroads intersection turn treatment warrants were conducted for left and right turning traffic from Goolma Road into the relocated site access. The assessment revealed that for the cumulative traffic impact assessment including Uungula Wind Farm construction traffic, AUL(S) and CHR type turn treatments will be required. For the cumulative traffic impact assessment excluding Uungula Wind Farm construction traffic, a BAL and CHR type turn treatments will be required.

An auxiliary short left turn bay AUL(S) and a short right turn bay CHR(S) is recommended. The CHR(S) is recommended due to the fact that a longer right turn bay will not be needed once the construction period is over. For the operational period, a longer right turn bay is not required.

It should be noted that the concept plan for the site access intersection has been prepared based on the single stage project whereby the maximum construction traffic generation will occur at the site. This is a conservative assessment. If the project proceeds in two separate stages, this concept plan will be updated based on the revised traffic volumes and submitted to DPE/TfNSW/Council for consideration and approval, prior to commencement of detailed design.

References

Austroads. (2016). *Guide to Traffic Management Part 3: Traffic Studies and Analysis.*

Austroads. (2017). *Guide to Road Design Part 4A: Unsignalised & Signalised Intersections.*

GHD. (2021). *Wellington North Solar Project Development.* Traffic Impact Assessment.

HCM. (2016). *Highway Capacity Manual.*

RTA. (2002). *Guide to Traffic Generating Developments.*

Samsa Consulting. (2020). *Uungula Wind Farm Project.* Transport Assessment.

Appendix A
DRC traffic counts

EMM
creating opportunities

MetroCount Traffic Executive
Class Bin Chart

ClassBin-336 -- English (ENA)

Datasets:

Site:	**[531] Goolma Road at Twelve Mile Intersection**
Attribute:	
Direction:	1 - North bound, A trigger first. **Lane:** 0
Survey Duration:	11:42 Tuesday, 13 October 2020 => 9:15 Thursday, 19 November 2020,
Zone:	
File:	531 Goolma Road at the Curve near Twelve Mile Road Intersection.EC0 (Plus)
Identifier:	B5642DCS MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm:	Factory default axle (v5.06)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**11:43 Tuesday, 13 October 2020 => 9:15 Thursday, 19 November 2020**
(36.8975)	
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound), P = North, Lane = 0-16
Separation:	Headway > 0 sec, Span 0 - 100 metre
Name:	Default Profile
Scheme:	Vehicle classification (AustRoads94)
Units:	Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile:	Vehicles = 65574 / 65593 (99.97%)

MetroCount Traffic Executive
Class Bin Chart

ClassBin-337 -- English (ENA)

Datasets:

Site:	**[532] Twelve Mile Road At Goolma Road Intersection**
Attribute:	
Direction:	2 - East bound, A trigger first. **Lane:** 0
Survey Duration:	11:53 Tuesday, 13 October 2020 => 11:29 Thursday, 26 November 2020,
Zone:	
File:	532 Twelve Mile Rd at Goolma Rd Intersection.EC0 (Plus)
Identifier:	SS06TCPS MC5900-X13 (c)MetroCount 09Nov16
Algorithm:	Factory default axle (v5.06)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**11:54 Tuesday, 13 October 2020 => 11:29 Thursday, 26 November 2020**
(43.983)	
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound), P = East, Lane = 0-16
Separation:	Headway > 0 sec, Span 0 - 100 metre
Name:	Default Profile
Scheme:	Vehicle classification (AustRoads94)
Units:	Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile:	Vehicles = 7743 / 7766 (99.70%)

Class Bins

Class 1 - 4003 (51.70%)
Class 2 - 164 (2.12%)
Class 3 - 3209 (41.44%)
Class 4 - 87 (1.12%)
Class 5 - 5 (0.06%)
Class 6 - 78 (1.01%)
Class 7 - 70 (0.90%)
Class 8 - 5 (0.06%)
Class 9 - 87 (1.12%)
Class 10 - 35 (0.45%)
Class 11 - 0 (0.00%)
Class 12 - 0 (0.00%)

MetroCount Traffic Executive
Speed Statistics

SpeedStat-339 -- English (ENA)

Datasets:

Site:	**[532] Twelve Mile Road At Goolma Road Intersection**
Attribute:	
Direction:	2 - East bound, A trigger first. **Lane:** 0
Survey Duration:	11:53 Tuesday, 13 October 2020 => 11:29 Thursday, 26 November 2020,
Zone:	
File:	532 Twelve Mile Rd at Goolma Rd Intersection.EC0 (Plus)
Identifier:	SS06TCPS MC5900-X13 (c)MetroCount 09Nov16
Algorithm:	Factory default axle (v5.06)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**11:54 Tuesday, 13 October 2020 => 11:29 Thursday, 26 November 2020**
(43.983)	
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound), P = East, Lane = 0-16
Separation:	Headway > 0 sec, Span 0 - 100 metre
Name:	Default Profile
Scheme:	Vehicle classification (AustRoads94)
Units:	Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile:	Vehicles = 7743 / 7766 (99.70%)

Speed Statistics

SpeedStat-339
Site: 532.0.0E
Description: **Twelve Mile Road At Goolma Road Intersection**
Filter time: **11:54 Tuesday, 13 October 2020 => 11:29 Thursday, 26 November 2020**
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Vehicles = 7743
Posted speed limit = 60 km/h, Exceeding = 6555 (84.66%), Mean Exceeding = 89.18 km/h
Maximum = 159.9 km/h, **Minimum** = 11.4 km/h, **Mean** = 82.9 km/h
85% Speed = 112.68 km/h, **95% Speed** = 128.52 km/h, **Median** = 77.40 km/h
20 km/h Pace = 62 - 82, **Number in Pace** = 3105 (40.10%)
Variance = 640.28, **Standard Deviation** = 25.30 km/h

Speed Bins (Partial days)

Speed	Bin	Below	Above	Energy	vMult	n * vMult
0 - **10**	0 0.000%	0 0.000%	7743 100.0%	0.00	0.00	0.00
10 - **20**	9 0.116%	9 0.116%	7734 99.88%	0.00	0.00	0.00
20 - **30**	60 0.775%	69 0.891%	7674 99.11%	0.00	0.00	0.00
30 - **40**	182 2.351%	251 3.242%	7492 96.76%	0.00	0.00	0.00
40 - **50**	330 4.262%	581 7.504%	7162 92.50%	0.00	0.00	0.00
50 - **60**	607 7.839%	1188 15.34%	6555 84.66%	0.00	0.00	0.00
60 - **70**	1348 17.41%	2536 32.75%	5207 67.25%	0.00	0.00	0.00
70 - **80**	1729 22.33%	4265 55.08%	3478 44.92%	0.00	0.00	0.00
80 - **90**	851 10.99%	5116 66.07%	2627 33.93%	0.00	0.00	0.00
90 - **100**	598 7.723%	5714 73.80%	2029 26.20%	0.00	0.00	0.00
100 - **110**	696 8.989%	6410 82.78%	1333 17.22%	0.00	0.00	0.00
110 - **120**	586 7.568%	6996 90.35%	747 9.647%	0.00	0.00	0.00
120 - **130**	404 5.218%	7400 95.57%	343 4.430%	0.00	0.00	0.00
130 - **140**	218 2.815%	7618 98.39%	125 1.614%	0.00	0.00	0.00
140 - **150**	86 1.111%	7704 99.50%	39 0.504%	0.00	0.00	0.00
150 - **160**	39 0.504%	7743 100.0%	0 0.000%	0.00	0.00	0.00
160 - **170**	0 0.000%	7743 100.0%	0 0.000%	0.00	0.00	0.00
170 - **180**	0 0.000%	7743 100.0%	0 0.000%	0.00	0.00	0.00
180 - **190**	0 0.000%	7743 100.0%	0 0.000%	0.00	0.00	0.00
190 - **200**	0 0.000%	7743 100.0%	0 0.000%	0.00	0.00	0.00

Total Speed Rating = 0.00
Total Moving Energy (Estimated) = 0.00

Speed limit fields (Partial days)

	Limit	Below	Above
0	60 (PSL)	1188 15.3%	6555 84.7%

MetroCount Traffic Executive
Speed Statistics

SpeedStat-334 -- English (ENA)

Datasets:

Site:	**[531] Goolma Road at Twelve Mile Intersection**
Attribute:	
Direction:	1 - North bound, A trigger first. **Lane:** 0
Survey Duration:	11:42 Tuesday, 13 October 2020 => 9:15 Thursday, 19 November 2020,
Zone:	
File:	531 Goolma Road at the Curve near Twelve Mile Road Intersection.EC0 (Plus)
Identifier:	B5642DCS MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm:	Factory default axle (v5.06)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**11:00 Wednesday, 21 October 2020 => 9:15 Thursday, 19 November 2020**
(28.9274)	
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound), P = North, Lane = 0-16
Separation:	Headway > 0 sec, Span 0 - 100 metre
Name:	Default Profile
Scheme:	Vehicle classification (AustRoads94)
Units:	Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile:	Vehicles = 49306 / 65593 (75.17%)

Speed Statistics

SpeedStat-334
Site: 531.0.0N
Description: **Goolma Road at Twelve Mile Intersection**
Filter time: **11:00 Wednesday, 21 October 2020 => 9:15 Thursday, 19 November 2020**
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Vehicles = 49306
Posted speed limit = 60 km/h, Exceeding = 48465 (98.29%), Mean Exceeding = 89.34 km/h
Maximum = 151.7 km/h, **Minimum** = 13.2 km/h, **Mean** = 88.6 km/h
85% Speed = 102.60 km/h, **95% Speed** = 110.64 km/h, **Median** = 88.20 km/h
20 km/h Pace = 77 - 97, **Number in Pace** = 28467 (57.74%)
Variance = 180.79, **Standard Deviation** = 13.45 km/h

Speed Bins (Partial days)

Speed	Bin	Below	Above	Energy	vMult	n * vMult
0 - **10**	0 0.000%	0 0.000%	49306 100.0%	0.00	0.00	0.00
10 - **20**	3 0.006%	3 0.006%	49303 100.0%	0.00	0.00	0.00
20 - **30**	66 0.134%	69 0.140%	49237 99.86%	0.00	0.00	0.00
30 - **40**	240 0.487%	309 0.627%	48997 99.37%	0.00	0.00	0.00
40 - **50**	193 0.391%	502 1.018%	48804 98.98%	0.00	0.00	0.00
50 - **60**	339 0.688%	841 1.706%	48465 98.29%	0.00	0.00	0.00
60 - **70**	2216 4.494%	3057 6.200%	46249 93.80%	0.00	0.00	0.00
70 - **80**	9017 18.29%	12074 24.49%	37232 75.51%	0.00	0.00	0.00
80 - **90**	15378 31.19%	27452 55.68%	21854 44.32%	0.00	0.00	0.00
90 - **100**	12315 24.98%	39767 80.65%	9539 19.35%	0.00	0.00	0.00
100 - **110**	6829 13.85%	46596 94.50%	2710 5.496%	0.00	0.00	0.00
110 - **120**	2356 4.778%	48952 99.28%	354 0.718%	0.00	0.00	0.00
120 - **130**	310 0.629%	49262 99.91%	44 0.089%	0.00	0.00	0.00
130 - **140**	34 0.069%	49296 100.0%	10 0.020%	0.00	0.00	0.00
140 - **150**	8 0.016%	49304 100.0%	2 0.004%	0.00	0.00	0.00
150 - **160**	2 0.004%	49306 100.0%	0 0.000%	0.00	0.00	0.00
160 - **170**	0 0.000%	49306 100.0%	0 0.000%	0.00	0.00	0.00
170 - **180**	0 0.000%	49306 100.0%	0 0.000%	0.00	0.00	0.00
180 - **190**	0 0.000%	49306 100.0%	0 0.000%	0.00	0.00	0.00
190 - **200**	0 0.000%	49306 100.0%	0 0.000%	0.00	0.00	0.00

Total Speed Rating = 0.00
Total Moving Energy (Estimated) = 0.00

Speed limit fields (Partial days)

	Limit	Below	Above
0	60 (PSL)	841 1.7%	48465 98.3%

MetroCount Traffic Executive
Weekly Vehicle Counts (Virtual Week)

VirtWeeklyVehicle-335 -- English (ENA)

Datasets:

Site:	**[531] Goolma Road at Twelve Mile Intersection**
Attribute:	
Direction:	1 - North bound, A trigger first. **Lane:** 0
Survey Duration:	11:42 Tuesday, 13 October 2020 => 9:15 Thursday, 19 November 2020,
Zone:	
File:	531 Goolma Road at the Curve near Twelve Mile Road Intersection.EC0 (Plus)
Identifier:	B5642DCS MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm:	Factory default axle (v5.06)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**11:43 Tuesday, 13 October 2020 => 9:15 Thursday, 19 November 2020 (36.8975)**
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound), P = North, Lane = 0-16
Separation:	Headway > 0 sec, Span 0 - 100 metre
Name:	Default Profile
Scheme:	Vehicle classification (AustRoads94)
Units:	Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile:	Vehicles = 65574 / 65593 (99.97%)

Weekly Vehicle Counts (Virtual Week)

VirtWeeklyVehicle-335
Site: 531.0.0N
Description: **Goolma Road at Twelve Mile Intersection**
Filter time: **11:43 Tuesday, 13 October 2020 => 9:15 Thursday, 19 November 2020**
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages 1 - 5	Averages 1 - 7
Hour									
0000-0100	3.0	2.4	2.2	2.8	5.6	3.8	5.6	3.1	3.6
0100-0200	0.2	1.0	1.2	1.8	1.2	1.4	1.0	1.1	1.1
0200-0300	2.4	2.2	1.8	3.0	2.4	1.8	1.0	2.4	2.1
0300-0400	3.8	4.4	2.2	3.2	3.2	2.2	1.8	3.3	2.9
0400-0500	12.6	9.2	10.3	12.5	11.8	6.2	4.6	11.3	9.7
0500-0600	91.2	88.0	77.8	95.0	87.0	61.4	58.0	87.7	80.1
0600-0700	147.2	151.0	144.5	172.2	**177.4**	**125.8**	46.2	158.4	138.9
0700-0800	**179.0**	**176.6**	**147.2**	**179.0**	168.2	99.0	72.8	**169.5**	**146.9**
0800-0900	116.4	122.8	105.7	131.2	123.0	76.0	46.6	119.7	103.9
0900-1000	116.0	120.2	119.0	110.2	132.4	88.4	65.4	119.2	107.8
1000-1100	113.4	107.8	116.0	110.6	129.2	102.8	86.8	115.4	109.7
1100-1200	109.6	81.0	119.0	119.8	131.4	97.2	**98.0**	111.3	107.6
1200-1300	104.8	84.7	123.7	112.4	128.0	91.2	89.8	110.2	104.9
1300-1400	112.4	92.5	121.8	127.8	143.4	81.6	100.4	118.7	111.2
1400-1500	112.2	97.3	141.5	123.2	149.0	91.8	101.4	124.3	116.8
1500-1600	**186.6**	**157.2**	188.2	174.6	**215.6**	**129.6**	**128.0**	**183.6**	**168.8**
1600-1700	174.6	139.0	**205.5**	**180.6**	206.2	121.4	89.2	180.5	160.2
1700-1800	165.8	145.8	184.7	177.2	210.6	123.8	113.0	176.0	160.4
1800-1900	58.6	50.3	66.5	64.6	66.4	41.6	48.4	61.1	56.7
1900-2000	27.0	23.2	31.0	31.8	41.2	31.8	34.0	30.6	31.2
2000-2100	12.2	14.8	17.0	19.2	26.6	14.6	17.6	17.8	17.4
2100-2200	10.6	13.0	12.2	17.0	16.0	9.8	12.0	13.7	12.9
2200-2300	6.2	5.2	8.2	7.2	11.6	9.2	6.2	7.6	7.6
2300-2400	13.4	11.7	12.3	11.6	12.8	15.2	13.8	12.3	12.9
Totals									
0700-1900	1549.4	1375.2	1638.7	1611.1	1803.4	1144.4	1039.8	1589.3	1454.8
0600-2200	1746.4	1577.2	1843.3	1851.3	2064.6	1326.4	1149.6	1809.8	1655.1
0600-0000	1766.0	1594.1	1863.8	1870.1	2089.0	1350.8	1169.6	1829.7	1675.6
0000-0000	1879.2	1701.3	1959.3	1988.4	2200.2	1427.6	1241.6	1938.6	1775.2
AM Peak	0700	0700	0700	0700	0600	0600	1100		
	179.0	176.6	147.2	179.0	177.4	125.8	98.0		
PM Peak	1500	1500	1600	1600	1500	1500	1500		
	186.6	157.2	205.5	180.6	215.6	129.6	128.0		

*** - No data.**

MetroCount Traffic Executive
Weekly Vehicle Counts (Virtual Week)

VirtWeeklyVehicle-338 -- English (ENA)

Datasets:

Site:	**[532] Twelve Mile Road At Goolma Road Intersection**
Attribute:	
Direction:	2 - East bound, A trigger first. **Lane:** 0
Survey Duration:	11:53 Tuesday, 13 October 2020 => 11:29 Thursday, 26 November 2020,
Zone:	
File:	532 Twelve Mile Rd at Goolma Rd Intersection.EC0 (Plus)
Identifier:	SS06TCPS MC5900-X13 (c)MetroCount 09Nov16
Algorithm:	Factory default axle (v5.06)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**11:54 Tuesday, 13 October 2020 => 11:29 Thursday, 26 November 2020**
(43.983)	
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range:	10 - 160 km/h.
Direction:	North, East, South, West (bound), P = East, Lane = 0-16
Separation:	Headway > 0 sec, Span 0 - 100 metre
Name:	Default Profile
Scheme:	Vehicle classification (AustRoads94)
Units:	Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile:	Vehicles = 7743 / 7766 (99.70%)

Weekly Vehicle Counts (Virtual Week)

VirtWeeklyVehicle-338
Site: 532.0.0E
Description: **Twelve Mile Road At Goolma Road Intersection**
Filter time: **11:54 Tuesday, 13 October 2020 => 11:29 Thursday, 26 November 2020**
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages 1 - 5	1 - 7
Hour									
0000-0100	0.0	0.0	0.3	0.7	0.7	1.3	0.7	0.3	0.5
0100-0200	0.2	0.0	0.1	0.1	0.2	0.5	0.7	0.1	0.3
0200-0300	0.0	0.2	0.0	0.0	0.0	0.5	0.2	0.0	0.1
0300-0400	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0
0400-0500	0.3	0.3	0.4	0.4	0.3	0.0	0.2	0.4	0.3
0500-0600	1.8	1.2	2.7	2.1	2.2	0.7	0.3	2.0	1.6
0600-0700	9.2	11.5	10.4	12.0	10.5	3.8	1.5	10.8	8.5
0700-0800	**15.7**	14.8	**16.4**	17.1	13.3	5.3	3.7	15.6	12.5
0800-0900	14.5	**17.7**	14.3	**17.7**	**14.3**	8.5	4.8	**15.7**	**13.3**
0900-1000	9.7	9.8	11.6	9.9	12.5	12.7	9.8	10.7	10.8
1000-1100	9.7	8.0	7.7	9.3	9.2	**14.8**	**10.5**	8.8	9.8
1100-1200	7.5	8.1	11.9	7.6	7.3	12.3	10.0	8.5	9.2
1200-1300	10.2	7.7	11.4	10.3	10.8	**12.2**	10.0	10.1	10.3
1300-1400	12.2	9.0	12.0	7.2	10.3	10.0	9.2	10.2	10.0
1400-1500	11.5	8.6	13.9	10.0	11.7	10.2	10.0	11.1	10.8
1500-1600	13.8	14.1	15.4	14.3	16.2	12.0	**13.5**	14.8	14.2
1600-1700	15.5	**18.6**	20.0	**20.0**	**18.7**	8.8	8.8	**18.6**	15.9
1700-1800	**16.3**	18.4	**22.9**	13.7	18.5	11.8	10.3	18.1	**16.2**
1800-1900	12.7	10.3	13.0	9.8	11.8	10.2	7.8	11.5	10.8
1900-2000	7.8	7.4	11.4	9.3	8.2	8.7	6.2	8.9	8.5
2000-2100	5.2	4.0	6.6	4.7	4.7	6.8	2.5	5.0	4.9
2100-2200	3.2	4.4	4.7	2.0	6.8	3.2	3.2	4.3	4.0
2200-2300	1.3	1.0	3.0	1.2	3.5	2.7	1.0	2.0	2.0
2300-2400	0.5	0.3	1.3	0.2	3.5	0.8	0.3	1.1	

1.0

Totals

0700-1900	149.2	145.2	170.4	146.9	154.7	128.8	108.5	153.6
144.1								
0600-2200	174.5	172.5	203.6	174.9	184.8	151.3	121.8	182.5
170.0								
0600-0000	176.3	173.8	207.9	176.2	191.8	154.8	123.2	185.7
172.9								
0000-0000	178.7	175.5	211.4	179.7	195.3	157.8	125.3	188.6
175.8								

AM Peak	0700	0800	0700	0800	0800	1000	1000
	15.7	17.7	16.4	17.7	14.3	14.8	10.5
PM Peak	1700	1600	1700	1600	1600	1200	1500
	16.3	18.6	22.9	20.0	18.7	12.2	13.5

*** - No data.**

Class Bins

Class 1 - 46931 (71.57%)
Class 2 - 2135 (3.26%)
Class 3 - 11886 (18.13%)
Class 4 - 1467 (2.24%)
Class 5 - 374 (0.57%)
Class 6 - 376 (0.57%)
Class 7 - 471 (0.72%)
Class 8 - 179 (0.27%)
Class 9 - 1220 (1.86%)
Class 10 - 501 (0.76%)
Class 11 - 34 (0.05%)
Class 12 - 0 (0.00%)

Appendix B

Proposed Goolma Road/Twelve Mile Road intersection concept design

EMM
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A1

WARNING:
UTILITY SERVICES HAVE NOT BEEN SHOWN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ACCURATELY LOCATE AND PROTECT SERVICES WITHIN THE ROAD RESERVE OR DRAINAGE EASEMENT.

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PLAN
SCALE 1:400

SHEET INDEX

SHEET No	DESCRIPTION	REV
EMM - C01	SOLAR FARM CONCEPT LAYOUT PLAN	B
EMM - C02	SOLAR FARM CONCEPT LAYOUT PLAN	B
EMM - C03	SOLAR FARM CONCEPT LAYOUT PLAN - SWEPT PATH	B
EMM- C04	SOLAR FARM CONCEPT LAYOUT PLAN- SWEPT PATH	B

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St Leonards NSW 2065

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REV	DATE	COMMENT	DRAWN	REVIEWED
B	24/8/22	UPDATE BOUNDARY INFO	C.J.	A.U.
A	1/8/22	UPDATE LAYOUT	C.J.	A.U.
-	25/3/22	FOR COMMENT	C.J.	A.U.

REV	DATE	COMMENT	DRAWN	REVIEWED

PROJECT:
GOOLMA ROAD AND TWELVE MILE ROAD, WUULUMAN - CONCEPT ACCESS DESIGN.

DRAWING TITLE:
SOLAR FARM CONCEPT LAYOUT

CLIENT: AMPYR Energy

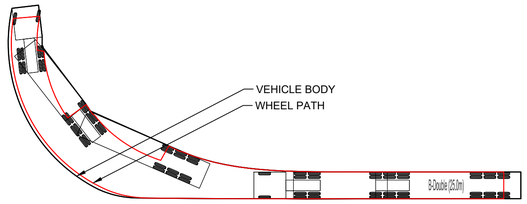
DRG. #: EMM - C01

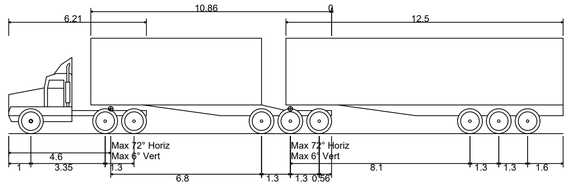
PROJECT #: J210534

SCALE: AS SHOWN

REV: B

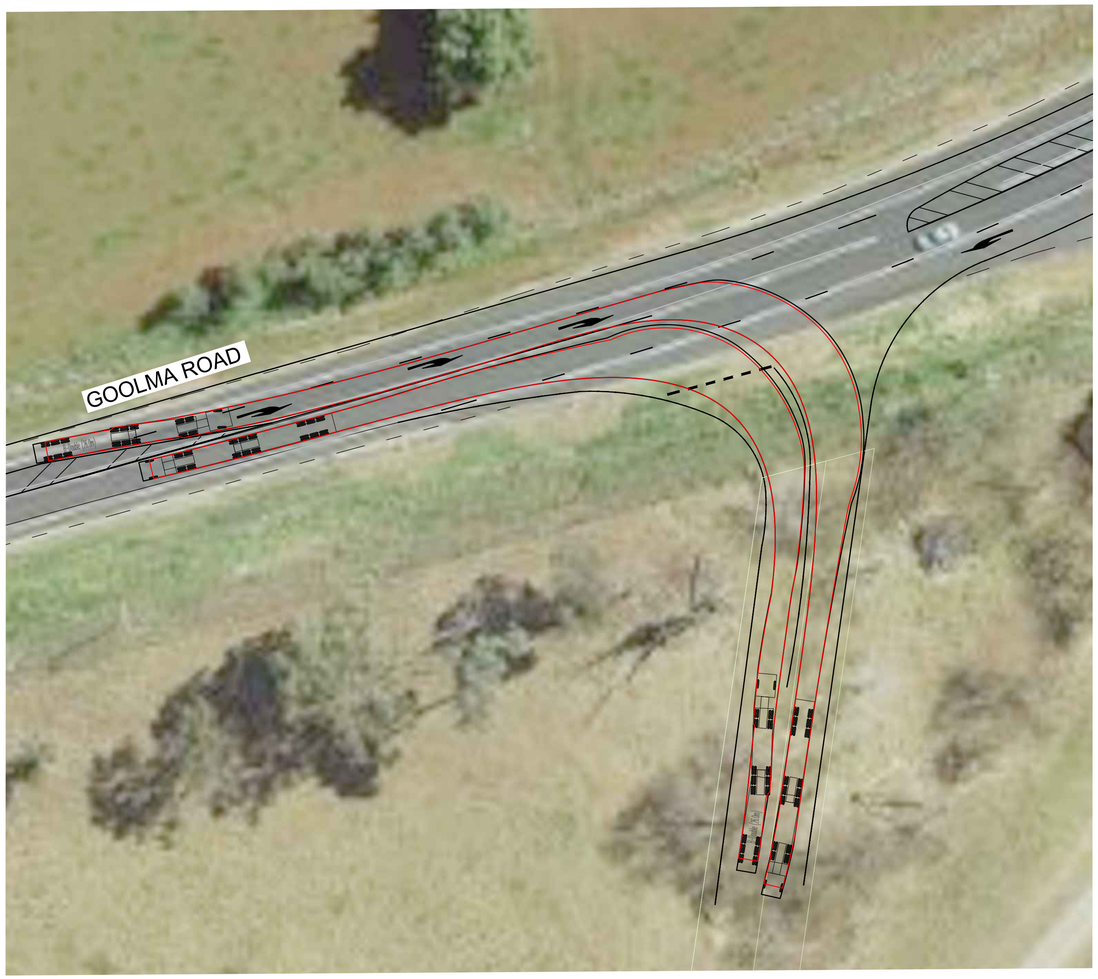
A1



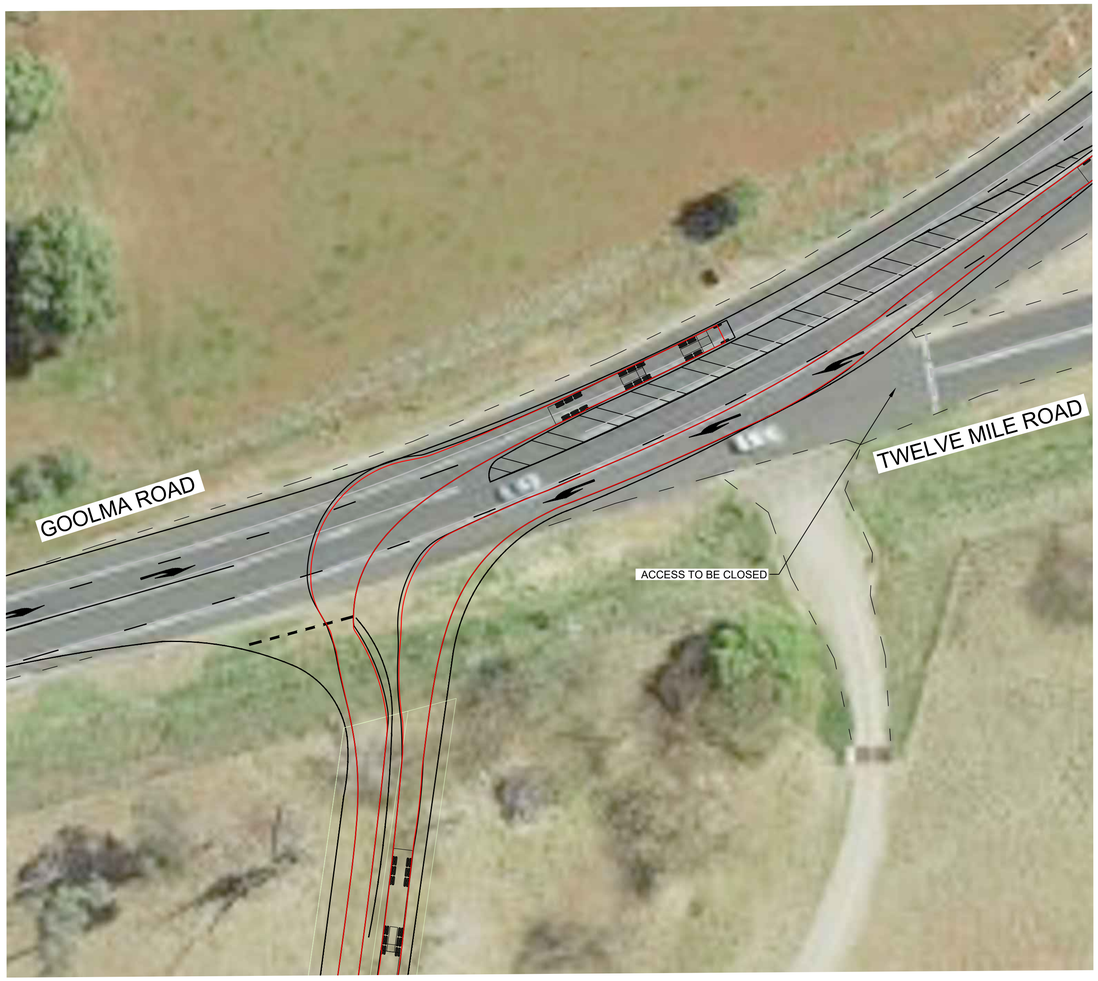


B-Double (26.0m)

Overall Length	26.000m
Overall Width	2.500m
Overall Body Height	4.300m
Min Body Ground Clearance	0.540m
Track Width	2.500m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	15.000m



SWEPT PATH 26m B-DOUBLE
SCALE 1:400



SWEPT PATH 26m B-DOUBLE
SCALE 1:400

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REV	DATE	COMMENT	DRAWN	REVIEWED
B	24/8/22	UPDATE BOUNDARY INFO	C.J.	A.U.
A	1/8/22	UPDATE LAYOUT	C.J.	A.U.
-	25/3/22	FOR COMMENT	C.J.	A.U.

REV	DATE	COMMENT	DRAWN	REVIEWED

PROJECT:
GOOLMA ROAD AND TWELVE MILE ROAD, WUULUMAN - CONCEPT ACCESS DESIGN.

DRAWING TITLE:
SOLAR FARM CONCEPT LAYOUT
SWEPT PATHS

CLIENT: AMPYR Energy
DRG. #: EMM - C03
PROJECT #: J210534
SCALE: AS SHOWN

REV: B

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