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Stringybark Solar Farm

Traffic and Transport Assessment

Prepared for

Stringybark Solar Farm Pty Ltd

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Report prepared by Constructive Solutions Pty Ltd

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Executive Summary

Stringybark Solar Farm Pty Ltd ('the Proponent") is seeking development consent from Armidale Regional Council for the construction and operation of a new solar farm, referred to as the Stringybark Solar Farm ('the Project").

The Project Site ("the Site") is located at 597 Gara Road in Armidale NSW approximately 10 km east of the Armidale Town Centre. Access to the Site for construction and operations shall be from Gara Road.

The construction of the Stringybark Solar Farm will also include the construction of an offsite substation however, traffic associated with the construction of the substation will use an existing access from Waterfall Way.

This report assesses the traffic and transport related impacts of the Project on the surrounding road network and has been prepared with reference to the following guidelines:

- Guide to Traffic Generating Developments (RTA 2002);
- Road Design Guide (RMS) and relevant Austroads Guides; and
- Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development.

Matters relating to traffic and transport for the proposed Stringybark Solar Farm have been addressed in this report. The study area comprising of the following:

- Waterfall Way from approximately 2km west of the Gara Road intersection to approximately 2km east of the Silverton Road intersection;
- The access from the Waterfall Way for the proposed substation development which will facilitate vehicles only associated with the construction of the substation; and
- Gara Road between Waterfall Way and the proposed Site access.

The analysis and discussions presented in this report can be summarised as follows:

- The construction phase for the Stringybark Solar Farm is anticipated to be approximately 9 months and the concurrent construction phase for the substation is anticipated to be approximately 7 months.
- The majority of workers during the construction phase of the solar farm are anticipated to travel to the Site in mini busses therefore minimising the impact of Project related traffic on the surrounding road network.
- Project related traffic during the construction phase and operational phase over the 10 year horizon will result in a minor increase to traffic volumes on the Waterfall Way however, it is considered that the road has sufficient capacity to cater for the combined background traffic;
- The existing daily traffic volumes on Gara Road are low (less than 50 vehicles per day) and remain relatively low taking into consideration the average daily traffic volumes associated with the construction phase (5 heavy vehicles (HV) and 11 light vehicles (LV)) and the operational phase (7 LV) beyond the 10 year horizon following the commencement of operations. It is therefore considered that the upgrading and sealing of Gara Road between Waterfall Way and the Site access is not considered necessary as a result of the Project.
- Impacts on the surrounding road network in terms of school bus services will be minimal and insignificant for pedestrians and cyclists.
- The following roadworks are recommended for the Waterfall Way and Gara Road intersection:
    - Provision of shoulder widening on Waterfall Way to provide a Basic Right (BAR) rural turn treatment; and
    - Provision of advanced side road ahead and truck warning signs along Waterfall Way on both approaches to the Gara Road intersection, during the construction phase.

- The following works are recommended for the Site access:
    - Provision of advanced side road ahead and truck warning signs along Gara Road on both approaches to the Site access.
- The existing daily traffic volumes on the Waterfall Way are almost 1,500 vehicles per day (vpd), The average daily traffic volumes associated with the construction of the substation are 1 HV and 5 LV. These daily traffic volumes are considered to be negligible and there is sufficient capacity for the road to accommodate the additional substation construction traffic without the need for any upgrades.
- The following roadworks are recommended for the proposed access from the Waterfall Way for the substation to accommodate substation construction traffic:
    - Upgrade of the existing site access to satisfy the requirements for a rural property access as per Figure 7.4 of *AUSTROADS Guide to Road Design – Part 4: Intersections and Crossings-General;*
    - Provision of shoulder widening on Waterfall Way to provide Basic Right (BAR) rural turn treatments;
    - Provision of tree pruning or removal adjacent to the eastbound lane of Waterfall Way to improve sight distance to the west; and
    - Provision of advanced side road ahead and truck warning signs along Waterfall Way on both approaches to the proposed Substation site access, during the construction phase.
- Consideration for the regular use of water carts along Gara Road between Waterfall Way and the Site access to suppress dust generated by Project related traffic during the construction phase only.
- Existing road safety issues along Gara Road between the Waterfall Way and the Site access have been identified. Whilst these are existing deficiencies for all road users and are the responsibility of Armidale Regional Council, interim measures, such as the provision of give way signage in one direction at the locations where the road has a narrow formation and tight radius bends, could be implemented during the construction phase only to ensure that HV passing manoeuvres at these locations are mitigated.
- Provision of Traffic Management Plan (TMP) and driver code of conduct is considered desirable during the construction phase. This will assist with the control of Project related traffic movements, and ensure that driver behaviour within the Site and on the surrounding road network is maintained to a safe level that accounts for local conditions given the deficiencies along Gara Road identified from the road safety audit.
- The cumulative impacts of constructing the Olive Grove Solar Farm concurrently with the Stringybark Solar Farm does not result in any additional road upgrades attributable to the Stringybark Solar Farm development other than those listed above.

It is concluded that subject to the recommended roadworks being implemented, there are no Project related traffic and transport issues which would prevent the Project from proceeding.

1 Introduction

Stringybark Solar Farm Pty Ltd ('the Proponent") is seeking development consent for the construction and operation of a new solar farm, referred to as the Stringybark Solar Farm ('the Project").

The Project Site ("the Site") is situated within the Armidale Regional Council local government area approximately 10km by road along the Waterfall Way and Gara Road east of the Armidale Town Centre (refer **Figure 1)**.

The Site is located at 597 Gara Road, Metz in NSW on Lot 2, DP 1206469. Access to the Site during construction and operations is from Gara Road (refer **Figure 2)**.

The Project will also include the construction of an offsite substation located at 1060 Grafton Road, Metz in NSW. Traffic associated with the construction of the substation will access this site from Grafton Road (referred to as Waterfall Way) (refer **Figure 2)**.

Constructive Solutions Pty Ltd (CSPL) was engaged by the Proponent to undertake a traffic and transport assessment for inclusion in the Environmental Effects Statement (EES) to be lodged with Armidale Regional Council.

1.1 Project Overview

A full Project description is provided in the EES prepared by Ecological Australia. The key components of the Project are as follows:

- Installation of photovoltaic panels mounted above the ground on a tracking system with a combined capacity of 29.9MW;
- An on-site operation and maintenance building with parking spaces; and
- An off-site substation including transformer, switchgear, communications equipment and parking spaces which will connect into the 66kV power line that lies adjacent to the substation.

1.2 Scope of the Report

This report assesses the traffic and transport related impacts of the Project on the surrounding road network and in particular, the Waterfall Way and Gara Road between Waterfall Way and the Site access. The report has been prepared with reference to the following guidelines:

- Guide to Traffic Generating Developments (RTA 2002);
- Road Design Guide (RMS) and relevant Austroads Guides; and
- Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development.

The scope of the assessment includes:

- Site inspection of the Waterfall Way in the vicinity of the Site and Gara Road between Waterfall Way and the Site access, reporting on the local setting, conditions of the road transport network and proposed Site access arrangement;
- Likely traffic generation of the Project;
- Assessment of the proposed access arrangements during construction and operation of the Project;
- Assessment of any road safety concerns;
- Assessment of predicted traffic and transport impacts of the Project; and
- Recommendations on any mitigation measures to alleviate potential traffic and transport impacts as a result of the Project.

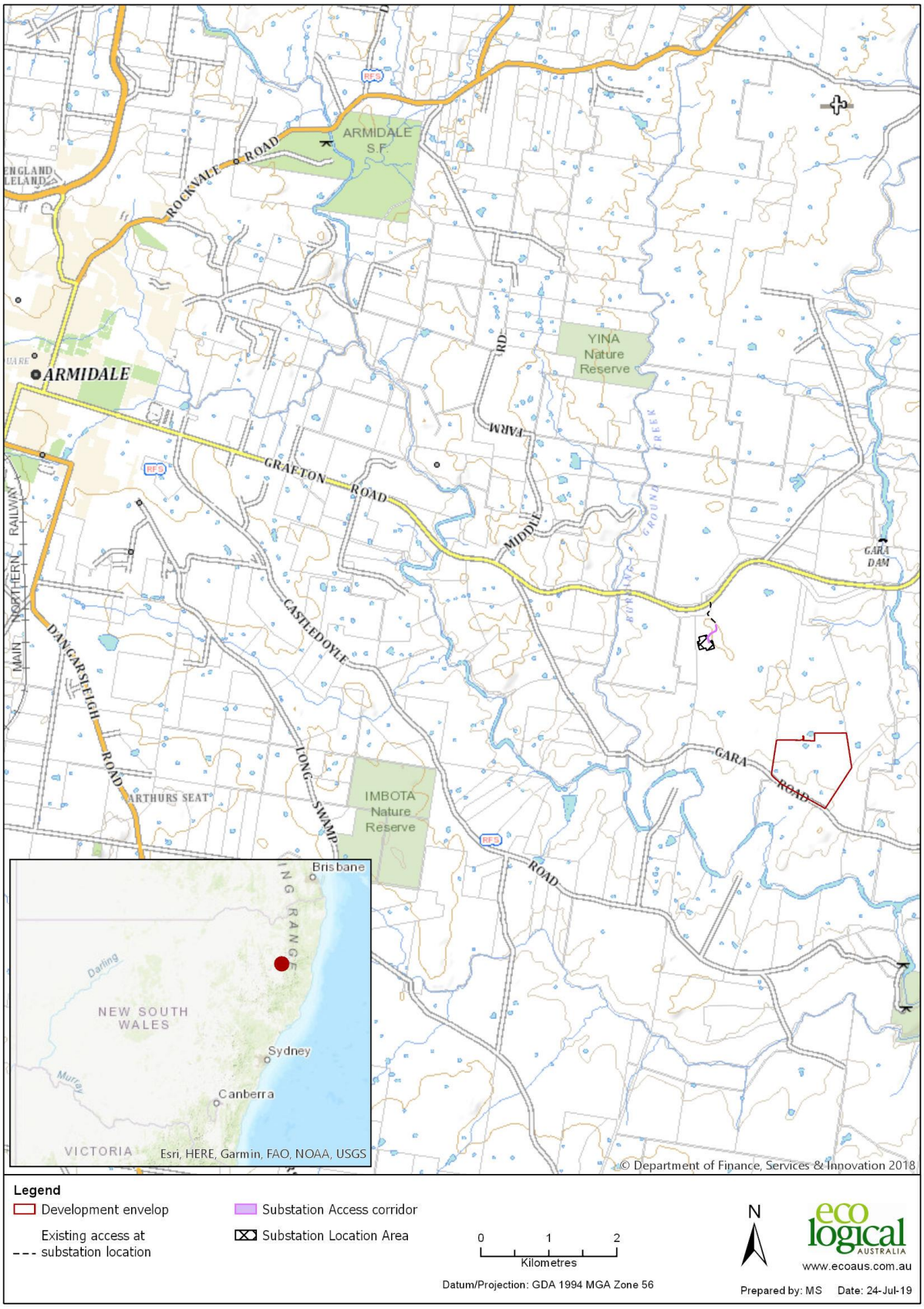


Figure 1 – Locality Plan and access routes

(Source: Stringybark Pty Ltd, 2019)

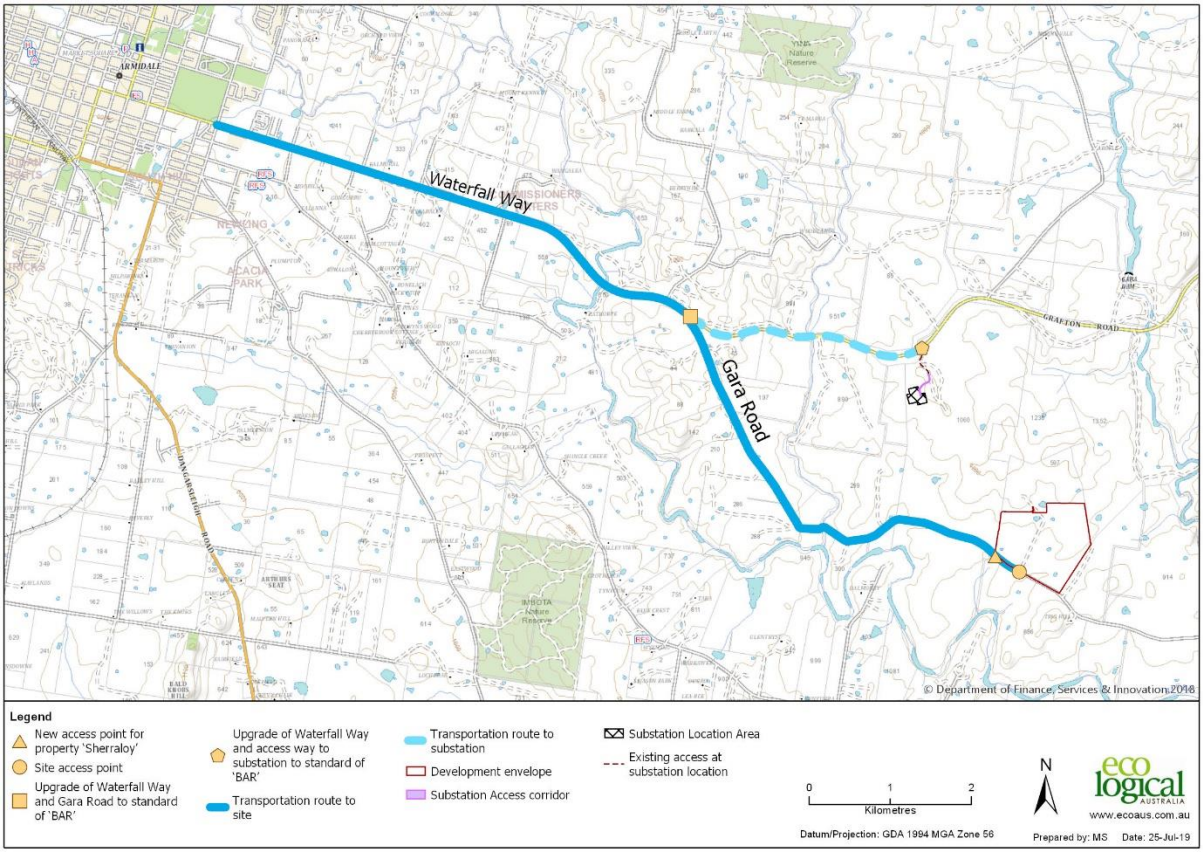


Figure 2 – Proposal Site and access points

(Source: Stringybark Pty Ltd, 2019)

2 The Surrounding Road Network

2.1 The Study Area

An inspection of the roads impacted by the Project was conducted on 30 April 2019. These included those nominated as the preferred transportation route for the Project and included:

- Waterfall Way from approximately 2km west of the Gara Road intersection to approximately 2km east of the Silverton Road intersection;
- Gara Road between Waterfall Way and the proposed Site access; and
- The access from the Waterfall Way for the proposed substation which will facilitate vehicles only associated with the construction of the substation.

RMS online interactive Restricted Access Vehicle Maps[1] as follows:

- approved for B-doubles up to 25m in length between the New England Highway in Armidale and its intersection with Dome Road, located south east of Dorrigo;
- general access only from its intersection at Dome Road to its intersection at Darkwood Road (i.e.: effectively the section across the Dorrigo Mountain Range); and
- approved route for B-Doubles with travel conditions from its intersection at Darkwood Road to the Pacific Highway at Raleigh.

2.1.1 Gara Road

Gara Road a local road providing access to rural properties between the Waterfall Way and Silverton Road with Armidale Regional Council as the road authority. The road effectively runs parallel with Waterfall Way to the south.

Gara Road is unsealed however there is a bitumen seal for the first 100m from the Waterfall Way intersection. The gravel pavement width varies however, it is generally between 5m and 6m. The horizontal and vertical alignment consists of several curves, crests and single lane causeways. The overall condition of the unsealed pavement was considered to be good however there were some sections where corrugations were present (refer **Photo 2**).

[1] RMS Website – 31/05/2019

Photo 2 – Typical Section of Gara Road

Whilst there was no posted speed limit, it was assumed that the speed limit is 100km/h. There was no traffic count data available for Gara Road however, based on observations during the inspections it was considered that the average annual daily traffic (AADT) would be less than 50 vpd.

Gara Road is not listed as a RMS approved B-double route.

2.2 Intersections

2.2.1 Waterfall Way and Gara Road

The intersection of Waterfall Way and Gara Road is a basic T-intersection configuration with Waterfall Way as the priority road. There are no auxiliary turn lanes on Waterfall Way. Sight distance in both directions is greater than 300m along Waterfall Way and signage consists of a Give Way sign and sight board located opposite the intersection. There is a continuity line at the intersection but no give way (TB) line. The pavement is sealed and considered to be in reasonable condition in the mouth of the intersection (refer **Photo 3** and **Photo 4**).

Photo 3 – Gara Road Approach to Waterfall Way

Photo 4 – Waterfall Way and Gara Road intersection – Looking East

2.2.2 Gara Road and Proposed Site Access

The proposed Site access is unsealed and is located on the northern side of Gara Road as shown in **Photo 6**. Sight distance to the east is greater than 300m however, the sight distance to the west is restricted to approximately 200m due to the crest (refer **Photo 7** and **Photo 8**).

This access is proposed for use during both the construction and operational phase of the Project.

Photo 6 – Proposed Site Access

Photo 7 – Proposed Site Access – Looking east along Gara Road

Photo 8 – Proposed Site Access – Looking west along Gara Road

The proposed Site access is currently the main access to the Sherraloy rural property and as a result of this development, a new access for the owners of the Sherraloy property will be required. It is proposed that this new access be located further west along Gara Road and be constructed to satisfy the requirements for a rural property access as per Figure 7.4 of *AUSTROADS Guide to Road Design – Part 4: Intersections and Crossings-General* (refer **Figure 3** below).

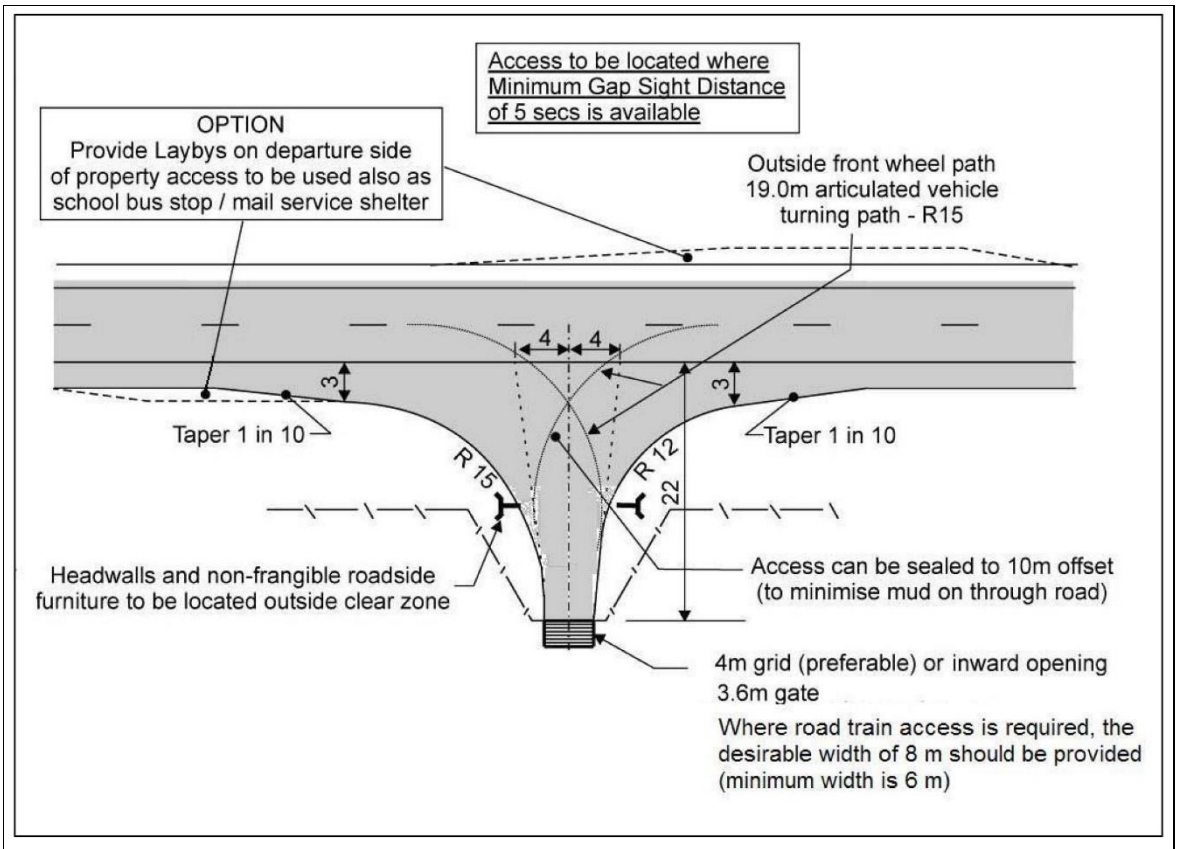


Figure 3 – Rural Property Access

2.2.3 Waterfall Way and Proposed Substation Access

The existing access point is located approximately 3km east of the Gara Road intersection, is unsealed and is located on the southern side of Waterfall Way as shown in **Photo 5**. The existing access is located on the outside of a curve and the sight distance to the east and west along the Waterfall Way is approximately 300m and 260m respectively from measurements taken during the site inspection.

This access is proposed for use by vehicles only associated with the construction of the substation, however, if approved, could also cater for the proposed Olive Grove Solar Farm traffic as well. *(Note: the Olive Grove Solar Farm will be subject to a separate development application).*

Photo 5 – Proposed Substation Site Access off the Waterfall Way (MR76)

2.3 Road Safety

2.3.1 Waterfall Way and Proposed Substation Solar Farm Access

Road safety issues identified during the inspection, particularly in proximity to the proposed substation site access were the presence of trees located within the clear zone adjacent to the westbound lane along Waterfall Way (refer **Photo 9**). These trees are located in an area signposted as a 'Significant Roadside Environment Area'.

Another potential road safety concern is the limited sight distance for eastbound vehicles on approach to the proposed substation site access. The sight distance is obscured due to the curve and presence of trees and vegetation located adjacent to the eastbound lane (refer **Photo 10**).

Photo 9 – Trees within the Clear Zone along Waterfall Way adjacent to the westbound approach to the Proposed Substation Site Access

Photo 10 – Looking west from the Site Access, trees adjacent to the eastbound lane obscure sight distance at the curve

2.3.2 Gara Road

A road safety audit was completed for the section of Gara Road between the Waterfall Way and the proposed Site access. The deficiencies identified included:

- Missing guideposts;
- Steep batters with no protection;
- Narrow formation on tight radius curves;
- Substandard end terminals on safety barrier;
- Roadside hazards within the clear zone including trees;
- Damaged and missing advanced warning signs;
- Missing advanced warning signs ahead of the single lane causeway; and

- Missing transverse line marking at the Waterfall Way intersection.

The findings identified from the road safety audit are existing deficiencies for all road users and not just for Project related traffic. A number of interim mitigation measures have been suggested for the construction phase of the Project which are discussed in **Section 4.2.2**. A copy of the road safety report is provided in **Appendix 2.**

2.4 Traffic Volumes

2.4.1 Background and Forecast Traffic Volumes

Gara Road

No traffic data is available for Gara Road. As the road is primarily used to provide access to rural properties and based on observations during the site inspections, it is assumed that the AADT would be less than 50vpd.

As there is no peak hour volume data available, Section 4.8 in *AUSTROADS Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections* advises as follows:

> *"Where peak hour volumes or peak hour percentages are not available, assume that the design peak hour volume equals 8% to 10% of the AADT for urban situations and that the design hour volume equals 11% to 16% of AADT for rural situations."*

As Gara Road is a rural road, a peak hourly volume of 15% has been adopted, the resultant peak background traffic has been calculated at 8 vehicles per hour (vph).

Waterfall Way

Traffic data for the Waterfall Way was obtained from the RMS Traffic Volume Viewer website[2] and is presented in **Table 1**.

Table 1 – Waterfall Way Traffic Data

Location	AADT			
	2007	2008	2011	2012
Waterfall Way at Gara River, east of Argyle-Mining Vale Road (RMS Count Station 92.394)	1391	1450	1295	1326 (1)

Note (1) – includes 6% HV

RMS Count Station 92.394 is located approximately 6km to the east of the Waterfall Way and Gara Road intersection. The daily traffic volumes at this location are relatively low and would be well within the capacity of a state road. As a result, it is considered that there would be sufficient capacity for Waterfall Way to accommodate additional traffic.

Whilst the traffic data does not show a trend in terms of growth, a growth rate of 1.5% has conservatively been adopted to forecast background traffic during Project construction (2019), traffic when the solar farm becomes operational (2020) and 10-year traffic forecast (2029).

Table 2 provides a summary of the background and forecast traffic volumes as annual average daily traffic (AADT) including percentage of heavy vehicles (%HV).

[2] RMS Traffic Volume Viewer Website (31/05/2019)

Table 2 – Background and 10 Year Forecast Traffic Volumes

	Background Traffic (Year 0 - 2019)		Forecast Traffic (Year 1 – 2020)		Forecast Traffic (Year 10 – 2029)	
Road	**AADT**	**%HV**	**AADT**	**%HV**	**AADT**	**%HV**
Waterfall Way	1472	6%	1494	6%	1708	6%

As there is no peak hour volume data available and Waterfall Way is a rural road, 15% of AADT has been adopted as described above. The resultant peak background traffic has been calculated at 224 vph.

2.5 Crash History

2.5.1 Gara Road

No crash data was available for Gara Road.

2.5.2 Waterfall Way

Crash data for a five year period from 2013 to 2017 from the NSW Government Centre for Road Safety Interactive Crashes website[3] was used to assess crash history along the Waterfall Way in the Armidale Regional Council local government area. There are over 80 recorded crash sites with 11 of these recorded from the centre of Armidale to approximately 15km east along Waterfall Way (within the vicinity of the Site).

The crash data for the 11 sites is summarized in **Table 3**. Refer **Appendix 1** for a map of the 11 crash sites and for more detailed information for all other crash sites refer to the website.

Table 3 – Crash Data (2013 to 2017)

Year	Crash ID	Type of Location	Accident Type	Degree of Crash	Day or Night	No. Injured
2013	824311	2-way undivided	Off bend	Non-casualty	Day	0
2013	838071	2-way undivided	Off bend hit object	Minor / Other Injury	Day	1
2013	854540	2-way undivided	Off bend	Moderate Injury	Day	2
2013	1002951	2-way undivided	Off straight hit object	Moderate Injury	Day	1
2013	1004022	2-way undivided	Off bend	Non-casualty	Day	0
2014	1028714	2-way undivided	Off bend hit object	Serious Injury	Night	2
2015	108547	2-way undivided	Off bend hit object	Moderate Injury	Day	1
2015	1090740	2-way undivided	Off bend	Moderate Injury	Day	1
2017	1144360	2-way undivided	Off straight hit object	Serious Injury	Day	1

[3] RMS Centre for Road Safety Website – Interactive Crash Statistics (31/05/2019)

Year	Crash ID	Type of Location	Accident Type	Degree of Crash	Day or Night	No. Injured
2017	1146457	2-way undivided	Off straight hit object	Moderate Injury	Day	1
2017	1160392	2-way undivided	Off straight hit object	Moderate Injury	Day	1

The number of crashes reported is considered to be relatively minor given the volume of traffic using this road. There are reoccurring accident patterns whereby vehicles are leaving the carriageway on bends and vehicles hitting roadside objects.

2.6 Bus Services

There are two school bus services operated by Edwards Coaches. The operator advised that these services travel along Waterfall Way, one to Wollomombi and one to Hillgrove. Both services commence pick-ups at approximately 7:30am in the morning with students arriving in Armidale at approximately 8:15am. The afternoon runs commence at approximately 3:45pm from Armidale and end at approximately 4:30pm. The school buses stop at informal locations along the Waterfall Way to pick up and drop off passengers (i.e.: side road intersections and property entrances).

2.7 Pedestrian and Cycling Activity

No pedestrians or cyclist were observed during the inspections along Waterfall Way within the study area. As the surrounding area is rural, there are no dedicated on-road cycleways or off-road shared paths (for cyclists and pedestrians) along the surrounding road network.

3 Project Related Traffic

3.1 Development Generated Traffic

Estimates of traffic generated by the Project during construction and the operational phases were provided by the Proponent based on is experience in the development of similar developments, and used to assess the traffic impact at the following locations:

- Waterfall Way and Gara Road intersection;
- Proposed Site access from Gara Road Waterfall Way; and
- Proposed substation site access.

Details of the vehicle movements for the construction of the solar farm are included in **Table 4** and details of the vehicle movements for the construction of the substation are included in **Table 5.**

3.2 Project Phases

3.2.1 Construction Phase – Solar Farm

The construction phase for the solar farm is anticipated to take 9 months to complete with a daily construction workforce of approximately 50 staff. The work will be undertaken during the following working hours:

- Monday to Friday 7:00am to 6:00pm;
- Saturday 8:00am to 1:00pm; and
- No work on Sunday or public holidays.

The majority of construction workers are anticipated to be transported to the Site in 3 mini buses (approx. 40 staff) with the remainder using LV (approx. 10 staff, along with visitors and 'misc. small tools'), which equates to approximately 11 LV per day into the Site in total.

Construction deliveries are anticipated to be on average, 5 HV per day into the Site.

The anticipated origin of all vehicles is 100% from the west using the Waterfall Way and Gara Road intersection and Gara Road to access the Site.

3.2.2 Construction Phase – Substation

The construction phase for the substation is anticipated to take 7 months to complete with a daily construction workforce of approximately 10 staff. The construction of the substation will be undertaken concurrently with the solar farm construction. The work will be undertaken during the same working hours for the construction of the solar farm as detailed in Section 3.2.1.

The majority of construction workers associated with the substation are anticipated to be transported to the site in LV (approx. 2 staff per LV) which equates to approximately 5 LV per day into the site.

Construction deliveries are anticipated to be on average, 1 HV per day into the site.

The anticipated origin of all vehicles being 100% from the west using the Waterfall Way substation site access.

3.2.3 Operational Phase

The operational phase is anticipated for a period of 29 years with a daily full time workforce of between 3 to 6 staff (up to 6 LV per day into the Site). Working hours for operations are as follows:

- Monday to Friday 7:00am to 6:00pm;
- Saturday 8:00am to 1:00pm; and
- No work on Sunday or public holidays.

Operational staff are anticipated to use LV to access the Site with deliveries of between 1 and 2 LV per day and the anticipated origin of all vehicles is 100% from the west using the Waterfall Way and Gara Road intersection and Gara Road to access the Site.

Table 4 – Development Generated Traffic Volumes for the Solar Farm

Construction Activity	Purpose	Vehicle Type	Total HV Inward Movements	Daily Average (1,2)
Heavy Vehicles (HV)				
PV Component Delivery	PV Modules	Semi-trailer	252	1.1
	Tracker Systems and Mounting Posts	Semi-trailer	244	1.0
	Cabling	Semi-trailer	23	0.1
	Inverter Stations	L Low Loader	6	0.0
General Construction	Water delivery	Truck tanker	90	0.4
	Fuel delivery	Truck tanker	41	0.2
	Skip delivery	SM Flat bed	78	0.3
	Portaloo Pump out	SM Flat bed	49	0.2
Site Mobilisation	Miscellaneous Establishment Deliveries	L Low Loader	3	0.0
	Earthworks equipment delivery	H Low Loader	4	0.0
Site setup / access roads	Imported material for site office and laydown areas	Truck and dog	78	0.3
	Imported material for site roads base fill	Truck and dog	258	1.1
HV trench	Excavator Delivery	H Low Loader	2	0.0
	Cable laying equipment	L Low Loader	2	0.0
	Cable Bedding Sand	L Low Loader	58	0.2
		Total HV Inward Movements	**1189**	
			Average Daily HV Inward Movements	**5.1 (5)**
Light Vehicles (LV)				
Light vehicle	Workers and visitors in cars (3,4)	Vans, cars	1872	8.0
	Workers in buses (5)	mini bus	702	3.0
	Misc. small tools etc. (6)	Light goods van	50	0.2
		Total LV Inward Movements	**2624**	
			Average Daily LV Inward Movements	**11.2 (11)**

Assumptions:

(1) 26 working days per month.
(2) 9 month construction timeframe.
(3) 50 workers per day for solar farm construction.
(4) 10 workers per day using cars (assume 8 cars including visitors) for solar farm construction.
(5) 40 workers in 3 mini buses for solar farm construction.
(6) 50 Miscellaneous specialist tool deliveries and use estimated over 9 month period totaling 0.2 Light Vehicles per day.

Table 5 – Development Generated Traffic Volumes for the Substation

Construction Activity	Purpose	Vehicle Type	Total HV Inward Movements	Daily Average (1)
Heavy Vehicles (HV)				
Substation works	Miscellaneous Movements (building materials etc.)	Semi-trailer	10	0.1
	Primary transformer	OD H - Low Loader	1	0.0
	Substation components	OD L - Low Loader	4	0.0
	Switchboard	L Low Loader	4	0.0
	Cabling	L Low Loader	4	0.0
	Switchgear Components	Semi-trailer	10	0.1
		Total HV Inward Movements	**33**	
			Average Daily HV Inward Movements	**0.2 (1)**
Light Vehicles (LV)				
Light vehicles	Workers in cars (3)	Vans, cars	910	5.0
		Total LV Inward Movements	**910**	
			Average Daily LV Inward Movements	**5.0 (5)**

Assumptions:

(1) 26 working days per month.
(2) 7 month construction timeframe
(3) 10 workers per day using cars (assume 2 staff per car)

3.3 Access to the Project Site

The existing access to the Site is via Gara Road and is a rural property access that is unsealed. It is considered that the existing access is suitable for the Project related traffic as it currently caters for semi-trailer cattle trucks that access the Sherraloy property.

Vehicle movements at the Site access will be left in and right out.

3.4 Access to the Substation Site

The existing access to the Site is via the Waterfall Way and is an informal rural property access that is unsealed. It is envisaged that this access will need to be upgraded to at least the minimum requirement for a semi-trailer in accordance with Figure 7.4 of *AUSTROADS Guide to Road Design – Part 4: Intersections and Crossings* (refer **Figure 3**).

It is expected that all works in relation to the design and construction of the substation site access will be in accordance with the development consent and more specifically, the requirements of an RMS Works Authorisation Deed (WAD).

3.5 Peak Hour Volumes

Whilst no peak AM and peak PM hours can be quantified for background traffic or development traffic, it is expected that peak hour movements will occur at the start and end of daily shifts given the vast majority of vehicle movements to and from the Site will be workers during both the construction and operational phases.

Using the information from **Table 4** and **Table 5** for the construction phase and **Section 3.2.2** for the operational phase, the peak hour volumes have been calculated using the average daily inward movements based on the following assumptions:

Construction Phase: 100% LV + 15% HV

Operational Phase: 100% LV (assumes 6 workers and 1 delivery)

A summary of the resultant peak hour volumes for the construction phase and the 10 year horizon for the operational phase are presented in **Table 6, Table 7 and Table 8**.

Table 6 – Peak Hour Calculations – Waterfall Way at Proposed Substation Site Access

Activity	Year		Waterfall Way		Substation			
			AADT	Peak Hour	HV	LV	Total	Peak Hour
Construction	0	2020	1494	224	0.2	5.0	5.2	5.0

Table 7 – Peak Hour Calculations – Waterfall Way at Gara Road Intersection

Activity	Year		Waterfall Way		Solar Farm			
			AADT	Peak Hour	HV	LV	Total	Peak Hour
Construction	0	2020	1494	224	5.1	11.2	16.3	12.0
Operations	1	2020	1494	224	-	7.0	7.0	7.0
Operations	2	2021	1516	227	-	7.0	7.0	7.0
Operations	3	2022	1539	231	-	7.0	7.0	7.0
Operations	4	2023	1562	234	-	7.0	7.0	7.0
Operations	5	2024	1585	238	-	7.0	7.0	7.0
Operations	6	2025	1609	241	-	7.0	7.0	7.0
Operations	7	2026	1633	245	-	7.0	7.0	7.0
Operations	8	2027	1658	249	-	7.0	7.0	7.0
Operations	9	2028	1683	252	-	7.0	7.0	7.0
Operations	10	2029	1708	256	-	7.0	7.0	7.0

Table 8 – Peak Hour Calculations – Gara Road and Site Access Intersection

Activity	Year		Gara Road		Solar Farm			
			AADT	Peak Hour	HV	LV	Total	Peak Hour
Construction	0	2020	50	8	5.1	11.2	16.3	12.0
Operations	1	2020	50	8	-	7.0	7.0	7.0
Operations	2	2021	50	8	-	7.0	7.0	7.0
Operations	3	2022	50	8	-	7.0	7.0	7.0
Operations	4	2023	50	8	-	7.0	7.0	7.0
Operations	5	2024	50	8	-	7.0	7.0	7.0
Operations	6	2025	50	8	-	7.0	7.0	7.0
Operations	7	2026	50	8	-	7.0	7.0	7.0
Operations	8	2027	50	8	-	7.0	7.0	7.0
Operations	9	2028	50	8	-	7.0	7.0	7.0
Operations	10	2029	50	8	-	7.0	7.0	7.0

4 Assessment and Recommendations

The following subsections review the anticipated impacts of the Project on the road network. Discussions relevant to the recommendations for impact mitigation or other controls are also included, where appropriate.

4.1 Construction and Operational Traffic Impacts

Peak Project related traffic movements are expected to occur during the construction phase as described in **Section 3.2.1**. During this phase the vast majority of vehicle movements to and from the Site will be worker LV and mini buses. These LV will have negligible impact to road pavement condition. It is anticipated that the majority of workers will travel to the Site in mini busses during the construction phase which will minimise the volume of Project related within the study area.

4.1.1 Heavy Vehicle Impacts

HV movements required for the Project are limited to those required during the construction phase. Quantities of HV deliveries expected to occur during these phases are described in **Sections 3.2.** The expected origin of these vehicles is 100% from the west during both the construction and operational phases.

Any oversized and over mass HV deliveries will occur during the construction phase (e.g.: transportation of the primary transformer). These oversized and over mass HV deliveries will be conducted in accordance with requirements of the National Heavy Vehicle Regulator (NHVR) requiring permits prior to haulage of these loads. The transport route for each load will be planned in consultation with RMS and will vary depending on the origin of each load.

4.2 Roads

4.2.1 Waterfall Way

The Waterfall Way in the vicinity of the proposed Site is currently approved for B-doubles up to 25m in length and the pavement and associated traffic facilities are in good condition. General access is available for all HV types associated with the Project, except for those required to transport oversized and over mass deliveries.

During the construction phase for the substation, there is an average inward movement of 1 HV and 5 LV per day using the substation site access.

During the construction phase of the solar farm, there is an average inward movement of 5 HV and 11 LV per day using the Waterfall Way and Gara Road intersection.

During the operational phase, it is assumed that there is an inward movement of 7 LV per day inclusive of workers and deliveries using the Waterfall Way and Gara Road intersection.

The daily traffic volumes are relatively low even beyond the 10 year horizon following the commencement of operations of the solar farm as detailed in **Table 2**. It is considered that there is sufficient capacity for the road to accommodate the additional construction and operational traffic as a result of the Project without the need for any upgrades along Waterfall Way.

Ongoing maintenance will be the responsibility of RMS funded from routine maintenance programs.

4.2.2 Gara Road

Gara Road is not an approved B-double route however general access is available for all HV types associated with the Project, except for those required to transport oversized and over mass deliveries.

During the construction phase, there is an average inward movement of 5 HV and 11 LV per day.

During the operational phase, it is assumed that there is an inward movement of 7 LV per day inclusive of workers and deliveries.

A number of deficiencies have been identified from the road safety audit as detailed in **Section 2.4.** Whilst these are existing deficiencies for all road users and their rectification is the responsibility of Armidale Regional Council, an interim measure during the construction phase that could be adopted, particularly at the locations where the road has a narrow formation, tight radius bends and single lane causeways, is the provision of give way signage in one direction to ensure that HV passing manoeuvres at these locations are mitigated.

The daily traffic volumes are low even beyond the 10 year horizon following the commencement of operations of the solar farm and it is therefore considered that the upgrading and sealing of Gara Road is not considered necessary as a result of the Project.

Ongoing maintenance will be the responsibility of Armidale Regional Council funded from routine maintenance programs.

4.3 Intersections

4.3.1 Warrants for Basic, Auxiliary and Channelised Turn Treatments

Figure 4.9(a) of *AUSTROADS Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections,* specifies warrants for providing left and right turn treatments at unsignalised intersections. The graph reproduced below as **Figure 4** shows the volumes of traffic at an intersection subject to speed limits equal to and greater than 100km/h.

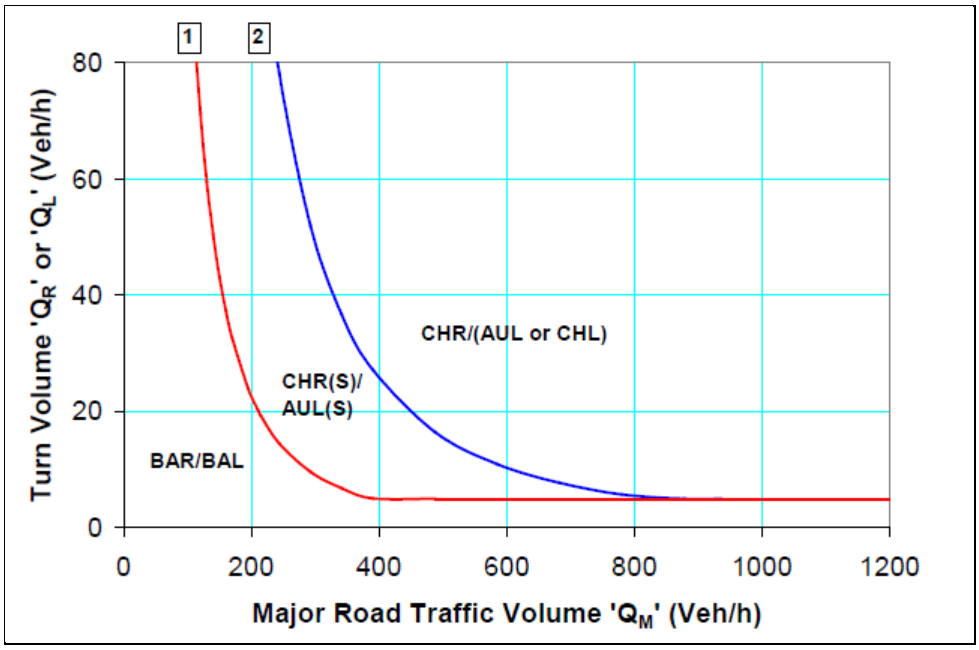
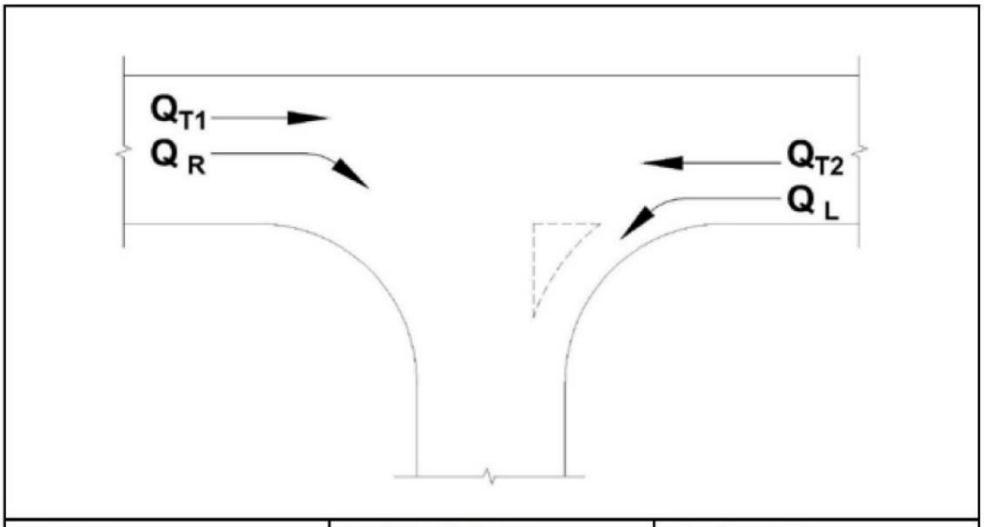


Figure 4 – Warrants for turn treatments – Design speed ≥ 100km/h

Figure 4.10 of *AUSTROADS Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections* defines the traffic and turn volume parameters and this has been reproduced as **Figure 5**.



Turn type	Splitter island	Q_M (veh/h)
Right	No	= $Q_{T1} + Q_{T2} + Q_L$
Right	Yes	= $Q_{T1} + Q_{T2}$
Left	No/Yes	= Q_{T2}

Figure 5 – Traffic and Turn Volume Parameters

4.3.2 Intersection of Gara Road and Site Access

The Site access is located approximately 200m from the top of a crest. The sight distance to the east is greater than 300m however the sight distance to west is compromised by a small crest. The safe intersection sight distance (SISD) for a 100km/h speed zone is generally within the range of 250m to 300m depending on a number of criteria as defined in *AUSTROADS Guide to Road Design – Part 4A: Unsignalised and Signalised*. Sight distance to the west is compromised due to the location of the crest however, given that speeds along this unsealed road are considered to be less than 100km/h on average, and there is sight distance further west beyond the crest, it is considered that the Site access in its current location and configuration would be satisfactory.

Traffic volume parameters have been calculated for two scenarios, the construction phase (year 0 - 2019) and the 10 year operational phase (year 10 - 2029). These parameters have been listed in **Table 9.**

Table 9 – Traffic Parameters (vehicles per hour)

Parameter	Year 0 (2019)	Year 10 (2029)
	Peak Hour (vph)	Peak Hour (vph)
Q_R	0	0
Q_L	12	7
$Q_{M\ (R)}$	19	15
$Q_{M\ (L)}$	4	4

Figure 6 and **Figure 7** show the traffic volume parameters diagrammatically for the Gara Road and Site access intersection and these parameters have then used to determine the warrant for turn treatments by plotting them on the Austroads graph**.**

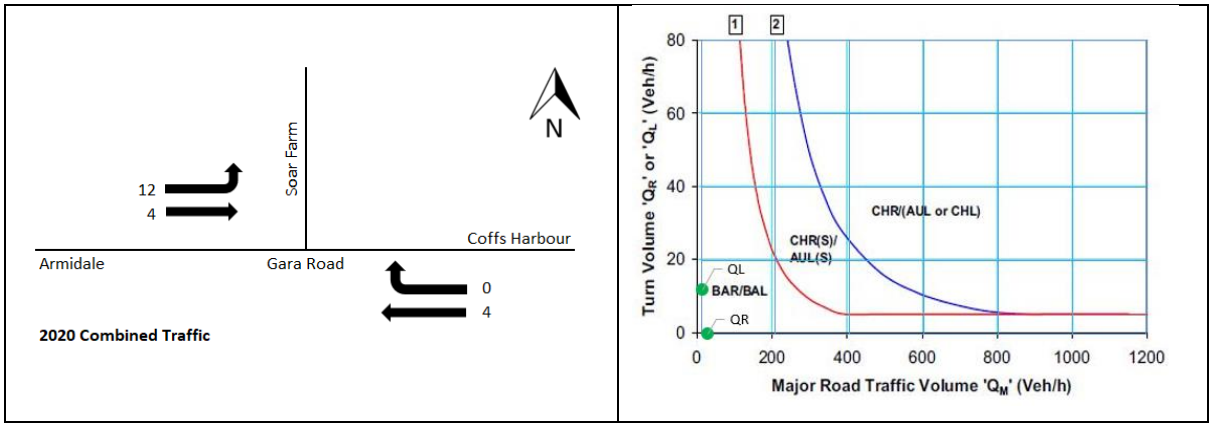


Figure 6 – Peak Hour Flows (2019)

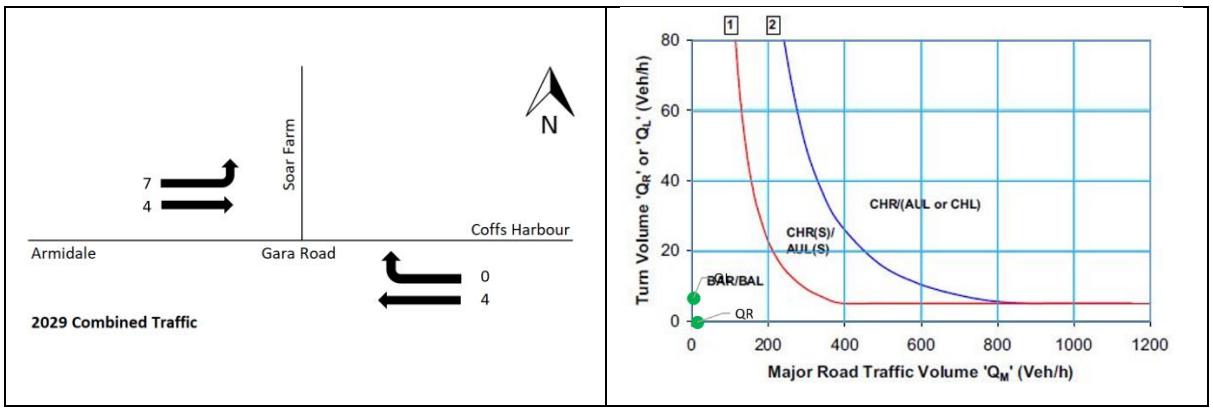


Figure 7 – Peak Hour Flows (2029)

The resultant warrant for turn treatments for both of the scenarios is that the Gara Road and Site access intersection will require Basis Left (BAL) and Basic Right (BAR) rural turn treatments however, However, as Gara Road is unsealed and the background traffic is less than 50vpd, the provision of turn treatments for the Site access are considered unnecessary. It is further considered that the existing access is suitable for the Project related traffic as it currently caters for semi-trailer cattle trucks that access the Sherraloy property.

4.3.3 Intersection of Waterfall Way and Gara Road

Sight distance in both directions is greater than 300m along Waterfall Way. The safe intersection sight distance (SISD) for a 100km/h speed zone is generally within the range of 250m to 300m depending on a number of criteria as defined in *AUSTROADS Guide to Road Design – Part 4A: Unsignalised and Signalised.*

Traffic volume parameters have been calculated for two scenarios, the construction phase (year 0 - 2019) and the 10 year operational phase (year 10 - 2029). These parameters have been listed in **Table 10.**

Table 10 – Traffic Parameters (vehicles per hour)

Parameter	Year 0 (2019)	Year 10 (2029)
	Peak Hour (vph)	Peak Hour (vph)
Q_R	12	7
Q_L	0	0
$Q_{M\ (R)}$	224	256
$Q_{M\ (L)}$	112	128

Figure 8 and **Figure 9** show the traffic volume parameters diagrammatically for the Waterfall Way and Gara Road intersection and these parameters have then used to determine the warrant for turn treatments by plotting them on the Austroads graph**.**

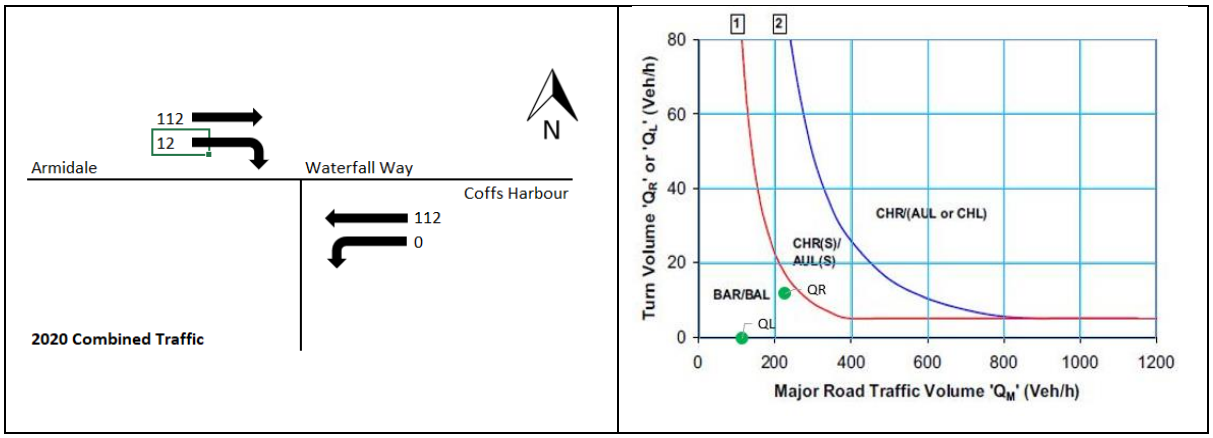


Figure 8 – Peak Hour Flows (2019)

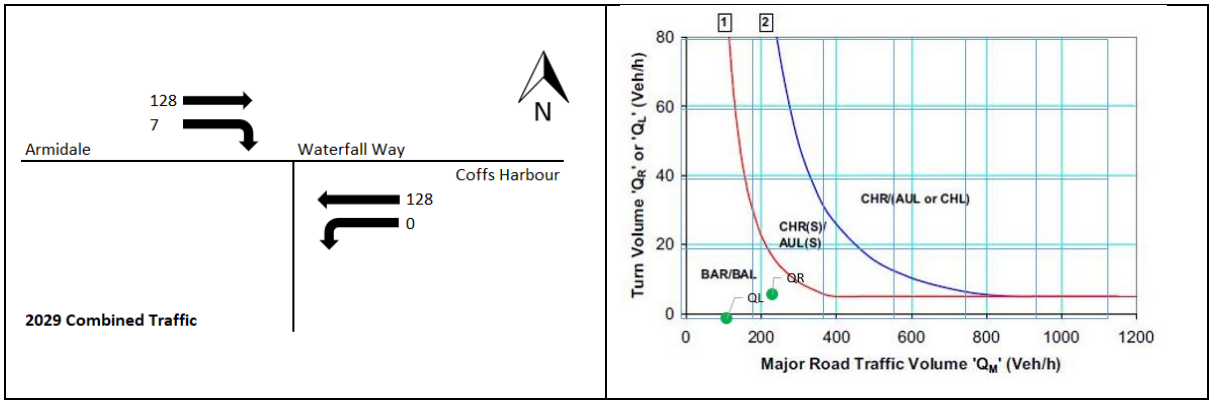


Figure 9 – Peak Hour Flows (2029)

The resultant warrant for turn treatments for both of the scenarios is that the Waterfall Way and Gara Road intersection will require shoulder widening on Waterfall Way to provide Basis Left (BAL) and Basic Right (BAR) rural turn treatments. As all Project related traffic is coming from the west, the requirement for a BAL is considered to be unnecessary. Furthermore, the construction of a BAL will require the removal of trees, widening of the upstream side of the existing 900mm diameter stormwater pipe and the relocation/replacement of the safety barriers and associated end terminals.

With regards to the provision of auxiliary lanes such as an acceleration lane for HVs entering Waterfall Way, trucks will be unladen leaving the Site, and given relatively low traffic volumes there would be sufficient gaps for HV's to enter the Waterfall Way. Therefore, provision of an acceleration lane is considered to be unnecessary.

4.3.4 Intersection of Waterfall Way and Proposed Substation Site Access

Sight distance to the east and west along the Waterfall Way is approximately 300m and 260m respectively. The safe intersection sight distance (SISD) for a 100km/h speed zone is generally within the range of 250m to 300m depending on a number of criteria as defined in *AUSTROADS Guide to Road Design – Part 4A: Unsignalised and Signalised*. Sight distance to the west could be improved by the pruning and/or removal of a number of trees adjacent to the eastbound lane.

As described in **Section 3.4**, it is anticipated that the substation site access will require upgrading to satisfy the requirements for a rural property access as per **Figure 3** catering for the largest vehicle type.

Table 11 – Traffic Parameters (vehicles per hour)

Parameter	Year 0 (2019)
	Peak Hour (vph)
Q_R	5
Q_L	0
$Q_{M\ (R)}$	224
$Q_{M\ (L)}$	112

Figure 10 show the traffic volume parameters diagrammatically for the proposed substation site access. These parameters have then used to determine the warrant for turn treatments by plotting them on the Austroads graph**.**

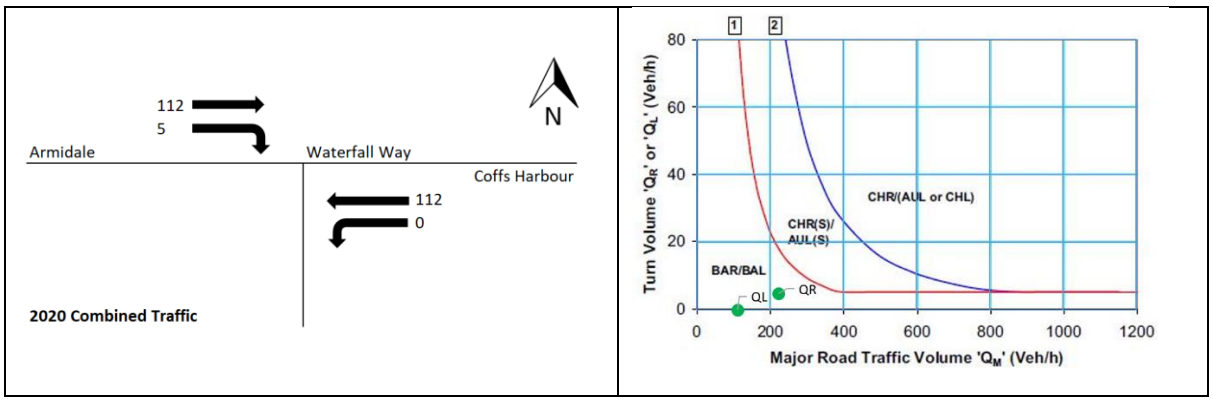


Figure 10 – Peak Hour Flows (2019)

The resultant warrant for turn treatments for both of the scenarios is that the substation site access will require shoulder widening on Waterfall Way to provide Basis Left (BAL) and Basic Right (BAR) rural turn treatments. As all the substation construction traffic is coming from the west, the requirement for a BAL is considered to be unnecessary. Furthermore, the construction of a BAL will require the removal of trees located adjacent to the westbound lane along Waterfall Way which are located in an area signposted as a 'Significant Roadside Environment Area'.

With regards to the provision of auxiliary lanes such as an acceleration lane for HVs entering Waterfall Way, trucks will be unladen leaving the substation site, and given relatively low traffic volumes there would be sufficient gaps for HVs to enter the Waterfall Way. Therefore, provision of an acceleration lane is considered to be unnecessary.

4.3.5 Warning Signs

Given the 100km/h speed limit on Waterfall Way and the number of HV using the Gara Road intersection and proposed substation site access during the construction phase, the provision of intersection advanced warning signs and truck warning signage located on Waterfall Way on the approaches to Gara Road and the proposed substation site access should be considered to warn road users of the HV activity at these locations (refer **Figure 11** and **Figure 12**).

Figure 11 – Side Road Warning Sign

Figure 12 – Truck Warning Sign

In addition, the provision of intersection advanced warning signs and truck warning signage located on Gara Road on the approaches to the Site access should be considered, particularly for the construction phase, to warn road users of the HV activity in the area during this time.

4.4 Traffic Management and Code of Conduct

Although there are relatively low traffic volumes associated with the construction and operational phases**,** it would be desirable for a Traffic Management Plan (TMP) be developed for traffic during the construction period. This will assist with the control of Project related traffic movements, and ensure that driver behaviour within the Site and on the surrounding road network is maintained to a safe level that accounts for local conditions given the deficiencies along Gara Road identified from the road safety audit.

During the construction phase, a driver code of conduct phase should also be implemented as this will outline rules to be followed within the Site and on the surrounding road network. The code, which will form part of the TMP, will encourage driving in a considerate manner at all times and respect for the rights of others to use and share the road space. A copy of the code would be provided to drivers during their workplace inductions to the Site.

4.5 Parking

All parking during the construction and operational phases will be available within the Site. It is envisaged that designated parking areas will be determined as part of the Project planning.

4.6 Road Traffic Noise and Dust.

Dust associated with the Project will be addressed as part of a separate report to be included with the EES. It is envisaged that significant dust associated with internal roads of the Site will be suppressed by the use of water trucks.

During the construction phase, there will be increased traffic movements along Gara Road. As the road is unsealed and given the number of residences along the 5km transportation route, the regular use of water trucks along Gara Road may be warranted to suppress the increased dust generation during the construction phase of the Project.

Road traffic noise will be addressed as part of a separate report to be included with the EES.

4.7 Buses

As described in **Section 2.7,** there are 2 school bus services that operate along Waterfall Way in the vicinity of the Project Area. Other than increased traffic volumes during peak morning and afternoon times when workers enter and leave the Site during the construction phase, it is considered that the Project will have a minimal impact on bus services.

4.8 Pedestrians and Cyclists

Given the surrounding rural environment, low numbers of pedestrian and cyclists, and the distance of the Site from populated areas such as Armidale and Wollomombi, it is considered that the Project is unlikely to impact on pedestrians and cyclists.

4.9 Cumulative Traffic Impacts

Depending on the timing of this development, there may be cumulative traffic impacts along Waterfall Way associated with a proposal named Olive Grove Solar Farm. The traffic associated with the Olive Grove Solar Farm development will be very similar to this development however, access to the Olive Grove Solar Farm shall be directly from Waterfall Way where the Stringybark Solar Farm substation construction traffic will access the site as described in **Section 2.3.2**.

As no traffic for the Olive Grove Solar Farm development will use Gara Road, this development will a have a negligible impact on the Waterfall Way and Gara Road intersection however, there will be a cumulative impact at the Olive Grove Solar Farm access off Waterfall Way as this access is to be used by construction vehicles associated with the Stringybark Solar Farm development. While Olive Grove Solar Farm is not currently submitted into planning, any future Development Application for the Olive Grove Solar Farm should also account for the traffic numbers associated with the construction of the Stringybark Solar Farm substation in its Traffic Impact Assessment.

5 Conclusion

Matters relating to traffic and transport for the proposed Stringybark Solar Farm have been addressed in this report. The study area comprising of the following:

- Waterfall Way from approximately 2km west of the Gara Road intersection to approximately 2km east of the Silverton Road intersection;
- The access from the Waterfall Way for the proposed substation development which will facilitate vehicles only associated with the construction of the substation; and
- Gara Road between Waterfall Way and the proposed Site access.

The analysis and discussions presented in this report can be summarised as follows:

- The construction phase for the Stringybark Solar Farm is anticipated to be approximately 9 months and the concurrent construction phase for the substation is anticipated to be approximately 7 months;
- The majority of workers during the construction phase of the solar farm are anticipated to travel to the Site in mini busses therefore minimising the impact of Project related traffic on the surrounding road network;
- Project related traffic during the construction phase and operational phase over the 10 year horizon will result in a minor increase to traffic volumes on the Waterfall Way however, it is considered that the road has sufficient capacity to cater for the combined background traffic;
- The existing daily traffic volumes on Gara Road are low (less than 50vpd) and remain relatively low taking into consideration the average daily traffic volumes associated with the construction phase (5 heavy vehicles (HV) and 11 light vehicles (LV)) and the operational phase (7 LV) beyond the 10 year horizon following the commencement of operations. It is therefore considered that the upgrading and sealing of Gara Road between Waterfall Way and the Site access is not considered necessary as a result of the Project; and
- Impacts on the surrounding road network in terms of school bus services will be minimal and insignificant for pedestrians and cyclists.
- The following roadworks are recommended for the Waterfall Way and Gara Road intersection:
    - Provision of shoulder widening on Waterfall Way to provide a Basic Right (BAR) rural turn treatment; and
    - Provision of advanced side road ahead and truck warning signs along Waterfall Way on both approaches to the Gara Road intersection, during the construction phase.
- The following works are recommended for the Site access:
    - Provision of advanced side road ahead and truck warning signs along Gara Road on both approaches to the Site access.
- The existing daily traffic volumes on the Waterfall Way are almost 1,500 vpd, The average daily traffic volumes associated with the construction of the substation are 1 HV and 5 LV. These daily traffic volumes are considered to be negligible and there is sufficient capacity for the road to accommodate the additional substation construction traffic without the need for any upgrades;
- The following roadworks are recommended for the proposed access from the Waterfall Way for the substation to accommodate substation construction traffic:
    - Upgrade of the existing site access to satisfy the requirements for a rural property access as per Figure 7.4 of *AUSTROADS Guide to Road Design – Part 4: Intersections and Crossings-General;*
    - Provision of shoulder widening on Waterfall Way to provide Basic Right (BAR) rural turn treatments;
    - Provision of tree pruning or removal adjacent to the eastbound lane of Waterfall Way to improve sight distance to the west; and

  - Provision of advanced side road ahead and truck warning signs along Waterfall Way on both approaches to the proposed Substation site access, during the construction phase.

- Consideration for the regular use of water carts along Gara Road between Waterfall Way and the Site access to suppress dust generated by Project related traffic during the construction phase only.
- Existing road safety issues along Gara Road between the Waterfall Way and the Site access have been identified. Whilst these are existing deficiencies for all road users and are the responsibility of Armidale Regional Council, interim measures, such as the provision of give way signage in one direction at the locations where the road has a narrow formation and tight radius bends, could be implemented during the construction phase only to ensure that HV passing manoeuvres at these locations are mitigated.
- Provision of Traffic Management Plan and driver code of conduct is considered desirable during the construction phase. This will assist with the control of Project related traffic and ensure that driver behaviour within the Site and on the surrounding road network is maintained to a safe level that accounts for local conditions given the deficiencies along Gara Road identified from the road safety audit.
- Any future Development Application for the Olive Grove Solar Farm should also account for the traffic numbers associated with the construction of the Stringybark Solar Farm substation in its Traffic Impact Assessment.

It is concluded that subject to the recommended roadworks being implemented, there are no Project related traffic and transport issues which would prevent the Project from proceeding.

6 References

- RTA Publication (2002), 'Guide to Traffic Generating Developments'.
- Austroads (2010), 'Guide to Road Design – Part 3: Geometric Design'.
- Austroads (2009), 'Guide to Road Design – Part 4: Intersections and Crossings-General''
- Austroads (2009), 'Guide to Road Design – Part 4A: Un-signalised and Signalised Intersections'.
- Australian Standard AS 1742.2, 'Manual of uniform traffic control devices Part 2: Traffic control devices for general use'.
- RMS Australian Standard Supplements (July 2013), 'Australian Standard AS 1742 – Manual of uniform traffic control devices Parts 1 to 15'.

Appendix 1: Crash Data

Crashes Map - Armidale Regional

Navigation and Help

Select your LGA:

Armidale Regional

Reporting year
All

Degree of crash
All

Type of crash
All

Speed limit
All

RUM code group
All

Type of location group
All

Speeding involved in crash
All

Fatigue involved in crash
All

Road classification
All

DATA AVAILABILITY
Finalised data is available for the 5 year period 2013 to 2017.

Degree of crash
Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injure
2013	824311	Non-casualty (t..	86	Off left/left bend	2-way undivided	Daylight	151.818201	-30.530975	-	-
	838071	Minor/Other Inj..	81	Off left/rt bnd=>obj	2-way undivided	Daylight	151.774956	-30.541234	-	1
	854540	Moderate Injury	80	Off left/right bend	2-way undivided	Daylight	151.770009	-30.545889	-	2
	1002951	Moderate Injury	71	Off rd left => obj	2-way undivided	Daylight	151.724981	-30.535129	-	1
	1004022	Non-casualty (t..	86	Off left/left bend	2-way undivided	Daylight	151.817901	-30.531061	-	-
2014	1028714	Serious Injury	87	Off lft/lft bnd=>obj	2-way undivided	Darkness	151.813417	-30.533255	-	2
2015	1086547	Moderate Injury	85	Off rt/lft bnd=>obj	2-way undivided	Daylight	151.817947	-30.531046	-	1
	1090740	Moderate Injury	84	Off right/left bend	2-way undivided	Daylight	151.818355	-30.530944	-	1
2017	1144360	Serious Injury	73	Off rd right => obj	2-way undivided	Daylight	151.778494	-30.540982	-	1

Appendix 2: Road Safety Audit Report

constructive solutions

providing total solutions

Stage 5 - Road Safety Audit

Stringy Bark Solar Farm Transportation Route

Prepared for

Stringybark Solar Farm Pty Limited

July 2019

Report prepared by Constructive Solutions Pty Ltd

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TAMWORTH NSW 2340

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DOCUMENT HISTORY AND STATUS

Issue	Rev	Issued To	Date	Reviewed	Approved
1	A	Internal	31/05/2019	M. Bloem	
1	0	Client	15/07/2019	M. Bloem	
1	1	Client	19/07/2019	M. Bloem	M. Bloem
1	2	Client	24/07/2019	M. Bloem	M. Bloem

Author:	Jerome Malvern
Project Manager:	Michael Bloem
Project Name:	Stringy Bark Solar Farm Transportation Route – Stage 5 Road Safety Audit
Project Number:	201948
Name of Client:	Stringybark Solar Farm Pty Limited

ISO 9001 certified Equal Assurance

AS 4801 certified Equal Assurance

Template: Rev 5 (February 2019)

Table of Contents

AUDIT REPORT

CLIENT:	Stringybark Solar Farm Pty Ltd
TELEPHONE:	+64 22 033 1587
PROJECT MANAGER/ PROJECT SPONSOR	Richard Seymour Development Director
DESIGNER:	Not Applicable
PROJECT:	Stringy Bark Solar Farm Transportation Route Stage 5 Road Safety Audit
DRAWINGS:	Not Applicable
TYPE OF AUDIT:	Stage 5
DATE OF AUDIT:	02/05/2019
AUDIT TEAM:	
Accredited Level 3 Road Safety Auditor in NSW	Michael Bloem
Accredited Level 2 Road Safety Auditor in NSW	Jerome Malvern
COMMENCEMENT MEETING:	Not Required
COMPLETION MEETING:	19/07/2019
PREVIOUS AUDIT:	Nil

Executive Summary

Stringybark Solar Farm Pty Limited are preparing a Development Application (DA) for the proposed new Stringy Bark Solar Farm to be located near Armidale in north-west NSW. The solar farm will have a generation capacity of less than 30MW. The proposed Stringy Bark Solar Farm will be located off Gara Road, approximately east of Armidale as shown in **Figure 1**.

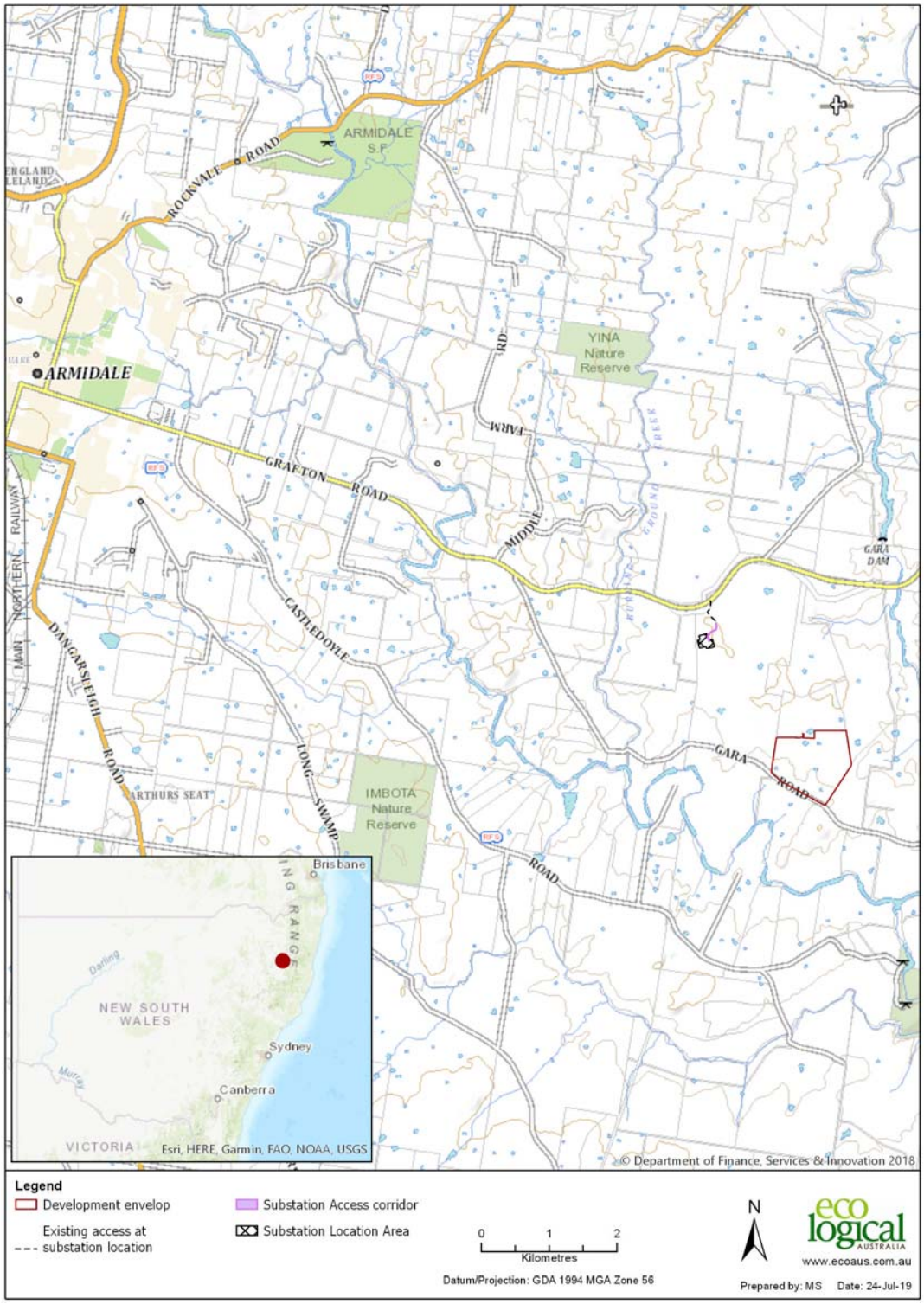

Figure 1 – Locality Plan

Stringy Bark Solar Farm Pty Limited have identified that the transportation route for construction traffic and general access traffic will be via Gara Road from the Waterfall Way intersection. The route from the Waterfall Way intersection along Gara Road is approximately 6km to the proposed property access point.

A Stage 5 (existing road) road safety audit has been requested by Stringybark Solar Farm Pty Limited for the proposed transportation route to be included with the Traffic and Transport Assessment to be lodged together with the Environmental Impact Statement.

The purpose of this audit is to report on the potential safety deficiencies and areas of risk associated with the existing road network from a safety perspective for all road users.

The audit consisted of a site inspection in both day and night conditions on 02 May 2019. The safety issues identified have been scheduled in **Table 1** in **Section 5** of the report with seven (7) Corrective Action Requests (CARs) raised. The safety issues identified fall within the following safety categories:

- Delineation;
- Road Alignment and Cross Section;
- Roadside Hazards;
- Safety Barrier; and
- Traffic Signs.

The comments listed under the heading ‘General Observations’ are observations noted whilst carrying out the audit and do not necessarily relate to safety issues. This list is not comprehensive, it is simply a record of some of the additional observations made by the auditors and has been provided purely as an item for additional information for the Client.

The risk ratings provided in this audit are the assessment of the auditor. Ultimately, it is the Client’s responsibility to determine the response to risk for each road safety risk identified.

This report does not provide recommendations with regards to addressing the corrective actions identified from this audit.

The Corrective Action Request (CAR) forms in **APPENDIX 2** have been provided for the use of the Client. The purpose of the form is to formalise the process of attending to the specific safety risk raised, whether it be the “do nothing” action or what action was taken to address the risk, and then the form can be signed off. CARs have been provided for all audit findings irrespective of the risk rating of the issue raised.

1 Introduction

1.1 Project Description

Stringybark Solar Farm Pty Limited have identified that the transportation route for construction traffic and general access traffic will be for the proposed Stringy Bark Solar Farm will be via Gara Road from the Waterfall Way intersection.

A Stage 5 (existing road) audit has been requested by Stringybark Solar Farm Pty Limited for the approximately 6km long transportation route along Gara Road between the Waterfall Way proposed property access point.

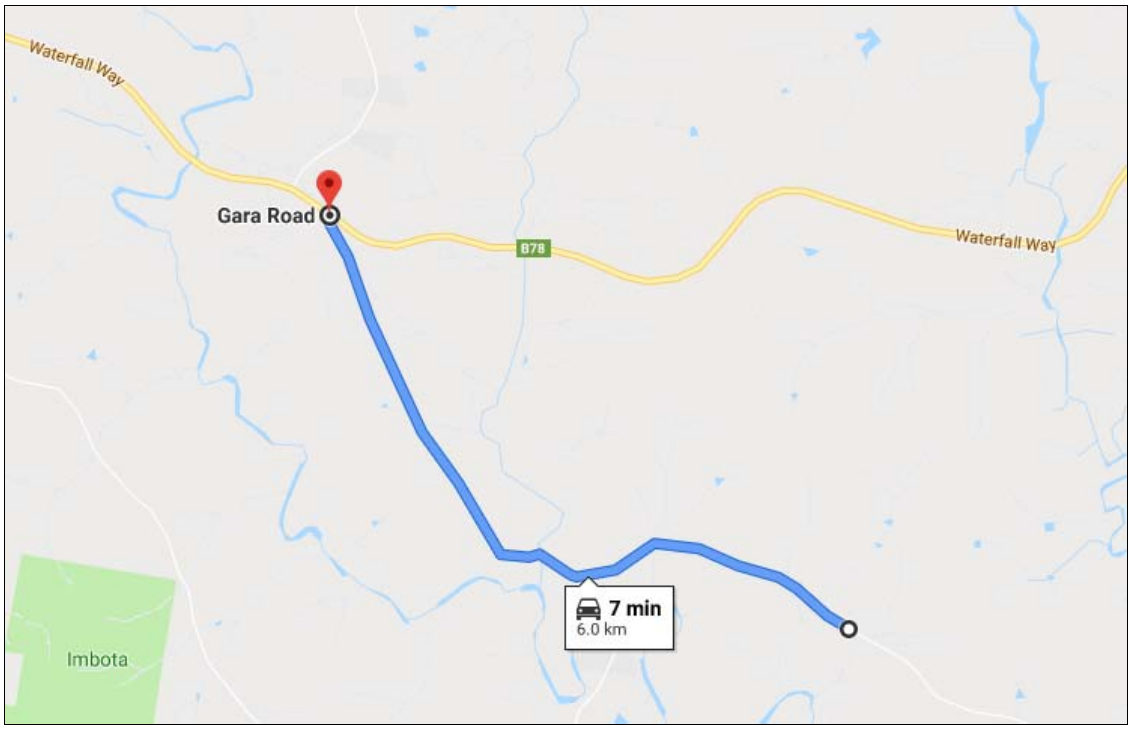

Figure 2 - Locality Map (source Google Maps, June 2019)

Traffic associated with the construction of the substation for the Stringybark Solar Farm will access the property via an alternate location directly off the Waterfall Way approximately 2km east of the Waterfall Way and Gara Road intersection. No specific road safety audit was undertaken at this location as this access point will be assessed in terms of upgrades and road safety as part of the traffic impact assessment report for the development.

1.2 Current Status of the Audited Road(s)

Gara Road a local road providing access to rural properties between the Waterfall Way and the intersection of Gara Road with Silverton Road.

The road is unsealed however there is a bitumen seal for the first 100m from the Waterfall Way intersection. The gravel pavement width varies however, it is generally between 5m and 6m. The horizontal and vertical alignment consists of several curves, crests and causeways. The overall condition of the unsealed pavement was considered to be good however there were some sections where corrugations were present.

Whilst there was no posted speed limit, it was assumed that the speed limit is 100km/h. There was no traffic count data available for Gara Road however, the AADT is assumed to be less than 100vpd.

Gara Road is not listed as an RMS approved B-double route.

2 Audit Scope and Objectives

The scope of the road safety audit was to assess the length of Gara Road between the Waterfall Way intersection and the proposed Stringy Bark Solar Farm property access.

The objective of this audit is to identify any potential road safety issues/deficiencies and areas of risk associated with the transportation routes from a safety perspective of all road users which may need to be investigated and rectified within the road network.

This report does not provide recommendations with regards to addressing the corrective actions identified from this audit.

3 Road Safety Audit Program

3.1 Commencement Meeting

No commencement was held however it was confirmed with the Client and the Lead Auditor prior to the site inspection that no night audit was required as construction and operational activities at the solar farm would be restricted to normal working hours.

3.2 Site Inspection

The day audit was undertaken on 2 May 2019 commencing at 14:50pm and concluded at 4:30pm. The weather conditions at the time of the audit were fine and sunny. The audited section of Gara Road was inspected in both directions.

3.3 Completion Meeting

The completion meeting was held on 19 July 2019 and included the Project Manager and Lead Auditor with the findings discussed prior to finalising the audit report.

4 Road Safety Audit

4.1 Audit Findings

The summary of the audit findings has been documented in **Table 1** below:

A detailed list of specific audit findings has been documented in **APPENDIX 3** which includes:

- Specific details of the nature of the audit findings;
- A risk rating of high, medium or low (refer **APPENDIX 1** for Risk Assessment Tools); and
- A reference to a Corrective Action Request (CAR) form (refer **APPENDIX 2**).

The CAR forms will facilitate proper close out of each of the potential road safety deficiencies as these require follow up action from the Client Project Manager as well as formal close out of each CAR.

Table 1 – Audit Findings

CAR No.	Audit Findings	Photographs	
Road Safety Category: Deliniation			
001	<u>Missing Guide Post(s)</u> Guide posts are only provided at culverts. There are no guide posts in place to delineate the alignment of the road including crests and curves as per the requirements of Section 16 of the RTA Delineation Guide. Missing guide posts can make it difficult for road users to visualise the road alignment, particularly at night. This is undesirable as an errant driver may run off the road and lose control of the vehicle potentially resulting in serious injury to the vehicle occupants given the relatively narrow road formation width.		

CAR No.	Audit Findings	Photographs	
Road Safety Category: Road Alignment and Cross Section			
002	<u>Steep Embankment Batters</u> There are number of unprotected steep batters located at numerous locations. There is a risk that an errant driver may leave the road, have insufficient shoulder width to recover and lose control down a steep batter. In most cases there is insufficient clear zone area at the base of the batter to allow recovery of the vehicle without impacting obstacles. There is also an increased risk potential for vehicle rollover type crashes, particularly heavy vehicles, on the verge/batter as the road has batter slopes in numerous locations which are less than the minimum standard of 4:1 and less than the desirable minimum batter of 6:1 for heavy vehicles as per Austroads Guide to Road Design.		
003	<u>Narrow Formation on Tight Radius Curves</u> There are a number of locations where there are tight radius substandard curves. There is a risk that an errant driver driving at speed may lose control at the curve and leave the road which has the potential to cause serious injuries to the occupants of the vehicle, particularly if there are objects within the clear zone		

CAR No.	Audit Findings	Photographs	
Road Safety Category: Roadside Hazards			
004	Objects within the Clear Zone There are a number of non-frangible trees, fence strainer posts and culverts with steep drop offs located within the clear zone. The location of these objects creates a hazard as there is a risk that errant drivers may leave the road and collide with unprotected objects within the clear zone which has the potential to cause serious injuries to the occupants of the vehicle.		
Road Safety Category: Safety Barrier			
005	Substandard End-Terminals The is a substandard end terminal at the end of the safety barrier on approach to the Waterfall Way intersection. There is a risk that an errant driver could leave the roadway and come into contact with a substandard safety barrier which does not correctly perform at impact due to the poor condition resulting with the potential for causing serious injuries to occupants of the vehicle.		

CAR No.	Audit Findings	Photographs	
Road Safety Category: Traffic Signs			
006	<u>Damaged and Missing Signs</u> There are a number of substandard curve warning signs on the approaches to substandard curves. There are missing advanced warning signs on the approaches to crests. There is a causeway without advanced warning signs on the approaches or depth markers at the causeway. Many of the CAMs provided for substandard curves are damaged, faded, or at a substandard height. The Give Way sign at the Waterfall Way intersection is located too far back from the intersection. Signs are provided to alert road users to oncoming features or changes in road condition. There is a risk that road users may not be aware of the oncoming conditions such as substandard curves which may result in the possibility of an errant driver coming into contact with oncoming traffic or leaving the roadway potentially resulting in serious injuries to occupants of the vehicle. A lack of warning signage can compromise road safety as road users are not properly advised of the changed traffic conditions ahead.	 	 

CAR No.	Audit Findings	Photographs	
Road Safety Category: Delineation			
007	<u>Transverse Line Marking</u> There is a Give Way signs in place at the Waterfall Way intersection however, there is no holding line, only the continuity line for the west bound travel lane. Holding lines at intersections with Give Way control are required to indicate to road users the safe position for their vehicles to be held when waiting at the intersection. There is a risk that when there is no holding line, an errant road user may encroach into the travel lane of the through road (100km/h speed zone) that may result in a vehicle collision.		

5 General Observations

The following general observations have been included with respect to the Project:

- Nil.

6 Formal Statement

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

It should be noted that while every effort has been made to identify potential safety hazards, no guarantee could be made that every deficiency has been identified.

It is recommended that audit findings be investigated with satisfactory corrective actions identified and implemented.

Name: Michael Bloem
Position: Road Safety Auditor Level 3
Auditor ID: RSA-02-0466
Date: 19/07/2019

Name: Jerome Malvern
Position: Road Safety Auditor Level 2
Auditor ID: RSA-02-1169
Date: 19/07/2019

7 References

- Austroads 2009, 'Guide to Road Safety – Part 6: Road Safety Audit'.
- RTA/Pub No. 11.291 (July 2011), 'Guidelines for Road Safety Audit Practices'.
- RTA 2011, 'Road Safety Audit Practices Information Sheet – Road Safety Categories', August 2011 RTA/Pub 11.348.
- RMS Delineation Guide – Section 16: Guide Posts and Delineation for Safety Barrier, Version 1, February 2010.
- Australian Standard, AS 1742.2 (2009) Manual for uniform traffic control devices. Part 2: Traffic control devices for general use.

Appendix 1: Risk Assessment Tools

Measures of Effectiveness

The following table can be used to assess the effectiveness of existing risk treatments, which should then be taken into account when determining the Consequence, Likelihood and therefore the level of Residual Risk.

No.	Level	Communication and documentation	General effectiveness
5	Excellent	Risk treatments and procedures are implemented, with communication and monitoring on a regular basis to determine their level of effectiveness in 'managing' the risk.	Is effective in reducing the risk under all conditions.
4	Good	Risk treatments and procedures are well documented and implemented, but with some room for improvement. Good communication and understanding of treatments with some degree of monitoring.	Is effective in reducing the risk under most conditions.
3	Fair	Risk treatments and procedures documented, but not well implemented, with minimal monitoring to ensure compliance or to determine their level of relevance.	Is effective in reducing the risk under ideal conditions.
2	Marginal	Risk treatments and procedures are informal, not well communicated and are implemented in an inconsistent manner.	Is partially effective in reducing the risk.
1	Poor or non-existent	Risk treatments and procedures are non–existent or ineffective; not communicated, sparsely implemented and of little value.	Makes little impact in reducing the risk.

Measures of Consequence (or Impact)

Level	Financial (Revenue & Costs)	Property	Provision of Service	Reputation	Environment	Road Safety
1. Insignificant	Low financial loss (e.g. < 1% of revenue or budget)	Negligible damage to or loss of assets.	Short-term, localised interruption to service / performance.	Issue of no public concern. Isolated communications expressing concern.	Issue of no public concern. Isolated communications expressing concern. Non-compliance identified internally and rectified.	Some low speed single vehicle collisions. Pedestrian walks into object (no head injury). Vehicle reverses into post.
2. Minor	Minor financial loss (e.g. 1% to 2% of revenue or budget).	Minor loss / damage. Some repairs may be required.	Minor, temporary disruption to services; Minor inconvenience to client(s).	Local public concern. May cause some complaints (justified or unjustified).	Local public concern. May cause some complaints (justified or unjustified). Regulatory non-compliances identified by external auditor.	Some low speed vehicle collisions. Cyclist falls from bicycle at low speed. Rear end collision
3. Moderate	High financial loss (e.g. 2% to 5% of revenue or budget).	Moderate to high damage requiring specialist / contractor equipment to repair or replace.	Some serious disruption to services. Some contravention of legal / contractual obligations.	Regional public concern. Significant complaints. Some adverse publicity. Local media coverage.	Regional public concern. Significant complaints. Some adverse publicity. Brought to the attention of regulator. Local media coverage.	Medium or slow speed vehicle/vehicle collision. Cyclist falls from bicycle at moderate speed. Rear end collision and pushed into object.
4. Major	Major financial loss (e.g. 5% to 10% of revenue or budget).	Significant / permanent damage to assets and / or infrastructure.	Major, long-term disruption to services. Serious breach of a legal / contractual obligation.	Significant public concern. Adverse publicity in national media. Embarrassment to the organisation. Damage to credibility and confidence in the organisation. Inquiry by regulators. State or regional media coverage.	Significant public concern. Adverse publicity in national media. Embarrassment to the organisation. Damage to credibility and confidence in the organisation. Inquiry by regulator. State or regional media coverage.	High or medium speed vehicle/vehicle collision. High or medium speed collision with a fixed roadside object. Pedestrian / cyclist struck (minor injuries).

Level	Financial (Revenue & Costs)	Property	Provision of Service	Reputation	Environment	Road Safety
5. Catastrophic	Huge financial loss (e.g. >10% of revenue or budget).	Widespread, substantial / permanent damage to assets and/or infrastructure.	Long term/irreversible impact on ability to deliver client services. Viability of the organisation in its current form is questionable.	Major public concern. Widespread, ongoing national and possibly international media attention. Severe embarrassment to the organisation. Loss of credibility and confidence in the organisation. Adverse findings and/or penalties by regulator.	Major public concern. Widespread, ongoing national and possibly international media attention. Severe embarrassment to the organisation. Loss of credibility and confidence in the organisation. Adverse findings and/or penalties by regulator.	High-speed multiple vehicle crash resulting in fatality. Pedestrian / cyclist struck (fatality). Significant number of casualties.

Measures of Likelihood

No.	Level	Description	Examples
5	Almost certain	The event will occur in most conditions	Expected frequency range: One or more per week
4	Likely	The event will probably occur in most conditions	Expected frequency range:-One or more per year (but less than once per week)
3	Possible	The event should happen at some time	Expected frequency range: Once every five or ten years
2	Unlikely	The event could happen at some time	Expected frequency range: Less often than once every ten years
1	Rare	The event may only occur in exceptional circumstances	Expected frequency range: Unlikely to occur in a 10-year period

Residual Risk Assessment Matrix

Likelihood		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
		1	2	3	4	5
Almost certain	5	M (ii)	H (ii)	E (i)	E (iv)	E (v)
Likely	4	M (i)	H (i)	H (ii)	E (ii)	E (iv)
Possible	3	L (iv)	M (ii)	H (i)	H (iv)	E (iii)
Unlikely	2	L (ii)	L (iv)	M (iii)	H (iii)	E (i)
Rare	1	L (i)	L (iii)	M (ii)	M (iii)	H (iv)

Appendix 2: Corrective Action Requests

Project:	**Proposed Stringy Bark Solar Farm Transportation Route**							
NCR/CAR No:	**001**							
Issue Identified By:	Audit Team				**Date:**	2 May 2019		
NCR/CAR Issued to:	Stringybark Solar Farm Pty Ltd				**Date:**	19 July 2019		
NCR/CAR Category:	WHS	☐	Quality	☐	Enviro	☐	Road Safety	☒

Section 1: Details of Non-Conformance/Corrective Action

Road Safety Category - Delineation

Missing Guide Post(s)

Guide posts are only provided at culverts. There are no guide posts in place to delineate the alignment of the road including crests and curves as per the requirements of Section 16 of the RTA Delineation Guide.

Missing guide posts can make it difficult for road users to visualise the road alignment, particularly at night. This is undesirable as an errant driver may run off the road and lose control of the vehicle potentially resulting in serious injury to the vehicle occupants given the relatively narrow road formation width.

Name:	Michael Bloem	**Position:**	Level 3 Road Safety Auditor
Signature:		**Date:**	19 July 2019

Section 2: Proposed action to be undertaken to rectify the issue

Name:		**Position:**	
Signature:		**Date:**	

Section 3: NCR/CAR Close out

Action undertaken to rectify the issue (if differing from proposed action):

Was the action taken successful in rectifying the issue?	Yes	☐	No	☐
Was further action necessary? If yes, describe below.	Yes	☐	No	☐

Name:		**Position:**	
Signature:		**Date:**	

Project:	**Proposed Stringy Bark Solar Farm Transportation Route**							
NCR/CAR No:	**002**							
Issue Identified By:	Audit Team				**Date:**	2 May 2019		
NCR/CAR Issued to:	Stringybark Solar Farm Pty Ltd				**Date:**	19 July 2019		
NCR/CAR Category:	WHS	☐	Quality	☐	Enviro	☐	Road Safety	☒

Section 1: Details of Non-Conformance/Corrective Action

Road Safety Category – Road Cross Section and Alignment

Steep Embankment Batters

There are number of unprotected steep batters located at numerous locations.

There is a risk that an errant driver may leave the road, have insufficient shoulder width to recover and lose control down a steep batter. In most cases there is insufficient clear zone area at the base of the batter to allow recovery of the vehicle without impacting obstacles.

There is also an increased risk potential for vehicle rollover type crashes, particularly heavy vehicles, on the verge/batter as the road has batter slopes in numerous locations which are less than the minimum standard of 4:1 and less than the desirable minimum batter of 6:1 for heavy vehicles as per Austroads Guide to Road Design.

Name:	Michael Bloem	**Position:**	Level 3 Road Safety Auditor
Signature:		**Date:**	19 July 2019

Section 2: Proposed action to be undertaken to rectify the issue

Name:		**Position:**	
Signature:		**Date:**	

Section 3: NCR/CAR Close out

Action undertaken to rectify the issue (if differing from proposed action):

Was the action taken successful in rectifying the issue?	Yes	☐	No	☐
Was further action necessary? If yes, describe below.	Yes	☐	No	☐

Name:		**Position:**	
Signature:		**Date:**	

Project:	**Proposed Stringy Bark Solar Farm Transportation Route**							
NCR/CAR No:	**003**							
Issue Identified By:	Audit Team				**Date:**	2 May 2019		
NCR/CAR Issued to:	Stringybark Solar Farm Pty Ltd				**Date:**	19 July 2019		
NCR/CAR Category:	WHS	☐	Quality	☐	Enviro	☐	Road Safety	☒

Section 1: Details of Non-Conformance/Corrective Action

Road Safety Category – Road Cross Section Alignment

Narrow Formation on Tight Radius Curves

There are a number of locations where there are tight radius substandard curves.

There is a risk that an errant driver driving at speed may lose control at the curve and leave the road which has the potential to cause serious injuries to the occupants of the vehicle, particularly if there are objects within the clear zone.

Name:	Michael Bloem	**Position:**	Level 3 Road Safety Auditor
Signature:		**Date:**	19 July 2019

Section 2: Proposed action to be undertaken to rectify the issue

Name:		**Position:**	
Signature:		**Date:**	

Section 3: NCR/CAR Close out

Action undertaken to rectify the issue (if differing from proposed action):

Was the action taken successful in rectifying the issue?	Yes	☐	No	☐
Was further action necessary? If yes, describe below.	Yes	☐	No	☐

Name:		**Position:**	
Signature:		**Date:**	

Project:	**Proposed Stringy Bark Solar Farm Transportation Route**							
NCR/CAR No:	**004**							
Issue Identified By:	Audit Team				**Date:**	2 May 2019		
NCR/CAR Issued to:	Stringybark Solar Farm Pty Ltd				**Date:**	19 July 2019		
NCR/CAR Category:	WHS	☐	Quality	☐	Enviro	☐	Road Safety	☒

Section 1: Details of Non-Conformance/Corrective Action

Road Safety Category – Roadside Hazards

Objects within the Clear Zone

There are a number of non-frangible trees, fence strainer posts and culverts with steep drop offs located within the clear zone.

The location of these objects creates a hazard as there is a risk that errant drivers may leave the road and collide with unprotected objects within the clear zone which has the potential to cause serious injuries to the occupants of the vehicle.

Name:	Michael Bloem	**Position:**	Level 3 Road Safety Auditor
Signature:		**Date:**	19 July 2019

Section 2: Proposed action to be undertaken to rectify the issue

Name:		**Position:**	
Signature:		**Date:**	

Section 3: NCR/CAR Close out

Action undertaken to rectify the issue (if differing from proposed action):

Was the action taken successful in rectifying the issue?	Yes	☐	No	☐
Was further action necessary? If yes, describe below.	Yes	☐	No	☐

Name:		**Position:**	
Signature:		**Date:**	

Project:	**Proposed Stringy Bark Solar Farm Transportation Route**							
NCR/CAR No:	**005**							
Issue Identified By:	Audit Team				**Date:**	2 May 2019		
NCR/CAR Issued to:	Stringybark Solar Farm Pty Ltd				**Date:**	19 July 2019		
NCR/CAR Category:	WHS	☐	Quality	☐	Enviro	☐	Road Safety	☒

Section 1: Details of Non-Conformance/Corrective Action

Road Safety Category – Safety Barriers

Substandard End-Terminals

The is a substandard end terminal at the end of the safety barrier on approach to the Waterfall Way intersection.

There is a risk that an errant driver could leave the roadway and come into contact with a substandard safety barrier which does not correctly perform at impact due to the poor condition resulting with the potential for causing serious injuries to occupants of the vehicle.

Name:	Michael Bloem	**Position:**	Level 3 Road Safety Auditor
Signature:		**Date:**	19 July 2019

Section 2: Proposed action to be undertaken to rectify the issue

Name:		**Position:**	
Signature:		**Date:**	

Section 3: NCR/CAR Close out

Action undertaken to rectify the issue (if differing from proposed action):

Was the action taken successful in rectifying the issue?	Yes	☐	No	☐
Was further action necessary? If yes, describe below.	Yes	☐	No	☐

Name:		**Position:**	
Signature:		**Date:**	

Project:	**Proposed Stringy Bark Solar Farm Transportation Route**							
NCR/CAR No:	**006**							
Issue Identified By:	Audit Team				**Date:**	2 May 2019		
NCR/CAR Issued to:	Stringybark Solar Farm Pty Ltd				**Date:**	19 July 2019		
NCR/CAR Category:	WHS	☐	Quality	☐	Enviro	☐	Road Safety	☒

Section 1: Details of Non-Conformance/Corrective Action

Road Safety Category – Traffic Signs

Damaged and Missing Signs

There are a number of substandard curve warning signs on the approaches to substandard curves.

There are missing advanced warning signs on the approaches to crests.

There is a causeway without advanced warning signs on the approaches or depth markers at the causeway.

Many of the CAMs provided for substandard curves are damaged, faded, or at a substandard height.

The Give Way sign at the Waterfall Way intersection is located too far back from the intersection.

Signs are provided to alert road users to oncoming features or changes in road condition. There is a risk that road users may not be aware of the oncoming conditions such as substandard curves which may result in the possibility of an errant driver coming into contact with oncoming traffic or leaving the roadway potentially resulting in serious injuries to occupants of the vehicle.

A lack of warning signage can compromise road safety as road users are not properly advised of the changed traffic conditions ahead.

Name:	Michael Bloem	**Position:**	Level 3 Road Safety Auditor
Signature:		**Date:**	19 July 2019

Section 2: Proposed action to be undertaken to rectify the issue

Name:		**Position:**	
Signature:		**Date:**	

Section 3: NCR/CAR Close out

Action undertaken to rectify the issue (if differing from proposed action):

Was the action taken successful in rectifying the issue?	Yes	☐	No	☐
Was further action necessary? If yes, describe below.	Yes	☐	No	☐

Name:		**Position:**	
Signature:		**Date:**	

Project:	**Proposed Stringy Bark Solar Farm Transportation Route**							
NCR/CAR No:	**007**							
Issue Identified By:	Audit Team				**Date:**	2 May 2019		
NCR/CAR Issued to:	Stringybark Solar Farm Pty Ltd				**Date:**	19 July 2019		
NCR/CAR Category:	WHS	☐	Quality	☐	Enviro	☐	Road Safety	☒

Section 1: Details of Non-Conformance/Corrective Action

Road Safety Category - Delineation

Transverse Line Marking

There is a Give Way signs in place at the Waterfall Way intersection however, there is no holding line, only the continuity line for the west bound travel lane.

Holding lines at intersections with Give Way control are required to indicate to road users the safe position for their vehicles to be held when waiting at the intersection.

There is a risk that when there is no holding line, an errant road user may encroach into the travel lane of the through road (100km/h speed zone) that may result in a vehicle collision.

Name:	Michael Bloem	**Position:**	Level 3 Road Safety Auditor
Signature:		**Date:**	19 July 2019

Section 2: Proposed action to be undertaken to rectify the issue

Name:		**Position:**	
Signature:		**Date:**	

Section 3: NCR/CAR Close out

Action undertaken to rectify the issue (if differing from proposed action):

Was the action taken successful in rectifying the issue?	Yes	☐	No	☐
Was further action necessary? If yes, describe below.	Yes	☐	No	☐

Name:		**Position:**	
Signature:		**Date:**	

Appendix 3: Findings by Chainage

Start Chainage	Finish Chainage	Day / Night	Travel Direction	Photo	Category	Hazard Description	Location / notes	Likelihood	Consequence	Risk Rating	CARs
0.0		day	west				Start of Audit –Solar Farm Property Access				
0.0			west		Roadside Hazards	clear zone obstruction - fence strainer post	north side of road	2 Unlikely	3 Moderate	Medium	004
0.1			west		Roadside Hazards	clear zone obstruction - culvert	protruding headwalls in clear zone	3 Possible	3 Moderate	High	004
0.2			west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone	2 Unlikely	3 Moderate	Medium	004
0.6			west		Road Alignment and Cross Section	batters steep	southern side of causeway	3 Possible	3 Moderate	High	002
0.6			west		Roadside Hazards	clear zone obstruction - tree(s)	both sides of road	2 Unlikely	3 Moderate	Medium	004
0.6			west		Traffic Signs	sign missing - crest	on approach to crest	2 Unlikely	4 Major	High	006
1.0		day	west		Traffic Signs	sign missing - crest	on approach to crest	2 Unlikely	3 Moderate	Medium	006
1.2	1.5	day	west		Roadside Hazards	clear zone obstruction - tree(s)	trees within the clear zone on both sides of road	2 Unlikely	3 Moderate	Medium	004
1.6		day	west		Traffic Signs	sign missing - causeway advanced warning	on approach to causeway in both directions	2 Unlikely	2 Minor	Low	006
1.6		day	west		Traffic Signs	sign missing - flood depth marker	at causeway	2 Unlikely	2 Minor	Low	006
1.7	1.8	day	west		Roadside Hazards	clear zone obstruction - tree(s)	Smaller trees located within the clear zone on both sides of road	2 Unlikely	2 Minor	Low	004
1.8		day	west		Traffic Signs	sign missing - crest	on approach to crest in both directions	2 Unlikely	3 Moderate	Medium	006
1.9		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls located within the clear zone	2 Unlikely	3 Moderate	Medium	004
2.1		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls located within the clear zone	2 Unlikely	3 Moderate	Medium	004
2.3		day	west		Traffic Signs	sign missing - crest	on approach to crest located on a curve	2 Unlikely	3 Moderate	Medium	006

Start Chainage	Finish Chainage	Day / Night	Travel Direction	Photo	Category	Hazard Description	Location / notes	Likelihood	Consequence	Risk Rating	CARs
2.3		day	west		Traffic Signs	sign low – Chevron Alignment Markers (CAMs)	located on the southern side of the road on both sides of the curve through the crest	2 Unlikely	3 Moderate	**Medium**	**006**
2.3		day	west		Traffic Signs	sign faded – Chevron Alignment Markers (CAMs)	located on the southern side of the road on both sides of the curve through the crest	2 Unlikely	3 Moderate	**Medium**	**006**
2.3		day	west		Traffic Signs	sign damaged – Chevron Alignment Markers (CAMs)	located on the southern side of the road	2 Unlikely	3 Moderate	**Medium**	**006**
2.3	1.6	day	west	 	Road Alignment and Cross Section	Narrow formation and tight radius curves	through causeway with relatively steep grades on each approach. (Burying Ground Creek)	2 Unlikely	3 Moderate	**Medium**	**003**
2.7		day	west		Roadside Hazards	clear zone obstruction - fence strainer post	located within clear zone on northern side of the road	2 Unlikely	3 Moderate	**Medium**	**004**
2.8		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls located within the clear zone	2 Unlikely	3 Moderate	**Medium**	**004**
2.9		day	west		Roadside Hazards	clear zone obstruction - fence strainer post	located within clear zone on northern side of the road	2 Unlikely	3 Moderate	**Medium**	**004**

Start Chainage	Finish Chainage	Day / Night	Travel Direction	Photo	Category	Hazard Description	Location / notes	Likelihood	Consequence	Risk Rating	CARs
2.9		day	west		Road Alignment and Cross Section	tight radius curves	limited sight distance as vegetation obscures sight distance through the curve	2 Unlikely	3 Moderate	**Medium**	**003**
2.9		day	west		Traffic Signs	sign low - Chevron Alignment Markers (CAMs)	outside of curve in both directions.	2 Unlikely	3 Moderate	**Medium**	**006**
2.9		day	west		Traffic Signs	sign damaged - Chevron Alignment Markers (CAMs)	outside of curve. Both directions.	2 Unlikely	3 Moderate	**Medium**	**006**
2.9		day	west		Traffic Signs	sign faded - Chevron Alignment Markers (CAMs)	outside of curve. Both directions.	2 Unlikely	3 Moderate	**Medium**	**006**
3.0		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone at property access	2 Unlikely	3 Moderate	**Medium**	**004**
3.1	3.6	day	west		Roadside Hazards	clear zone obstruction - tree(s)	south side of road	2 Unlikely	3 Moderate	**Medium**	**004**
33		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone	2 Unlikely	3 Moderate	**Medium**	**004**
3.5		day	west		Roadside Hazards	clear zone obstruction - tree(s)	north side of road	2 Unlikely	3 Moderate	**Medium**	**004**
3.7		day	west		Roadside Hazards	clear zone obstruction - tree(s)	north side of road	2 Unlikely	3 Moderate	**Medium**	**004**

Start Chainage	Finish Chainage	Day / Night	Travel Direction	Photo	Category	Hazard Description	Location / notes	Likelihood	Consequence	Risk Rating	CARs
3.8		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone at property access	2 Unlikely	3 Moderate	**Medium**	**004**
3.9		day	west		Roadside Hazards	clear zone obstruction - tree(s)	both sides of road	2 Unlikely	3 Moderate	**Medium**	**004**
3.9		day	west		Roadside Hazards	clear zone obstruction - culvert	protruding headwalls in clear zone	2 Unlikely	3 Moderate	**Medium**	**004**
4.0		day	west		Roadside Hazards	clear zone obstruction - tree(s)	south side of road	2 Unlikely	3 Moderate	**Medium**	**004**
4.1	4.8	day	west		Roadside Hazards	clear zone obstruction - tree(s)	both sides of road	2 Unlikely	3 Moderate	**Medium**	**004**
4.5		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone at property access	2 Unlikely	3 Moderate	**Medium**	**004**
4.7		day	west		Traffic Signs	sign missing - crest	on approach to crest	2 Unlikely	3 Moderate	**Medium**	**006**
4.8		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone	2 Unlikely	3 Moderate	**Medium**	**004**
4.8		day	west		Road Alignment and Cross Section	batters steep	both sides of road	2 Unlikely	3 Moderate	**Medium**	**002**
5.0		day	west		Traffic Signs	sign missing - crest	on approach to crest	2 Unlikely	3 Moderate	**Medium**	**006**
5.0		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone	2 Unlikely	3 Moderate	**Medium**	**004**
5.0		day	west		Road Alignment and Cross Section	batters steep	both sides of road	3 Unlikely	3 Moderate	**Medium**	**002**
5.2		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone	2 Unlikely	3 Moderate	**Medium**	**004**
5.8		day	west		Roadside Hazards	clear zone obstruction - culvert	headwalls in clear zone	2 Unlikely	3 Moderate	**Medium**	**004**
5.8		day	west		Road Alignment and Cross Section	batters steep	north side of road. (Steep drop off)	2 Unlikely	3 Moderate	**Medium**	**002**

Start Chainage	Finish Chainage	Day / Night	Travel Direction	Photo	Category	Hazard Description	Location / notes	Likelihood	Consequence	Risk Rating	CARs
5.8		day	west		Roadside Hazards	clear zone obstruction - tree(s)	south side of road	2 Unlikely	3 Moderate	**Medium**	**004**
5.8		day	west				Start sealed section				
5.8		day	west		Delineation	guide post(s) damaged	north side of road	2 Unlikely	2 Minor	**Low**	**001**
5.8		day	west		Traffic Signs	sign position - give way	Set too far back from intersection	1 Rare	3 Moderate	**Medium**	**006**
5.8		day	west		Delineation	line marking missing - hold line	No hold line for the give way control	1 Rare	2 Minor	**Low**	**007**
5.8		day	west		Safety Barriers	safety barrier end-terminal sub-standard	on north side of road	2 Unlikely	3 Moderate	**Medium**	**005**
5.8		day	west				End audit - Waterfall Way intersection				

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