Appendix H

Traffic impact assessment

Limondale Sun Farm

Overland Sun Farming

Limondale Sun Farm

Traffic Impact Assessment

Prepared for Overland Sun Farming Pty Ltd | 7 April 2017

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Traffic Impact Assessment

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Limondale Sun Farm

Final

Report J16155RP1 | Prepared for Overland Sun Farming Pty Ltd | 7 April 2017

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1 Introduction

1.1 Overview

OVERLAND **Sun Farming** Pty Ltd (OVERLAND) proposes to develop the Limondale Sun Farm, a large-scale solar photovoltaic (PV) generation facility and associated infrastructure in the Murray Darling Depression bioregion of south-western NSW (Figure 1.1) (the project). OVERLAND proposes to develop the project on a site within the Balranald local government area (LGA), approximately 14 kilometres (km) south of the township of Balranald.

The project is a State significant development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP). A development application (DA) for the project is required to be submitted under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The NSW Minister for Planning, or the Minister's delegate, is the consent authority.

An environmental impact statement (EIS) is a requirement of the approval process. This Traffic Impact Assessment (TIA) report forms part of the EIS. It documents the traffic impact assessment methods and results, the initiatives built into the project design to avoid and minimise associated traffic impacts, and the additional mitigation and management measures proposed to address residual impacts.

1.2 Assessment guidelines and requirements

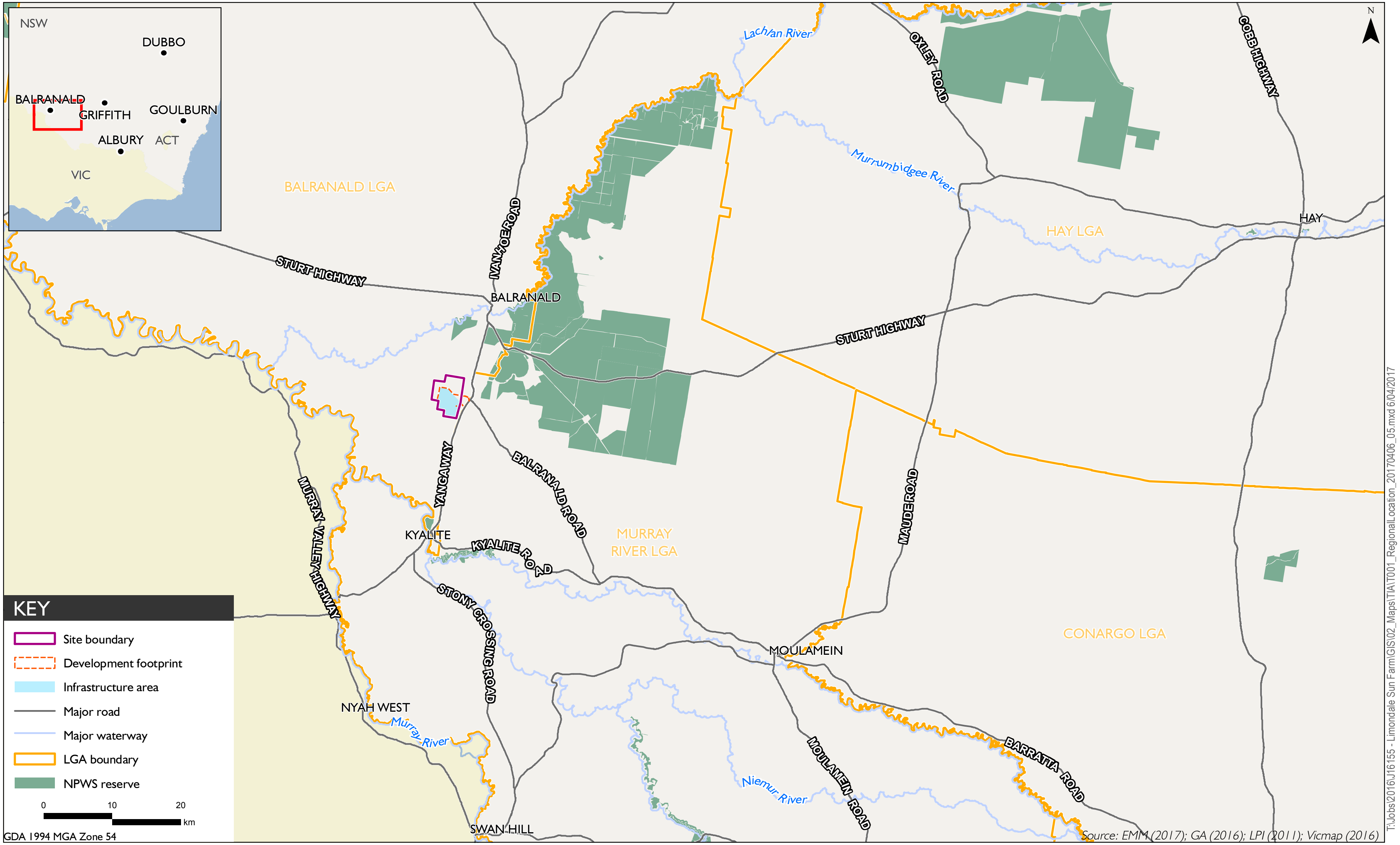
This TIA has been prepared in accordance with the relevant governmental assessment requirements, guidelines and policies, and in consultation with the relevant government agencies.

The assessment is based on the following general scope for matters to consider in a TIA which is defined by the NSW Roads and Maritime Services (RMS) *Guide to Traffic Generating Developments* (RTA 2002):

- the existing locality and surrounding land uses;
- the existing road network and intersections;
- traffic and car parking generation characteristics of the project;
- traffic and car parking impacts of the project; and
- a summary of the assessed traffic impacts and any traffic management or mitigation measures.

The TIA also addresses the requirements of the NSW Department of Planning and Environment (DP&E). These were set out in the Secretary’s Environmental Assessment Requirements (SEARs) for the project, issued on 4 November 2016.

The SEARs matters must be addressed in the EIS. A copy of the SEARs is attached to the EIS as Appendix A, while Table 1.1 lists the individual requirements relevant to this TIA and where they are addressed in this report.



Regional project location

Limondale Sun Farm

Traffic impact assessment

Figure 1.1

Table 1.1 Relevant matters raised in SEARs

Requirement	Section addressed
Site access routes	Sections 2.3 and 3.4
Site access point	Sections 2.2, 3.1,4.3 and 4.4
Rail safety issues	Not applicable
Likely transport impacts of the development on the capacity and condition of roads	Sections 4.1 and 4.2
Measures to be implemented to mitigate impacts during construction	Section 4.5 and Appendix B
Description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required)	Sections 2.1, 2.4, 4.3 and 4.4

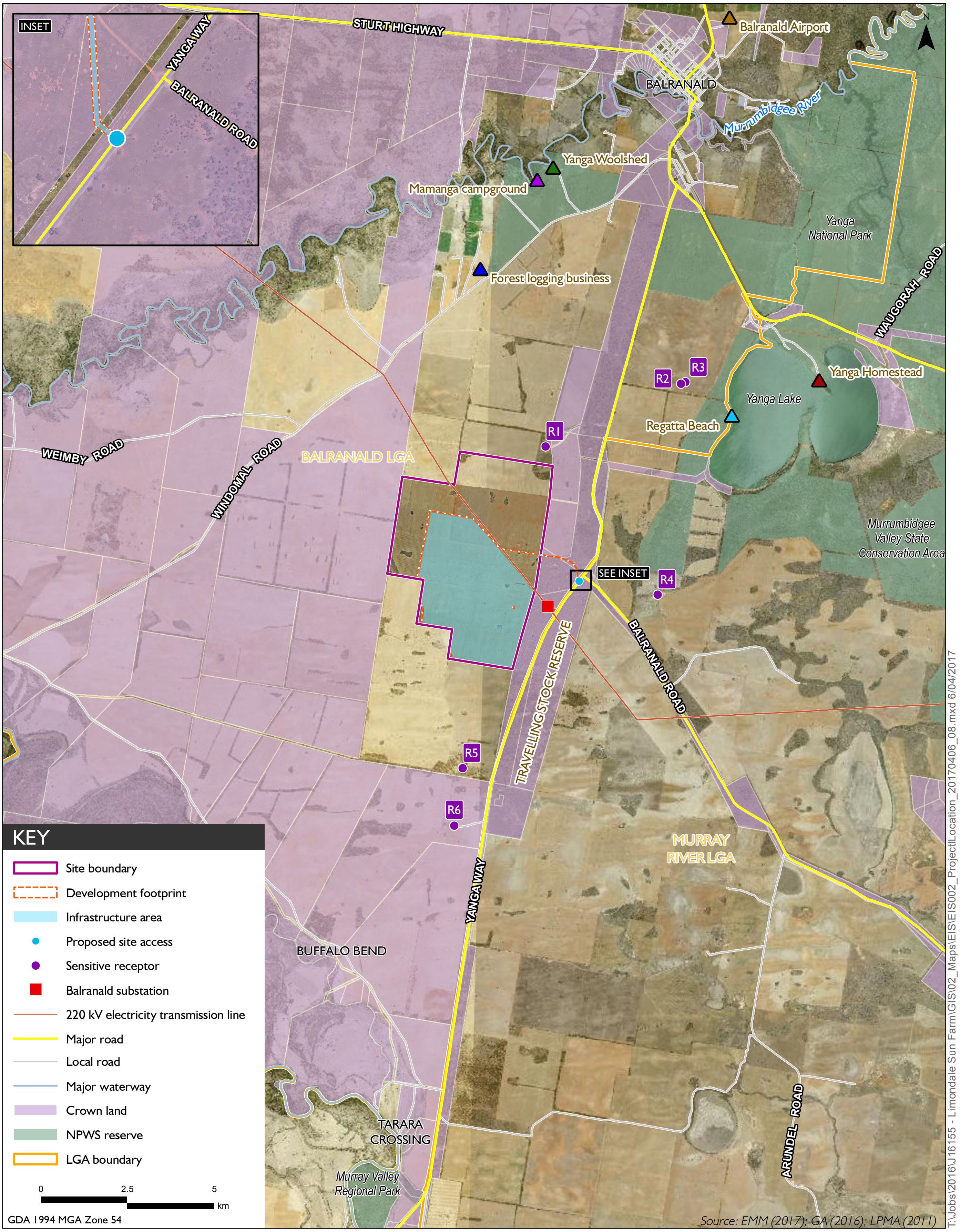
To inform preparation of the SEARs, DP&E invited other government agencies to recommend matters to be addressed in the EIS. These matters were taken into account by the Secretary for DP&E when preparing the SEARs.

Copies of the RMS advice to DP&E were attached to the SEARs and matters relevant to the TIA are listed in Table 1.2.

Table 1.2 Government agency (RMS) traffic impact assessment recommendations

Requirement	Section addressed
Assess the project establishment and decommissioning stages separately to the project operations stage traffic impacts	Section 3.2 and Section 4.1
Assess the transport of materials and equipment/components for the facility and ancillary infrastructure and the movement and parking of construction related vehicles, including personal vehicles, during the construction of the facility	Section 3.2 and Section 3.3
Address existing and anticipated additional traffic generation on the surrounding road network	Section 3.2 and Section 4.1
Vehicle types and volumes	Section 3.2
Peak traffic volumes	Section 3.2 and Section 4.3
Travel routes	Sections 2.3 and 3.4
Cumulative impacts	Sections 2.7, 3.5 and 4.2
Traffic management and mitigation measures	Section 3.1 and Section 4.5
A traffic management plan for the construction period	In Appendix B
Potential distraction and glare impacts for traffic using Yanga Way	Section 4.6

Consultation with RMS was completed during preparation of the TIA. The key matters discussed related to the site new access intersection. RMS advised that if propose in the vicinity of Balranald Road, it should be located at least 100 m north or south of the existing local road intersection with Balranald Road. In order to meet RMS safety requirements for intersection design, the proposed site access intersection location has been proposed approximately 150 m south of the existing intersection of Yanga Way and Balranald Road (Figure 1.2). Detailed design of the new intersection design will be developed in consultation with RMS and is discussed in Chapter 4.



Location of the Limondale Sun Farm

Limondale Sun Farm
Traffic impact assessment
Figure 1.2

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2 Existing traffic conditions

2.1 Road network and transport routes

The site location has been selected to benefit from proximity to the existing electricity grid and the major road network in the locality. The major road network is suitable for the transport of project infrastructure and equipment to the site during construction, operations and decommissioning stages, and for the workforce to easily travel from the site during each stage of the project.

The three roads (transport routes) in NSW that would primarily be used by the project are shown on Figure 1.1. These routes are within Balranald LGA and the two adjoining LGAs of Hay and Murray River:

- Yanga Way (MR 694) (also known as the Balranald – Tooleybuc Road), a state funded main road, which connects between the Sturt Highway, 1 km south of Balranald and the Murray Valley Highway and Mallee Highway within Victoria, crossing the Murray River at the bridge at Tooleybuc (NSW).

- Sturt Highway, a major NSW state highway, which connects from the Balranald area to Buronga/Mildura and the Silver City Highway in the west and travels through Hay and several other major townships in the east to Wagga Wagga, where it connects to the Hume Highway.

- Stony Crossing Road, a local road, which connects from Yanga Way, near Kyalite, approximately 20 km south of the site, to Swan Hill in Victoria. This route would be used by project traffic which is travelling to and from the direction of Swan Hill.

Also in the vicinity of the site is Balranald Road, a major local road which connects Yanga Way to Moulamein, over a distance of approximately 60 km. It is generally an unsealed road. This route is not anticipated to be a major transport route for the proposed project traffic. However, the existing traffic usage for the route and its intersection with Yanga Way needs to be considered in the future intersection design for site access intersection to the project from Yanga Way near Balranald Road.

The speed limits on the relevant roads are generally 100 km/hr near the site. On the Sturt Highway however, the speed limit is generally 110 km/hr on the rural sections, with lower speed limits (50 km/hr on some sections) through the township of Balranald. The centre line of the road is always marked (except where the road has recently been resurfaced) and overtaking is generally permitted on sections of the road where the sight distance and road curvature meet the minimum safe requirements for overtaking.

Only the most important intersections on the local road network such as the intersection between the Sturt Highway and Yanga Way (1.5 km south of Balranald) have additional turning lanes. On Yanga Way, all the major local road intersections, including with Balranald Road in the vicinity of the site, are unimproved T-intersections with no additional turning lanes.

Due to the generally low prevailing daily traffic volumes using Yanga Way, the left and right turning traffic at intersections rarely conflicts with any northbound or southbound through traffic movements currently.

2.2 Site access

An existing access road is proposed to be used to access the site. This road has no regular daily traffic usage currently, with only occasional access required to the site for agricultural activities, and users of the travelling stock reserve through which it passes.

The existing access road is opposite the intersection of Yanga Way and Balranald Road (which provides access to Moulamein), an unimproved T-intersection with no additional left or right turning lanes. The Balranald Road approach is sealed for a distance of approximately 50 m from the intersection. The Yanga Way approach to the intersection, looking north towards Balranald is shown in Photograph 2.1.

The sight distances for traffic approaching the intersection along Yanga Way are very good, as the road is straight and level in both directions and drivers can clearly see for at least 500 m both north and south of the intersection.

The existing access road approach to the intersection on the western side is unsealed as shown in Photograph 2.2, which restricts the available turning width and the turning speed for large vehicles at the intersection.

Photograph 2.1 Visibility on Yanga Way at the Balranald Road intersection looking north

Photograph 2.2 Condition of the existing site access road at Balranald Road intersection

2.3 Traffic volumes and capacity standards

Baseline daily traffic volumes for the affected roads (project access routes) have primarily been determined from published RMS daily traffic surveys, for the years between 2006 and 2012. To establish a baseline year 2017 daily traffic volume, +1% annual (linear) traffic growth has been added to the year 2010 survey. Traffic volumes are presented in Table 2.1.

Table 2.1 Historic and projected daily vehicle volumes

Road	Historic daily traffic volumes			2017 projected daily traffic volume[3]	Average proportion of heavy vehicles
	2006	2010	2012		
Yanga Way[1]	575	559	568	596	29%
Sturt Highway, east of Yanga Way	999	1,050	1,031	1,083	45%
Stony Crossing Road, south east of the Yanga Way intersection towards Swan Hill	245	276[2]	-	295	22%

Notes: 1. At most locations between Stony Crossing Road and the Sturt Highway.

2. Based on doubling the surveyed volume in one direction only.

3. Assumes +1% annual (linear) traffic growth, which gives a growth factor x 1.05 the 2012 volumes.

At two other locations on the roads considered, additional daily traffic volume survey data is also available from a road pavement condition survey which was conducted on several major roads in the Balranald area (Aurecon 2014). These additional traffic volume surveys correspond to the following growth adjusted baseline year 2017 daily traffic volumes.

- Sturt Highway, west of Yanga Way – 1,520 daily vehicles; and
- Yanga Way, south of Stony Crossing Road – 396 daily vehicles.

Road width design standards for low volume (generally rural) roads are defined by the Austroads *Guide to Road Design* (Austroads 2010) and are based on daily traffic volumes. The current design standards applicable to the major roads are presented in Table 2.2.

Table 2.2 Daily traffic volumes and corresponding design standards

Daily traffic volume	Austroads (2010) design standard	Applicable roads	Meets design standard?
0–150	Single lane sealed, however unsealed dual lane is also generally acceptable, based on other historic standards (eg NAASRA 1984)	Balranald Road	Yes
150–500	Austroads requires a 6–7 m wide seal (7 m wide if more than 15% heavy vehicles)	Stony Crossing Road and Yanga Way (southern section) south of Stony Crossing Road	Yes
500–1,000	Austroads requires a 7–8 m wide seal	Yanga Way (northern section) north of Stony Crossing Road	Yes
1,000–3,000	Austroads requires a 9 m wide seal	Sturt Highway rural sections to the east and the west of Balranald	Yes

The roads surrounding the site each have acceptable road cross sections which meet the Austroads (2010) road design standard for the daily traffic volumes using each route. In most cases there is also a reasonable margin of spare traffic capacity to accommodate significant daily traffic increases, without requiring any increase to the design standard of the route.

2.4 Warrants for intersection improvements

Rural intersection operations are assessed from the combination of the peak hourly through and turning traffic volumes which are occurring at each intersection. This determines the need for additional intersection turning lanes for which the current Austroads design standards are shown in Appendix A.

The intersection peak hourly traffic volumes should comply with the relevant Austroads Warrant Charts for rural intersection design which are shown in Figure 2.1. There are separate design charts for roads with either 100 km/hr or higher design speeds or design speeds lower than 100 km/hr.

The design speed for intersections on Yanga Way in the locality of the proposed site access is 100 km/hr. For this design speed, additional left or right turn traffic lanes are not generally required, as long as the peak hourly traffic volume remains below approximately 120 vehicles per hour on the major road.

At locations where the peak hourly traffic volume on the major road is above 120 vehicles per hour, the hourly right or left turn traffic volumes can be up to 80 vehicles per hour (depending on the peak hourly major road traffic volume which is shown on the upper chart in Figure 2.1) before an additional left or right turn traffic lane is needed.

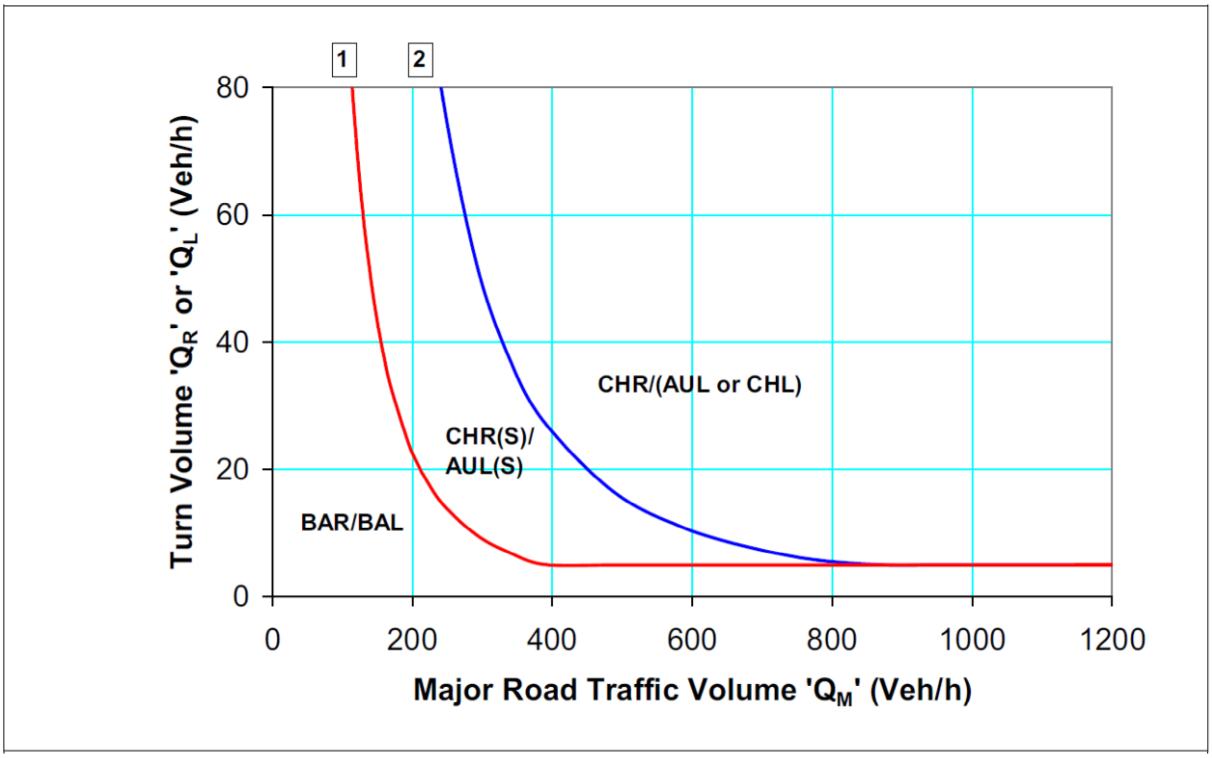
The current year 2017 baseline Yanga Way daily traffic volume (see Section 2.3) has been calculated to be 596 daily vehicles, which corresponds to approximately 60 vehicles per hour. Any intersections on Yanga Way, in the vicinity of the site are therefore acceptable without additional left or right turn traffic lanes, as the peak hourly traffic volume is significantly below 120 vehicles per hour.

A detailed assessment of the future effects of project-generated traffic at the site access and other relevant intersections, during the project construction and operations periods, is provided in Section 4.2.

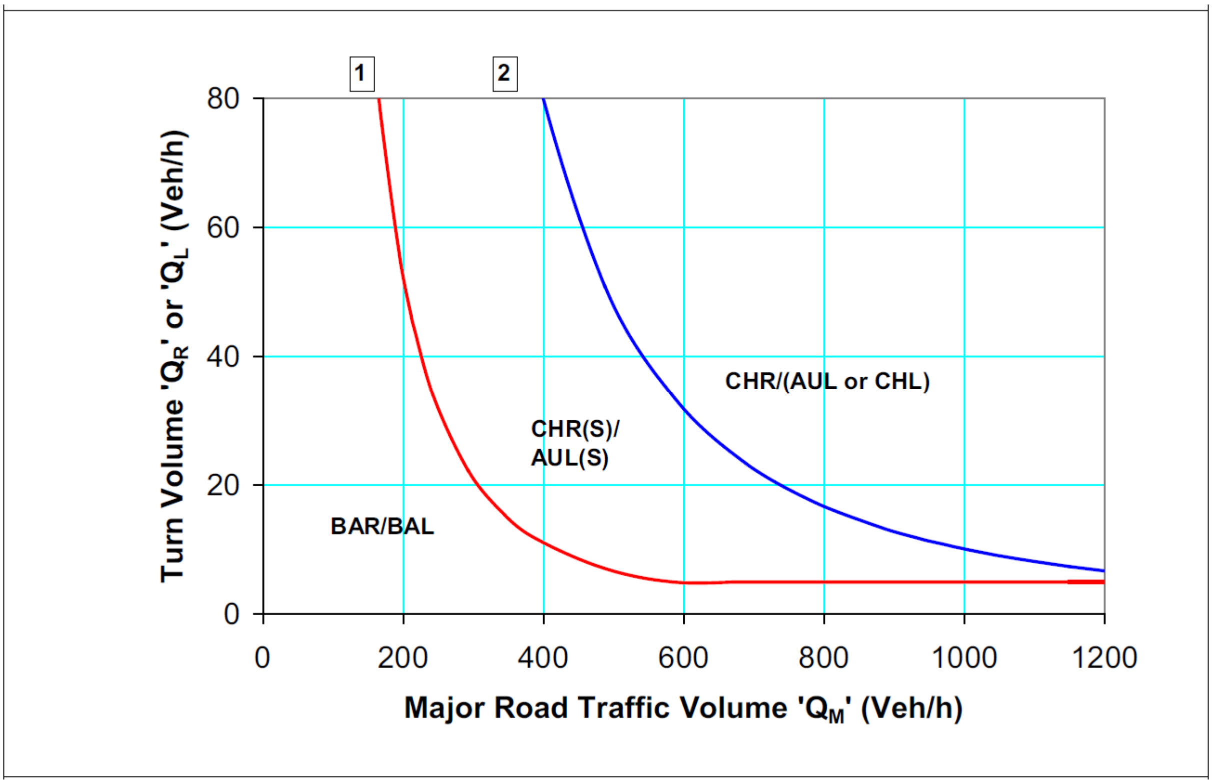
2.5 Public transport

Although a former railway lines passes relatively close to the site (the former railway line between Deniliquin and Balranald) the tracks have been lifted and the railway line is no longer operational.

There are no operating passenger rail services in the Balranald area. There are school bus services which operate between Balranald and rural areas to the south, via Yanga Way.



Warrant Chart for additional turn lanes for traffic volumes for design speeds 100 km/hr or greater.



Warrant Chart for additional turn lanes for traffic volumes for design speeds lower than 100 km/hr.

Figure 2.1 Austroads warrant design charts for rural intersection turn lanes

2.6 Traffic safety

Traffic safety conditions in the vicinity of the proposed site access on Yanga Way near the existing Balranald Road intersection are considered to be adequate, with excellent intersection visibility in both directions along the major road (Photographs 2.1).

The general traffic safety conditions on the Yanga Way route have been reviewed from the most recent five year accident history for the years 2011 to 2015 inclusive, from the Transport for NSW (TfNSW) interactive accident history database.

Within Balranald LGA there was only one recorded traffic accident on Yanga Way, approximately 20 km south of Balranald (approximately 5 km south of the proposed site access).

Within the former Wakool LGA there were a further three recorded traffic accidents on Yanga Way and two recorded traffic accidents on Stony Crossing Road, between Yanga Way and Swan Hill.

The total of four recorded traffic accidents on Yanga Way over a five year period, represents an acceptable safety record for the route, when considering the total route length which is over 50 km, between the Sturt Highway and Tooleybuc.

The majority of the road pavement along the route has been recently resurfaced and widened over the past five years, such that all the route length now has a sealed width of at least 7 m and the road centre line and edge lines are also marked along the entire route length.

Similarly the recorded accident history for the Stony Crossing Road route of two accidents in a five year period (which also has a total route length of over 50 km) is acceptable. This route has a correspondingly lower daily traffic volume which is approximately half that of most of the Yanga Way route.

Stony Crossing Road also has a relatively straight and level alignment over the majority of the route length, which provides good traffic safety conditions.

3 Traffic and parking demands for the proposal

3.1 Construction and other traffic generating activities

Construction of the project will take approximately 12–15 months from the commencement of site establishment works. Construction activities will be undertaken during the standard daytime construction hours of:

- 7am–6pm Monday to Friday; and
- 8am–1pm Saturday.

In general, no construction activities will occur on Sundays or public holidays. Exceptions to these hours may be required on limited occasions. The local council and surrounding landholders will be notified of any exceptions.

When operational, the project will produce electricity for contribution to the grid network. The PV solar panels will operate during daylight hours, seven days per week, 365 days per year. The operational lifespan of the project may be in the order of 30 years, depending on the nature of solar PV technology and energy markets. An operational workforce of between four and seven full-time equivalents (FTE) will be required for the project once construction had been completed. This workforce would undertake ongoing routine maintenance of the site and the associated project infrastructure.

The future decommissioning of the site, when it occurs, will require the removal of all above ground infrastructure from the site. This would entail reduced workforce requirements and daily traffic movements by both car and truck traffic as would previously have occurred during the project construction stage

3.2 Site access and circulation

Access to the site is proposed via a new intersection on Yanga Way, approximately 150 m south of the Yanga Way/Balranald Road intersection (Figure 3.1), and a short section of new access road will be required from the intersection to the existing access track. The new intersection and access road will involve:

- construction of a new portion of site access road from the intersection with proposed intersection with Yanga Way;
- asphalt surfacing for approximately 50 m of the site access road approach to Yanga Way; and
- an intersection design corresponding to Austroads type BAR/BAL intersection standard on both sides of Yanga Way on the approaches to and departures from the future intersection.

The above intersection requirements have been discussed with RMS and agreed in principle. RMS will be consulted further in relation to the detailed design requirements for the proposed site access intersection prior to construction.

All weather gravel surfaces will be provided for the internal site access roads which will have a minimum width of either 4 or 6 m and have appropriate passing places provided. The indicative locations of the internal access roads are illustrated in the detailed site layout plan.

During construction, a suitable number of parking spaces will be available within the temporary construction compound. The indicative locations of the parking spaces are also illustrated in the detailed site layout plan.

3.3 Traffic generation

The following generated daily traffic movements and corresponding vehicle types have been calculated for the average construction, peak construction and operations stage activities for the project (Table 3.1). Truck traffic movements will typically be semi-trailer type truckloads for all deliveries of plant and equipment to the site:

- Average construction – this period would typically be the site establishment stage and final commissioning. There will be on average 12 daily truck deliveries to the site and 90 light vehicle visits, corresponding to 204 daily traffic movements in total.
- Peak construction – this period would typically occur during the early and mid stages of construction including earthworks and delivery activities, there will be on average 22 daily truck deliveries to the site and 200 light vehicle visits, corresponding to 444 daily traffic movements in total.
- Typical operation – there will be an average three daily truck deliveries to the site and seven light vehicles, corresponding to 20 daily traffic movements in total.
- Decommissioning – this assumes that all above ground infrastructure will be removed from the site. This would entail reduced workforce requirements and daily traffic movements by both car and truck traffic as would previously have occurred during the project construction stage.

The site daily traffic volumes for the project are presented in Table 3.1, including the estimated peak hourly traffic volumes for each stage of the project.

Table 3.1 Additional daily and hourly traffic volumes generated by the project

Project phase	Average construction (daily traffic)	Average construction (peak hour traffic)	Peak construction (daily traffic)	Peak construction (peak hour traffic)	Project operations (daily traffic)	Project operations (peak hour traffic)
Workforce (car) traffic movements	180	45	400	100	14	4
Delivery (truck) traffic movements	24	4	44	6	6	2
Total site traffic movements	**204**	**49**	**444**	**106**	**20**	**6**

The daily traffic will be greatest during the peak construction stage, with approximately 444 daily vehicle trips, including up to 106 peak hourly vehicle movements (100 light vehicle trips and six truck trips) during both the morning and afternoon peak hourly traffic periods.

During the average stages of project construction there will be approximately 204 daily vehicle trips, including up to 49 peak hourly vehicles (45 staff vehicle trips and four truck trips) during the morning and afternoon peak hourly traffic periods.

During operation there will be much lower daily traffic movements, estimated as up to 20 daily vehicle trips, including up to six peak hourly vehicles (four light vehicle trips and two truck trips) during the morning and afternoon peak hourly traffic periods.

During project decommissioning, the project generated daily and peak hourly traffic movements have not been specifically calculated and assessed. It is anticipated that during project decommissioning, reduced workforce requirements and daily traffic movements as would previously have occurred during the project construction stage will be required.

3.4 Traffic distribution

The proposed transport routes for the project workforce (car) and heavy vehicle traffic (which is primarily construction deliveries are as follows:

For car traffic:

- 20% of the workforce will be based locally travelling to and from the Balranald area via Yanga Way north and the Sturt Highway (west);
- 20% of workforce will be based in the Hay LGA travelling via the Sturt Highway (east); and
- 60% of the workforce will be based in the Swan Hill area, travelling via Yanga Way (south) or Stony Crossing Road.

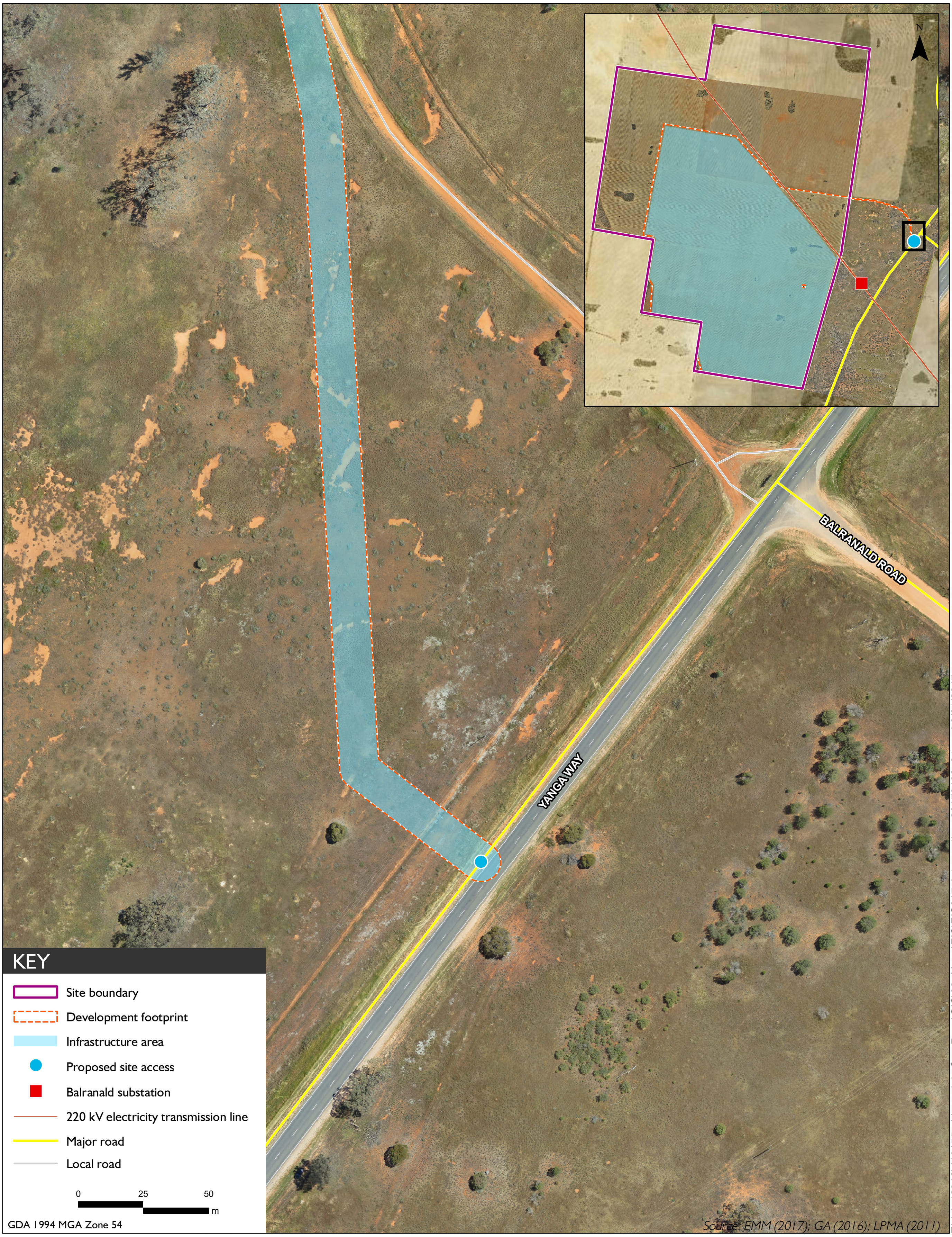
For truck traffic:

- 80% of truck deliveries will be travelling to and from the south from locations and equipment suppliers in Victoria travelling via Yanga Way (south) or Stony Crossing Road; and
- 20% of truck deliveries will be travelling to and from the north from locations and equipment suppliers in NSW from Balranald or via the Sturt Highway, east or west of Balranald.

Approximately 40% of the project generated car traffic will be travelling to and from the north via Yanga Way and 20% of the project generated truck traffic would also be travelling to and from this direction via Yanga Way and other routes such as the Sturt Highway, east or west of Balranald.

The major proportions of the project generated car and truck traffic (60% and 80% respectively) will be travelling to and from the south via Yanga Way or Stony Crossing Road. The project car traffic would mainly be travelling to and from the direction of Swan Hill, which is a major population centre in the region. Significant proportions of the project truck traffic would be travelling further, from the Melbourne area probably.

The daily traffic distributions for the proposed project car and truck traffic are shown on the map of proposed access routes (traffic distribution) in Figure 3.2.



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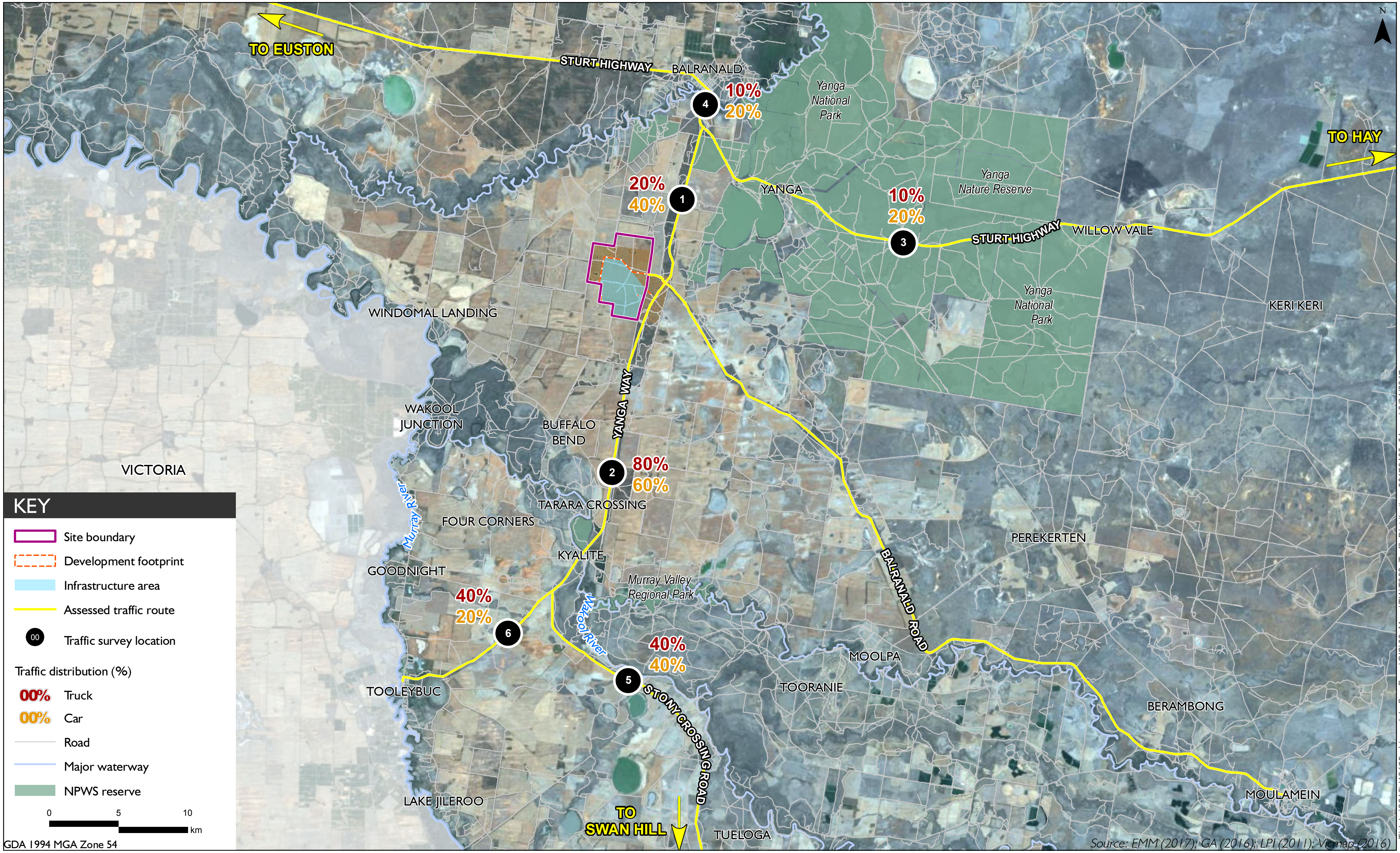
Proposed intersection location

Limondale Sun Farm
Traffic impact assessment
Figure 3.1



Traffic distribution

Limondale Sun Farm

Traffic impact assessment

Figure 3.2

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3.5 Car parking

Parking for the project construction and operations workforces will be provided on-site in gravel surfaced parking areas with appropriate dimensions to accommodate the number and size of vehicles.

3.6 Other transport

There is no formal proposal to use shuttle buses for any specific task of the project construction workforce transport arrangements.

However, ordinary full size buses, shuttle buses or mini vans could potentially be used at times to transport some components of the project construction workforce to and from the site at times of peak construction from areas of relatively high population concentration in the region such as Balranald or Swan Hill.

3.7 Other developments in the locality

Other significant proposed and approved projects in proximity to the site, and how they have been considered in this assessment are presented in Table 3.2.

Table 3.2 Other developments in the locality

Development	Consideration in this assessment
Sunraysia Solar Farm (SSD 7680) – Sunraysia Solar Farm Two Pty Ltd proposes to develop a commercial scale solar PV farm with a capacity of around 200 MW. The proposed solar farm will be on Lots 9, 10, 11 and 14 of DP 751179, adjacent to the southern boundary of the site, and covers an area of approximately 1,000 ha. The operation of the Sunraysia Solar Farm will require the construction of an overhead transmission line to connect the proposed solar farm to the Balranald Substation (NGH Environmental 2017). This connection infrastructure will traverse the TSR and will be adjacent to the project's eastern site boundary for a length of approximately 1.3 km. The EIS for the proposed Sunraysia Solar Farm was available on public exhibition from 4 February 2017 to 5 March 2017.	The Sunraysia Solar Farm is a proposed development. To enable consideration of cumulative impacts, it has been conservatively assumed that the construction period coincides with the construction of the project, and is assessed in Section 4.2. Traffic volumes from the Sunraysia Solar Farm EIS (NGH Environmental 2017) have been adopted.
Balranald Mineral Sands Mine (SSD 5285) – Iluka Resources Limited has approval to develop a mineral sands mine on two linear mineral sand deposits, known as the West Balranald and Nepean deposits, approximately 12 km and 66 km north-west of the township of Balranald, respectively. This development includes construction, mining, primary processing and rehabilitation. The mine has a potential life of up to 15 years. The Minister for Planning issued development consent on 5 April 2016.	The Balranald Mineral Sands Mine is approved, however it is understood that construction has not yet commenced. The construction period is predicted to take two and a half years (EMGA Mitchell McLennan 2015). It has been conservatively assumed that the construction period coincides with the construction of the project, and is assessed in Section 4.2. Traffic volumes from the Balranald Mineral Sands Project EIS (EMGA Mitchell McLennan 2015) have been adopted.

Table 3.2 Other developments in the locality

Development	Consideration in this assessment
goFARM Australia Pty Ltd (goFARM) expanded agricultural operation and temporary accommodation facility – goFARM is seeking development consent from Balranald Shire Council to expand its agricultural operation and develop a temporary accommodation camp on Lot 21 DP 751173, adjacent to the site's northern boundary. If approved, the camp would house up to 70 people who would be involved in the development of a large almond and pistachio crop. goFARM also intend to expand their current agricultural operations, which will include the development of a large almond and pistachio crop (approximately 7,000 ha).	No specific traffic volumes are available for consideration in this assessment.

4 Impact assessment

4.1 Traffic volumes on the road network

The existing daily traffic volumes (estimated baseline daily traffic volumes for the year 2017) for Yanga Way, the Sturt Highway and Stony Crossing Road and the existing adequacy of the road design standards for these routes is discussed in Section 2.3.

The effective current daily traffic capacities for the various roads considered, according the current Austroads (2010) *Guide to Road Design* (the road design standards) standards are:

- Sturt Highway rural sections 1,000–3,000 daily vehicles;
- Yanga Way 500–1,000 daily vehicles;
- Stony Crossing Road 150–500 daily vehicles; and
- Balranald Road, 0–150 daily vehicles.

The additional daily traffic volumes generated during the project average construction, peak construction and operations stages are summarised for the affected travel routes (Yanga Way, the Sturt Highway and Stony Crossing Road) are summarised in the following sections.

4.1.1 Average construction traffic

Table 4.1 summarises the project baseline traffic conditions within the local road network and the predicted future daily traffic during the average construction phase of the project.

Table 4.1 Future daily traffic assessment for project average construction traffic

Traffic generation route	Projected baseline daily traffic volume (year 2017)	Peak daily traffic from the project	Future total daily traffic	Percent traffic increase	Daily traffic volume design standard
Yanga Way north of the site	596	78	674	13%	500–1,000
Yanga Way south of the site	596	126	724	21%	
Sturt Highway, east of Yanga Way (towards Hay)	1,083	39	1,122	4%	1,000–3,000
Sturt Highway, west of Yanga Way (to Balranald)	1,520	39	1,559	3%	
Stony Crossing Road, east of Yanga Way (to Swan Hill)	295	81	376	27%	150–500
Yanga Way, south of Stony Crossing Road (to Tooleybuc)	396	45	441	11%	

The results in Table 4.1 show that the highest proportional daily traffic increases from the project will be on Stony Crossing Road, from Yanga Way towards Swan Hill, where there will be approximately +27% daily traffic increases compared to the calculated year 2017 baseline traffic conditions.

At the other assessed locations on Yanga Way, north and south of the site, and south of Stony Crossing Road (towards Tooleybuc), there will be more moderate +11% to +21% daily traffic increases. On the Sturt Highway, east and west of Yanga Way, in the directions of either Hay or Balranald, the predicted daily traffic increases will be much more marginal at between +4% to +3%.

Although, the project generated daily traffic increase on Stony Crossing Road is proportionally significant at +27%, the overall future daily traffic volume for the route would remain below the the road design standards value of 500 daily vehicles (Austroads 2010).

At the other assessed locations in Table 4.1, the project generated daily traffic increases will not generally be noticeable for the future traffic using the road and will have only minimal effects on the future traffic operations, level of service or traffic safety.

4.1.2 Peak construction traffic

Table 4.2 summarises the project baseline traffic conditions within the local road network and the predicted future daily traffic during the peak construction phase of the project.

Table 4.2 Future daily traffic assessment for project peak construction traffic

Traffic generation route	Projected baseline daily traffic volume (year 2017)	Peak daily traffic from the project	Future total daily traffic	Percent traffic increase	Daily traffic volume design standard
Yanga Way north of the site	596	168	764	28%	500–1,000
Yanga Way south of the site	596	276	872	46%	
Sturt Highway, east of Yanga Way (towards Hay)	1,083	84	1,167	8%	1,000–3,000
Sturt Highway, west of Yanga Way (to Balranald)	1,520	84	1,604	6%	
Stony Crossing Road, east of Yanga Way (to Swan Hill)	295	178	473	60%	150–500
Yanga Way, south of Stony Crossing Road (to Tooleybuc)	396	98	494	25%	

The results in Table 4.2 show that the highest proportional daily traffic increase from the project during the peak stage of project construction will be on Stony Crossing Road, between Yanga Way and Swan Hill, where there will be approximately +60% daily traffic increases compared to the calculated year 2017 baseline traffic conditions.

At the other assessed locations on Yanga Way, north and south of the site, and south of Stony Crossing Road (towards Tooleybuc), there will be more moderate +25% to +46% daily traffic increases. On the Sturt Highway, east and west of Yanga Way, in the directions of either Hay or Balranald, the predicted daily traffic increases will be much more marginal at between +8% to +6%.

Although, the project generated daily traffic increase on Stony Crossing Road is proportionally significant at +60%, the overall future daily traffic volume for the route would remain below the road design standards threshold value of 500 daily vehicles (Austroads 2010).

The anticipated duration of the peak stages of construction activity for the project would be relatively short (a maximum of 80 days) such that the duration of the predicted traffic impacts for Stony Crossing Road and the other project affected traffic routes should be acceptable to the other traffic which is using these routes and will have only minimal effects on the future traffic operations, level of service or traffic safety.

4.1.3 Operational traffic

Table 4.3 summarises the project baseline traffic conditions within the local road network and the predicted future daily traffic during the operational phase of the project.

Table 4.3 Future daily traffic assessment for project operations traffic

Traffic generation route	Projected baseline daily traffic volume (year 2017)	Peak daily traffic from the proposal	Future total daily traffic	Percent traffic increase	Daily traffic volume design standard
Yanga Way north of the site	596	8	604	1%	500–1,000
Yanga Way south of the site	596	12	608	2%	
Sturt Highway, east of Yanga Way (towards Hay)	1,083	4	1,087	0.4%	1,000–3,000
Sturt Highway, west of Yanga Way (to Balranald)	1,520	4	1,524	0.3%	
Stony Crossing Road, east of Yanga Way (to Swan Hill)	295	8	303	3%	150–500
Yanga Way, south of Stony Crossing Road (to Tooleybuc)	396	4	400	1%	

The results in Table 4.3 show on all the traffic routes considered, including Yanga Way, the Sturt Highway and Stony Crossing Road the project operations daily traffic increases will be marginal at between +0.3% to +3% at all locations.

These daily traffic increases will not be noticeable and will have no effects on the future traffic operations, level of service or traffic safety for the future traffic using these routes.

4.2 Future cumulative traffic impacts

The proposed Sunraysia Solar Farm is also on the western side of Yanga Way, immediately south of the project. The future combined (cumulative) traffic assessment has assumed construction of both projects could occur simultaneously. The assessment has estimated 100 daily vehicle construction traffic movements from the Sunraysia Solar Farm occurring concurrently with the average construction stage traffic movements (204 daily vehicle movements) from the Limondale Sun Farm.

Table 4.4 Future cumulative construction traffic assessment

Traffic generation route	Projected baseline daily traffic volume (year 2017)	Peak daily traffic from both projects			Future total daily traffic	Percent traffic increase
		Limondale Sun Farm	Sunraysia Solar Farm	Balranald Mineral Sands Mine		
Yanga Way north of the site	596	78	30	136	840	41%
Yanga Way south of the site	596	126	70	136	928	41%
Sturt Highway, east of Yanga Way (towards Hay)	1,083	39	15	18	1155	7%
Sturt Highway, west of Yanga Way (to Balranald)	1,520	39	15	154	1728	14%
Stony Crossing Road, east of Yanga Way (to Swan Hill)	295	81	45	-	376	43%
Yanga Way, south of Stony Crossing Road (to Tooleybuc)	396	45	25	-	466	18%

The results in Table 4.4 demonstrate that the daily traffic volume design standards would still be met for each of the traffic routes.

The highest proportional daily traffic increases from the combined construction stage traffic movements from the three projects (average construction traffic) will occur on Stony Crossing Road, between Yanga Way and Swan Hill, where there would potentially be +43% daily traffic increases compared to the calculated year 2017 baseline daily traffic volume.

At the other assessed locations on Yanga Way, north and south of the site, and south of Stony Crossing Road (towards Tooleybuc), there is a potential traffic increase of +18% to +41% with the combined construction stage traffic movements .

On the Sturt Highway, east and west of Yanga Way, in the directions of either Hay or Balranald, the predicted combined construction stage traffic movements (average construction traffic) will potentially generate daily traffic increases of between +7% to +14%.

At the assessed locations in Table 4.4, on roads other than the Sturt Highway, the proportional daily traffic increases will be noticeable and will have some effects on the future traffic operations for traffic using these routes if the combined construction activity for these projects is occurring concurrently. However, the assessment is considered to be conservative, and it is unlikely that construction of all three developments would occur simultaneously and for the full duration of the respective construction periods.

On Yanga Way, the existing road cross section has recently been improved (since 2011) with a new cross section total sealed width of between 7 to 8 metres which is appropriate for a daily traffic volumes of between 500-1,000 daily vehicle movements. This road cross section is therefore adequate to accommodate the future route daily traffic, including the potential combined daily construction traffic movements from the three projects using the route.

Similarly on Stony Crossing Road, the existing road cross section sealed width is approximately 7 metres which is appropriate for a daily traffic volume of between 150-500 daily vehicle movements. This road cross section is therefore adequate to accommodate future route daily traffic, including the potential combined daily construction traffic movements from the projects using the route.

4.3 Traffic impact at intersections

The future volumes of through traffic using the intersection on Yanga Way are not anticipated to increase significantly as a result of the project and will remain at approximately 60 hourly vehicle movements (two-way traffic) for the duration of the project construction work, which is a 12-15 month period approximately. The existing peak hourly traffic movement using the intersection from the Balranald Road direction are not known but are assumed to be 10 hourly vehicle movements (which corresponds to approximately 100 daily vehicle movements).

The potential need for additional turning lanes at the proposed site access intersection has been assessed by reference to the upper the road design standards intersection design warrant chart in Figure 2.1 and the Austroads intersection road design guide extracts, included as Appendix A.

From the forecast project peak hourly traffic volumes in Table 3.1, the corresponding maximum peak hourly turning traffic volumes which will be using the intersection during each stage of the project construction and operations activity are summarised for typical future morning and afternoon peak hour traffic periods in Table 4.5.

Table 4.5 Future forecast turning traffic volumes using the site access at Yanga Way

Stage	Peak hour	Hourly traffic entering the site		Hourly traffic leaving the site	
Site Activity	**Time of day**	**From the north**	**From the south**	**To the north**	**To the south**
Average construction	Morning peak hour	18	27	1	3
Average construction	Afternoon peak hour	1	3	18	27
Peak construction	Morning peak hour	40	60	2	4
Peak construction	Afternoon peak hour	2	4	40	60
Operations	Morning peak hour	2	2	1	1
Operations	Afternoon peak hour	1	1	2	2

From the summary of the future site access turning traffic volumes in Table 4.5, the combination of the future maximum site entry turning traffic volume from either the north of the south (60 hourly vehicles) when combined with the major road traffic flow using Yanga Way (which is also 60 hourly vehicles) the intersection would only require the minimum (Type BAR/BAL) intersection left or right turn safety treatments, according to the upper warrant chart, which is in Figure 2.1.

Similarly for the existing traffic which is using the Balranald Road route (travelling to or from the Moulamein direction), the combination of the maximum minor road turning traffic volume (10 hourly vehicles) when combined with the major road traffic flow using Yanga Way (60 hourly vehicles) would not require intersection left or right turning lanes.

The findings of this intersection traffic assessment, using the forecast major road and minor road traffic volumes for each leg of the intersection show, with reference to the warrant chart in Figure 2.1, that only the minimum (Type BAR/BAL) intersection left or right turn safety treatment is required at both the Yanga Way major road approaches to the two offset minor road T-intersections.

4.4 Site access road traffic impact

The predicted project daily traffic usage on the minor road (private access road) approach to the future Yanga Way site access intersection, which has minimal or zero daily traffic usage currently, will be approximately:

- 204 daily vehicle trips, during average construction activity;
- 444 daily vehicle trips, during peak construction activity; and
- a maximum of 20 daily vehicle trips during site operations.

For operation, a single lane width, unsealed rural road is acceptable.

However, in view of the higher forecast daily traffic volumes during the site construction period, sealing of the initial length of approximately 50 m of the site access road, with a minimum sealed width of 6.5 m, is proposed. This improvement would facilitate the turning trips by large vehicles to and from Yanga Way at the intersection and minimise the potential tracking of dirt and debris onto public roads by the site construction vehicles.

4.5 Traffic management

The proposed intersection treatments would be incorporated into a Construction Traffic Management Plan, which will utilise Austroads and RMS guidelines for the major road intersection operations and worksite traffic control throughout the project construction period.

Details of the road design standards (Austroads, 2010) for the additional intersection widening (type BAR/BAL) are included in Appendix A.

Temporary traffic control arrangements may be required at the site access intersection during the peak stages of construction traffic activity and on days when deliveries by oversize vehicles may be required. Generally during the construction period the largest vehicles which are anticipated to be visiting the site for construction deliveries on a regular basis will be 19 m long semi trailers.

The proponent would be required to lodge a Section 138 Certificate (Work on Public Lands) before any future road work for the proposed intersection improvement is carried out.

4.6 Driver distraction from glare

The potential impacts of reflectivity on motorists travelling along Yanga Way, are glint and glare. Glint refers to shorter period and more intense levels of exposure, while glare refers to sustained or continuous periods of exposure to excessive brightness, but at a reduced level of intensity (Morelli 2014). The amount of glint and glare produced by a PV solar panel is variable and is dependent on the angle of the panels, with lower angles producing less glint and glare (Morelli 2014).

The potential for glint and glare to cause a distraction to drivers travelling either northbound or southbound along Yanga Way, or westbound along Balranald Road, from the direction of Moulamein, was considered. Vegetative screening is not considered to be necessary, given the offset distances of over 500 m to the nearest solar panel infrastructure from vehicles travelling along Yanga Way, and the significant vegetative buffer screening which is already provided within the travelling stock reserve along the western side of Yanga Way (refer to Figure 1.2).

5 Summary and conclusions

The traffic impacts from the proposed Limondale Sun Farm have been assessed and the key findings are as follows:

- Access will be from Yanga Way via a new intersection approximately 150 m south of the existing intersection between Yanga Way and Balranald Road. There is an existing unsealed access road which provides access to the site currently, which would be partially sealed and upgraded to connect to the new intersection.

- The existing daily traffic volumes using Yanga Way, Stony Crossing Road and Sturt Highway between Balranald and Swan Hill have been determined with +1% annual traffic growth adjustments from the published RMS daily traffic volume surveys from2006-2012. The existing daily traffic volumes satisfy the relevant Austroads (2010) design standards.

- The available intersection sight distances of the proposed site access intersections with Yanga Way provide for very good traffic safety. The intersection has straight and level approaches on Yanga Way in both the northbound and the southbound directions and more than adequate for the road speed limit which is 100 km/hr.

- The requirements of the Austroads Warrant design charts for additional turning lanes at rural intersections indicate that additional intersection turning traffic lanes are not required. Type BAR/BAL right and left turn sealed shoulder widening is required for both the northbound and the southbound traffic approaches on Yanga Way.

- The predicted additional daily traffic usage for the assessed roads at the peak stage of project construction will be approximately 444 daily vehicle trips, reducing to approximately 204 daily vehicle trips during the earlier and later (average) stages of project construction and a maximum of 20 daily vehicle trips during operation.

- Additional traffic generated by the project (including cumulative impacts with other approved and proposed developments) will not cause the future daily traffic volumes on either the Sturt Highway, Yanga Way or Stony Crossing Road, to increase above the relevant design levels that would trigger road widening improvements.

- The internal site roads and car parking will be constructed to serve the project's construction access and car parking needs. Internal roads will generally be all weather gravel surfaced roads, either 4 m or 6 m wide. Car parking for the project construction and operations workforces will be provided in appropriate gravel surfaced car parking areas with appropriate dimensions to accommodate the required number of vehicles.

- A Construction Traffic Management Plan will be prepared in consultation with RMS and in accordance with RMS's, *Traffic Control at Worksites Manual* (RTA 2010).

References

Aurecon 2014, *Haulage Route Pavement Strength Review*.

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EMGA Mitchell McLennan Pty Ltd 2015, *Balranald Mineral Sands Project – Environmental Impact Statement*.

Morelli, C 2014, *Glint and Glare Assessment for the proposed Mynthurst Farm Solar Park Photovoltaic Array*. Report prepared by AARDVaRC Ltd for Mynthurst Farms Ltd.

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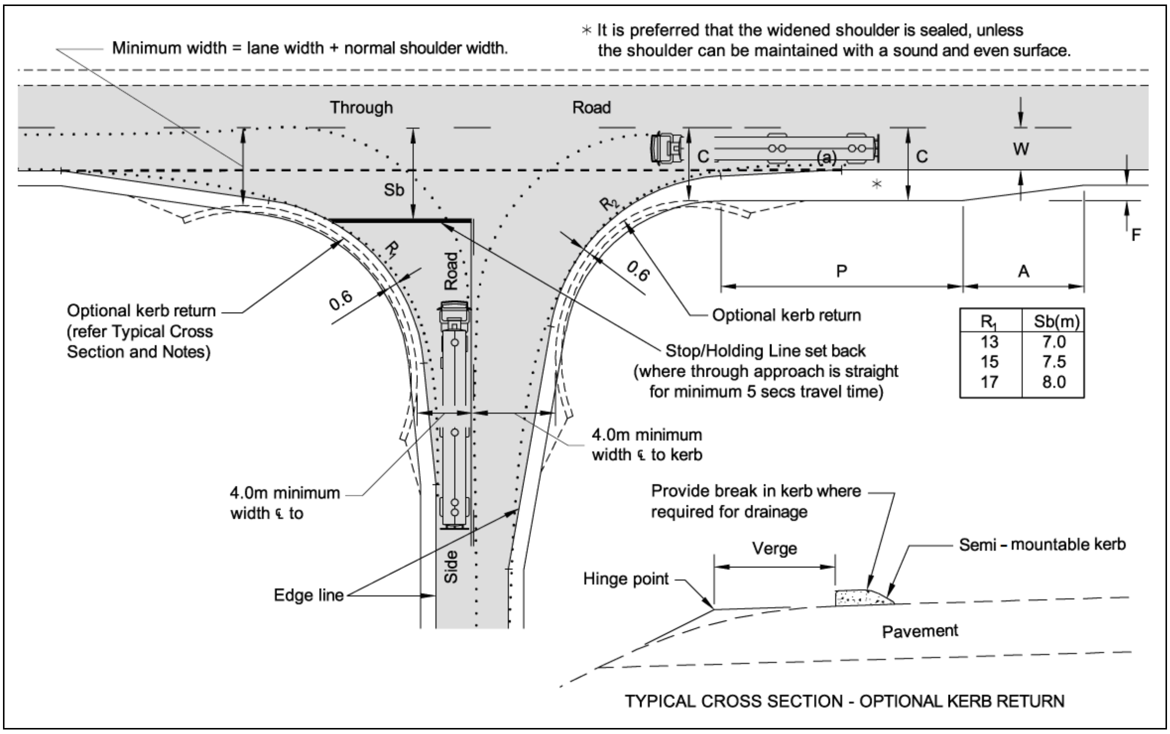
NSW Roads and Traffic Authority (RTA) 2002, *Guide to Traffic Generating Developments*.

2010, *Traffic Control at Worksites Manual,* version 4.

Appendix A

Design standards for intersection turning lanes



Notes:

1. R1 and R2 are determined by the swept path of the design vehicle.
2. The dimensions of the treatment are defined thus:

W = Nominal through lane width (m) (including widening for curves).

C = On straights – 6.0 m minimum.

On curves – 6.0 m plus curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle).

A = $\frac{0.5VF}{3.6}$

V = Design speed of major road approach (km/h).

F = Formation/carriageway widening (m).

P = Minimum length of parallel widened shoulder (Table 8.1).

Source: QDMR (2006).

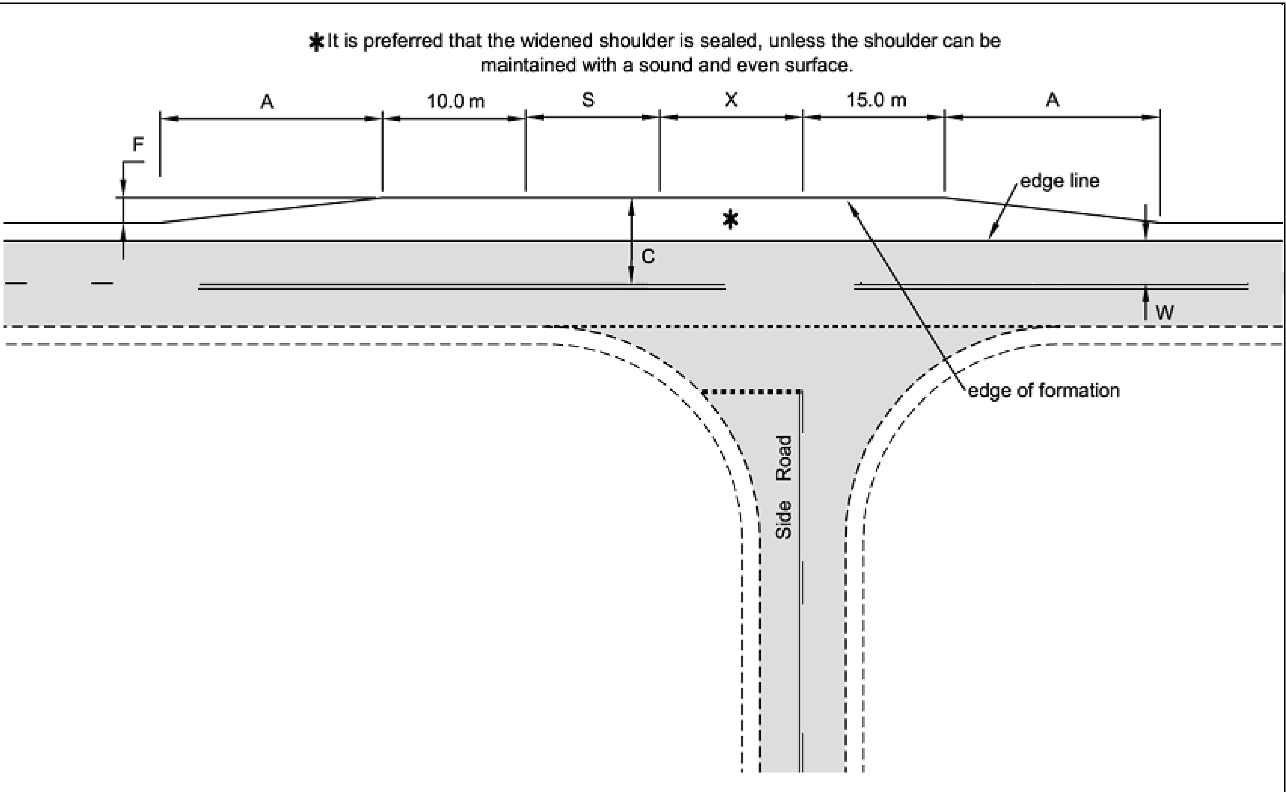
Figure 8.2: Rural basic left-turn treatment (BAL)

Table 8.1: Minimum length of widened parallel shoulder

Design speed of major road approach (km/h)	Minimum length of parallel widened shoulder P (m)
50	0
60	5
70	10
80	15
90	20
100	25
110	35
120	45

Note: Adjust the length for grade using the ‘correction to grade’ factor in Table 5.3

Source: QDMR (2006).



Notes:

1. This treatment applies to the right turn from a major road to a minor road.
2. The dimensions of the treatment are defined thus:

W = Nominal through lane width (m) (including widening for curves). Width to be continuous through the intersection.

C = On straights – 6.5 m minimum

7.0 m minimum for Type 1 & Type 2 road trains

On curves – widths as above + curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle).

A = $\frac{0.5VF}{3.6}$

Increase length A on tighter curves (e.g. those with a side friction demand greater than the maximum desirable). Where the design through vehicle is larger than or equal to a 19 m semi-trailer the minimum speed used to calculate A is 80 km/h.

V = Design speed of major road approach (km/h).

F = Formation/carriageway widening (m).

S = Storage length to cater for one design turning vehicle (m) (minimum length 12.5 m).

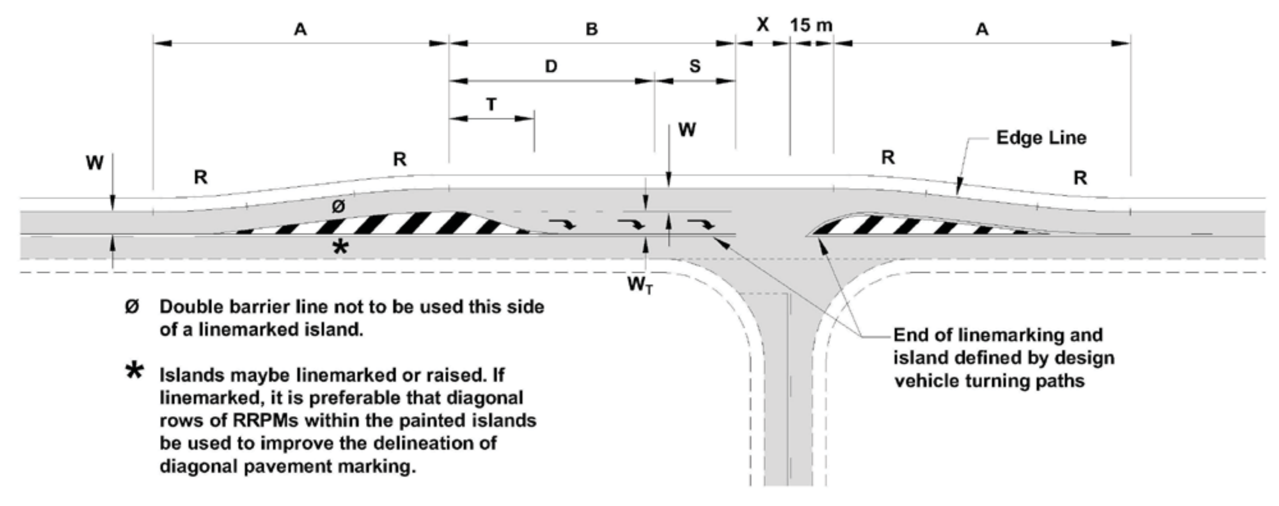
X = Distance based on design vehicle turning path, typically 10–15 m.

Source: QDMR (2006).

Figure 7.5: Basic right (BAR) turn treatment on a two-lane rural road

7.5.2 Rural Channelised T-junction – Short Lane Type CHR(S)

The CHR(S) turn treatment shown in Figure 7.6 is a more desirable treatment than the BAR treatment because it provides greater protection for vehicles waiting to turn right from the centre of the road. This treatment is suitable where there are low to moderate through and turning volumes. For higher volume sites, a full-length CHR turn treatment (Figure 7.7) is preferred.



Notes:

1. An alternative to the double white line on the offside edge of the right-turn slot is a 1.0 m painted median. The 1.0 m median is particularly useful when the major road is on a tight horizontal curve and oncoming vehicles track across the centreline. Provision of this median will require the dimension 'A' to be increased.
2. A raised concrete median on the minor road may be used with this treatment to minimise 'corner cutting', particularly for higher turning volumes.
3. The dimensions of the treatment are defined below and values of A, D, R and T are shown in Table 7.2:

W = Nominal through lane width (m) (including widening for curves). For a new intersection on an existing road, the width is to be in accordance with the current link strategy.

W_T = Nominal width of turn lane (m), including widening for curves based on the design turning vehicle. Desirable minimum = W, absolute minimum = 3.0 m.

B = Total length of auxiliary lane including taper, diverge/deceleration and storage (m).

D = Diverge/deceleration length including taper. Adjust for grade using the 'correction to grade' factor (Section 5)

T = Physical taper length (m) and is given by:

$$T = \frac{0.33VW_T}{3.6}$$

S = Storage length (m) should be the greater of:

1. the length of one design turning vehicle or

2. (calculated car spaces –1) x 8 m (*Guide to Traffic Management – Part 3: Traffic Studies and Analysis* (Austroads 2009h), or use computer program e.g. aaSIDRA).

V = Design speed of major road approach (km/h)

X = Distance based on design vehicle turning path, typically 10–15 m

Source: Based on QDMR (2006).

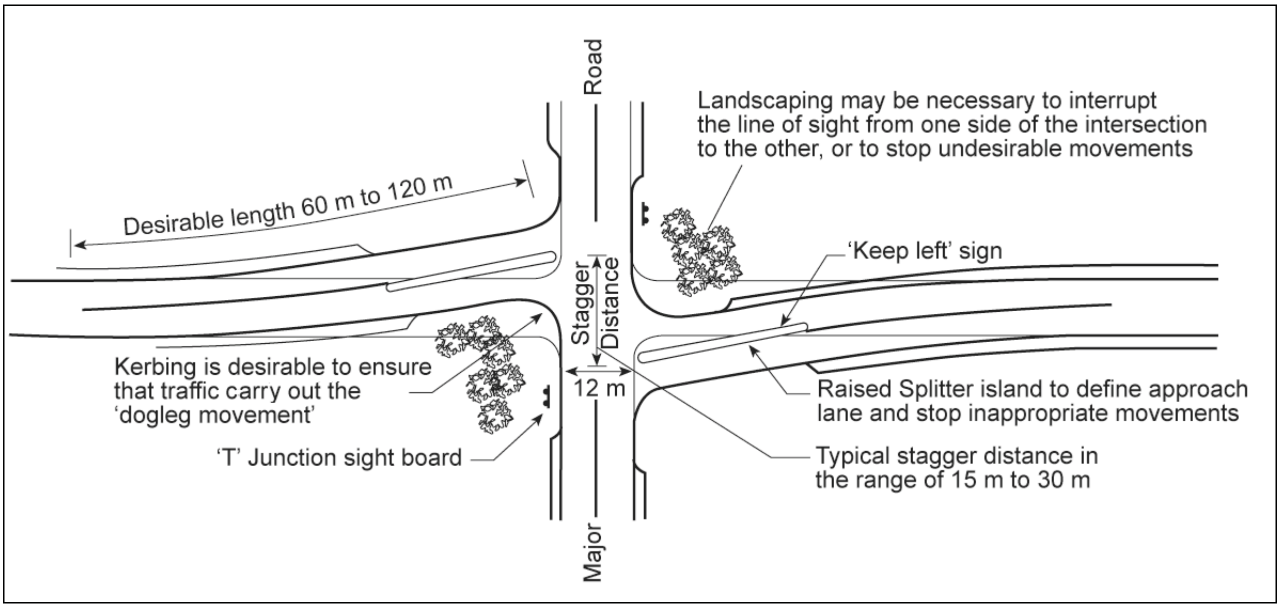
Figure 7.7: Channelised right turn (CHR) on a two-lane rural road

7.5.4 Rural Right-Left Staggered T

Basic two-lane two-way road

This layout should be designed to ensure that:

- the stagger distance between the minor legs is large enough to discourage drivers from 'taking a short-cut on the wrong side of the traffic islands (e.g. at least 15 m to 25 m depending on the site characteristics)
- the island treatments in the minor roads are long enough to also discourage wrong way movements
- sufficient width is provided on the major road within the intersection to enable through vehicles to pass slowly to the left of vehicles waiting to turn right (e.g. 12 m), a similar principle to the BAR treatment.



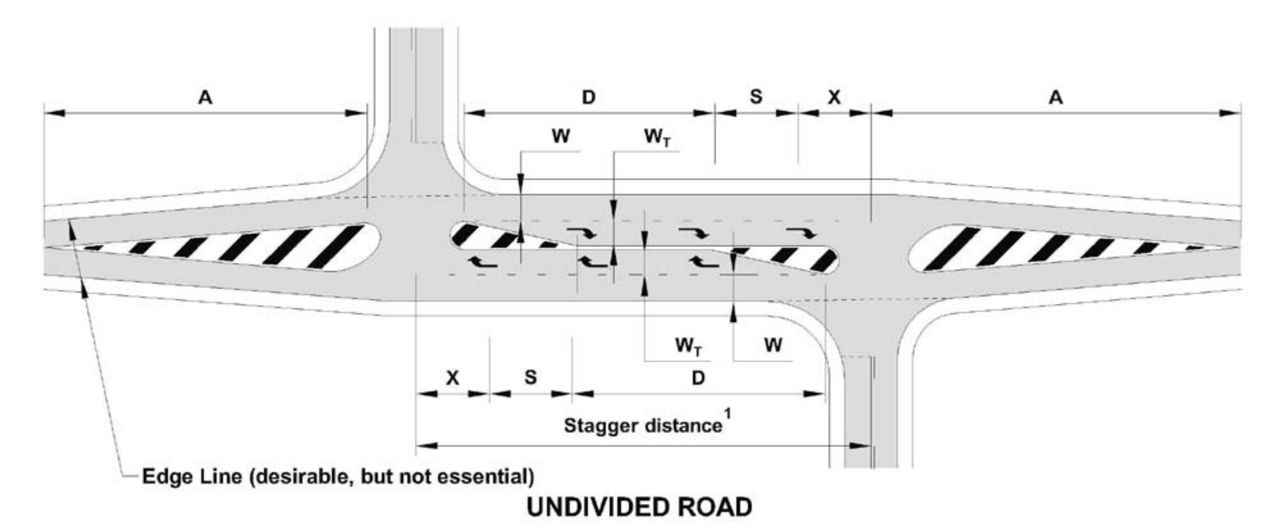
Source: Austroads (2005).

Figure 7.8: Right-left staggered T-intersection on a two-lane rural road (low turning volume)

7.5.5 Left-Right Staggered T

Overlapping right turns on a two-lane two-way road

Figure 7.9 shows a diagram of a left-right staggered intersection where the right-turning lanes on the major road overlap. This layout may be suitable in situations where two existing minor roads are located relatively close to each other, or where constraints exist on both ends of the treatment which prevent it extending further along the major road.



Notes:

1. The stagger distance must be sufficient to ensure that deceleration and storage length can be accommodated. This should also ensure that the through design vehicle from the minor roads can store clear of the major road through lane when positioned in the right-turn lane.
2. The dimensions of the treatment are defined thus:

W = Nominal through lane width (m) (including widening for curves).

W_T = Nominal width of turn lane (m) including widening for curves based on the design turning vehicle. Desirable minimum = W, absolute minimum = 3.0 m.

A = Design the through lane alignments in accordance with the *Guide to Road Design – Part 3: Geometric Design (Austroads 2009a).*

D = Diverge/deceleration length including taper Table 5.2. Adjust for grade using the 'correction to grade' factor in Table 5.3.

S = Storage length (m) is the greater of:

(a) the length of one design turning vehicle or

(b) (calculated car spaces –1) x 8 m (*Guide to Traffic Management – Part 3: Traffic Studies and Analysis,* Austroads 2009h, or use computer program e.g. aaSIDRA).

V = Design speed of major road approach (km/h).

X = Distance based on design vehicle turning path, typically 10–15 m.

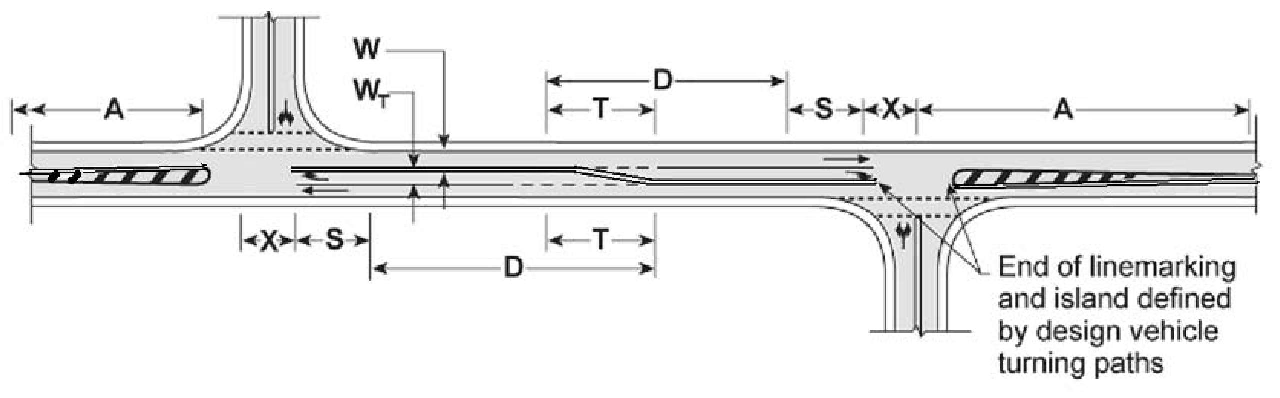
Source: Based on QDMR (2006).

Figure 7.9: Rural left-right staggered T with overlapping turns on a two-lane road

The treatment requires a relatively wide pavement area and large islands at each end to shelter turning vehicles from both directions. This means that the transitions at each end required to guide through traffic may be relatively long. The islands may be raised or painted.

Back-to-back right turns on a two-lane two-way road

This treatment is shown in Figure 7.10. It results in a relatively narrow layout which requires shorter transitions than the overlapping layout. However, it requires a large stagger between intersections (e.g. about 300 m for a 100 km/h operating speed) which is often impracticable due to land acquisition and other constraints.



Note: The dimensions of the treatment are defined thus:

W = Nominal through lane width (m) (including widening for curves).

W_T = Nominal width of turn lane (m), including widening for curves based on the design turning vehicle. Desirable minimum = W, absolute minimum = 3.0 m.

A = Design the through lane alignments in accordance with the *Guide to Road Design – Part 3: Geometric Design,* Austroads 2009a).

D = Diverge/deceleration length including taper (Table 5.2). Adjust for grade using the 'correction to grade' factor in Table 5.3.

T = Physical taper length (m) is given by:

$$T = \frac{0.33VW_T}{3.6}$$

S = Storage length (m) is the greater of:

1. the length of one design turning vehicle or

2. (calculated car spaces –1) x 8 m (*Guide to Traffic Management – Part 3: Traffic Studies and Analysis*, Austroads 2009h, or use computer program e.g. aaSIDRA).

V = Design speed of major road approach (km/h).

X = Distance based on design vehicle turning path, typically 10–15 m.

Figure 7.10: Rural left-right staggered T with back-to-back turns on a two-lane road

7.6 Rural Right-turn Treatments – Divided Roads

7.6.1 Two Staged Crossing on a Rural Road

The use of this treatment is discussed in Section 4.9.1 and illustrated in Figure 7.11. The width of the median should be sufficient to cater for the length of the turning design vehicle (denoted S in the figure). For the right turn from the major road, the median width should also cater for the calculated storage length. This is to provide drivers turning right from the minor road a clear view of approaching major road vehicles, although this may be difficult to achieve where a large heavy vehicle is used as the design vehicle. Turning paths are not to cross the centreline of the street being entered. The layout shown in Figure 7.11 may also be applicable in some urban situations.

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