Environmental Impact Statement
Glenellen Solar Farm

Appendix H: Traffic Assessment and Road Safety Audit

October 2020

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Traffic Impact Assessment

Glenellen Solar Farm

CWP Renewables

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Revision Record

No.	Author	Reviewed/Approved	Description	Date
1.	Paul Cai	Calum Hutcheson	Rev00	25.10.2018
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4.				
5.				

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1 Introduction

1.1 Background

TTM Consulting was engaged to undertake a traffic impact assessment for the proposed Glenellen Solar Farm located approximately 20km north of Albury, NSW. This report documents the findings of the traffic study for inclusion in an Environmental Impact Assessment to be lodged with the NSW Department of Planning and Environment.

1.2 Scope

This report investigates the transport aspects associated with the construction and operation of the site, particularly the access point and haulage route to the site from the Hume Highway. The scope of the transport aspects investigated include:

- Likely traffic generation and impacts.
- Access arrangements for staff and deliveries.
- Assessment of the implications and recommendation arising from a Road Safety Audit prepared independently of this report.
- Identification of any roads or intersections which need to be upgraded, in addition to mitigations for pavement impacts.
- Assessment of the outcomes of the Road Safety Audit.
- Traffic Impact Assessment.

A separate independent Road Safety Audit has been undertaken. The audit identifies issues which are assessed as part of this report.

To assess the proposed transport arrangements, the proposal has been assessed against the following guidelines and planning documents:

- RMS (RTA) Guide to Traffic Generating Developments Version 2.2 (2002).
- RMS (RTA) Delineation Guideline
- Austroads Guide to Road Safety: Part 6; Road Safety Audit Third Edition (2009).
- RMS (RTA) Traffic Control at Work Sites Version 5 (July 2018).

1.3 Site Location

The site is located approximately 20km north of Albury NSW. The site location is shown in Figure 1.1. Access to the site is via Ortlipp Road (see Figure 1-2). A TransGrid substation is located adjacent to the site on Ortlipp Road which will serve as the grid connection point.

Figure 1-1: Site location map view

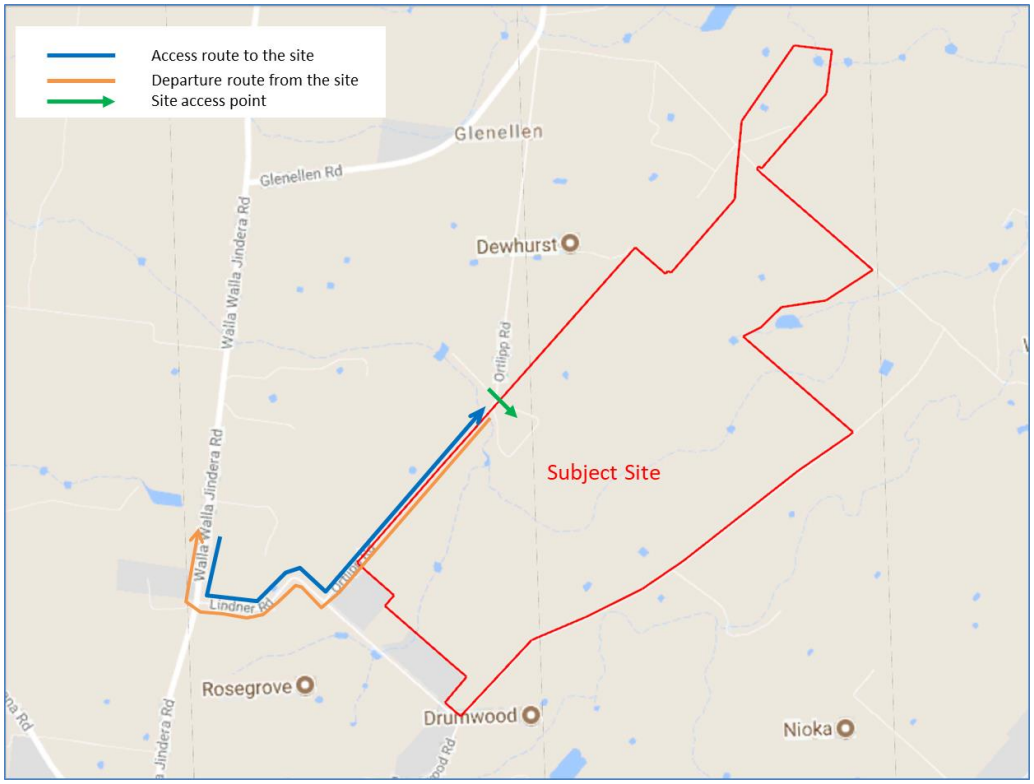


Figure 1-2: Site access point and proposed access route

2 The Proposal

2.1 Development Profile

The proposal is the development of a solar farm near Glenellen with an estimated capacity of approximately 150 MW. The proposal is located on land within the Greater Hume Local Government Area (LGA). The identified land is predominately used for grazing.

The proposed development will include the following:

- Installation of photovoltaic (PV) panels, steel racking and piled supports.
- Installation of battery based storage to dispatch the power generated by the panels.
- Installation of electrical transformers and inverters, electrical cabling, telecommunications equipment and security fencing.
- Construction of 4 metre wide formed gravel roads for permanent access infrequently distributed throughout the project.
- A project office consisting of a temporary building fitted out with necessary office, communication and messing facilities.

The solar panels would be fitted a single-axis tracking system which tracks the daily movement of the sun. Motorised linkages rotate the modules from the east in the morning to the west in the afternoon

2.2 Traffic Generation

2.2.1 Site Access

The Glenellen solar farm site will be accessed off Ortlipp Road, primarily from the western part of Lindner Road (see Figure 1-2).

Most construction trucks and staff vehicles will come via Hume Highway, Olympic Highway, Gerogery Gorad, Glenellen Road, Walla Walla Jindera Road, Lindner Road, and Ortlipp Road. Access through Drumwood Road and the eastern part of Lindner Road will not be utilised except for the case of emergency.

2.2.2 Construction Traffic

The Glenellen Solar Farm proposes to utilise around 5,000 heavy and light vehicles over a construction period of approximately 12 to 18 months. There will be up to 40 light vehicles and 13 buses daily for labour and staff transportation. Deliveries will depend on day to day operational requirements. The quantity of vehicles will decrease significantly at the completion of construction. Post construction will require service by a limited number of staff.

A breakdown of types and quantities of vehicles that will be utilised for the construction phase is presented in Table 2-1. The workers are expected to be local tradespeople plus workers sourced from elsewhere. The workers sourced from elsewhere will be housed nearby in Albury or surrounding towns and bused in and out.

Table 2-1:Types and quantities of vehicles during construction

Stage	Area of work	Typical delivery vehicle	Typical quantity	Duration (approximation)
Site Clearing Works	Earthworks construction machinery	Low loader	25	27 weeks
	Tree Removal	Low loader	6	27 weeks
Access Road Construction	Earthworks construction machinery	Low loader	21	20 weeks
	Access Track Road Base	32T Truck and Dog Moxy	20	20 weeks
Civil Construction of Benches	Construction equipment	Low loader	25	10 weeks
	Foundation Compound	32T Truck and Dog Moxy	15	10 weeks
Construction / Installation Activities	Site Fencing	Low loader Utes and trailer Concrete truck	20	20 weeks
	Site Offices	Low Loader Flatbed truck Hiab truck	20	4 weeks
	Concrete Foundations	Concrete truck Water cart Sand cart	30	Ad hoc
	Piling Works	Low loader	15	30 weeks
	Pre-drilling works	Low loader Utes and trailers	10	15 weeks
	Tracking System Installation	Low loader Tractors and trailers	20	40 weeks
	PV Module Installation	Low loader Tractors and trailers	20	40 weeks
	Onsite Logistics	Low loader Tractors and trailers Side loader	20	40 weeks
	Cable and Trenching	Low loader Utes and trailer Medium rigid vehicle Front end loader	20	35 weeks
	OHL Construction	Low loader Concrete truck Heavy rigid vehicle Hiab truck	20	25 weeks
Deliveries	Piling Machines	Low loader or side loader semi	7	2 weeks
	Main Equipment (Tracking, Piers, Modules, Inverters)	B-double	2000	6 months
	Gravel / Access Track Road Base	B-double	430	25 weeks
	Sand	B-double	350	35 weeks
	Mobile Crane	180T Mobile Crane	3	Ad hoc as needed
Waste Collection	Waste Collection	Waste collection truck	20	30 months (approximately 20 trucks weekly)
Workforce Requirements	Management	Light vehicles	30	Daily
	Labour Workers	20PAX buses	13	Daily
	Misc.	Light vehicles	10	Daily

Some of the construction activities may overlap. It is expected that of the scheduled days of operation there is a 5 percent leakage due to conditions such as bad weather or public holidays resulting in no movements on a particular day. This represents a worst-case scenario for traffic assessment purposes.

Based on the current proposed schedule, the average daily movements will include up to 45 trucks (see Figure 2-1). There is potential that the peak truck movements could be 60 to 100 vehicles on some major delivery days. This could also occur where the construction schedule is impeded due to weather or other causes of delay. This is not forecast to occur for extended periods.

The forecast truck movements shown in Figure 2-1 are an estimate only and assumes a construction period of 47 weeks where the trucks will be accessing the site. A longer construction period would result in lesser trucks per day.

Various types of trucks will visit the site. These consist of low loader trailers, truck and dog, B-double trucks, waste collection trucks, utes and trailers, etc.

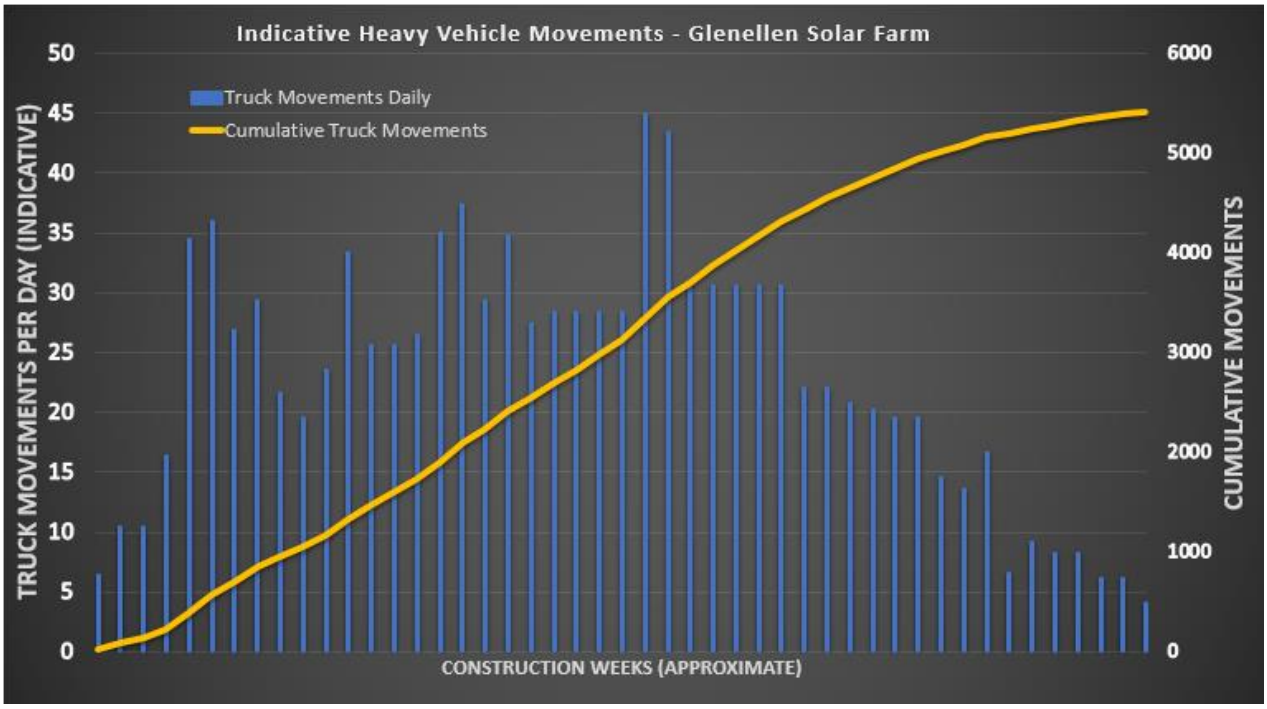


Figure 2-1: Indicative truck movements

A traffic management plan is proposed to be used for heavy vehicle deliveries to the site. The traffic management plan should include arrival of heavy vehicle deliveries through a proper schedule.

It is proposed that transportation of construction workers be encouraged to use bus services supplied by the applicant. Staff accessing the construction site by personal vehicle will be encouraged to adopt car-pooling. It is estimated two staff would ride per car. Overall traffic movements during construction will be approximately 40 light vehicles, 13 buses and up to 45 heavy vehicles daily.

2.2.3 Haulage Routes

The construction haulage route for the majority of the project infrastructure will be required from a container port to the site. It is not known at this stage whether that will be from Port of Melbourne or Port Kembla. This will be confirmed during the detailed design stage and procurement. Nevertheless, most of the site delivery traffic will be accessing the site via the Hume Highway. The proposed construction heavy vehicle movement plan is presented in Figure 2-2.

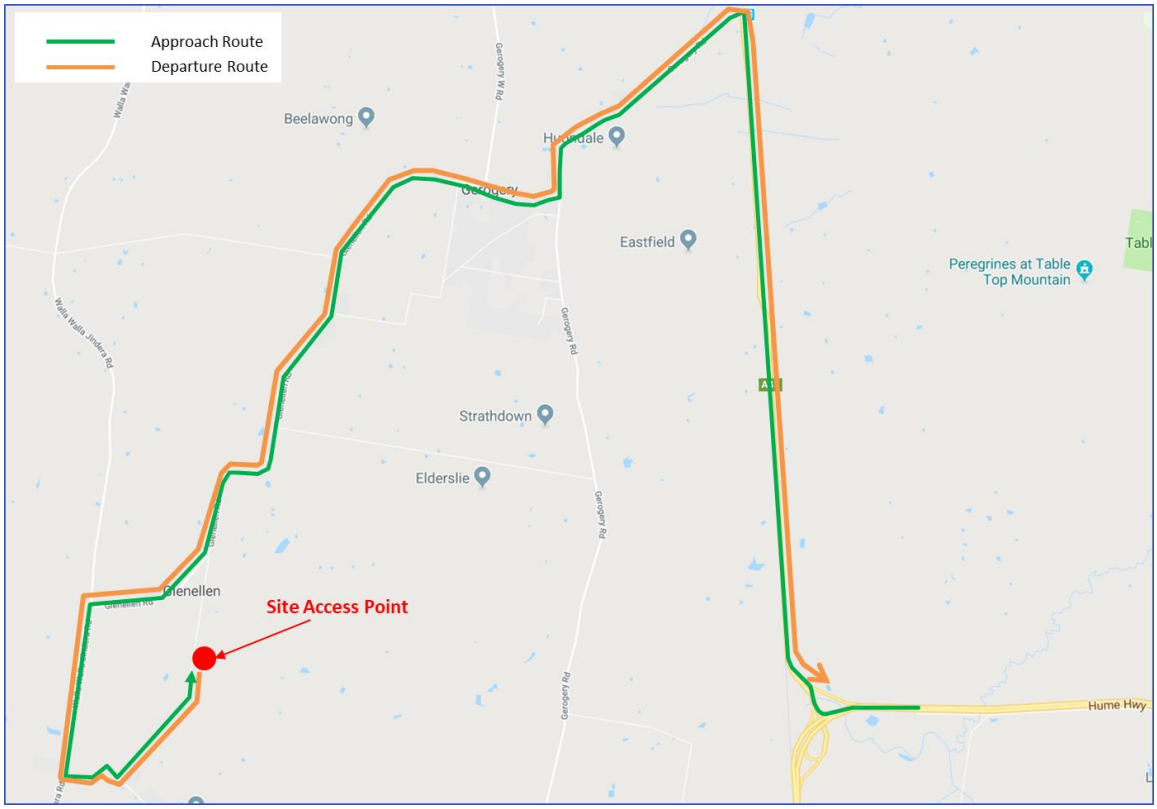


Figure 2-2: Proposed construction traffic haulage route

The proposed haulage route of construction vehicles accessing the solar farm site is:

- Existing Hume Highway onto Olympic Highway
- Turning left from Olympic Highway onto Main Street (Gerogery Road)
- Turning right from Gerogery Road onto Glenellen Road
- Turning left from Glenellen Road onto Walla Walla Jindera Road
- Turning left onto Lindner Road from Walla Walla Jindera Road
- Turning left from Lindner Road onto Ortlipp Road
- Turning right into the site from Ortlipp Road

The proposed exit route for construction vehicles from the solar farm is shown below:

- Exiting the site by turning left onto Ortlipp Road
- Turning right from Ortlipp Road onto Lindner Road
- Turning right from Lindner Road onto Walla Walla Jindera Road, then turn right onto Glenellen Road
- Turning left from Glenellen Road onto Gerogery Road, then turn right onto Olympic Highway
- Entering onto Hume Highway from Olympic Highway

Scheduling of construction vehicles would be required to minimise the occurrence of passing construction vehicles. This is due to the limited carriageway width of Ortlipp Road and Lindner Road. Construction and site managers are required to manage the vehicle movements to ensure that there is minimal conflict between inbound and outbound trucks.

Layby areas are also required on Lindner Road and Ortlipp Road. These will be used as a holding bay for either outbound or inbound vehicles when there is construction vehicle coming from other direction on the same road.

An alternative for a departure route is to utilise the northbound lane of Ortlipp Road, then turn right onto Glenellen Road. This will require an update for the intersection of Ortlipp Road and Glenellen Road.

There is another possible access route to the site from Hume Highway and Wagga Road, then onto Gerogery Road. Gerogery Road has a 15 tonne limit restriction for vehicles as shown in Figure 2-3. This route could be used for staff vehicles, buses, and small construction vehicles but not for large laden trucks.

Figure 2-3: Load limit restriction on Gerogery Road

The proposed construction traffic haulage route is approved for B-double trucks up to 26 metres in length as shown in NSW combined higher mass limits and restricted access vehicles map in Figure 2-4.

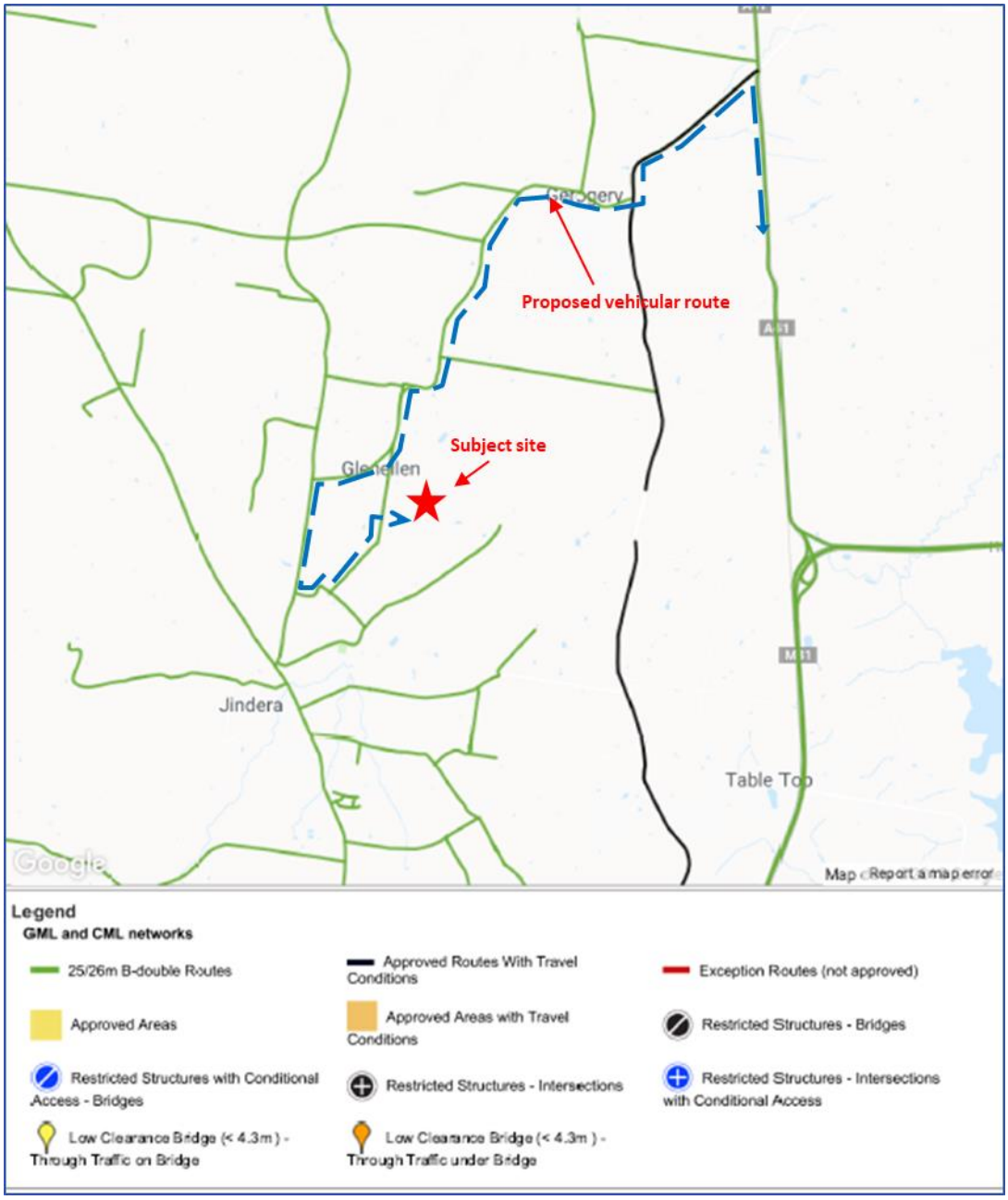


Figure 2-4: NSW combined higher mass limits and restricted access vehicles map[1]

[1] Source: Roads and Maritime Services (Link: http://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/restricted-access-vehicles-map/map/)

3 Existing Transport Infrastructure

3.1 The Road Network

The characteristics of roads in the immediate vicinity of the site are shown below in Table 3-1.

Table 3-1: Road Characteristics

Road	Speed Limit	Lanes	Road Authority
Hume Highway	110km/h	4 (Divided)	RMS
Olympic Highway	100 km/h	2 (Undivided, Asphalt Road)	RMS
Wagga Road	100 km/h	2 (Undivided, Asphalt Road)	Council
Gerogery Road	100 km/h	2 (Undivided, Asphalt Road)	Council
Glenellen Road	100 km/h	1 (Undivided, Asphalt Road)	Council
Walla Walla Jindera Road	100 km/h	2 (Undivided, Asphalt Road)	Council
Lindner Road	100 km/h	2 (Rural Gravel Road)	Council
Ortlip Road	100 km/h	2 (Rural Gravel Road)	Council

The posted speed limit on the Olympic Highway, Wagga Road and Gerogery Road is 100km/h. The other roads noted in Table 3-1 are not sign posted and therefore are assumed to have a rural speed limit of 100km/h.

The intersection between Hume Highway and Olympic Highway is a seagull intersection. The intersection is properly lane marked with acceleration and deceleration lanes in both directions.

The intersection of Olympic Highway and Main Street (Gerogery Road) is a T-intersection with Olympic Highway as the major road. The intersections of Gerogery Road & Glenellen Road, Glenellen Road & Walla Walla Jindera Road, Walla Walla Jindera Road & Lindner Road, Lindner Road & Ortlipp Road are priority controlled intersections.

3.2 Traffic Flows

3.2.1 Hume Highway

Traffic counts along the Hume Highway near Albury were obtained from the NSW Road & Maritime Services website. The traffic counts are shown in Table 3-2.

Table 3-2: Traffic volumes on Hume Highway

Road	Location	Station ID	2016 Daily Vol	2017 Daily Vol	2018 Daily Vol
Hume Highway	10km south east of the site	ALBSTC	11,455 (28.57%)	11,732 (30.06%)	12,107 (29.29%)
Heavy vehicle proportion shown in brackets					

The directional classification of traffic volumes from 2016 to 2018 is shown in Table 3-3.

Table 3-3: Directional traffic volumes on Hume Highway

Direction	2016	2017	2018
Northbound	5,745 (28.16%)	5,848 (29.77%)	6,006 (29.04%)
Southbound	5,710 (28.98%)	5,884 (30.35%)	6,101 (29.54%)
Heavy vehicles volume shown in brackets			

The daily traffic flows recorded on Hume Highway are well within the capacity of the existing road infrastructure leaving spare capacity to accommodate additional traffic. The percentage of heavy vehicle volume is about 30%.

3.2.2 Local Roads

The proposed route does not pass any town centre. The local roads are used by the residents to access their farms and houses. Traffic flows on the local roads are low. Flows on Lindner Road and Ortlipp Road are around ten vehicles per hour during the weekday. Flows on Glenellen Road onto Walla Walla Jindera Road are slightly higher. The flows on these roads varies depending on the local farming activities.

Overall, existing traffic flows on the local roads within the vicinity of the site are negligible in comparison to the Hume Highway.

3.3 Road Safety

Records of road traffic crashes within the vicinity of the subject site were obtained from the NSW Roads and Maritime Services. The extent of the crashes in the area are indicated in Figure 3-1.

There was only one crash reported at the Walla Walla Jindera Road – Glenellen Road intersection. The crash involved a driver veering off the road and hitting a barrier/guardrail. The crash was reported as a non-casualty crash.

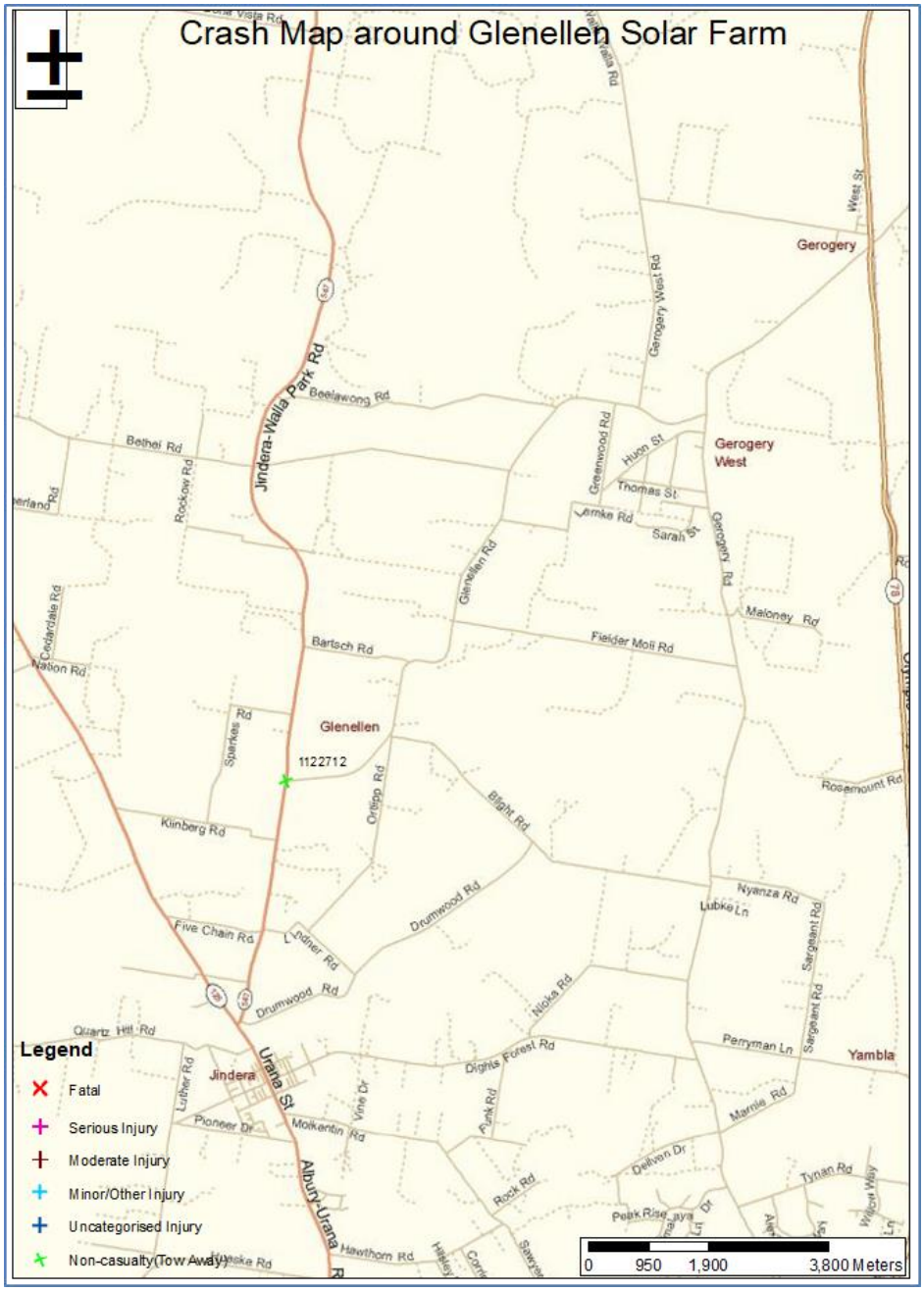


Figure 3-1: RMS 5 Year Crash Data (2013 to 2017)

3.4 Jindera Solar Farm

Another solar farm has been proposed by Jindera Solar Farm Pty Ltd in the Greater Hume Local Government Area (LGA), approximately 5.5 km north of Jindera in the suburb of Glenellen.

The proposal involves the construction of a ground mounted PV solar array with a total capacity of 130 MW.

The preliminary Environmental Assessment (dated August 2018) prepared by NGH Environmental states that the construction traffic could impact traffic along Urana Road, Walla Walla Jindera Road and Glenellen Road. The new Jindera Solar Farm site accesses would be constructed off Urana Road and Walla Walla Jindera Road, with proposed emergency and maintenance only access from Klinbergs Lane and Ortlipp Road.

The timeframe of this project is currently unknown. If the Jindera Solar Farm and Glenellen Solar Farm were being constructed at the same time, the potential cumulative traffic impacts would be on Glenellen Road and Walla Walla Jindera Road. This would only include a proportion of the Jindera Solar Farm traffic as the bulk of this site fronts Urana Road which would be used for access to and from the south.

4 Traffic Impacts

Traffic impacts relate to the effects of the traffic generated by the solar farm and conditions on roads and at intersections. Each is addressed below.

4.1 Traffic Flows

The proposed solar farm is forecast to generate up to 45 heavy vehicle movements in average during the construction period with 40 light vehicles and 13 buses daily. There is potential that the heavy vehicle movements could be 60 to 100 vehicles. The existing road network will not be significantly affected by the site.

4.2 Intersection Operation and Safety

The 'Road Safety Audit' has identified potential sight distance issues. The sight distance issues are addressed in section 5.1. The sight distances of the proposed intersections are sufficient.

These is only one crash reported at the Walla Walla Jindera Road – Glenellen Road intersection near the site. It involved a driver veering off the road to the left. No injury was reported. It occurred on a Sunday. This would not be related to potential future or past road crashes.

4.3 Construction and Operational Traffic Management

4.3.1 Construction Phase

Figure 2-2 show the proposed routes for heavy vehicles.

Construction traffic will enter the site via the Hume Highway, Olympic Highway, Main Street (Gerogery Road), Glenellen Road, Walla Walla Jindera Road, Lindner Road (western), Ortlipp Road (southern).

Construction traffic will exit the site through the same inbound route via Ortlipp Road (southern), Lindner Road (western), Walla Walla Jindera Road, Glenellen Road, Gerogery Road, Olympic Highway and Hume Highway.

Staff traffic will use the local road system to access the site. Roads used will depend on where the construction staff live during the working week

Recommendations and controls have been provided in the Road Safety Audit. The traffic assessment of these issues is contained in Chapter 5.

4.3.2 Operational Phase

For the operational phase, traffic will enter and exit the site via Ortlipp Road. Large trucks will use the same routes specified above.

Due to extremely low traffic flows and good visibility at the surrounding intersections, no specific management controls are considered necessary during operational phase.

5 Road Safety Audit

The separate independent Existing Stage Road Safety Audit was completed in accordance with the requirements of Austroads' Guide to Road Safety: Part 6; Road Safety Audit Third Edition (2009).

The audit identifies issues to review as part of the assessment of the proposed development. It is based on a site visit conducted during the day. It is not a guarantee of safety and does not necessarily differentiate between issues associated with the proposed development and issues that are part of daily traffic conditions in the area. Nevertheless, it provides an independent and unbiased platform from which issues can be assessed.

Issues identified in the Road Safety Audit are given a priority ranking based on the following criteria:

- Priority A (High Risk) – Highest priority for action from a safety view point.
- Priority B (Medium Risk) – Action needs to be taken from safety view point.
- Priority C (Low Risk) – Action is desirable from a safety view point.
- Priority D (Comment) – An observation which may improve overall performance or safety. It could be of wider significance and possibly outside the scope of the Road Safety Audit but may be where action should be considered.

The priority ranking is based on the subjective assessment of the audit team. The following sections discuss each of the issues and how they should be addressed. The recommendations below take into consideration the contribution of the proposed development to the safety issue. They are not necessarily the recommendations of the Road Safety audit itself.

5.1 Road Safety Audit Report

The following items addressed in the road safety audit report have been addressed in terms of the actions required to mitigate these issues.

5.1.1 Item 1

Truck crossing signs (W5-22) for truck crossing or entering are recommended to be installed throughout the intersections along the route during the construction period (see Figure 5-1 to Figure 5-6).

A new speed limit of 60 km/hr is recommended for consideration by Council on Glenellen Road, Lindner Road and Ortlipp Road to minimise the potential conflict for passing traffic during the construction period. The speed limit restriction would be removed after the construction of the solar farm is completed.

This does not prevent Council from retaining the existing speed limits.

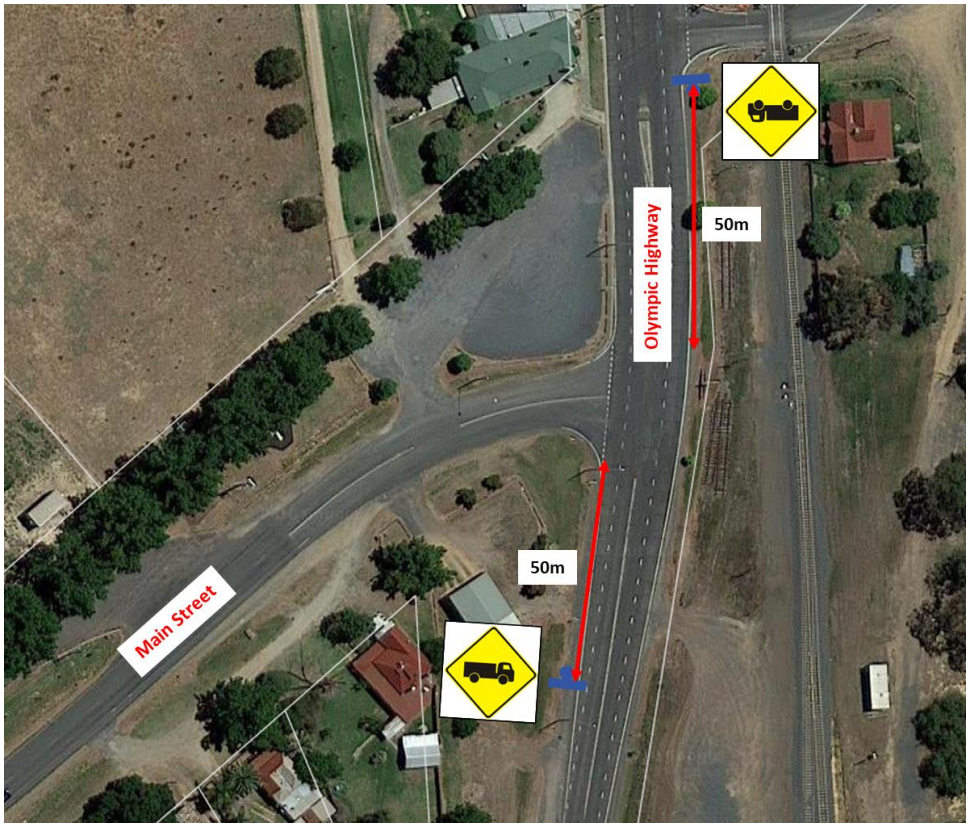


Figure 5-1: Truck crossing signs at the intersection of Olympic Highway and Main Street

Figure 5-2: Truck crossing signs at the intersection of Gerogery Road and Glenellen Road

Figure 5-3: Truck crossing signs at the intersection of Glenellen Road and Ortlipp Road

Figure 5-4: Truck crossing signs at the intersection of Glenellen Road and Walla Walla Jindera Road

Figure 5-5: Truck crossing signs at the intersection of Walla Walla Jindera Road and Lindner Road

Figure 5-6: Truck crossing signs at the intersection of Lindner Road and Ortlipp Road

5.1.2 Item 2

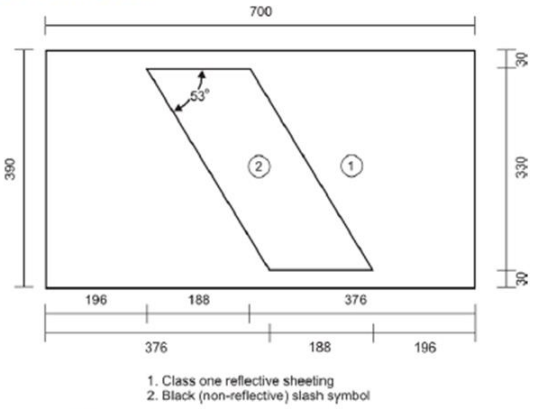
A guardrail is recommended to be installed at the intersection of Gerogery Road and Glenellen Road (see Figure 5-7). The design guidance can be referred to AUSTROADS Guide to Road Design - Part 6 Roadside Design, Safety and Barriers. The delineator is recommended to be installed at the ends of the guardrail.

Figure 5-7: Recommended guardrail at the intersection of Gerogery Road and Glenellen Road

A design from RMS guidelines for delineators is provided below[2].

16.4.1.3 Steel rail safety barrier buffered end terminal and impact head delineation

Safety barrier terminals on high-speed rural highways may require delineation of buffered end terminals and/or impact heads. A delineator comprising of reflective sheeting, containing a black diagonal slash (non reflective) on a yellow background (class 1), may be used to delineate these ends. See Figure 16.7.



1. Class one reflective sheeting
2. Black (non-reflective) slash symbol

Figure 16.7: Bull Nose delineation (all dimension in mm)

[2] from page 16-13 of NSW RTA Delineation Guidelines Section 16 Guide posts and delineation of safety barriers (Version 1.0 Feb 10)

5.1.3 Item 3

It is our advice that this issue should be reviewed and addressed by Council. Delineators are recommended to be installed at the ends of the guardrails.

5.1.4 Item 4

W-beam guardrails with delineators could be installed on both sides of the culvert on Glenellen Road near the intersection of Glenellen Road and Ortlipp Road. This would assist in preventing vehicles falling into the culvert should the drivers leave the main carriageway. Council has addressed the potential run off of vehicles by installing guide posts on the sides of the road. It will be up to Council to determine if any further measures are required.

5.1.5 Item 5

It is proposed that construction vehicles will approach the site from Lindner Road through the southern end of Ortlipp Road and exit the site on the same route.

Temporary speed limits during construction period are being proposed on Glenellen Road, Lindner Road and Ortlipp Road.

Scheduling of inbound and outbound vehicles are being recommended to avoid the passing construction vehicle on Ortlipp Road and Lindner Road.

Layby areas are also recommended to be provided on Ortlipp Road and Lindner Road.

5.1.6 Item 6

Truck crossing signs are recommended near the intersection of Walla Walla Jindera Road and Lindner Road (see Figure 5-5).

5.1.7 Item 7

A maintenance plan is recommended to maintain the road conditions to a level suitable for the proposed access and for all vehicle types. A dilapidation survey should be conducted periodically to review the condition of the road.

5.1.8 Item 8

Speed limits on Lindner Road are recommended to be restricted to 80 km/hr during the construction period (subject to Council approval). Frangible hazard marker posts are recommended to be installed along the bends.

5.1.9 Item 9

The access point off Ortlipp Road will need to be upgraded to accommodate the heavy vehicles. Improved surface pavement / grading and drainage, with periodical maintenance is recommended.

6 NSW Department of Planning and Environment and NSW RMS Requirements

Roads and Maritime Services has requested the following information to be addresses in Environmental Assessment (EA) in their letter to NSW Department of Planning & Environment dated 31st August 2018.

- *The traffic related issues relevant to the development should be considered and addressed in 2 distinct stages as follows:*
  - *Construction & Decommission phase – the transport of materials and equipment/components for the establishment of the facility and ancillary infrastructure, the movement and parking of construction related vehicles, including personal vehicles, during the construction of the facility,*
  - *Operational phase – the ongoing traffic generation due to the operation, maintenance and servicing of the various elements of the project.*
- *A Transport Management Plan for the construction activity should also be prepared for the proposed development. This is referred to in the submitted Preliminary Environmental Assessment Report. Details for deliveries of ancillary materials such as gravel and concrete should also be considered as part of the submitted documentation.*
- *A traffic impact assessment (TIA) is required. The TIA shall detail the potential impacts associated with the phases of the development, the measures to be implemented to maintain the standard and safety of the road network, and procedures to monitor and ensure compliance. Where road safety concerns are identified at a specific location along the haulage route/s, the TIA may be supported by a targeted Road Safety Audit undertaken by suitably qualified persons.*
- *Further to the above it is understood that a development proposal for the Jindera solar farm project (SSD 9549) is being prepared for a nearby site. The potential for both projects being constructed at the same time needs to be considered. Therefore, unless it is guaranteed that the construction of these 2 projects will not coincide the cumulative traffic impacts of the simultaneous construction of both projects needs to be addressed as part of the TIA.*
- *The TIA should contain information such as the expected traffic generation, vehicle numbers and types of vehicles, and travel routes for vehicles accessing the development site.*

The following requirements are addressed in this report.

Table 6-1: NSW Planning and RMS Requirements

RMS Requirements	
Requirements	**Response**
the transport of materials and equipment/components for the establishment of the facility and ancillary infrastructure, the movement and parking of construction related vehicles, including personal vehicles, during the construction of the facility for the construction & decommission phase	This requirement is addressed in Sections 2.2.2 and 2.2.3 Overall traffic movements during construction will be approximately 40 light vehicles, 13 buses and 45 heavy vehicles daily.
the ongoing traffic generation due to the operation, maintenance and servicing of the various elements of the project for the operational phase.	For the operational phase, traffic will enter and exit the site via Ortlipp Road from Hume Highway. Traffic will then distribute along internal routes. Up to 10 vehicle movements expected during operational phase which will have negligible impacts.
Transport Management Plan	Refer to Section 4.3
Road Safety Audit	A separate independent Existing Stage Road Safety Audit was prepared and reviewed in accordance with the requirements of Austroads' Guide to Road Safety: Part 6; Road Safety Audit Third Edition (2009). Issues that stated out in the Road Safety Audit report are addressed in Section 5.1.
a cumulative impact assessment of traffic from nearby developments;	Refer to Section 3.4
the TIA should contain information such as the expected traffic generation, vehicle numbers and types of vehicles, and travel routes for vehicles accessing the development site	This requirement is addressed in Sections 2.2.2 and 2.2.3. The access point to the site will be off Ortlipp Road.

7 Summary and Conclusions

This report has examined the traffic and transport implications associated with the construction and operation of the proposed Glenellen Solar Farm located approximately 20km north of Albury NSW.

Traffic generation associated with the development during the construction and operational phases will be low. There are no adverse impacts in relation to traffic flows.

A separate Road Safety Audit has identified areas where road improvements could be made.

The following roadworks are recommended for consideration for the construction phase:

1. Installation of a guardrail at the intersection of Gerogery Road and Glenellen Road (on the left turn lane from Gerogery Road to Glenellen Road).
2. Consideration of the installation of W-beam guardrails with delineators at both sides of the culvert on Glenellen Road near the intersection of Glenellen Road and Ortlipp Road.
3. Installation of frangible hazard marker posts along the bends on Lindner Road.
4. Upgrade of the site access point off Ortlipp Road.

The requirements of Planning NSW and the NSW Roads and Maritime Services in relation to traffic and transport have been addressed in this report.

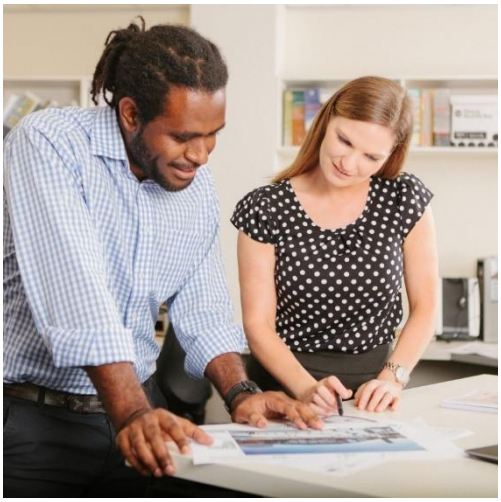
It is concluded that subject to the recommended roadworks being implemented there are no traffic issues which would prevent the proposal from proceeding.

Appendix A Road Safety Audit

Traffic Engineering

Glenellen Solar Farm, Glenellen NSW

Road Safety Audit



About TTM

For 30 years, we've been at the centre of the Australian development and infrastructure industry. Our unique combination of acoustics, data, traffic and waste services is fundamental to the success of any architectural or development project.

We have over 50 staff, with an unrivalled depth of experience. Our industry knowledge, technical expertise and commercial insight allow us to deliver an exceptional and reliable service.

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Accoustics Data Traffic Waste

Revision Record

No.	Author	Reviewed/Approved	Description	Date
1.	Baqir Husain/ R V Jones	R. V Jones	Road Safety Audit Report	26/10/18
2.	Baqir Husain/ R V Jones	R. V Jones	Road Safety Audit Report	07/11/18
3.				
4.				
5.				

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1 Introduction

1.1 Background

TTM Consulting was engaged by Ecological Australia to undertake a Road Safety Audit for the proposed Glenellen Solar Farm. The solar farm is located 20 kilometre north of Albury in southern NSW. The solar farm will have an estimated maximum capacity of approximately 150 MW.

This Road Safety Audit has considered the following intersections near the proposed solar farm site.

- Wagga Road / Gerogery Road intersection
- Gerogery Road / Glenellen Road intersection
- Glenellen Road / Ortlipp Road intersection
- Ortlipp Road / Linder Road intersection
- Walla Walla Jindera Road / Linder Road intersection
- Walla Walla Jindera Road / Glenellen Road intersection
- Olympic Highway / Main Street (Gerogery Road) intersection
- The proposed / existing site access points for the solar farm, which are accessed from Ortlipp Road

This report identifies possible safety issues, and these are noted by the audit team using a combination of onsite investigations and a review of background material. Recommendations for potential remedial treatments are made in response to each safety issue that is raised as part of this audit process.

1.2 Site Location

The location of the proposed solar farm is 20 kilometre north of Albury, NSW. Albury is a small city which sits on the border of New South Wales and Victoria. The location of the solar farm in terms of nearby areas is shown in Figure 1.1. The location of the solar farm in terms of surrounding roads is shown in Figure 1.2. Figure 1.3 show the roads in the immediate vicinity of the site.

Figure 1.1 Solar farm location with surrounding areas

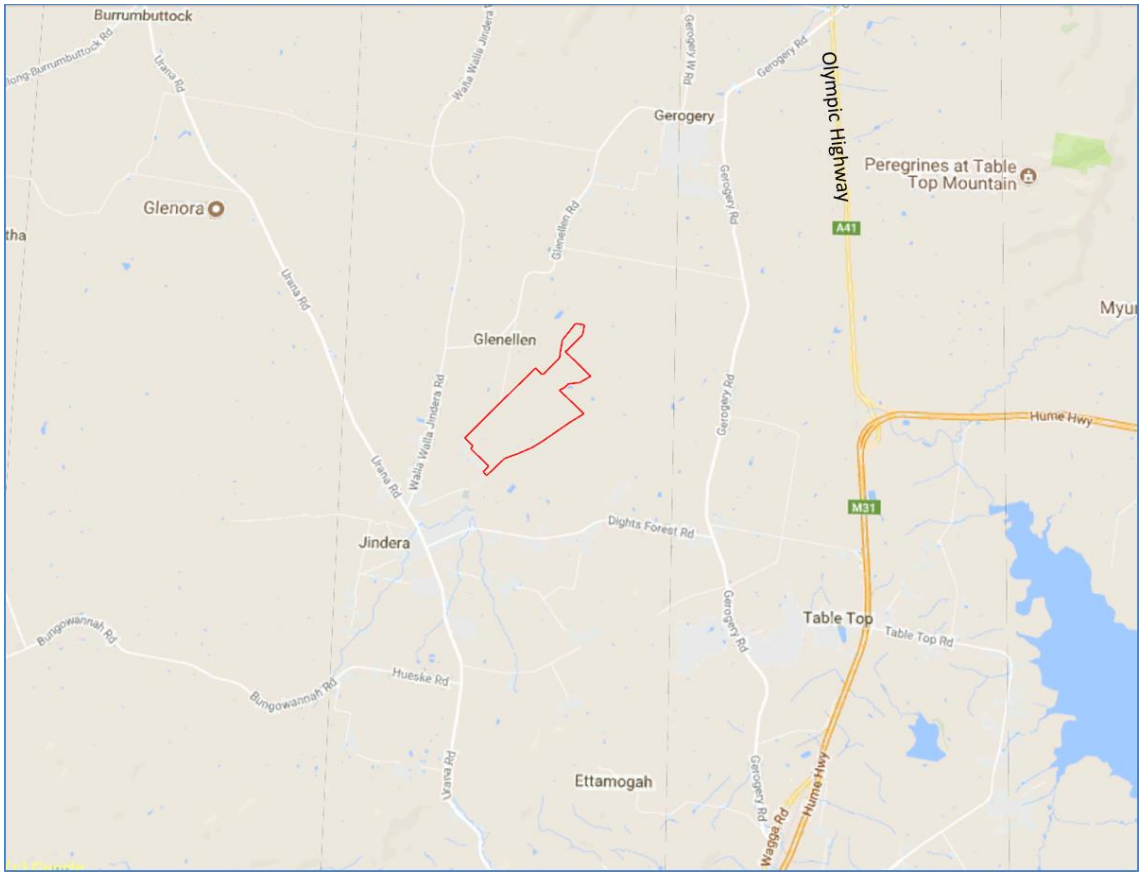


Figure 1.2 Solar farm location with surrounding roads

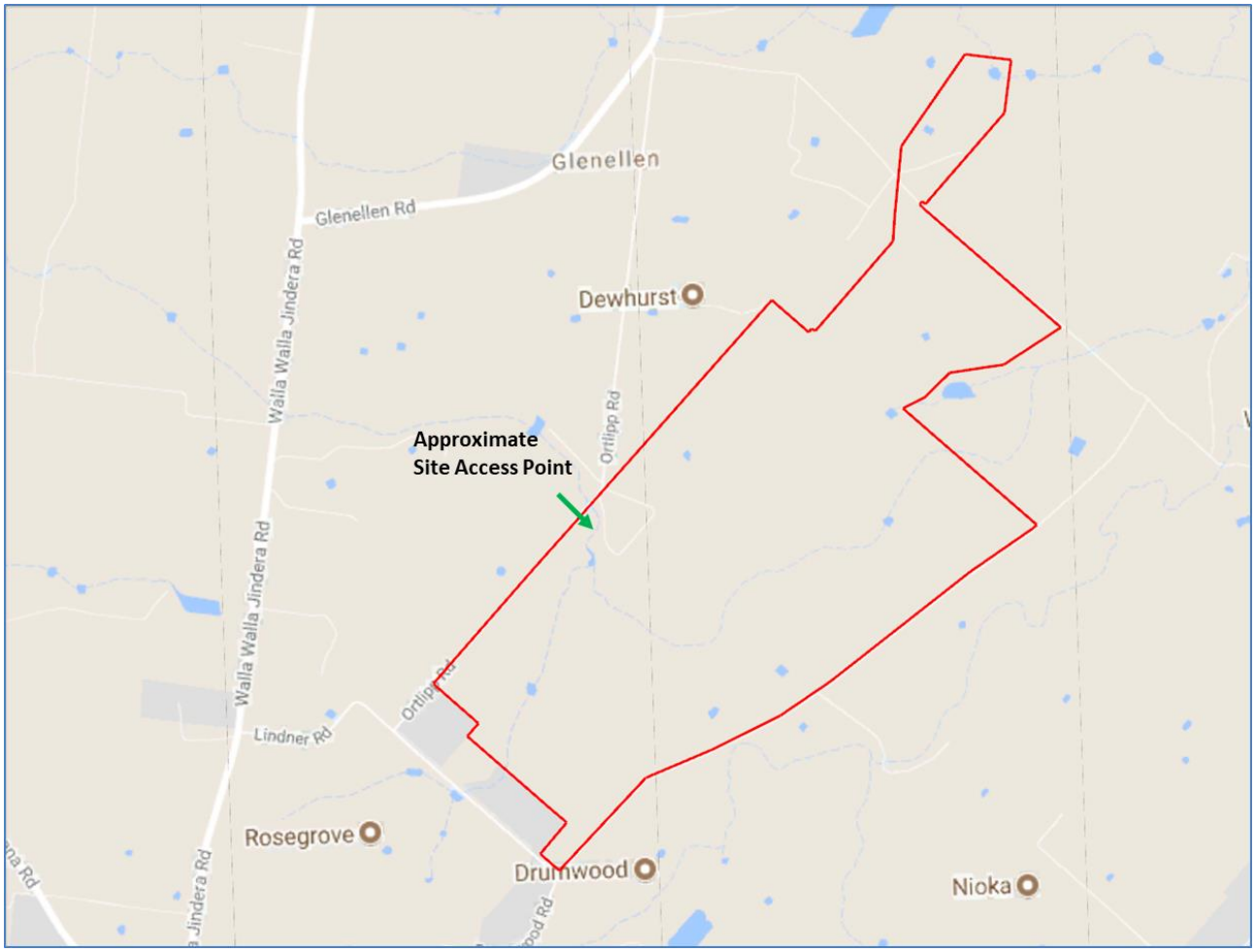


Figure 1.3 Solar farm location with roads in the immediate vicinity

1.3 Audit Stage

This report results from an Existing Stage Road Safety Audit, which has been undertaken in accordance with the requirements of Austroads' Guide to Road Safety: Part 6; Road Safety Audit Third Edition (2009). The audit report generally follows the format and topics outlined in the Austroads Checklist 6 for Existing stage audits.

This audit covers only the study area and has sought to identify potential safety hazards. However, the auditors would like to point out that no guarantee is made that every deficiency or hazard has been identified. Further, if all recommendations in this report were to be followed, this would not guarantee that the study area is 'safe'; rather, adoption of the recommendations should improve the level of safety at this location.

1.4 Audit Team

The persons undertaking in this road safety audit are;

- Richard V Jones – Senior Road Safety Auditor (Team Leader); TTM Consulting Pty Ltd
- Baqir Husain –Road Safety Auditor, TTM Consulting Pty Ltd

1.5 Site Inspection

A site inspection of the audit area was conducted on Wednesday 12th September 2018. The inspection was conducted in the day to assess the conditions noted in Austroads. The weather condition during the inspection was sunny with clear skies. The inspection was carried out on foot and by car.

1.6 Proposed Solar Farm

The proposed Glenellen Solar Farm (SSF) development is an approximately 150 MW utility scale electricity generation works comprised of solar photovoltaic (PV) modules, steel racking and piled supports, electrical transformers and inverters, battery storage, electrical cabling, telecommunications equipment, security fencing, a site office, maintenance building and car park facilities.

The proposal is located on land within the Greater Hume Local Government Area (LGA) 4km north east of Jindera, and 20km north of Albury in southern NSW. Access to the site is via the western part of Lindner Road, leading to Ortlipp Road on the north western side. A TransGrid substation is located adjacent to the site on Ortlipp Road, which will serve as the grid connection point. The identified land is currently used for grazing by landholders included in the project.

2 Existing Road Environment

2.1 Road Network

The Road Safety Audit was carried out in the area that covers the following roads and their classification:

Table 2-1: Road Classifications

Road	Speed Limit	Lanes	Classification	Management
Olympic Highway	100 km/h	2 (Undivided, Asphalt Road, 7-8m wide)	State	RMS
Wagga Road	100 km/h	2 (Undivided, Asphalt Road, 7-8m wide)	Regional	RMS/ Greater Hume Shire Council
Gerogery Road	100 km/h	2 (Undivided, Asphalt Road, 7-8m wide)	Rural	Greater Hume Shire Council
Glenellen Road	100 km/h	1 (Undivided, Asphalt Road, 5-7m wide)	Rural	Greater Hume Shire Council
Walla Walla Jindera Road	100 km/h	2 (Undivided, Asphalt Road,7.5m wide)	Regional	RMS/ Greater Hume Shire Council
Linder Road	100 km/h	1 (Undivided, Gravel Road, 5-6m wide)	Rural	Greater Hume Shire Council
Ortlipp Road	100 km/h	1 (Undivided, Gravel Road 5-6m wide)	Rural	Greater Hume Shire Council

The posted speed limit on the Olympic Highway, Wagga Road and Gerogery Road is 100km/h. The other roads noted in Table 2-1 are not sign posted and therefore are assumed to have a rural speed limit of 100km/h.

2.2 Traffic Counts

Traffic counts for 2018 were obtained from the RMS Traffic Volume Viewer website, which provided the following information. (Table 2-2)

Table 2-2 : Traffic Volumes on Hume Highway

Road	Location	Station ID	Daily Northbound Vol	Daily Southbound Vol
Hume Highway	4 km north of Wagga Road	ALBSTC	6,006 (29.04%)	6,101 (29.54%)

The closest station was on Hume Highway, 4km north of the Wagga Road / Hume Highway merge point. The heavy vehicle volume is close to 30%.

2.3 Construction Traffic

The Glenellen Solar Farm proposes to utilise around 5,000 heavy vehicles over a construction period of approximately 12 to 18 months. There will be on average up to 45 construction vehicles visiting the site daily. There is a potential for up to 60 to 100 heavy vehicles per day during the peak of construction when

delivery and waste collection occur at the same time. The construction traffic will consist of low loader trailers, truck and dog, B double trucks, utes, trailers and waste collection trucks. There will be up to 40 light vehicles and 13 buses daily for labour and staff transportation.

During the road safety audit site visit it was observed that the route from Wagga Road to Gerogery Road has 15 tonne limit for vehicles as shown in Figure 2.1. The route is shown in NSW combined higher mass limits and restricted access vehicles map Figure 2.3. The route is shown with a black line as approved route with travel conditions.

Figure 2.1 Load limit on Gerogery Road

Due to the travel conditions mentioned above, it is assumed that the solar farm construction traffic haulage route may be accessed via the following locations.

- Olympic Highway/ Main Street (Gerogery Road) intersection
- Gerogery Road/Glenellen Road intersection
- Glenellen Road/Ortlipp Road intersection
- Glenellen Road/Walla Walla Jindera Road intersection
- Walla Walla Jindera Road/Lindner Road intersection
- Lindner Road/Ortlipp Road intersection

The expected construction traffic haulage route is shown in Figure 2.2.

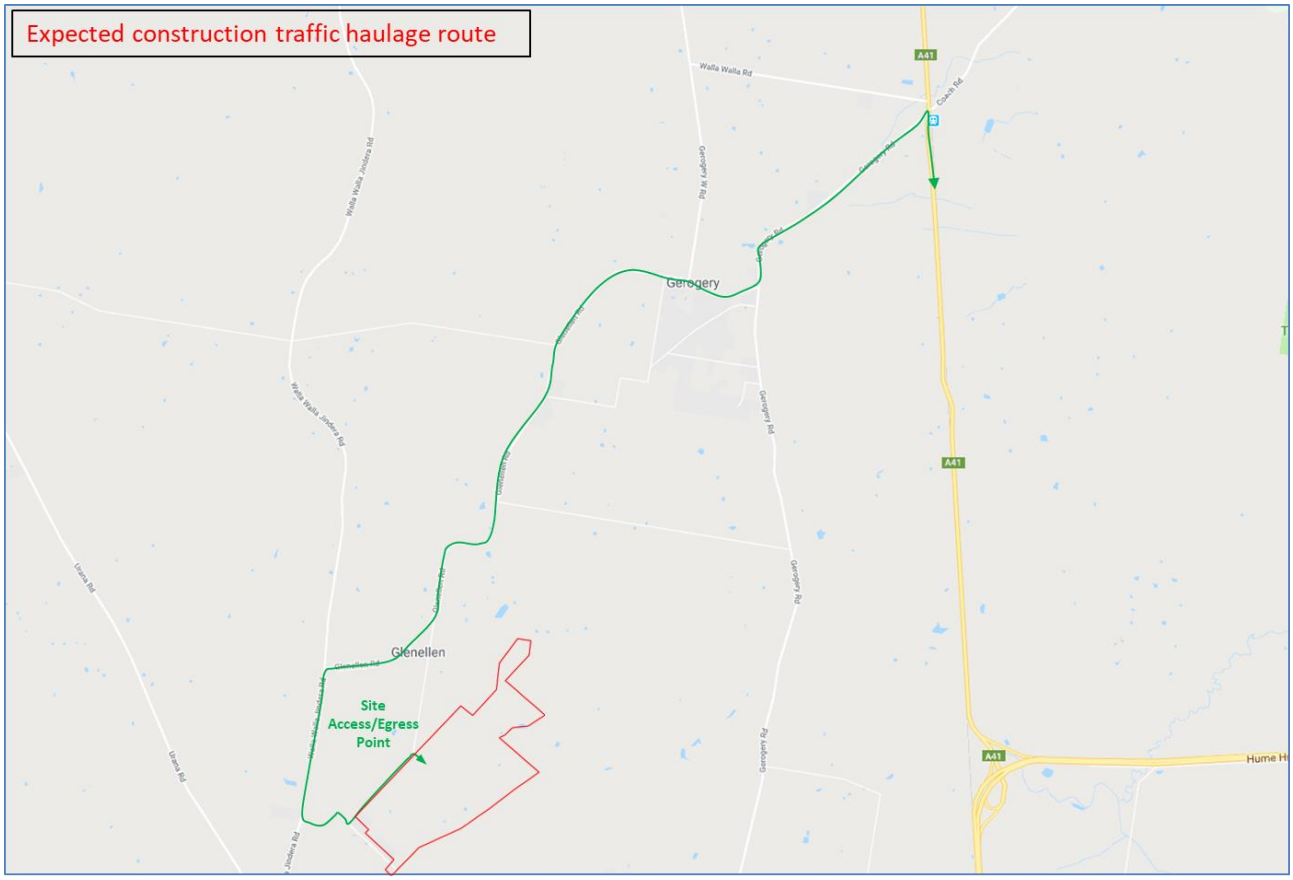


Figure 2.2 Expected construction traffic haulage route

The expected construction traffic haulage route is approved for up to 26m B-double trucks as shown in NSW 'General Mass Limit' and 'Concessional Mass Limit' restricted access vehicles map in Figure 2.3[1].

[1] https://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/restricted-access-vehicles-map/map/index.html

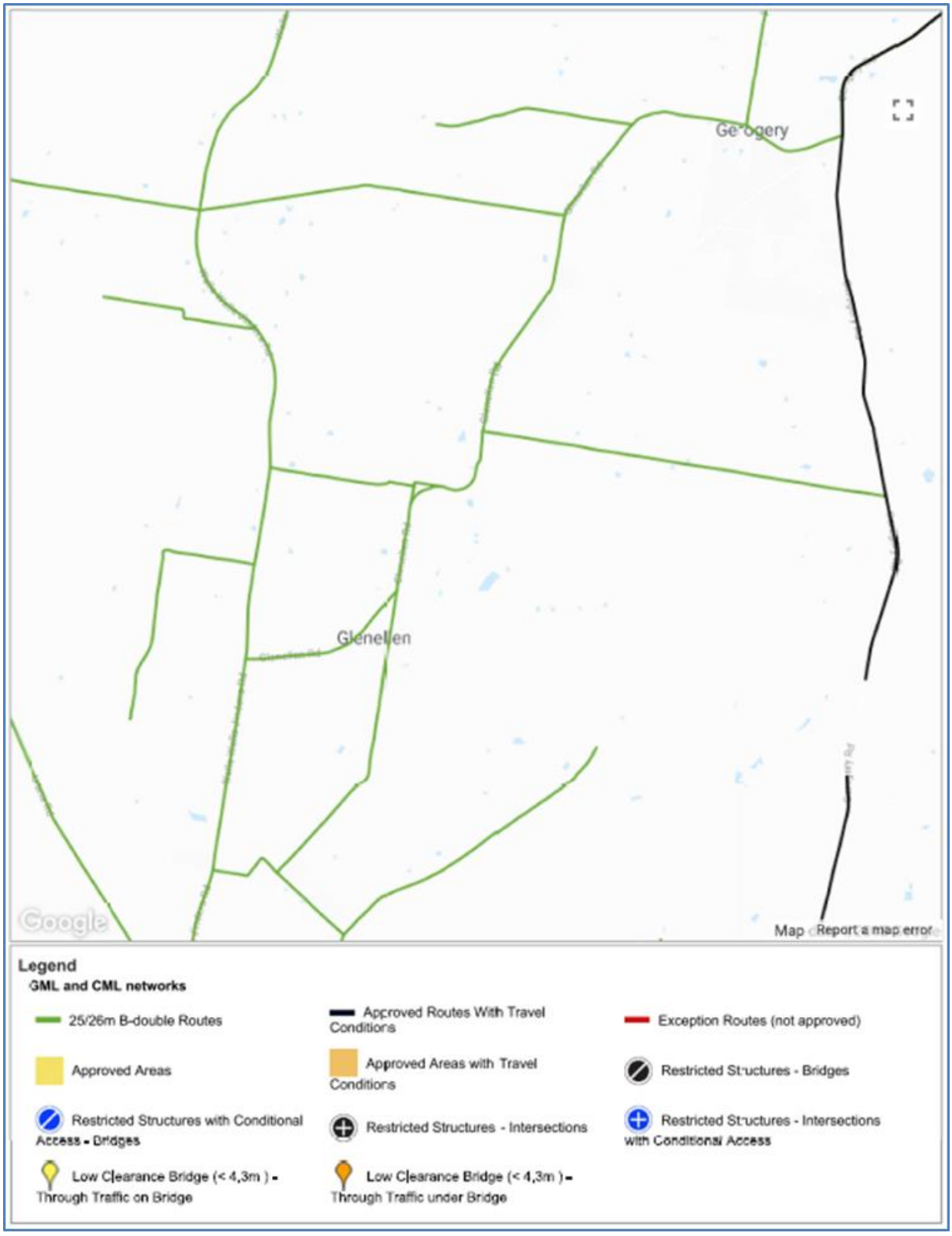


Figure 2.3 NSW 'General Mass Limit' and 'Concessional Mass Limit' restricted access vehicles map

2.4 Crash History

TTM requested crash data for the past five years from RMS for the locality of the area. The extent of the crashes in the area are indicated in Figure 2.4. A detailed breakdown of the crash data is presented in Appendix B.

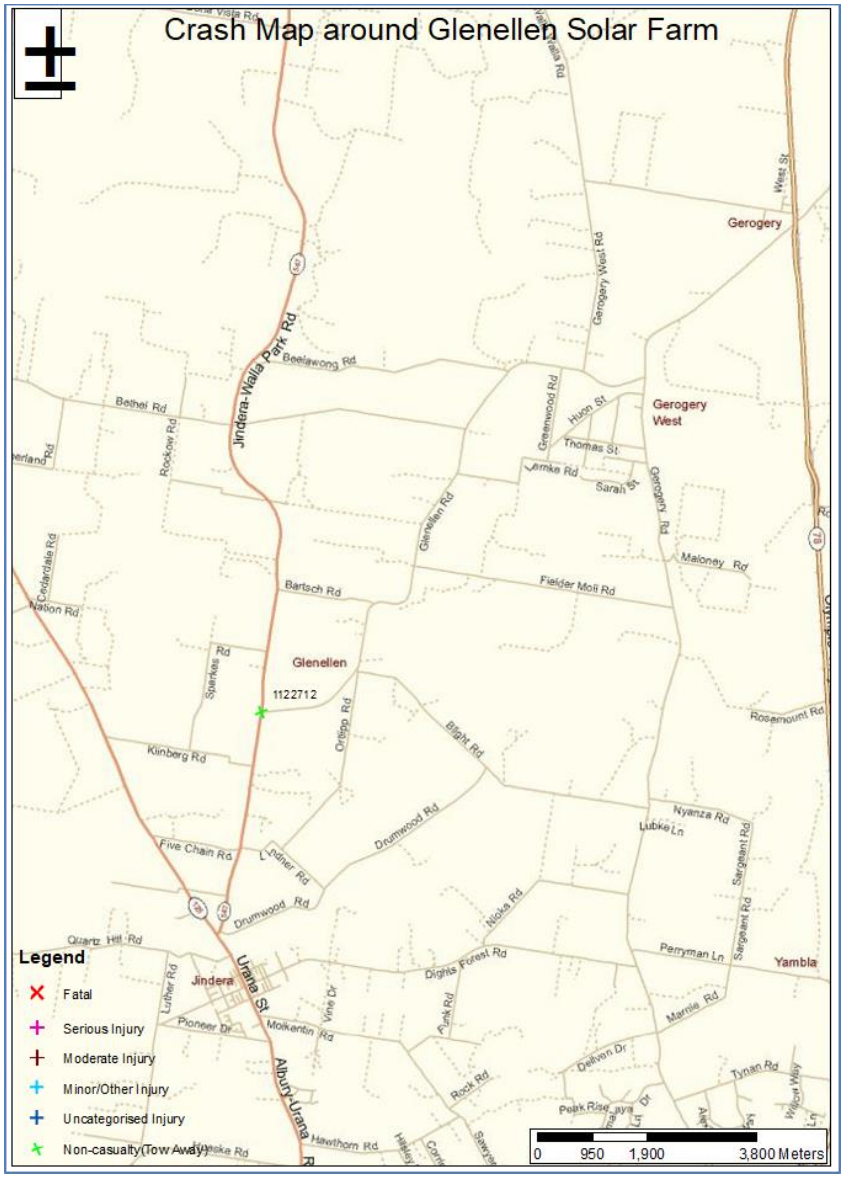


Figure 2.4 : RMS 5 Year Crash Data (2013 to 2017)

There was only one crash reported at the Walla Walla Jindera Road – Glenellen Road intersection. The crash involved a driver veering off the road and hitting a barrier/guardrail. The crash was reported as a non-casualty crash.

3 Road Safety Audit Findings

3.1 Audit Criteria

A ranking system for each of the issues has been adopted using the following priority ratings in Table 3-1:

Table 3-1 Road Safety Audit – Priority Ratings

Priority	Risk Ranking	Suggested Treatment Approach
A	High	Highest priority for action from a safety view point
B	Medium	Action needs to be taken from safety view point
C	Low	Action is desirable from a safety view point
D	Comment	An observation which may improve overall performance or safety, Be of wider significance and possibly outside the scope of this RSA, but where action should be considered

It is noted that the priority ranking is based on the subjective assessment of the audit team.

4 Formal Statement

4.1 Audit Team Statement

We, the undersigned, declare that we have reviewed the material and data listed in this report and identified the safety and operational deficiencies outlined in the preceding sections.

It should be noted that while every effort has been made to identify potential safety hazards, no guarantee can be made that every deficiency has been identified. We recommend that points of concern be investigated, and necessary corrective actions are undertaken.

Richard V Jones – Senior Road Safety Auditor (Team Leader) 26/10/18

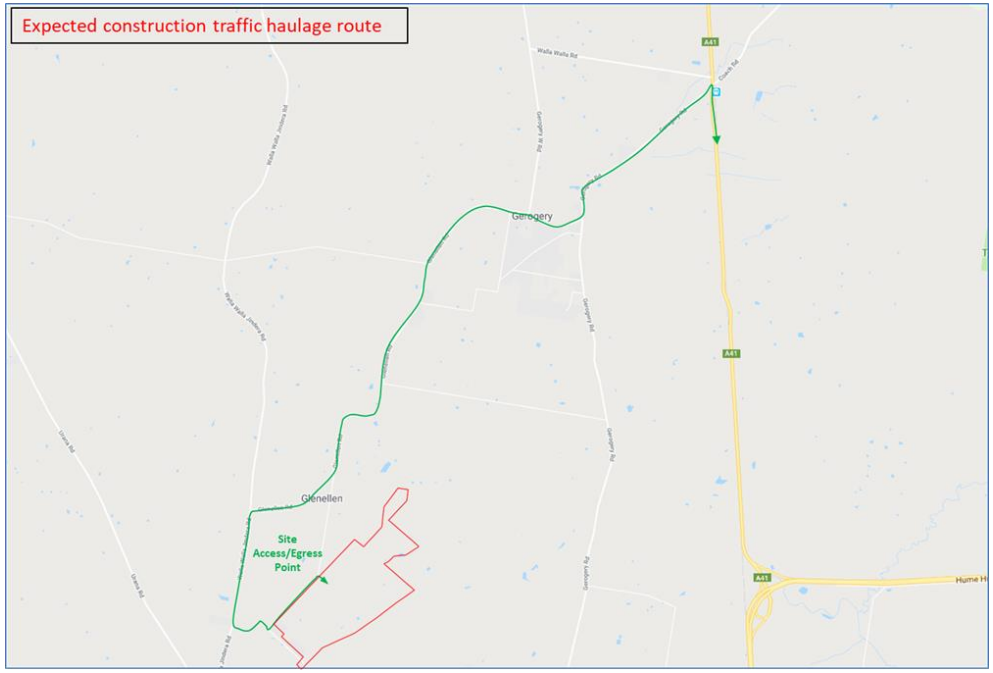
Ben Williamson – Senior Road Safety Auditor..... 26/10/18

Baqir Husain – Road Safety Auditor..... 26/10/18

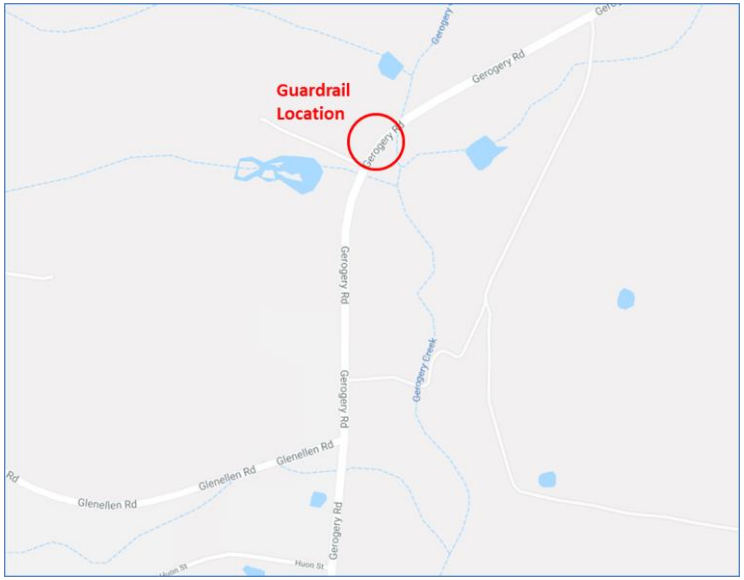
Appendix A Road Safety Audit Findings

Reviewer: Baqir Husain (TTM Consulting)

Date: 18/10/18

Item	Audit Findings/Recommendations	Rankings
1	There will be increased truck/construction traffic along the routes accessing the site. Many of the drivers will also be unfamiliar with this area too. There is an increased risk of crashes at the intersection along the route.  Consideration could be given to installation of advance warning sign or truck crossing signs throughout the intersections along the route. Consideration should be given to enforcing speed limit of 60 km/h on Glenellen, Linder and Ortlipp Road.	Medium

Item	Audit Findings/Recommendations	Rankings
2	The intersection of Gerogery Road and Glenellen Road will be used by delivery and staff vehicles to access the site. There will be increased construction traffic and it is expected that heavy vehicles will be making right turns from Gerogery Road to Glenellen Road. There is risk that vehicles might be waiting on Glenellen Road to exit and trucks turning right might veer off into the ditch to avoid the waiting vehicles. There is a risk of vehicles crashing and/or veering into the ditch resulting in serious injury.   Consideration could be given to installation of truck turning signs near the intersection. Consideration of a guardrail is recommended. Sharp rocks near the ditch could be removed to make the roadway intersection more forgiving	Low

Item	Audit Findings/Recommendations	Rankings
3	There is a guardrail present approximately 700m north of the Gerogery Road and Glenellen Road intersection. The guiderail is missing the guiding arrow at the end and seems to have insufficient height. The end of the guardrail has a bull nose treatment. There is a risk that with the increased traffic movements, trucks passing this bend may crash into the guardrail and veer off into the ditch.   Consideration could be given to review of the guard rail in relation to current standards.	Low

Item	Audit Findings/Recommendations	Rankings
4	There is a culvert on Glenellen Road near the intersection of Glenellen Road and Ortlipp Road. The culvert is protected by some barrier on one side and is unprotected from the other side. There is a risk that delivery trucks passing each other along this portion of the route may veer off over the culvert and into the ditch causing serious injury.  Consideration could be given to installation of guardrail with proper warning and end treatments on each side.	**Medium**

Item	Audit Findings/Recommendations	Rankings
5	The intersection of Glenellen Road and Ortlipp Road may be used by heavy and staff vehicles. There is a risk that the intersection is not wide enough to pass a vehicle waiting to turn or an approaching vehicle on Ortlipp Road. The width of Ortlipp Road may not be wide enough and pose difficulty for passage of heavy vehicles. There is a risk of side swipe crash which may result in injury. There is slight grade when approaching the intersection from Ortlipp Road. Vehicles waiting to turn may roll back in to vehicle behind and large trucks will take longer to exit as starting on an uphill grade. The insufficient width of the intersection may result in vehicles having a side swipe crash causing serious injury. Vehicles rolling back may result in a rear end crash.   Consideration could be given to conducting construction vehicle swept path at the intersection and localised widening to accommodate increased construction and heavy vehicles traffic.	**Medium**

Item	Audit Findings/Recommendations	Rankings
6	The intersection of Walla Walla Jindera Road and Lindner Road will be used by all construction vehicles and workers vehicles, as the main access to the solar farm. The main movements will be left turn from Walla Walla Jindera Road to Lindner Road and right turn from Linder Road to Walla Walla Jindera Road. There is some restricted sight distance from Lindner Road to the north (192m due to the brow of the hill). There is a risk that driver will enter or exit Lindner Road when there is insufficient sight distance to oncoming vehicles. This can result in a T-bone crash at this location leading to serious injury.  Consideration could be given to installation of advance warning sign or truck crossing signs.	Medium

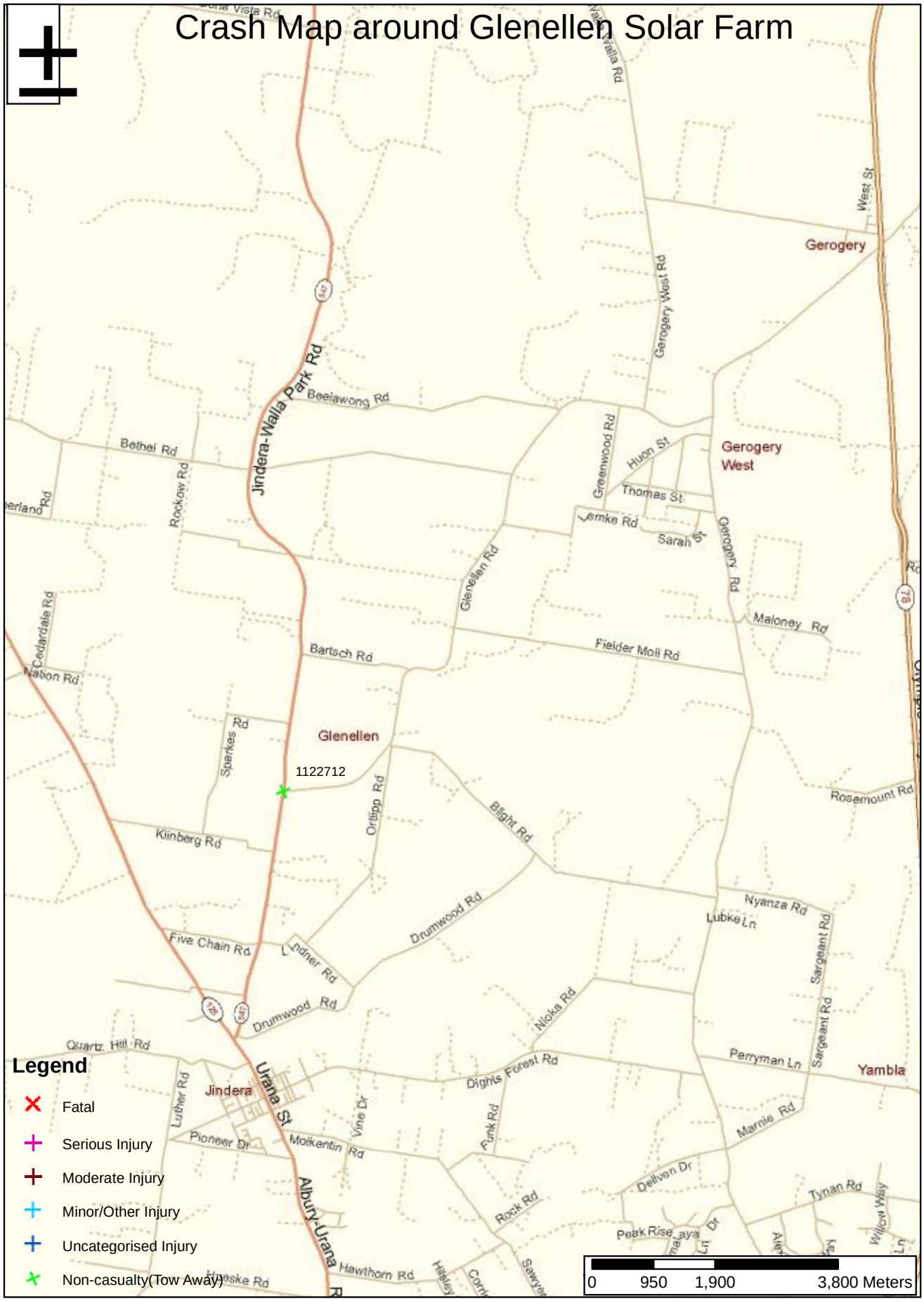
Item	Audit Findings/Recommendations	Rankings
7	Construction vehicles will be accessing the solar farm site from Lindner Road and Ortlipp Road intersection. The road surface of Lindner Road and Ortlipp Road has loose gravel, overgrown grass and is not completely sealed. There is an increased risk for vehicles turning right out on to Linder Road to skid on the surface especially when it is wet. The condition of the intersection may further deteriorate due to the passage of heavy and light vehicles. This can result in vehicles skidding out of control, resulting in a T-bone crash causing serious injury.   Consideration should be given to the development of a maintenance plan to maintain road conditions to a level suitable for the proposed access and for all vehicle types.	**Medium**

Item	Audit Findings/Recommendations	Rankings
8	The road section between Walla Walla Jindera Road and Lindner Road intersection and Lindner Road and Ortlipp Road intersection has two sharp bends. There is no traffic signage to alert road users of the upcoming sharp bends. There is a risk of drivers steering off the road while making a turn. This may lead to a head on crash with a tree and may lead to serious injury.   Consideration could be given to installation of speed control, advance warning signs and frangible hazard marker posts.	Medium

Item	Audit Findings/Recommendations	Rankings
9	The solar farm only has one access point which is from Ortlipp Road. The access point to the site has uneven surface with loose gravel and areas of ponding. There is a risk that a worker's car or motorcycle could lose control of their vehicles when driving over this rough surface / pond or when swerving to avoid them. There is an increased risk that this would result in a side swipe crash at this location causing injury.  Consideration could be given to maintaining the road surface to a level suitable to the proposed access and all vehicle types.	Medium

Appendix B Crash Data

Crash Map around Glenellen Solar Farm



Crash History

Date	Crash No.	Src	RUM Code	RUM Description	Type of Location	Surface Condition	Natural Lighting	K	S	M	O	U	Key Dir	MC Inv	Road Classification	Street of Crash	Street Type	DIST (m)	DIRN	Identifying Feature (ID)	ID Type	Town	LGA
02/10/2016	1122712	P	71	Off rd left => obj	T-junction	Dry	Daylight	-	-	-	-	-	South	No	Other classified road	JINDERA	Rd	0	AT	GLENELLEN	Rd	Jindera	Greater Hume

Report Totals: Total Crashes: 1 Fatal Crashes(FC): 0 Serious Injury Crashes(SC): 0 Moderate Injury Crashes(MC): 0 Minor/Other Injury Crashes(OC): 0 Uncateg'd Injury Crashes(UC): 0 Non-Casualty Crashes(NC): 1

Killed(K): 0 Seriously Injured(S): 0 Moderately Injured(M): 0 Minor/Other Injured(O): 0 Uncategorised Injured(U): 0

Crashid dataset Around Glenellen Solar Farm: Data Period: 01/01/13 to 31/12/17

Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data.
Reporting yrs 1996-2004 and 2018 onwards contain uncategorised inj crashes.

Summary Crash Report

# Crash Type		
Car Crash	1	100.0%
Light Truck Crash	0	0.0%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	*(0)*	*(0.0%)*
Bus Crash	0	0.0%
"Heavy Vehicle Crash	*(0)*	*(0.0%)*
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	0	0.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	1	100.0%
Non intersection	0	0.0%

* Up to 10 metres from an intersection

Collision Type		
Single Vehicle	1	100.0%
Multi Vehicle	0	0.0%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	1	100.0%
Unclassified Road	0	0.0%

Contributing Factors		
Speeding	0	0.0%
Fatigue	0	0.0%

Weather		
Fine	1	100.0%
Rain	0	0.0%
Overcast	0	0.0%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	0	0.0%
Dry	1	100.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	0	0.0%
Daylight	1	100.0%
Dusk	0	0.0%
Darkness	0	0.0%

Crash Movement		
Intersection, adjacent approaches	0	0.0%
Head-on (not overtaking)	0	0.0%
Opposing vehicles; turning	0	0.0%
U-turn	0	0.0%
Rear-end	0	0.0%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	1	100.0%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	0	0.0%
Out of control on curve	0	0.0%
Other crash type	0	0.0%

Speed Limit					
40 km/h or less	0	0.0%	80 km/h zone	0	0.0%
50 km/h zone	0	0.0%	90 km/h zone	0	0.0%
60 km/h zone	0	0.0%	100 km/h zone	1	100.0%
70 km/h zone	0	0.0%	110 km/h zone	0	0.0%

~ 07:30-09:30 or 14:30-17:00 on school days	~ 40km/h or less	0	0.0%	~ School Travel Time Involvement	0	0.0%

Day of the Week												
Monday	0	0.0%	Wednesday	0	0.0%	Friday	0	0.0%	Sunday	1	**********	WEEKEND	1	**********
Tuesday	0	0.0%	Thursday	0	0.0%	Saturday	0	0.0%	WEEKDAY	0	0.0%			

CRASHES	1	
Fatal	0	0.0%
Serious inj.	0	0.0%
Moderate inj.	0	0.0%
Minor/Other inj.	0	0.0%
Uncategorised inj.	0	0.0%
Non-casualty	1	100.0%

Self Reported Crash	0	0%

Time Group		% of Day	
00:01 - 02:59	0	0.0%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	0	0.0%	4.2%
08:00 - 08:59	0	0.0%	4.2%
09:00 - 09:59	0	0.0%	4.2%
10:00 - 10:59	0	0.0%	4.2%
11:00 - 11:59	0	0.0%	4.2%
12:00 - 12:59	0	0.0%	4.2%
13:00 - 13:59	0	0.0%	4.2%
14:00 - 14:59	0	0.0%	4.2%
15:00 - 15:59	1	**********	4.2%
16:00 - 16:59	0	0.0%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	0	0.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	0	0.0%	8.3%
22:00 - 24:00	0	0.0%	8.3%

Street Lighting Off/Nil		% of Dark
0	of 0	in Dark 0.0%

CASUALTIES	0	
Killed	0	0.0%
Seriously inj.	0	0.0%
Moderately inj.	0	0.0%
Minor/Other inj.	0	0.0%
Uncategorised inj.	0	0.0%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes	Casualties
1	2016 0

McLean Periods		% Week	
A	0	0.0%	17.9%
B	0	0.0%	7.1%
C	0	0.0%	17.9%
D	0	0.0%	3.5%
E	0	0.0%	3.6%
F	0	0.0%	10.7%
G	0	0.0%	7.1%
H	1	100.0%	7.1%
I	0	0.0%	12.5%
J	0	0.0%	10.7%

#Holiday Periods																		
New Year	0	0.0%	Easter	0	0.0%	Queen's BD	0	0.0%	Christmas	0	0.0%	Easter SH	0	0.0%	Sept./Oct. SH	1	*********	
Aust. Day	0	0.0%	Anzac Day	0	0.0%	Labour Day	1	*********	January SH	0	0.0%	June/July SH	0	0.0%	December SH	0	0.0%	

Crashid dataset Around Glenellen Solar Farm: Data Period: 01/01/13 to 31/12/17

Note: Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data. Reporting yrs 1996-2004 and 2018 onwards contain uncategorised inj crashes.

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Detailed Crash Report

Crash No.	Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash-Detailed	Killed	Seriously Inj.	Moderately Inj.	Minor/Other Inj.	Uncateg'd Inj.	Factors
																								A S F
South West Region																								
Greater Hume LGA																								
Jindera																								
Jindera Rd																								
1122712	P	02/10/2016	Sun	15:30	at	GLENELLEN RD	TJN	STR	Fine	Dry	100	1	CAR	U U	S in JINDERA RD	100	Proceeding in lane	NC	0	0	0	0	0	
E62341213							RUM:	71	Off rd left => obj						S/Barrier - Guardrail									

Report Totals: Crashes: 1 Fatal Crashes(FC): 0 Serious Injury Crashes(SC): 0 Moderate Injury Crashes(MC): 0 Minor/Other Injury Crashes(OC): 0 Uncategorised Injury Crashes(UC): 0 Non-Casualty Crashes(NC): 1

Killed(K): 0 Seriously Injured(S): 0 Moderately Injured(M): 0 Minor/Other Injured(O): 0 Uncategorised Injured(U): 0

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