pitt&sherry

CopperString 2032

Traffic Impact Assessment - FSC

Client reference:

CU2-FL00-REP-PAS-100-0003

Prepared for

CPB Contractors Pty Ltd

Client representative

Nick Poon

Date

16 February 2024

Rev03

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Revision History					
Rev No.	**Description**	**Prepared by**	**Reviewed by**	**Authorised by**	**Date**
A	Draft Traffic Impact Assessment	AK	RLR	RLR	29/09/2023
00	Final Traffic Impact Assessment	AK/ NPA	SM	RLR	13/10/2023
01	Final Traffic Impact Assessment – updated with Powerlink comments	AK/ NPA	SM	RLR	07/12/2023
02	Final Traffic Impact Assessment – updated with Powerlink comments	AK/ NPA	SM	RLR	25/01/2024
03	Final Traffic Impact Assessment - Removed Reference to Hughenden Store	AK/ NPA	SM	RLR	16/02/2024

Executive Summary

The purpose of the CopperString 2032 Traffic Impact Assessment – FSC (this report) is to assess the risk of traffic generated by the CopperString 2032 project on Flinders Shire Council (FSC) owned roads during the construction, operation and maintenance, and decommissioning phases to the operation, condition and safety of the public road network throughout the study area in Queensland using Australian Standards and Austroads Guidelines.

The risk of project-generated traffic to the road network has been assessed and quantified based on a site investigation, available information from the project description document and publicly available data.

The traffic assessment found that the additional traffic volumes generated as a result of the construction activities are low and would not be expected to reduce the road network operation to unsatisfactory levels.

There are, however, a number of areas within the road network that will require mitigation measures to be implemented as follows:

- Roads where the traffic volumes are above the practical capacity based on the road type and width. Traffic management or road pavement widening is generally required on these roads
- Locations throughout the route with poor sight distance. Vegetation clearance and signage installation is required at these locations prior to construction, in conjunction with ongoing maintenance during construction
- Road bends within the access road network where the road width is not sufficient for a B-double truck. Consider changing the vehicle to suit existing road geometry; changing the access route; or carrying out minor shoulder works in agreement with relevant road authority
- Road bends within the access road network where the road width is not sufficient for two heavy vehicles to pass each other, but the road width is sufficient for a single B-double truck. In these locations it is suitable to provide traffic management where road widening is not practical or cost effective due to the temporary nature of the construction works; and
- Areas with local schools. Restricted travel during peak school drop-off and pick-up times along with briefing for the community and drivers of the construction traffic is recommended.

The traffic assessment identified that the suitability of the construction access is predominantly impacted by the condition of the road, which is variable across the proposed access routes. With regular monitoring and repairs undertaken prior to and during construction, the risk of crashes due to poor road condition will be appropriately managed.

The operation and maintenance phase risks are negligible, with no recommended actions required for implementation. The decommissioning phase risks have the potential to be comparable to the construction phase risks.

Abbreviations

Table 1: Abbreviations

Abbreviation	Description
AADT	Annual Average Daily Traffic
ASD	Approach Sight Distance
CSC	Cloncurry Shire Council
CTRC	Charters Towers Regional Council
EDD	Extended Design Domain
FFS	Free Flow Speed
FSC	Flinders Shire Council
HML	Higher Mass Limit
HV	Heavy Vehicle
JV	UGL/CPB Joint Venture
LGA	Local Government Authority
LOS	Level of Service
MICC	Mount Isa City Council
MID	Major Infrastructure Development
MSC	McKinlay Shire Council
NDD	Normal Design Domain
NEM	National Electricity Market
NQCEH	North Queensland Clean Energy Hub
NWMP	North West Minerals Province
OSOM	Oversize Overmass
PTSF	Percentage Time Spent Following
RSC	Richmond Shire Council
RUMP	Road User Management Plan
SC	State Controlled
SISD	Safe Intersection Sight Distance
SSD	Stopping Sight Distance
TCC	Townsville City Council
TIA	Traffic Impact Assessment
TMR	Department of Transport and Main Roads (Queensland)
VPD	Vehicles Per Day
VPH	Vehicles Per Hour

1. Introduction

1.1 Project scope

The purpose of this Traffic Impact Assessment (TIA) for the CopperString 2032 project is to assess the risk and impact of the project-related construction vehicles to the operation, condition and safety of the Flinders Shire Council (FSC) owned road network and Queensland Department of Transport and Main Roads (TMR) road network within the FSC LGA.

The risks from project-generated traffic to the road network have been assessed and quantified based on site visits, available information from the UGL/CPB Joint Venture (JV) and publicly available data. Mitigation measures and ongoing monitoring are proposed in response to identified issues.

The report evaluates the impact on the public road network using Australian Standards and Austroads Guidelines. Details of the road network assessed are provided in Section 3.1 of this report and were based on the construction vehicle access route data provided by the JV.

1.2 Project description

The CopperString 2032 Project will connect the North West Minerals Province (NWMP) of Queensland to the National Electricity Market (NEM) to reduce the cost of power supply and facilitate the large-scale development of the Hughenden wind resource and solar resources within the North Queensland Clean Energy Hub (NQCEH).

The project will traverse a region of significant potential renewable energy resources that are currently constrained by the lack of access to the state electricity grid. The project is expected to unlock potential areas for renewable energy generation in the Northern Queensland Renewable Energy Zone between Townsville and Hughenden, particularly wind resources, and in the North West Minerals Province.

The scope of work, traversing east to west, consists of the following sections:

- Mulgrave Substation and 275kV line augmentation as the CopperString 2032 275kV connection point to the NEM
- Woodstock Substation as the CopperString 2032 500kV connection point to the Queensland SuperGrid
- Pentland Substation to support the NQCEH expansion and as the core for future load connections in the area
- Flinders Substation (Hughenden) as the core for the NQCEH
- Dajarra Road Substation (Cloncurry) as the core for distributions to larger load centres
- The primary CopperString 2032 transmission backbone; and
- Termination via the Mount Isa augmentation.

The North West Minerals Province is one the world's richest producing mineral regions and is emerging as an exploration area for new economy minerals and metals, such as vanadium, that are critical to the production of renewable energy technologies such as solar panels, wind turbines and large scale batteries. The project is predicted to reduce electricity prices in the North West Power System and has the potential to stimulate investment in the North West Minerals Province.

1.3 Project location

The transmission line will run approximately parallel to the Flinders Highway at an average of 15km south of the Highway for its length.

The Project traverses 7 Local Government Areas (LGAs):

- Burdekin Shire Council
- Charters Towers Regional Council
- Flinders Shire
- Richmond Shire
- McKinlay Shire
- Shite of Cloncurry; and
- City of Mount Isa.

TMR and LGA roads are used to access the transmission lines, camps, substations, materials and storage for the project in the majority of LGAs. In Burdekin Shire Council only TMR roads are used for access.

It is noted that vehicles use TMR and LGA roads in the Townsville LGA to access the Townsville Port for delivery of materials.

The major towns within proximity to the Project are Townsville, Charters Towers, Hughenden, Richmond, Julia Creek, Cloncurry and Mount Isa.

The project traverses the traditional lands of the Birriah, Jangga, Yirendali, Wanamara, Mitakoodi, Kalkadoon and Yulluna Peoples, Traditional Custodians of the land.

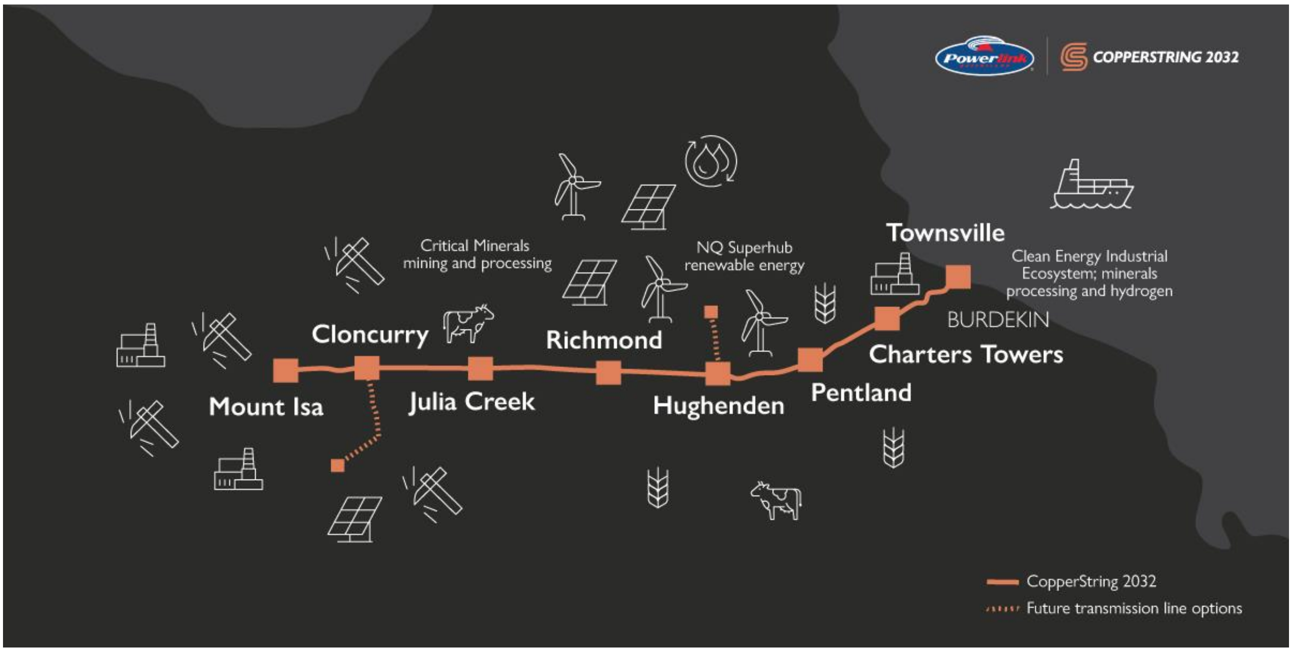


Figure 1: Project Map Geographic Location (source document https://www.powerlink.com.au/projects/copperstring-2032)

The CopperString 2032 Project is divided into eight logistics hubs, essentially creating Sub-Projects which have a defined scope based on the elements within their defined geographical area. Each hub has a geographical area defined by the minimisation of travel time from the camp to the tower location.

Work zones are based around the construction hubs and intended to limit travel time to tower sites to no more than 90 minutes.

Table 2: Logistics hubs

#	Hub	Camp	Substation	Towers
1	Mount Isa	Local accommodation	Mount Isa Substation	Mount Isa Sub to “Cloncurry & Mount Isa midpoint
2	Cloncurry	Camp	Dajarra Rd Substation	Darjarra Sub to Cloncurry River Dajarra Sub to Cloncurry & Mount Isa midpoint Dajarra Sub to Cloncurry & Julia Creek Midpoint
3	Julia Creek	Camp	Nil	Cloncurry & Julia Creek midpoint to Julia Creek & Richmond midpoint
4	Richmond	Camp	Nil	Julia Creek & Richmond midpoint to Richmond & Hughenden midpoint
5	Hughenden	Camp	Flinders Substation	Flinders Sub to Richmond & Hughenden midpoint Finders Sub to Mount James Flinders Sub to Hughenden & Pentland midpoint
6	Penland	Camp	Pentland Substation	Hughenden & Pentland midpoint to Pentland & Charters Towers midpoint
7	Charters Towers	Camp	Nil	Pentland & Charters Towers midpoint to Burdekin River
8	Woodstock	Local accommodation	Mulgrave Substation	Burdekin River to Mulgrave Substation

The location of camps proposed to be utilised during the Project is shown below in Table 3. It is noted that there are no camps at Woodstock or Mount Isa with workers staying in accommodation in the nearest town.

Table 3: Camp Locations

Location	Council	Distance from Nearest Town
Charters Towers	Charters Towers Regional Council	3km
Pentland	Charters Towers Regional Council	2km
Hughenden	Flinders Shire Council	2km
Richmond	Richmond Shire Council	1km
Julia Creek	McKinlay Shire Council	1km
Cloncurry	Cloncurry Shire Council	4km
Woodstock	Townsville City Council	In south Townsville
Mount Isa	Mount Isa City Council	In Mount Isa

1.4 Project generated traffic

The following construction/ operational items generated project related traffic:

- Construction/ demobilisation of the CopperString 2032 camps
- Construction of the transmission line between Woodstock and Mount Isa including traffic generated by the camps and from the Flinders and Barkly Highways; and
- Construction of the substations.

1.5 Project timing and duration

A detailed project program for the CopperString 2032 project, as supplied by the JV is included in Appendix A. It is noted that this program is subject to change.

1.6 Other reports for reference

There are several other reports being completed by pitt&sherry for the CopperString 2032 project that may provide more detail as follows:

Client reference number	Report title	Completion Date
CopperString 2032 Camps		
CU2-PW00-REP-PAS-100-0001	CopperString 2032 Early Works Package Camp Hubs MID Submission Support	15 September 2023
CU2-CT00-REP-PAS-100-0001	CopperString 2032 Charters Towers Camp Traffic Impact Assessment	15 September 2023
CU2-PE00-REP-PAS-100-0001	CopperString 2032 Pentland Camp Traffic Impact Assessment	15 September 2023
CU2-HU00-REP-PAS-100-0001	CopperString 2032 Hughenden Camp Traffic Impact Assessment	16 February 2024
CU2-RI00-REP-PAS-100-0001	CopperString 2032 Richmond Camp Traffic Impact Assessment	18 September 2023
CU2-JC00-REP-PAS-100-0001	CopperString 2032 Julia Creek Camp Traffic Impact Assessment	18 September 2023
CU2-CL00-REP-PAS-100-0001	CopperString 2032 Cloncurry Camp Traffic Impact Assessment	18 September 2023
CopperString 2032 TIAs (Councils)		
CU2-PW-REP-PAS-100-0003	CopperString 2032 Traffic Impact Assessment - TMR	16 February 2024
CU2-TS00-REP-PAS-100-0003	CopperString 2032 Traffic Impact Assessment - TCC	25 January 2024
CU2-CT00-REP-PAS-100-0003	CopperString 2032 Traffic Impact Assessment - CTRC	25 January 2024
CU2-RI00-REP-PAS-100-0003	CopperString 2032 Traffic Impact Assessment - RSC	25 January 2024

Client reference number	Report title	Completion Date
CU2-MC00-REP-PAS-100-0003	CopperString 2032 Traffic Impact Assessment- MSC	25 January 2024
CU2-CL00-REP-PAS-100-0003	CopperString 2032 Traffic Impact Assessment - CSC	25 January 2024
CU2-MI00-REP-PAS-100-0003	CopperString 2032 Traffic Impact Assessment - MICC	25 January 2024
CopperString 2032 RUMPs		
CU2-PW00-REP-PAS-100-0002	CopperString 2032 Road Use Management Plan – TMR	16 February 2024
CU2-PW00-REP-PAS-100-0004	CopperString 2032 – Road Use Management Plan - Councils	16 February 2024

1.7 Legislative context and standards

The following Australian Standards and Guidelines have been used throughout this report:

- AS 1742.2:2009 Manual of uniform traffic control devices – Part 2: Traffic control devices for general use
- AS 1742.7:2016 Manual of uniform traffic control devices – Part 7: Railway crossings
- AS 2890.2:2018 Parking facilities – Part 2: Off-street commercial vehicle facilities
- Austroads Guide to Road Design Part 3: Geometric Design
- Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections
- Austroads Guide to Road Design Part 4B: Roundabouts
- Austroads Guide to Road Safety Part 6A: Implementing Road Safety Audits
- Austroads Guide to Traffic Management Part 3: Transport Studies and Analysis Methods
- Austroads Guide to Traffic Management Part 6: Interchanges and Crossings Management
- Department of Transport and Main Road's Supplement to Austroads Guide to Road Design Part 3: Geometric Design
- Department of Transport and Main Road Supplement to Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections
- Department of Transport and Main Road Supplement to Austroads Guide to Road Design Part 4B: Roundabouts
- Department of Transport and Main Roads - Guide to Traffic Impact Assessment Practice Note: Pavement Impact Assessment, December 2018
- Department of Transport and Main Roads Routine Maintenance Guidelines – November 2017
- Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis; and
- Department of Transport and Main Road's Guide to Traffic Impact Assessment – December 2018.

1.8 Report Revisions

The submitted report revisions and their content is shown below:

Revision No.	Description
A	Draft Traffic Impact Assessment – for JV and Powerlink comments
00	Final Traffic Impact Assessment – incorporating JV comments
01	Final Traffic Impact Assessment – incorporating Powerlink comments from RevA
02	Final Traffic Impact Assessment – incorporating Powerlink comments from Rev00 (comments register included in Appendix D)
03	Final Traffic Impact Assessment – minor amendments to report to remove reference to Hughenden Store access

2. Study method

2.1 Overview

The study area includes a significant number of roads that were investigated as potential construction traffic routes. The assessment included site investigations as well as desktop analysis, as outlined in Section 2.2.

The assessment was based on:

- Information provided by the JV in relation to construction and operational traffic (routes, vehicle types, and traffic volumes), construction program and construction methodology
- Information available from road authorities; and
- Observations from the site investigations.

Key assumptions made during the assessment are included in this report.

2.2 Assessment process

The assessment process used for the traffic risk assessment and the relevant sections of the report are detailed below.

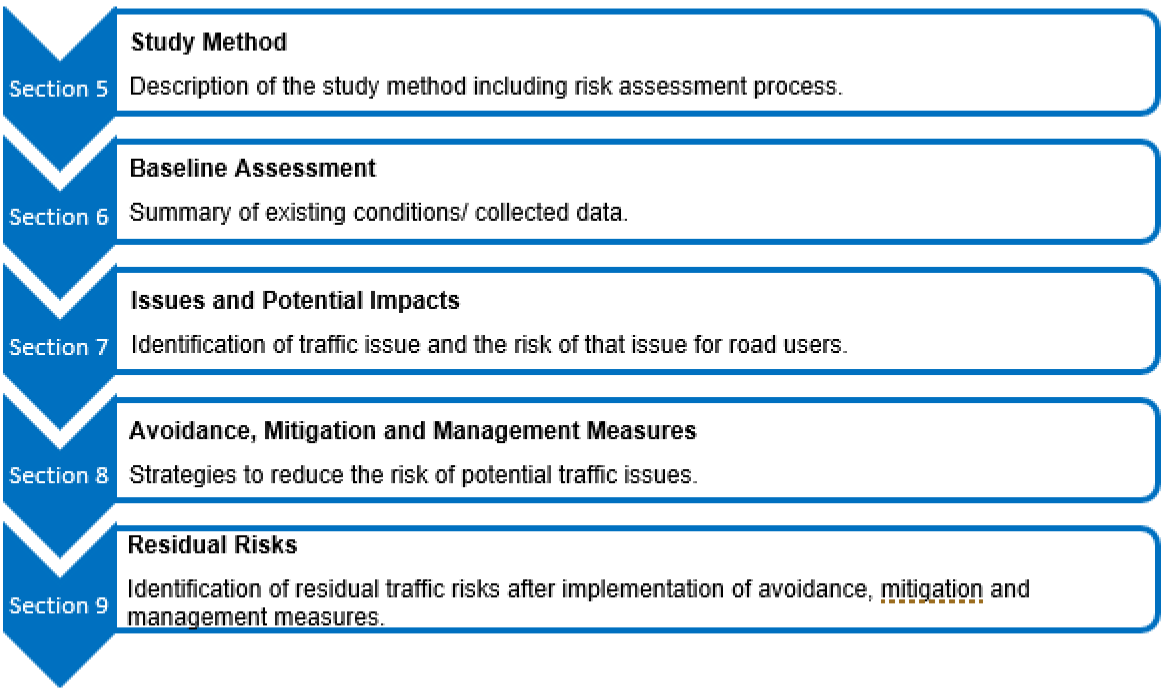


Figure 2: Assessment process

The risk assessment considers three major areas of risk as a result of the project:

- Road operation risk including:
  - Road width capacity
  - Traffic congestion
- Road condition risk; and
- Road safety risk.

2.2.1 Site investigations

Site investigations were undertaken between 19 June and 22 July 2023 to assess the current conditions of the road network where operation, condition and safety could be affected by the proposed project.

The site investigations required persons to drive along the State Controlled (SC) roads and Local Government Authority (LGA) roads that formed part of the Project route. The following parameters were captured during the site investigations:

- Road attributes and high-level road condition
- Traffic volumes
- Sight distances at existing and proposed intersections, driveways and turnouts
- Sight distances and attributes at rail crossings
- Locations/ structures of interest and relevant attributes; and
- Photos of the above.

Intersection traffic counts were undertaken during the site visits, where such data was deemed to be required, for a 15-minute period. The collected traffic data was subsequently scaled by a factor of 4 to extrapolate the hourly traffic volume. To establish the relationship between peak hour and the observed hour, data from the nearest traffic counter on TMR roads was extracted. This information was applied to calculate a peak-to-hour ratio. Multiplying the recorded traffic volumes by this ratio allowed for the estimation of the peak hour traffic volume at the specific location.

It is noted that this method provides a high-level estimate of traffic volumes which was considered acceptable due to the generally low traffic volumes on the road network.

It is noted that only public roads were assessed, however, where sufficient space was provided to safely pull over within the public road reserve, intersections between public and private roads were also assessed. It is noted that the use of private roads will be agreed between the road owner and the JV, including any requirements to implement management measures.

2.2.2 Data collection

Data was collected from various sources as follows:

- Site investigations
- Queensland Government's Queensland Globe and Open Data Portal; and
- LGAs.

Collectively, the data was used to inform the TIA.

2.2.3 Data analysis – baseline assessment

Due to the project's large area of interest, a significant amount of data was collected for analysis. The data was first analysed at a high-level via tabulation. Data was entered into tabular form to allow roads, intersections, and defects to be analysed individually and holistically. This approach identified intersections and roads that had potential issues and required assessment in further detail.

The purpose of the baseline assessment was to establish the current Level of Service (LOS) of roads with respect to:

- Suitability for construction access
- Traffic volumes
- Vehicle types
- Road (pavement) condition
- Road geometry
- Sight distances; and
- Other road safety issues.

2.2.4 Data analysis – risk assessment

Risk ratings

The risk ratings in the *Austroads Guide to Road Safety Part 6A: Implementing Road Safety Audits* were used to assess the potential for hazards associated with project activities to increase levels of risk for the proposed access roads. This process is suitable to use for road operation (road width and traffic congestion) risk and road condition risk, as well as road safety risk.

Potential issues identified as a result of the project have been ranked based on the likelihood of an operational hazard occurring and the potential consequence of that hazard.

Likelihood

The likelihood of a hazard and a consequential crash occurring is shown in Table 4.

Table 4: Likelihood of a hazard/crash occurring (Austroads 2019)

Frequency	Description
Frequent	Once or more per week
Probable	Once or more per year (but less than once a week)
Occasional	Once every five to ten years
Improbable	Less often than once every ten years

Consequence

The consequence of the hazard will depend on the assessment type (i.e., road operation, road condition or road safety) and type specific consequence tables are shown in Section 2.2.6.

Resulting level of risk and treatment

The level of risk is dependent on the likelihood and consequence of the hazard and is shown in Table 5. The treatment approach that should be applied is shown in Table 6.

Table 5: Resulting level of risk (Austroads 2019)

	Frequent	Probable	Occasional	Improbable
Catastrophic	Intolerable	Intolerable	Intolerable	High
Serious	Intolerable	Intolerable	High	Medium
Minor	Intolerable	High	Medium	Low
Limited	High	Medium	Low	Low

Table 6: Treatment approach (Austroads 2019)

Risk	Suggested treatment approach
Intolerable	Must be corrected
High	Should be corrected or the risk significantly reduced, even if the treatment cost is high
Medium	Should be corrected or the risk significantly reduced, if the treatment cost is moderate but not high
Low	Should be corrected or the risk reduced if the treatment cost is low

2.2.5 Traffic risk assessment ratings

Road operation (road width capacity)

The width of a road is related to how much traffic it can carry without affecting the safety of vehicles. Roads do not necessarily need to be carrying high levels of traffic causing congestion for volumes to impact the safety to vehicles. This is generally crucial to roads with a one lane carriageway or roads where there are large numbers of parked vehicles that reduce the available carriageway width.

The *Austroads Guide to Road Design Part 3* (AGRD Part 3) and TMR's *Supplement to Austroads Guide to Road Design Part 3: Geometric Design* (Supplement to AGRD Part 3) describe the minimum road width requirements for both urban and rural roads, including rural roads with very low traffic volumes.

The minimum urban arterial road widths are described below in Table 7.

Table 7: Urban road widths – general traffic lane (Source: AGRD Part 3 and Supplement to AGRD Part 3)

Element	Lane width (m)	Comments
General traffic lane	3.5	General traffic lane widths to be used for all roads
	3.0-3.4	For use on low speed roads with low truck volumes
	3.3-3.5	General traffic lane widths for use on roads in constrained corridors

The minimum single carriageway rural road widths for the Normal Design Domain (NDD) are described in Figure 3 and are based on the design AADT.

Design AADT	250 – 400(6)	400 – 1000	1000 – 2000		2000 – 4000		> 4000
Road Carriageway Type(1)	All	All	L	N	L	N	L/N
Lane Width	3.25	3.25/3.50(3)	3.50	3.50	3.50	3.50	- (7)
Shoulders	1.00	1.25/1.00(3)	1.00	1.50	1.50	2.00	- (7)
Carriageway(2)	8.50(5)	9.00	9.00	10.00	10.00	11.00	- (7)
Cycling(4)				P	P	P	- (7)

Notes:

(1) Road Carriageway formation type:

L – Low embankments (i.e. < 1 m) on lower order roads where batter slopes do not exceed 1 on 4.

N – nominal road values.

(2) Full width of seal required.

(3) Optional combination of lane width and shoulder width.

(4) A 'P' in these columns indicates cross sections generally considered suitable for 'Principle cycle routes' in rural areas. Refer to Section 4.9 for further details.

(5) Where a road is subject to the *State-controlled Priority Road Network Investment Guidelines* (2011) and *State-controlled Low Priority Road Network Investment Guideline* (2013), the final seal width to be applied is 9 m. In these cases, the cross-section widths for the next column (400 - 1000 AADT) should be adopted.

(6) Refer to Table 4.2.6(a) for carriageway width options for roads with less than 250 vpd AADT.

(7) Rural roads with AADT greater than 4,000 vpd should have a WCLT and ATLM. Refer to Appendix G for general guidance and particularly Section G.4 for cross section dimensions.

Figure 3: Minimum single carriageway rural road widths (m) – normal design domain (Source: Supplement to AGRD Part 3)

For roads with very low volumes (<250 vpd), the NDD is as shown in Figure 4.

Road Carriageway Option	Unsealed	Single-lane seal	Two-lane seal
Seal width	-	3.70	8.00
Unsealed width – each direction	4.00	2.50	0.00
Carriageway	8.00	8.70	8.00

Figure 4: Very low volume (<250 vpd) rural road minimum widths (m) – normal design domain (Source: Supplement to AGRD Part 3)

The Extended Design Domain (EDD) provided in the Supplement to AGRD Part 3 notes that many existing rural roads in Queensland often have carriageway widths less than the 8.5m total seal width specified, particularly those which carry less than 400vpd. The minimum single carriageway rural road widths are shown in Figure 5.

Table A.2.2 – Minimum single carriageway rural road widths (m) – extended design domain								
Design AADT	**250 – 400**	**400 – 1000**	**1000 – 2000**		**2000 – 4000**			**> 4000**
Road Carriageway Type(1)	All	All	L	N	L	N	H	Rural roads with AADT greater than 4,000 vehicles per day should have a wide centreline and ATLM. Refer to Appendix G for general guidance and in particular Section G.4 for cross section dimensions.
Lane Width	3.00	3.25	3.50	3.50	3.50	3.50	- (5)	
Shoulders	1.00	1.00	1.00	1.25	1.00	1.50	- (5)	
Wide Centre Line Treatment							- (5)	
Carriageway(2)	8.00(4)	8.50	9.00	9.50	9.00	10.00	- (5)	
Cycling(3)						P		

Notes:

1. Road Carriageway formation type:
2. L – Low embankments (i.e. < 1 m) on lower order roads where batter slopes do not exceed 1 on 4
   N – nominal road values
   H – Higher order roads requiring a WCLT
3. Full width of seal required.
4. A 'P' in these columns indicates cross sections generally considered suitable for 'Priority cycle routes' in rural areas. Otherwise if a route is part of a cycle network, additional sealed shoulder width will be required. Refer to Section 4.3.2 for further details.
5. Where a road is subject to the *State-controlled Priority Road Network Investment Guidelines* (2011) or the *State-controlled Low Priority Road Network Investment Guideline* (2013), the interim seal width to be applied is 8 m with allowance for a vision seal width of 9 m.
6. Higher order roads with AADT 2000-4000 should have a wide centreline and ATLM. Refer to Appendix G for general guidance and in particular Section G.4 for cross section dimensions.

Figure 5: Minimum single carriageway rural road widths (m) – extended design domain (Source: Supplement to AGRD Part 3)

The guidance above has informed the assessment in Section 5.1 of this report, which identifies roads which are carrying traffic volumes higher than their intended capacity or expected to carry traffic higher than their intended capacity as a result of the project.

There are several intersections within the study area with tight geometry. This creates instances in which B-doubles, the largest vehicle proposed to be utilised during construction, are required to pass by turning vehicles in the opposing direction.

Road operation (traffic congestion)

When roads carry high traffic volumes relative to their capacity, congestion is the result. To ensure safe and efficient traffic flow on roads it is necessary to manage congestion levels.

Theory from the *Austroads Guide to Traffic Management Part 3: Transport Studies and Analysis Methods* has been used to assess the expected risk of congestion, from the project to road operation (traffic congestion). The theory is derived from the Highway Capacity Manual 2016 (HCM 2016).

The conditions for the different levels of performance of two-lane highways are described in the following terms:

- At LOS A, motorists experience high operating speeds on Class I highways and little difficulty in passing. Platoons (or groups) of three or more vehicles are rare. On Class II highways, speed would be controlled primarily by roadway conditions. A small amount of platooning would be expected. On Class III highways, drivers should be able to maintain operating speeds close or equal to the Free Flow Speed (FFS) of the highway (i.e. drivers able to travel at their desired speed either at or below the speed limit)
- At LOS B, passing demand and passing capacity are balanced. On both Class I and Class II highways, the degree of platooning becomes noticeable. Some speed reductions are present on Class I highways. On Class III highways, it becomes difficult to maintain FFS operation, but the speed reduction is still relatively small
- At LOS C, most vehicles are travelling in platoons. Speeds are noticeably curtailed on all three classes of highway
- At LOS D, platooning increases significantly. Passing demand is high on both Class I and II facilities but passing capacity approaches zero. A high percentage of vehicles are now travelling in platoons, and Percentage Time Spent Following (PTSF) another vehicle is quite noticeable. On Class III highways, the fall-off from FFS is now significant
- At LOS E, demand is approaching capacity. Passing on Class I and II highways is virtually impossible, and PTSF is more than 80%. Speeds are seriously curtailed. On Class III highways, speed is less than two-thirds the FFS. The lower limit of this LOS represents capacity; and
- LOS F exists whenever arrival flow in one or both directions exceed the capacity of the segment. Operating conditions are unstable, and heavy congestion exists on all classes of two-lane highway.

The consequence of traffic congestion on the operation of the road network has been defined as shown in Table 8.

Table 8: Consequence of congestion

Severity	Description	Performance
Catastrophic	Significant risk to operation of multiple roads	LOS F
Serious	Considerable traffic delays expected	LOS D or E
Minor	Some acceptable delays expected	LOS C
Limited	Minor or no delays expected	LOS A or B

The levels of performance above have informed the assessment in Section 5.2, which assesses the LOS that is expected on each of the project route roads as a result of the project's construction traffic.

2.2.6 Road condition

Large volumes of heavy vehicles travelling on roads not designed for heavy vehicles can impact the condition of the road. Hazards such as potholes can change a vehicles course on the road and result in a collision and/ or a vehicle leaving the road.

Road condition was qualitatively assessed during site investigations. It is noted that the road condition may change over time.

Likelihood

The likelihood of a crash occurring on a road has been assessed based on the road condition. The condition of each road in the study area has been given a rating of between excellent and poor. The road condition ratings, typical defects and resultant assessed likelihood of a crash occurring is shown in Table 9.

Table 9: Suitability for construction access ratings

Road condition	Defect frequency and type	Likelihood of crash occurring as a result of road condition
Excellent	None or very minor defects Defects may include: • Polishing • Minor cracking • Minor potholing; and • Expedient patching.	Improbable
Good condition	Minor defects at sparse intervals Defects may include: • Polishing • Minor cracking • Minor potholing; and • Expedient patching.	Improbable
Reasonable condition	Minor defects at frequent intervals: Defects may include: • Polishing • Minor cracking • Minor potholing; and • Expedient patching.	Occasional
Average condition	Some major defects: Defects may include: • Corrugations • Significant shoving • Significant rutting • Wide cracking; and • Large potholes.	Probable
Poor condition	Major defects at multiple locations or on long sections: Defects may include: • Corrugations • Significant shoving • Significant rutting • Wide cracking; and • Large potholes.	Probable

Consequence

The consequence of a hazard occurring based on the road condition deteriorating has been based on several factors. The factors used are shown in Table 10 and have been developed from the *TMR Routine Maintenance Guidelines*.

Table 10: Factors influencing the consequence of a road condition hazard / crash

Factor	Conditions of study roads	Severity
Speed	>80km/h	Serious
	50-80km/h	Minor
	<50km/h	Limited
Visibility	Less than safe stopping sight distance* (SSD) (i.e. insufficient time to correct travel path)	Serious
	More than safe SSD (i.e. sufficient time to correct travel path)	Limited
Weather	Flooding or tropical cyclone (worst case scenario)	Serious

*SSD is the time taken to react to a hazard ahead and stop in time to avoid the hazard.

The consequences in the *Austroads Guide to Road Safety Part 6A: Implementing Road Safety Audits* were to assess the potential increased levels of safety risk arising from hazards associated with project activities for the proposed access roads. Where a road has varying consequence levels each of the factors have been considered and a conservative severity level has been applied (i.e. the highest severity). The consequence of a crash is shown in Table 11.

Table 11: Consequence of a safety hazard on crash severity (Austroads 2019)

Severity	Description	Examples
Catastrophic	Likely multiple deaths.	• High-speed, multi-vehicle crash on a freeway • Car runs into crowded bus stop • Bus and petrol tanker collide; and • Collapse of a bridge or tunnel.
Serious	Likely death or serious injury.	• High or medium speed single vehicle collision • High or medium speed with a fixed roadside object; and • Pedestrian or cyclists struck by a car.
Minor	Likely minor injury.	• Some low-speed vehicle collisions • Cyclist falls from bicycle at low speed; and • Left turn rear-end crash in a slip lane.
Limited	Likely trivial injury or property damage only.	• Some low-speed vehicle collisions • Pedestrian walks into object (no head injury); and • Car reverses into post.

The suitability and condition of the roads has informed the assessment in Section 5.4, which considers the risk of a crash on each of the study roads as a result of road condition and deterioration.

2.2.7 Recommendations: avoidance, mitigation, and management

The above risk-based approach was used to identify those items that were deemed to require mitigation measures. Potential courses of action were assessed, and recommendations concluded for mitigation using the hierarchy of avoid, minimise, manage, and offset.

Any residual risks to construction, operation and maintenance, and decommissioning phases were also considered with recommendations of ongoing monitoring during those phases as appropriate.

2.2.8 Project limitations

These notes are additional to any limitations noted elsewhere within this report. They have been provided by pitt&sherry to clarify the limitations of the report, and to clearly identify the individual responsibilities of all parties involved. It is important that all documents from pitt&sherry are read thoroughly, and that clarification is sought where necessary.

2.2.9 Specificity

This report has been developed based on pitt&sherry's understanding of the project requirements and applies only to this project. If there are subsequent changes to the proposed project, pitt&sherry should be consulted to assess how the changes would impact the recommendations detailed in this report. If pitt&sherry are not consulted, we do not accept responsibility for issues that may occur due to project changes. No responsibility is accepted for the use of this report, in whole or in part, in other contexts or for any other purpose.

2.2.10 Report integrity

This report is presented as a whole; with conclusions and recommendations reliant upon data presented in other sections. Reading parts of the report in isolation may lead to misinterpretations, and as such the report should not be copied in part or altered in any way.

Where information contained within this report is to be used for other purposes, such as tendering, it is recommended that the entire report be made available. In situations where this is not appropriate, pitt&sherry can assist in preparing a specially edited document to provide the information within an appropriate context.

2.2.11 Site variability

The results presented in this report represent the site conditions at specific locations at the time that the site investigations were carried out. Variations in site conditions may occur between or beyond assessment locations for various reasons due to natural variability (flooding, heat, landslides) or driven by human activities (cutting or filling in the vicinity and road upgrades or deterioration over time).

The advice presented in this report is based on the data gathered during the site investigations, the accuracy may be impacted by undetected variations in ground conditions or later changes to the site. Involving pitt&sherry throughout the development stages can assist in reducing the impact of these issues by identifying variances, conducting additional investigations, if required, and recommending solutions to problems encountered on site.

2.2.12 Interpretation by others

Costly problems can occur when other design professionals develop plans based on misinterpretation of a traffic risk assessment report. To assist in avoiding these problems, pitt&sherry can work with other project design professionals to interpret the findings in this report, and to review the suitability of any plans and specifications that reference the findings and recommendations of this report. pitt&sherry will not be responsible for any misinterpretation of report findings and recommendations.

2.2.13 Third party and client supplied information

Data and information supplied by the JV or third parties is assumed to be correct, unless otherwise stated. While every care has been taken by pitt&sherry in producing the report, pitt&sherry has not verified the accuracy of supplied information (unless specifically included in pitt&sherry's scope of services). Accordingly, no responsibility is accepted by pitt&sherry for incomplete or inaccurate data supplied by others.

Data and information provided by the JV includes but is not limited to:

- Project overview and description documentation including Traffic Management Plan
- Project construction phases and timing
- Workforce size including the number of workers at each camp hub and the size and number of work crews
- Estimates of construction traffic volumes during each project construction phase including traffic generated by the camp hubs
- Construction vehicle types; and
- GIS location data (construction traffic routes, camp hub and substation locations, tower locations, access track route, material sources).

3. Existing environments

3.1 Road network

3.1.1 Roads

The Project proposes to utilise FSC-owned roads as a part of the project route. All FSC-owned roads to be utilised during construction, as well as SC roads with the LGA are outlined in Table 12 and shown in Figure 6. The roads, as listed below, are referred to as the Project route throughout this report.

Table 12: Roads

Road ID	Road Name	Road owner	Section relevant to project
7	Flinders Highway	TMR	Full extent
37	Aramac Torrens Creek Road	TMR	Flinders Highway to transmission line easement
38	Cotonvale Road	Private	Flinders Highway to transmission line easement
39	Prairie Road	FSC	Flinders Highway to Woodbine Access
40	Woodbine Access	Private	Prairie Road to transmission line easement
41	Kennedy Energy Park Access Track	Private	Flinders Highway to transmission line easement
42	Redcliffe Road	FSC	Flinders Highway to transmission line easement
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	FSC	Flinders Highway to Hughenden Camp
45	Kennedy Developmental Road (south)	TMR	Flinders Highway to transmission line easement
46	Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82)	FSC	Flinders Highway to transmission line easement
47	Thornhill Tamworth Road	Private	Flinders Highway to transmission line easement
48	Marathon Stamford Road	FSC	Flinders Highway to transmission line easement
49	Barabon Terranburby Road	FSC	Flinders Highway to transmission line easement

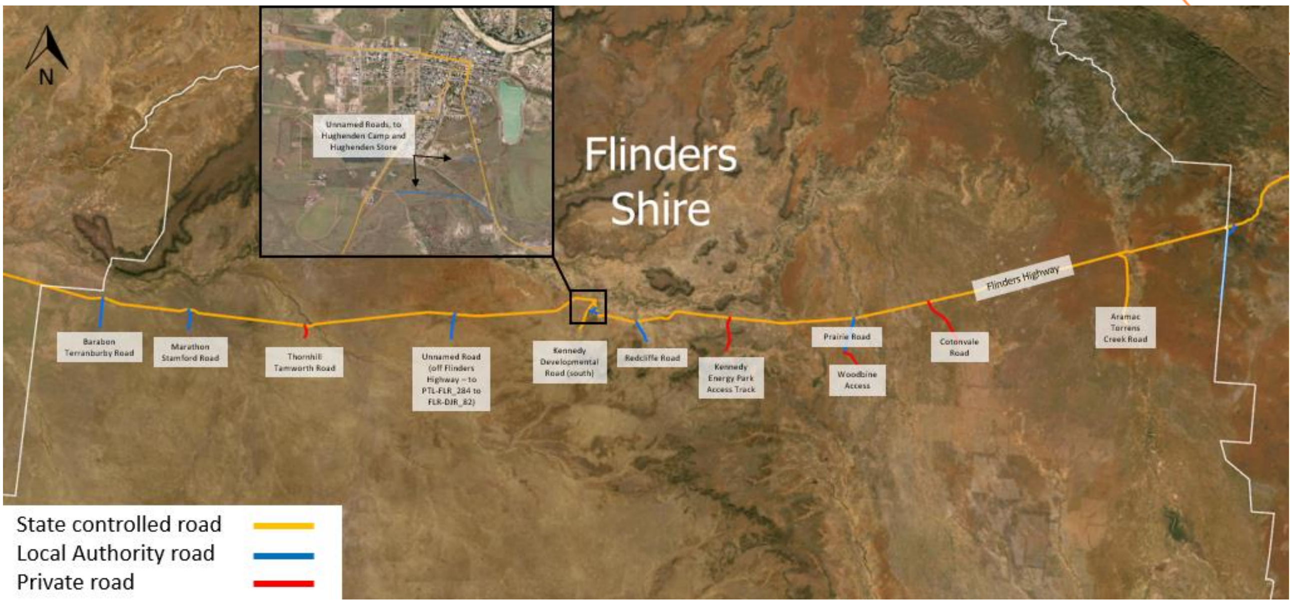


Figure 6: Project route

Road attributes and condition

Road and shoulder widths, seal types and road condition of FSC roads and SC roads within the FSC LGA are summarised below in Table 13. Refer to Appendix C for photos of the road condition where available.

Road condition has been determined to be excellent, good, reasonable, average or poor, with the following definitions applied to each:

- Excellent condition – no or very minor defects generally present
- Good condition – minor defects generally present at sparse intervals
- Reasonable condition – minor defects generally present at frequent intervals
- Average condition – some major defects present or minor defects continuously present; and
- Poor condition – major defects present at multiple locations, greatly limiting the viability of the road for construction traffic.

Table 13: Road attributes and condition

Road ID	Road Name	Road owner	Section relevant to project	Section distance (km)	Speed limit	Road Surface Type	Centreline (Yes/ No)	Edge line	Road width (typical)	Shoulder width - typical (on-site)	Road condition comment
7	Flinders Highway	TMR	Full extent	777.2	Typically 100 to 110km/h, slowing at towns along the extent	Sealed	Yes	Yes, short section south-west of Charters Towers without	7.0m	0.3 to 1.0m	Good condition Various minor defects present along the extent including patching, cracking, surface wear and bleeding, polishing, delamination, shoving, corrugations and depressions. Infrequent more significant defects present at very infrequent intervals, such as wide filled cracking west of Maxwelton.
37	Aramac Torrens Creek Road	TMR	Flinders Highway to transmission line easement	12.7	Unposted - Assume 100km/h Queensland rural speed limit	Sealed	Yes	No	7.8 to 8.1m	No shoulder provided	Good condition Significant pothole at Mount Isa Line
38	Cotonvale Road	Private	Flinders Highway to transmission line easement	8.7	-	-	-	-	-	-	Inaccessible per advice from JV
39	Prairie Road	FSC	Flinders Highway to Woodbine Access	6.2	60km/h	Sealed	No	No	5.8 to 6.5m	No shoulder provided	Good condition Rutting present for initial 500m south from Flinders Highway. Minor infrequent potholing, cracking and delamination present.
40	Woodbine Access	Private	Prairie Road to transmission line easement	3.0	-	-	-	-	-	-	Inaccessible per advice from JV
41	Kennedy Energy Park Access Track	Private	Flinders Highway to transmission line easement	5.8	-		-	-	-	-	Inaccessible per advice from JV
42	Redcliffe Road	FSC	Flinders Highway to transmission line easement	3.7	Unposted - assume 100km/h rural default speed limit	Gravel	No	No	-	-	Full extent inaccessible due to existing gate
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	FSC	Flinders Highway to Hughenden Camp	0.3	Unposted - Assume 100km/h rural speed limit. Note vehicles would travel much slower than this due to the road condition	Dirt	No	No	3.0m	No shoulder provided	Reasonable condition Unformed tyre track
45	Kennedy Developmental Road (south)	TMR	Flinders Highway to transmission line easement	5.7	Typically 100km/h, slowing to 80km/h and then 50km/h approaching Hughenden	Sealed	Yes	Yes - Hughenden No - south of Hughenden	6.4 to 7.6m	No shoulder provided, other than in Hughenden itself	Good condition Minor infrequent shoving, rutting, delineation, edge break and longitudinal cracking present. Minor rutting and depressions also present.
46	Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82)	FSC	Flinders Highway to transmission line easement	4.3	-	-	-	-	-	-	Inaccessible per advice from JV
47	Thornhill Tamworth Road	Private	Flinders Highway to transmission line easement	2.1	-	-	-	-	-	-	Inaccessible per advice from JV

Road ID	Road Name	Road owner	Section relevant to project	Section distance (km)	Speed limit	Road Surface Type	Centreline (Yes/ No)	Edge line	Road width (typical)	Shoulder width - typical (on-site)	Road condition comment
48	Marathon Stamford Road	FSC	Flinders Highway to transmission line easement	3.4	Not posted – assume 100km/hr urban rural speed limit	Gravel	No	No	Variable – 3.6 to 6.3m	No shoulder provided	Reasonable condition Minor corrugations, shoving and rutting present.
49	Barabon Terranburby Road	FSC	Flinders Highway to transmission line easement	5.1	60km/h	Gravel	No	No	6.4 to 7.9m	No shoulder provided	Average condition Corrugations and rutting present, as well as minor crests and dips.

Traffic volumes

Traffic volumes on SC roads were determined using the TMR 2021 and 2022 traffic census data. The 2023 AADT along SC roads has been estimated by multiplying the 2021 AADT by the growth rate provided for the most recent 5-year period, where the growth rate was positive. Where the 5-year growth rate was negative, a 1% compounding annual growth rate has been applied. Where a 5-year growth rate was not provided due to counts not having been undertaken for a period of 5-years, the growth rate was estimated based on other historic counts.

The 2023 AADT projections are expected to be conservative, although it is noted that many SC roads, other than the Flinders Highway, have had historically fluctuating vehicle volumes, likely due to the timing of counts and the economy of the various industries which utilise the roads.

As discussed, intersection traffic counts were conducted on FSC roads for a 15-minute period. The collected traffic data was subsequently scaled by a factor of 4 to extrapolate the hourly traffic volume. To establish the relationship between peak hour and the observed hour, data from the nearest traffic counter on TMR roads was extracted. This information was applied to calculate a peak-to-hour ratio. Multiplying the recorded traffic volumes by this ratio allowed for the estimation of the peak hour traffic volume at the specific location.

Estimated 2023 AADT has been added to the ‘Expected 2023 AADT’ column, peak hour counts to the ‘Estimated peak Hour VPH (2023)’ and HV percentage, where available, to the ‘Heavy Vehicle %’ column. Note that due to the time in which counts were undertaken, oftentimes no vehicles, or no heavy vehicles passed through the intersection and thus traffic volumes on the road and HV percentage had to either be estimated (where ‘<’ has been used).

Table 14: Traffic volumes

Road ID	Road Name	Road Owner	Lat	Lon	Approximate Location	Background traffic (two-way)					
						Count Site ID	**2021 AADT**	**Heavy Vehicle %**	**5-year Growth Rate**	**Expected 2023 AADT**	**Estimated peak Hour veh/hr (2023)**
7	Flinders Highway	TMR	-20.7636	145.051	4.0km north-east of Flinders Highway/ Aramac Torrens Creek Road intersection, Torrens Creek	100107	621	36%	2.95%	658	~70
37	Aramac Torrens Creek Road	TMR	-21.0788	145.008	35.4km south of Flinders Highway/ Aramac Torrens Creek Road intersection, Torrens Creek	100048	111	34%	21.46%	164	~20
38	Cotonvale Road	Private			Section relevant to project			Unknown		<10	<10
39	Prairie Road	FSC			Section relevant to project			Unknown		<100	<20
40	Woodbine Access	Private			Section relevant to project			Unknown		<10	<10
41	Kennedy Energy Park Access Track	Private			Section relevant to project			Unknown		Unknown	Unknown
42	Redcliffe Road	FSC			Section relevant to project			Unknown		20	<10

Road ID	Road Name	Road Owner	Lat	Lon	Approximate Location	Background traffic (two-way)					
						Count Site ID	2021 AADT	Heavy Vehicle %	5-year Growth Rate	Expected 2023 AADT	Estimated peak Hour veh/hr (2023)
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	FSC			Section relevant to project			Unknown		<10	<10
45	Kennedy Developmental Road (south)	TMR	-20.8474	144.197	0.2km south of Kennedy Developmental Road (south)/ Moran Street intersection, Hughenden	100080	908	15%	-6.83%	926	~85
45	Kennedy Developmental Road (south)	TMR	-20.9655	144.1	16.2km south-east of Kennedy Developmental Road (south)/ Disraeli Street intersection	100033	163	30%	4.15%	177	~20
7	Flinders Highway	TMR	-20.8664	144.042	17.4km south-west of Flinders Highway/ Kennedy Developmental Road (north), Hughenden	100148	497	43%	2.61%	523	~55
46	Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82)	FSC						Unknown		<10	<10
47	Thornhill Tamworth Road	Private			Inaccessible per JV advice			Unknown		<10	<10
48	Marathon Stamford Road	FSC			Section relevant to project			Unknown		12	<10
49	Barabon Terranburby Road	FSC			Section relevant to project			Unknown		12	<10

Current heavy vehicle (HV) routes and restrictions, as outlined by the relevant layer per Queensland Government's Queensland Globe, are designated as follows in Table 15 for FSC-owned roads and SC roads along the Project route.

Table 15: HV routes and restrictions

Road Name	HV approval
Aramac Torrens Creek Road	Type 2 road train approved
Cotonvale Road	No HV approval
Prairie Road	No HV approval
Woodbine Access	No HV approval
Kennedy Energy Park Access Track	No HV approval
Redcliffe Road	No HV approval
Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	No HV approval
Kennedy Developmental Road (south)	Type 2 road train approved
Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82)	No HV approval
Thornhill Tamworth Road	No HV approval
Marathon Stamford Road	No HV approval
Barabon Terranburby Road	No HV approval

3.1.2 Intersections

State-controlled intersections

Intersections between SC roads and other SC roads, between SC roads and FSC roads, and between FSC roads and FSC roads on the Project route within the FSC LGA are summarised in Table 16.

Table 16: Intersections

Intersection ID	Intersection		HV approval	Intersection Type
	Road 1	Road 2		
Intersections between SC and SC roads				
7.12	Flinders Highway	Aramac Torrens Creek Road	Type 2 road train approved	Unsignalised T-intersection

Intersection ID	Intersection		HV approval	Intersection Type
	Road 1	**Road 2**		
7.17	Flinders Highway	Kennedy Developmental Road (south) (Mowbray Street)	Type 2 road train approved	Unsignalised 4-way intersection
7.18	Flinders Highway* (Gray Street)	Flinders Highway* (Stansfield Street)	Type 2 road train approved	Unsignalised 4-way intersection
45.1	Kennedy Developmental Road (south)* (Resolution Street)	Kennedy Developmental Road (south)* (Mowbray Street)	Type 2 road train approved	Unsignalised 4-way intersection
Intersections between SC and FSC roads				
7.13	Flinders Highway	Prairie Road	Not approved	Unsignalised 4-way intersection
7.14	Flinders Highway	Redcliffe Road	Not approved	Unsignalised T-intersection
7.16	Flinders Highway	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	Not approved	Unsignalised T-intersection
45.2	Kennedy Developmental Road (south)	Kennedy Developmental Road (south)* (Mclaren Street)	Type 2 road train approved	Unsignalised T-intersection
7.19	Flinders Highway	Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82)	Not approved	Unsignalised T-intersection
7.20	Flinders Highway	Marathon Stamford Road	Not approved	Unsignalised 4-way intersection
7.21	Flinders Highway	Barabon Terranburby Road	Not approved	Unsignalised 4-way intersection

*Intersection is the continuation of a single defined SC or FSC road, however, requires navigation of two separate streets.

Flinders Shire Council LGA intersections are shown below in Figure 7.

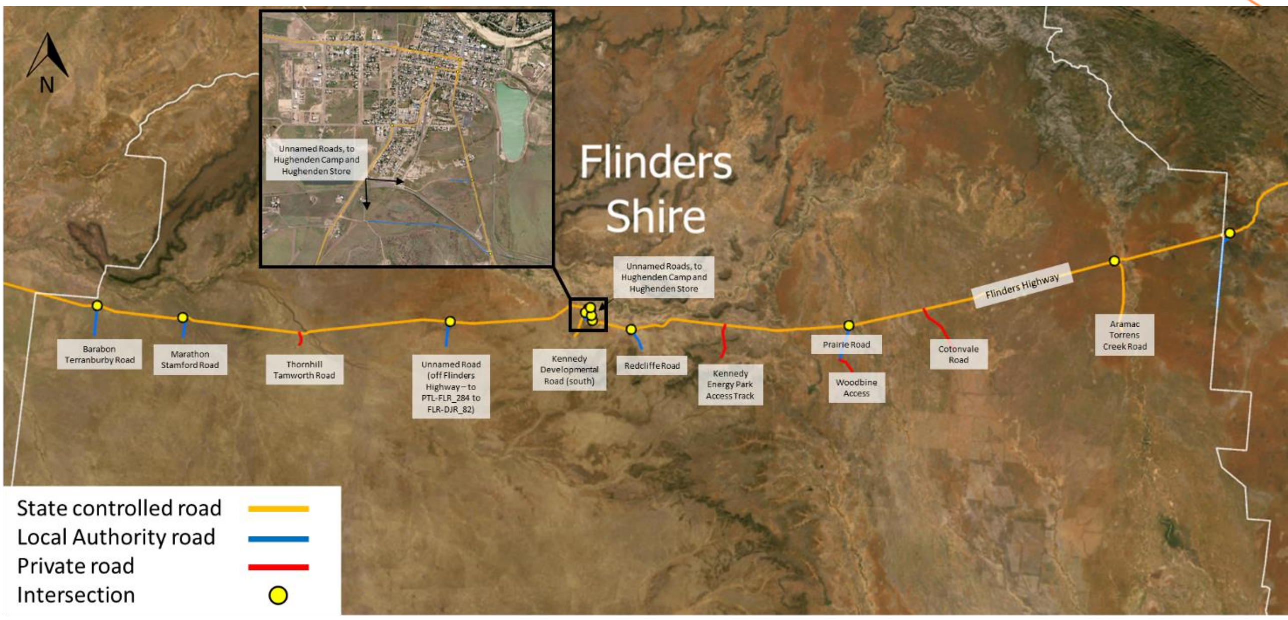


Figure 7: Intersections on the Project route – FSC

Sight distance

During the site investigations the available Approach Sight Distance (ASD) and Safe Intersection Sight Distance (SISD) at each of the intersections in the study area was measured. ASD is the minimum sight distance which a motorist should have along the minor road to an intersection hold line or other sign or device indicating an upcoming intersection. ASD allows sufficient recognition of an upcoming intersection. SISD is the minimum sight distance which should be provided between a vehicle travelling on a major road and a vehicle on a minor road attempting to turn into or travel through the major road. SISD allows enough time for a vehicle on the minor road to complete a necessary manoeuvre onto or through a major road without a collision.

<u>Approach Sight Distance</u>

The ASD was taken from a point on the minor road to the hold line in accordance with the *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Austroads Guide Part 4A) as shown in Figure 8. ASD was generally measured from a height of 1.1m, noting that this would generally produce a lower ASD, however was also considered at a height of 2.4m for trucks. The Austroads ASD requirements are defined by the equation shown in Figure 9.

Figure 3.1: Application of approach sight distance (ASD)

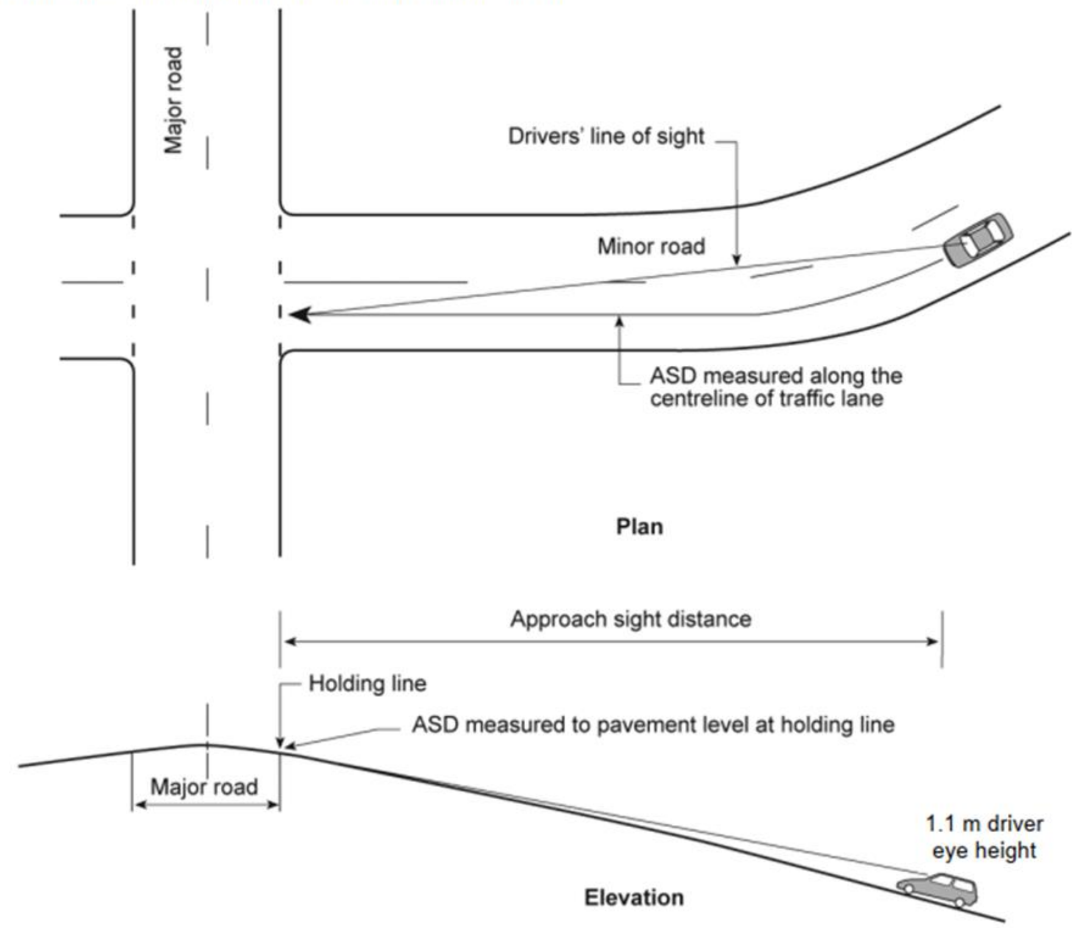


Figure 8: Austroads Guide to Road Design Part 4A: unsignalised and signalised intersections application of ASD

$$ASD = \frac{R_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)}$$

where

ASD	=	approach sight distance (m)
R_T	=	reaction time (sec), refer to *AGRD Part 3* (Austroads 2016b) for guidance on values
V	=	operating (85th percentile) speed (km/h)
d	=	coefficient of deceleration, refer to Table 3.3 and *AGRD Part 3* for values
a	=	a longitudinal grade in % (in direction of travel: positive for uphill grade, negative for downhill grade)

Figure 9: Austroads ASD equation

Using the above ASD equation, the following parameters were assumed for the largest vehicle proposed to be utilised during construction, a 26m B-double.

Table 17: ASD and SISD parameters

Reaction time (R_T)	2.5 – Desirable reaction time
Operating speed (V)	Road speed limit
Coefficient of deceleration (d)	0.24 – provided by Austroads for trucks
Longitudinal grade in percentage (a)	Typically taken to be 0 noting the typically flat grade of the road network

The Austroads ASD requirements for trucks (including B-doubles) on flat grades for the varying road speed limits were calculated as shown below in Table 18.

Table 18: Austroads ASD requirements for trucks on flat grades

Travel speed	Austroads ASD minimum requirement
40km/h	54m
50km/h	76m
60km/h	101m
80km/h	161m
100km/h	233m
110km/h	275m

Intersections within the FSC LGA with insufficient ASD are outlined below in Table 19, with commentary regarding the sight distance limitation. Note that, in the cases below, improvement of the ASD to meet the Austroads standards would require modification to the existing LGA roads. Where a stop-sign-controlled passive rail crossing was located within the ASD requirement and could be viewed from the major road, the ASD was considered sufficient as vehicles approaching the major road are required to stop.

Table 19: Intersections with insufficient ASD

Intersection ID	Road 1	Road 2	Minor road owner	Speed limit (minor road)	ASD	Required ASD	Comments
7.14	Flinders Highway	Redcliffe Road	FSC	Assume 100km/h rural default speed limit	135m	233m	Limited by crest Note that vehicles would likely be travelling slower than the 100km/h rural default speed limit

Mitigation for the insufficient ASD is discussed in Section 5 of this report.

Safe Intersection Sight Distance

The SISD was taken at a point 7m back (5m minimum) from the vehicle/ vehicle conflict point in accordance with the *TMR Supplement to Austroads Guide to Road Design Part 4A* (Supplement to AGRD Part 4A) as shown in Figure 10 below. SISD was generally measured from a height of 1.1m, noting that this would generally produce a lower SISD, however was also considered at a height of 2.4m for trucks.

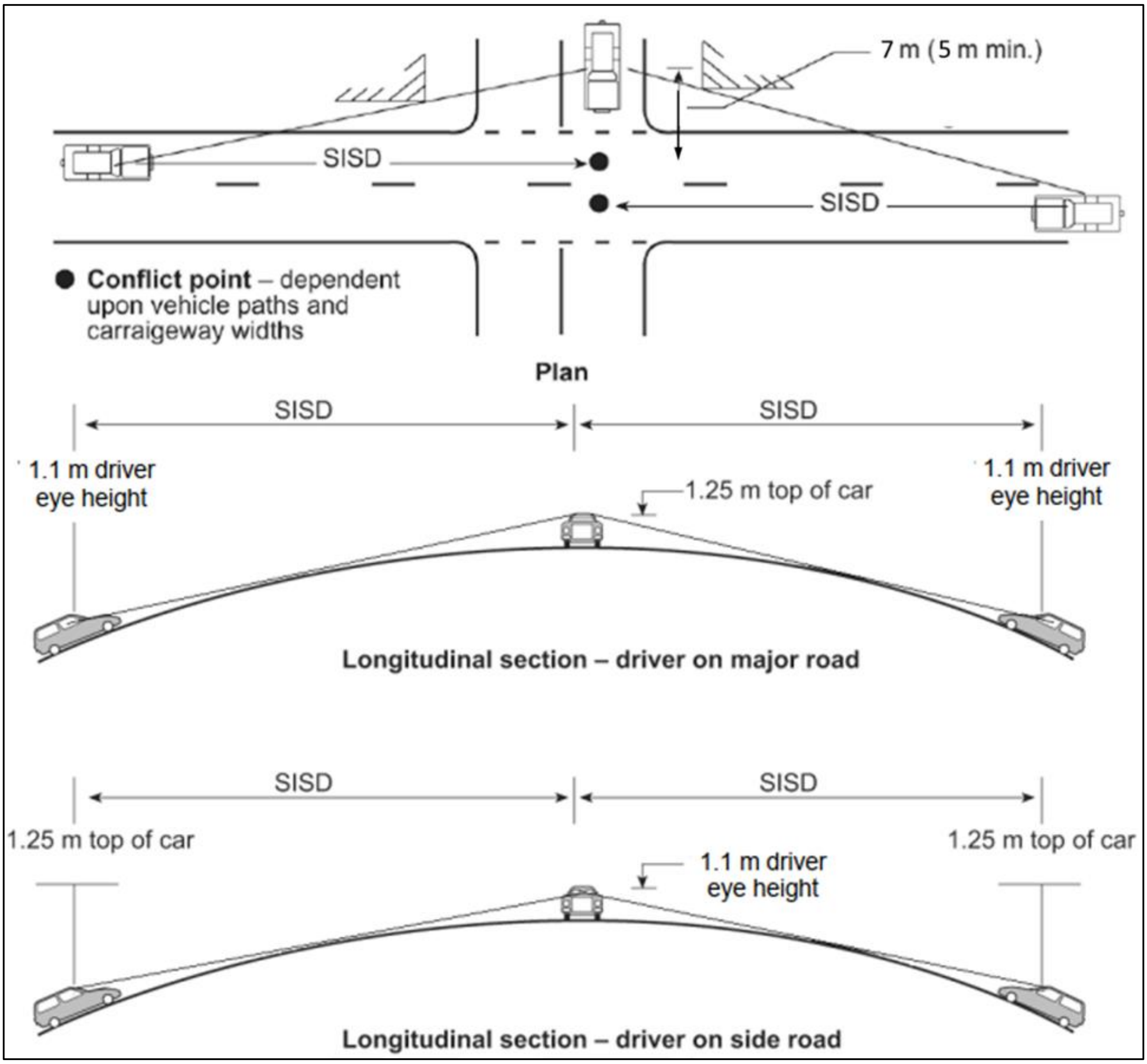


Figure 10: Supplement to AGRD Part 4A SISD

The Austroads SISD requirements are defined by the equation shown in Figure 11.

$$SISD = \frac{D_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)}$$

where

SISD	=	safe intersection sight distance (m)
D_T	=	decision time (sec) = observation time (3 sec) + reaction time (sec) – refer to *AGRD Part 3* (Austroads 2016b) for a guide to values
V	=	operating (85th percentile) speed (km/h)
d	=	coefficient of deceleration – refer to Table 3.3 and *AGRD Part 3* for a guide to values
a	=	longitudinal grade in % (in direction of travel: positive for uphill grade, negative for downhill grade)

Figure 11: Austroads SISD equation

The parameters defined in Table 17 were again used to determine the Austroads SISD requirements for B-doubles for varying road speed limits, shown below in Table 20.

Table 20: Austroads SISD requirements for trucks on flat grades

Travel speed	Austroads SISD minimum requirement
40km/h	87m
50km/h	117m
60km/h	151m
80km/h	227m
100km/h	317m
110km/h	367m

Intersections within the FSC LGA with insufficient SISD are outlined below in Table 21, with commentary regarding the sight distance limitation.

Table 21: Intersections with insufficient SISD

Intersection ID	Road 1	Road 2	Road 1 (major road) owner	Road 2 (minor road) owner	Speed limit (major road)	SISD	Required SISD	Comments	Estimated SISD if vegetation removed
7.21	Flinders Highway	Barabon Terranburby Road	TMR	FSC	110km/h	East - 270m	367m	Limited by vegetation, horizontal curve and minor dip. Note that the dip is minor and may not impede the view of a truck driver at the intersection	300m

Assessment of initial risk, potential mitigations and expected residual risk of the above intersections in provided in Section 5.3, Table 51 Table 51of this report.

Driveways

To access the transmission line easement, a number of existing and proposed access tracks will be utilised. The access tracks have been named based on the towers in which they are proposed to service. The naming convention is as follows:

'Road Name' and Access to 'Stringing Line'-'easternmost tower number'_'westernmost tower number'

Intersections within the FSC LGA between roads and access tracks have been termed as driveways. The driveways that intersect the roads are outlined below in Table 22.

Table 22: Driveways

Driveway ID	Driveway	Road owner	Latitude	Longitude	Comment
37.A	Aramac Torrens Creek Road and Western Access to PTL-FLR-T89_118	TMR	-20.87870429	145.0265674	-
37.B	Aramac Torrens Creek Road and Eastern Access to PTL-FLR-T119_168	TMR	-20.87871775	145.0264362	-
7.A	Flinders Highway and Cotonvale Road	TMR	-20.84610402	144.7184491	-
39.A	Prairie Road and Woodbine Access	FSC	-20.92467689	144.5876582	-
7.B	Flinders Highway and Kennedy Energy Park Access Track	TMR	-20.87059872	144.4094707	-
42.A	Redcliffe Road and Western Access to PTL-FLR-T239_263	FSC	-20.906231947	144.2796049412	Inaccessible due to closed gate
42.B	Redcliffe Road and Eastern Access to PTL-FLR-T264_283	FSC	-20.9062519361	144.2795498532	Inaccessible due to closed gate
44.A	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp) and Hughenden Camp Access	FSC	-20.856340319	144.19919971369	Inaccessible due to closed gate
45.A	Kennedy Developmental Road (south) and Western Access to PTL-FLR-T264_283	TMR	-20.88713636	144.1760751	-
45.B	Kennedy Developmental Road (south) and Eastern Access to PTL-FLR-T284_FLR-DJR-38	TMR	-20.88709695	144.1760069	-
46.A	Unnamed Road (off Flinders Highway) and Western Access to PTL-FLR-T284_FLR-DJR-38	FSC	-20.9020685364	143.97612386312	JV advised not to access
46.B	Unnamed Road (off Flinders Highway) and Eastern Access to FLR-DJR-39_82	FSC	-20.9020857647	143.9759965047	JV advised not to access

Driveway ID	Driveway	Road owner	Latitude	Longitude	Comment
7.C	Flinders Highway and Thornhill Tamworth Road	TMR	-20.88273699	143.7482221	-
48.A	Marathon Stamford Road and Western Access to FLR-DJR-T83_116	FSC	-20.88800737	143.5676812	-
48.B	Marathon Stamford Road and Eastern Access to FLR-DJR-T117_142	FSC	-20.88799976	143.567567	-
49.A	Barabon Terranbury Road and Western Access to FLR-DJR-T117_142	FSC	-20.88521618	143.4297283	-
49.B	Barabon Terranbury Road and Eastern Access to FLR-DJR-143_179	FSC	-20.88521925	143.4296481	-

Driveways within the FSC LGA are shown below in Figure 12.

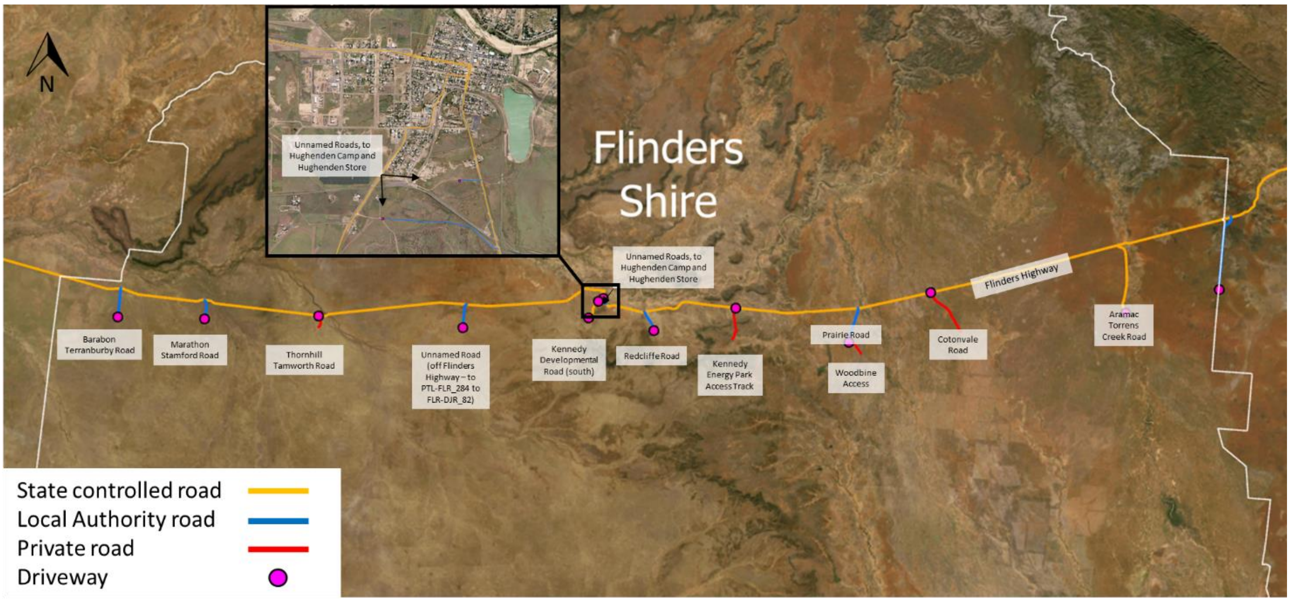
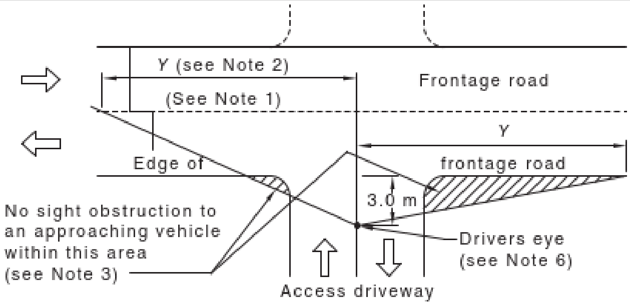


Figure 12: Driveways

Sight distance for commercial vehicle traffic entering a public roadway from an access driveway

The sight distance for commercial vehicle traffic entering a public roadway from an access driveway was taken at driver's eye height 3.0m back from the edge of the frontage road in accordance with AS 2890.2:2018 Off-street commercial vehicle facilities (AS 2890.2) as shown in Figure 13 below. The required sight distances for both a 5 second and 8 second gap are also shown below in Figure 13.



Frontage road speed (see Note 4) km/h	Distance (*Y*) along frontage road (see Note 5) m	
	5 s gap	8 s gap
40	55	89
50	69	111
60	83	133
70	97	156
80	111	178
90	125	200
100	139	222
110	153	244

NOTE 1 Centre-line or centre of roadway (undivided road), or right-hand edge of right-hand through lane (divided road).

NOTE 2 A check to the left is not required at a divided road where the median is wide enough to shelter a vehicle leaving the driveway.

NOTE 3 Parking on this side of the frontage road may need to be restricted on either side of the driveway so that the sight distance required by the above table to an approaching vehicle is not obstructed.

NOTE 4 This is the posted or general speed limit unless the 85th percentile speed is significantly higher.

NOTE 5 These distances are equivalent to minimum gap sight distance (MGSD) for an exiting vehicle. The minimum requirement is a 5 s gap. A right turn exit into a six lane road may require up to an 8 s gap, unless the median is wide enough to shelter a vehicle leaving the driveway.

NOTE 6 When checking sight distance the height of the object (approaching vehicle) is to be taken as 1.15 m above the road surface. The driver's eye height is to be taken as any height in the range 1.15 m to 2.5 m, to cater for both car and commercial vehicle drivers.

Figure 13: AS 2890.2 sight distance requirements

Sight distance was assessed against the requirements for an 8s gap, which is expected to be conservative. Driveways on FSC roads and SC roads within the FSC LGA with insufficient sight distance for commercial vehicles are outlined below in Table 23, with commentary regarding the sight distance limitation. Note that locations where sight distance was unable to be measured due to the road being private or inaccessible for other reasons were not included below.

Table 23: Driveways with insufficient sight distance

Driveway ID	Driveway	Road owner	Speed limit (major road)	Sight distance	Required sight distance	Comments	Estimated sight distance if vegetation removed
44.A	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp) and Hughenden Camp Access	FSC	100km/h	West – 150m	222m	Limited by vegetation	250+
45.A	Kennedy Developmental Road (south) and Western Access to PTL-FLR-T264_283	TMR	100km/h	South - 160m	222m	Limited by crest	
45.B	Kennedy Developmental Road (south) and Eastern Access to PTL-FLR-T284_FLR-DJR-38	TMR	100km/h	South - 160m	222m	Limited by crest	

Mitigation for the insufficient driveway sight distance is discussed in Section 5 of this report.

3.1.3 Rail crossings

The Project route will require vehicles to travel over Mount Isa Line rail crossings. The location of Mount Isa rail crossings on the Project route is shown in Figure 14 and outlined below in Table 24, noting that there is an impact of queueing onto SC and LGA roads from rail crossings located on LGA and privately-owned roads at some locations.

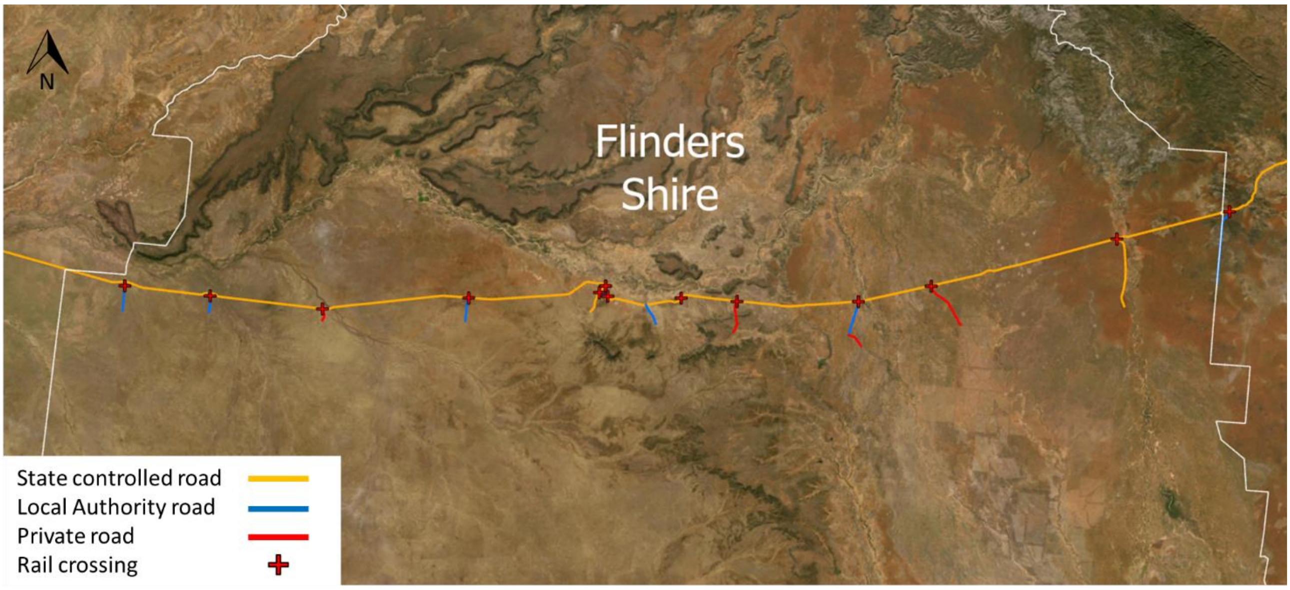


Figure 14: Rail crossings

Table 24: Rail crossings

Crossing Name	Road owner	Active or passive control	Latitude	Longitude
Mount Isa Line: Aramac Torrens Creek Road crossing	TMR	Passive - give-way controlled (southbound), stop controlled (northbound)	-20.771843	145.014835
Mount Isa Line: Cotonvale Road crossing	Private	Passive - stop sign controlled	-20.843179	144.734995
Mount Isa Line: Prairie Road crossing	FSC	Passive - stop sign controlled	-20.871547	144.60266
Mount Isa Line: Kennedy Energy Park Access Track crossing	Private	Passive - stop sign controlled	-20.871321	144.409346
Mount Isa Line: Flinders Highway (east of Redcliffe Road) crossing	TMR	Active	-20.865722	144.320159
Mount Isa Line: Flinders Highway (Hughenden south) crossing	TMR	Active	-20.862986	144.203219
Mount Isa Line: Flinders Highway (Hughenden north) crossing	TMR	Active	-20.846558	144.199869
Mount Isa Line: Kennedy Developmental Road (south) crossing	TMR	Passive - give-way controlled	-20.857077	144.189793

Crossing Name	Road owner	Active or passive control	Latitude	Longitude
Mount Isa Line: Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) crossing	FSC	Passive - stop sign controlled	-20.865709	143.98156
Mount Isa Line: Thornhill Tamworth Road crossing	Private	Passive - give-way controlled	-20.883069	143.748177
Mount Isa Line: Marathon Stamford Road crossing	FSC	Passive	-20.862421	143.569433
Mount Isa Line: Barabon Terranburby Road crossing	FSC	Passive	-20.846347	143.433425

AS 1742.7:2016 Railway crossings (AS 1742.7) outlines signage, pavement marking, queuing, bicycle treatment and sight distance requirements of railway crossings. This is supplemented by the TMR Queensland Manual of Uniform Traffic Control Devices Part 7: Railway crossings.

Signage

Passive control

Figure 15 and Figure 16 show the required signage assembly for railway crossings controlled by Give Way signs and by Stop signs, respectively. These are known as passive control devices.

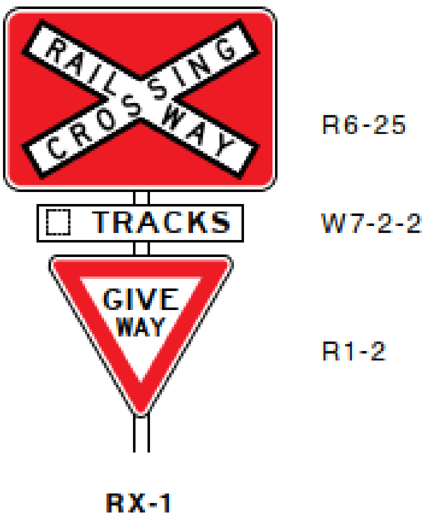


Figure 15: Railway crossing give-way assembly (RX-1)

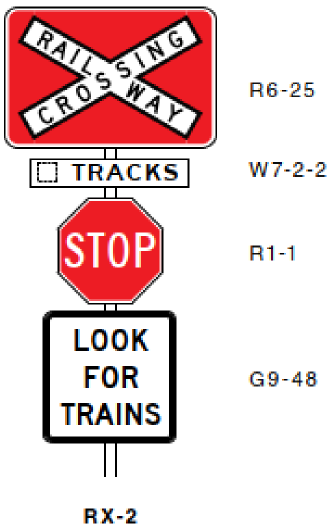


Figure 16: Railway crossing stop assembly (RX-2)

Give-way passive control is to be used where there is sufficient sight distance such that a driver of a vehicle approaching the rail crossing at the 85th percentile speed can see an approaching train and has time to stop prior to the rail crossing. Where this is not provided, a stop assembly shall be implemented.

Use of passive control also requires that sufficient sight distance for a vehicle stopped at the railway crossing to be able to start off and clear the crossing before the arrival of a previously unseen train is provided. Where there is inadequate sight distance for passive control, it may be improved by widening, clearing or geometric alteration of the crossing. Where this is not feasible or sight distance still does not meet the requirement, further risk mitigations may be implemented.

Railway crossing ahead and diagrammatic warning assemblies shall be used to give advance warning of a railway crossing controlled by passive devices (i.e. give-way or stop assemblies). Railway crossing ahead signs shall be the first warning sign encountered on approach to a passive rail crossing. Diagrammatic warning assemblies should be used as the second or as an intermediate sign on approach to a passive rail crossing. Where a passive railway crossing is located on a side road and is too close to the intersection to provide sufficient sight distance required to safely navigate, on side road signs may be used in conjunction with railway crossing ahead and diagrammatic warning assemblies on the major road. Examples of these signs are shown below in Figure 17 to Figure 20.

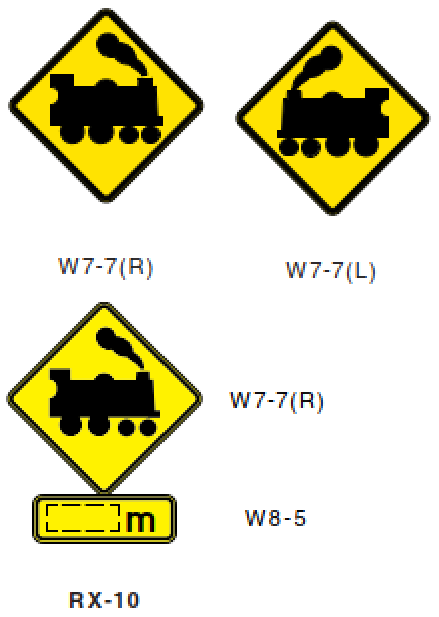


Figure 17: Railway crossing ahead passive control signs

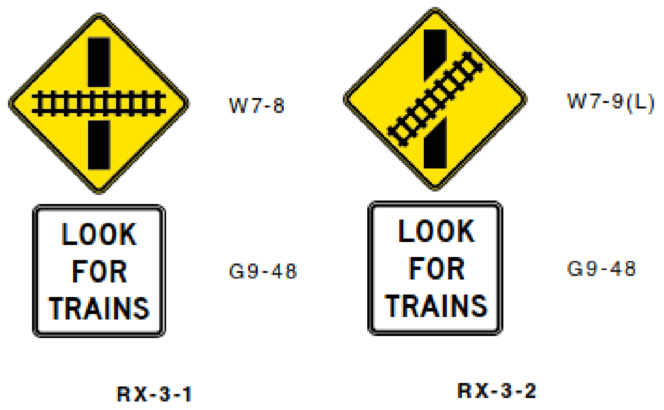


Figure 18: Railway crossing diagrammatic warning assemblies

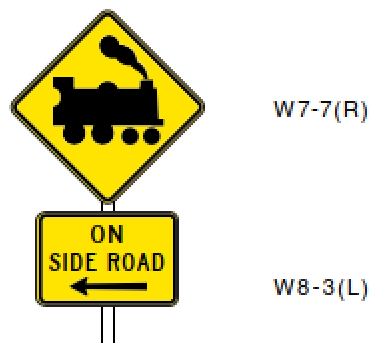


Figure 19: Railway crossing ahead passive control signs – on side road

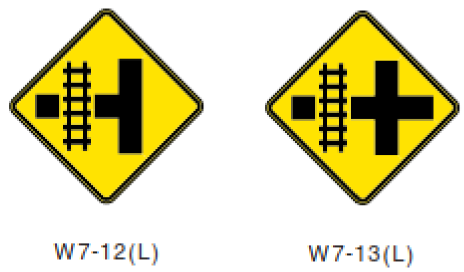


Figure 20: Railway crossing diagrammatic warning assemblies – on side road

The Stop Sign Ahead sign shall be used as the second or as an intermediate sign on approach to a rail crossing controlled by stop signs.

Signs other than those shown in Figure 15 or Figure 16 are not required in the following instances, shown in Figure 21.

TABLE 4.1

LIMITS ON USE OF MINIMUM TREATMENT CROSSINGS

Case	Maximum road approach speed (85th percentile approach speed)	Maximum visibility distance to controls for road users	Application
1	60 km/h	90 m	Applicable where traffic volume is less than 200 vehicles per day
2	40 km/h	40 m	Applicable to any road
3	any speed	20 m	Applicable only to a crossing on a side road not more than 40 m from the main road

Figure 21: AS 1742.7 minimum treatment crossings

Modified treatments may also be used in particular circumstances, as defined by AS 1742.7.

An assessment of the signage at passive controlled rail crossings on FSC roads and SC roads within the FSC LGA has been undertaken and is shown below in Table 25.

Table 25: Signage assessment – passive controlled rail crossings

Crossing Name	Active or passive control	Applicable minimum treatment crossings	Provides crossing ahead signs	Provides diagrammatic signs/ stop sign ahead signs - passive only
Mount Isa Line: Aramac Torrens Creek Road crossing	Passive - give-way controlled (southbound), stop controlled (northbound)	Not applicable	Northbound - Yes Southbound - Yes (on Flinders Highway eastbound and westbound)	Northbound - Yes Southbound - Yes (on Flinders Highway eastbound and westbound)
Mount Isa Line: Cotonvale Road crossing	Passive - stop sign controlled	Not applicable	Northbound – Unknown (inaccessible) Southbound – No	Northbound – Unknown (inaccessible) Southbound – No
Mount Isa Line: Prairie Road crossing	Passive – give-way controlled (southbound), stop controlled (northbound)	Not applicable	No crossing ahead signs on either approach	Northbound – No Southbound – Yes (on Flinders Highway eastbound and westbound)
Mount Isa Line: Kennedy Energy Park Access Track crossing	Passive - stop sign controlled	Not applicable	Northbound – Unknown (inaccessible) Southbound – No	Northbound – Unknown (inaccessible) Southbound – No
Mount Isa Line: Kennedy Developmental Road (south) crossing	Passive - give-way controlled	Not applicable	Northbound - Unknown Southbound - Yes	Northbound - Unknown Southbound - Yes

Crossing Name	Active or passive control	Applicable minimum treatment crossings	Provides crossing ahead signs	Provides diagrammatic signs/ stop sign ahead signs - passive only
Mount Isa Line: Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) crossing	Passive - stop sign controlled	Not applicable	No crossing ahead signs on either approach	No diagrammatic signs on either approach
Mount Isa Line: Thornhill Tamworth Road crossing	Passive - give-way controlled	Applicable	Northbound – Unknown (inaccessible) Southbound – No	Northbound – Unknown (inaccessible) Southbound - No
Mount Isa Line: Marathon Stamford Road crossing	Passive - stop controlled (southbound), stop controlled (northbound)	Not applicable	No crossing ahead signs on either approach	No diagrammatic signs on either approach
Mount Isa Line: Barabon Terranburby Road crossing	Passive - stop controlled (southbound), stop controlled (northbound)	Not applicable	No crossing ahead signs on either approach	No diagrammatic signs on either approach

Assessment of initial risk, potential mitigations and expected residual risk of the above rail crossings is provided in Section 5.5, Table 46 of this report.

<u>Active control</u>

Active control rail crossings shall be installed per either assembly shown in Figure 22, unless supplemented by a boom barrier or providing additional flash signals. W7-2-2 is only required to be used at crossings of multiple tracks.

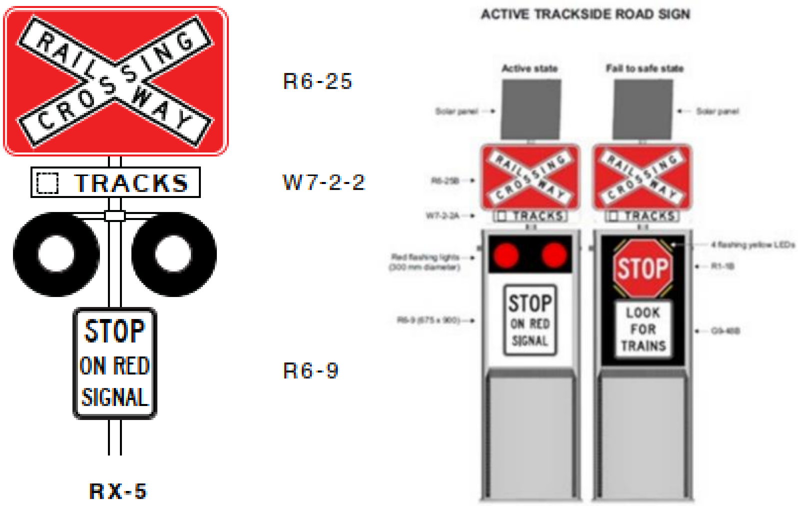


Figure 22: Railway crossing flashing signal assembly

Overhead flashing signals should be used in conjunction with pedestal mounted assemblies where there are obstructions to the latter, or where there are more than two traffic lanes on the approach.

Railway crossing flashing signals ahead shall be used to give advance warning of a railway crossing controlled by active devices. Railway crossing flashing signals ahead signs shall be used on approach to an active rail crossing. Where an active railway crossing is located on a side road and is too close to the intersection to provide sufficient sight distance required to safely navigate, on side road signs may be used in conjunction with railway crossing ahead and diagrammatic warning assemblies on the major road. Examples of these signs are shown below in Figure 23 and Figure 24.

Figure 23: Railway crossing ahead active control signs

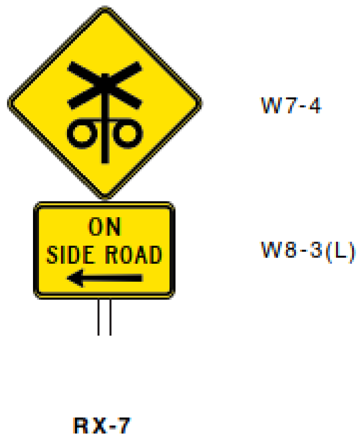


Figure 24: Railway crossing ahead active control signs – on side road

An assessment of active controlled rail crossings on SC roads within FSC has been undertaken and is shown below in Table 26. Note that the illumination and retro-reflectivity of signage, and location and size of signage was not assessed.

Table 26: Signage assessment – active controlled rail crossings

Crossing Name	**Applicable minimum treatment crossings**	**Provides crossing ahead signs**	**Provides diagrammatic signs/ stop sign ahead signs - passive only**
Mount Isa Line: Flinders Highway (east of Redcliffe Road) crossing	Not applicable	Eastbound - No Westbound - Yes	Not applicable
Mount Isa Line: Flinders Highway (Hughenden south) crossing	Not applicable	Northbound - Yes Southbound - Yes	Not applicable
Mount Isa Line: Flinders Highway (Hughenden north) crossing	Not applicable	Northbound - Yes Southbound - Yes	Not applicable

As evidenced, crossing ahead signage is not provided on the eastbound approach to the Flinders Highway (east of Redcliffe Road) crossing.

Assessment of initial risk, potential mitigations and expected residual risk of the above rail crossings is provided in Section 5.5, Table 46 of this report.

Pavement markings

The following pavement marking is required on both approaches to a passive or active rail crossing:

- RAIL X marking – unless the rail crossing on a side road is within 60m of the major road or within a speed zone of 80km/h or less
- Stop or give-way lines; and
- No overtaking lines – on undivided sealed two-way roads with seal width greater than 5.5m, extending from the crossing to the initial warning sign or the major road.

An assessment of pavement markings at and on approach to rail crossings on FSC roads has been completed and is shown below in Table 27.

Table 27: Pavement marking assessment

Crossing Name	Pavement markings – Rail X required	Pavement markings - RAIL X provided	Pavement markings - Stop or give-way lines required	Pavement markings - Stop or give-way lines provided	Pavement markings - No overtaking lines required	Pavement markings - No overtaking lines provided
Mount Isa Line: Aramac Torrens Creek Road crossing	Northbound - Yes Southbound - No	Northbound - Unknown Southbound - No	Northbound - Yes Southbound - Yes	Northbound - No Southbound - No	Northbound - Yes Southbound - Yes	Northbound - Yes, however does not extend to hold line as no hold line is provided Southbound - No
Mount Isa Line: Cotonvale Road crossing	Northbound – No Southbound - No	Northbound – No Southbound – No	Northbound – No Southbound - No	Northbound – No Southbound - No	Northbound - No Southbound - No	Northbound - No Southbound - No
Mount Isa Line: Prairie Road crossing	Northbound – No Southbound - No	Northbound – No Southbound – No	Northbound - Yes Southbound - Yes	Northbound – Yes Southbound - Yes	Northbound - Yes Southbound - Yes	Northbound - No Southbound - No
Mount Isa Line: Kennedy Energy Park Access Track crossing	Northbound – No (Private) Southbound – No (Private)	Northbound – No Southbound – No	Northbound – Yes Southbound – Yes	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes
Mount Isa Line: Flinders Highway (east of Redcliffe Road) crossing	Eastbound - Yes Westbound - Yes	Eastbound - Yes Westbound - Yes	Eastbound - Yes Westbound - Yes	Eastbound - Yes Westbound - Yes	Eastbound - Yes Westbound - Yes	Eastbound - Yes Westbound - Yes

Crossing Name	Pavement markings – Rail X required	Pavement markings - RAIL X provided	Pavement markings - Stop or give-way lines required	Pavement markings - Stop or give-way lines provided	Pavement markings - No overtaking lines required	Pavement markings - No overtaking lines provided
Mount Isa Line: Flinders Highway (Hughenden south) crossing	Northbound: No Southbound: No	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes
Mount Isa Line: Flinders Highway (Hughenden north) crossing	Northbound: No Southbound: No	Northbound - No Southbound - No	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - Yes
Mount Isa Line: Kennedy Developmental Road (south) crossing	Northbound: No Southbound: No	Northbound - Yes Southbound - No	Northbound - Yes Southbound - Yes	Northbound - Yes Southbound - No	Northbound - Yes Southbound - Yes	Northbound - Unknown Southbound - Unknown
Mount Isa Line: Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) crossing	Northbound – No Southbound - No	Northbound – No Southbound – No	Northbound – No Southbound - No	Northbound – No Southbound - No	Northbound - No Southbound - No	Northbound - No Southbound - No
Mount Isa Line: Thornhill Tamworth Road crossing	Northbound – No Southbound - No	Northbound – No Southbound – No	Northbound – No Southbound - No	Northbound – No Southbound - No	Northbound - No Southbound - No	Northbound - No Southbound - No
Mount Isa Line: Marathon Stamford Road crossing	Northbound – No Southbound - No	Northbound – No Southbound – No	Northbound – No Southbound - No	Northbound – No Southbound - No	Northbound - No Southbound - No	Northbound - No Southbound - No
Mount Isa Line: Barabon Terranburby Road crossing	Northbound – No Southbound - No	Northbound – No Southbound - No	Northbound – No Southbound – No	Northbound – No Southbound – No	Northbound - No Southbound - No	Northbound - No Southbound - No

Based on the above, multiple rail crossings are missing required pavement markings on approach. Note that Cotonvale Road, Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82), Thornhill Tamworth Road, Marathon Stamford Road and Barabon Terranburby Road are not sealed and thus do not require pavement markings.

Sight distance

Various sight distances have been assessed against the requirements of AS1742.7. These include:

- Stopping sight distance (SSD) – S1
- Visibility to an approaching train for the driver of a vehicle approaching a GIVE WAY sign needing to judge whether it must stop or can cross the crossing before the train arrives – S2; and
- Visibility to an approaching train for a vehicle stopped at a crossing and needing to start up and clear the crossing before the arrival of the train – S3.

The latter two are only required for passive control rail crossings.

The requirements for S1, S2 and S3 are given by the following equations:

$$S_1 = \frac{(R_T + B_T)V_v}{3.6} + \frac{{V_v}^2 \times S_c}{254(d+G)} + L_d + C_v$$

$$S_2 = \frac{V_T}{V_v}\left(\frac{(R_T + B_T)V_v}{3.6} + \frac{{V_v}^2 \times S_c}{254(d+G)} + \frac{W_T}{sinZ} + 2C_v + C_T + L\right)$$

$$S_3 = \frac{V_T}{3.6}\left(J + G_s\left(2\frac{\frac{W_R}{tanZ} + \frac{W_T}{sinZ} + 2C_v + C_T + L}{a}\right)^{\frac{1}{2}}\right)$$

Where,

R_T = total perception reaction time in seconds (general case assumption = 2.5s)

B_T = brake delay time (s)

V_v = vehicle approach speed (km/h)

S_c = unsealed road correction factor

d = coefficient of longitudinal deceleration

G = average approach grade in metres per metre, positive up-grade, negative down-grade

L_d = distance from the driver to the front of the vehicle (general case assumption = 1.5 metres)

C_v = clearance from the vehicle stop of give-way line to the nearest rail (general case assumption = 3.5m)

V_T = the speed of the train approaching the crossing (km/h)

W_T = width, outer rail to outer rail. Of the rail tracks at the crossing (m)

Z = angle between the road and the railway at the crossing (degrees)

C_T = clearance or safety margin from the vehicle stop or give-way line on the departure side of the crossing (general case assumption = 5 metres)

L = length of design vehicle

J = sum of the perception time and time to depress clutch

G_s = grade correction factor

W_R = width of the travelled way at the crossing (road width)

a = average acceleration of the design vehicle in starting gear

Parameters, as listed and described above, were often determined via desktop assessment, as site staff were unable to be within 3m of SC roads whilst outside of a vehicle or determined from relevant tables in AS 1742.7.

The S1, S2 and S3 requirements at rail crossings on FSC roads are shown below in Table 28. Where roads were inaccessible, various parameters have been estimated using aerial imagery and the speed limit has been assumed to be the rural default speed limit of 100km/h.

Table 28: S1, S2 and S3 requirements at rail crossings

Crossing Name	S1 requirement (m)	S2 requirement (m)	S3 requirement (m)
Mount Isa Line: Aramac Torrens Creek Road crossing	173	225	417
Mount Isa Line: Cotonvale Road crossing	180	235	392
Mount Isa Line: Prairie Road crossing	92	196	420
Mount Isa Line: Kennedy Energy Park Access Track crossing	173	214	392
Mount Isa Line: Flinders Highway (east of Redcliffe Road) crossing	199	245	488
Mount Isa Line: Flinders Highway (Hughenden south) crossing	141	208	456
Mount Isa Line: Flinders Highway (Hughenden north) crossing	97	205	444
Mount Isa Line: Kennedy Developmental Road (south) crossing	138	203	415
Mount Isa Line: Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) crossing	180	236	398
Mount Isa Line: Thornhill Tamworth Road crossing	180	236	400
Mount Isa Line: Marathon Stamford Road crossing	173	225	422
Mount Isa Line: Barabon Terranburby Road crossing	164	222	672

The stopping sight distance (S1) on FSC roads was determined during the site visit and has been estimated using pictures and video taken during the site visit and via Google Streetview on SC roads, however S2 and S3 were unable to be estimated using this approach as they require sight distance of trains, which are infrequent.

Table 29: S1 assessment at rail crossings

Crossing Name	S1 requirement (m)	S1 estimate (m) - Northbound/ Westbound	S1 estimate (m) - Southbound/ Eastbound	S1 meets requirements - Northbound/ Westbound	S1 meets requirements - Southbound/ Eastbound
Mount Isa Line: Aramac Torrens Creek Road crossing	173	>200	100 (From Flinders Highway)	Yes	Yes*
Mount Isa Line: Cotonvale Road crossing	180	Unknown (Inaccessible)	90 (From Flinders Highway)	Unknown	Yes*
Mount Isa Line: Prairie Road crossing	92	200+	200+	Yes	Yes
Mount Isa Line: Kennedy Energy Park Access Track crossing	173	Unknown (Inaccessible)	200+	Unknown	Yes
Mount Isa Line: Flinders Highway (east of Redcliffe Road) crossing	199	>200	>200	Yes	Yes
Mount Isa Line: Flinders Highway (Hughenden south) crossing	141	>200	>200	Yes	Yes
Mount Isa Line: Flinders Highway (Hughenden north) crossing	97	>200	>200	Yes	Yes
Mount Isa Line: Kennedy Developmental Road (south) crossing	138	Unknown	Unknown	Unknown	Unknown
Mount Isa Line: Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) crossing	180	Unknown (Inaccessible)	120m (From Flinders Highway)	Unknown	Yes*

Crossing Name	S1 requirement (m)	S1 estimate (m) - Northbound/ Westbound	S1 estimate (m) - Southbound/ Eastbound	S1 meets requirements - Northbound/ Westbound	S1 meets requirements - Southbound/ Eastbound
Mount Isa Line: Thornhill Tamworth Road crossing	180	Unknown (Inaccessible)	100m (From Flinders Highway)	Unknown	Yes*
Mount Isa Line: Marathon Stamford Road crossing	173	200+	200+	Yes	Yes
Mount Isa Line: Barabon Terranburby Road crossing	173	200+	200+	Yes	Yes

*The S1 estimate at the southbound approaches to the Aramac Torrens Creek Road, Cotonvale Road, Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) and Thornhill Tamworth Road rail crossings do not meet their respective S1 requirements for the 100km/h speed limit. However, due to the nearby location of upstream intersections which slow vehicles considerably, the sight distances are expected to be sufficient.

As shown above, the stopping sight distance (S1) to all rail crossings located on FSC roads and SC roads within the FSC LGA, where known, meets the S1 requirements.

Queueing

Due to the Mount Isa Line running parallel to the Flinders Highway along much of its extent, there are multiple locations on the Project route in which intersections with the Flinders Highway are located in close proximity to rail crossings. As a result, both due to queuing on the minor road at intersections and due to queueing at train tracks when waiting for a train to pass, there is potential for vehicles to block either the intersections or the rail crossing.

Locations where there is an intersection within the FSC LGA in close proximity of a rail line is shown in Table 30.

Where the proximity results in a high risk of queues forming on major road or a rail line, mitigation is discussed in Section 5 of this report.

Table 30: Distance between rail crossing and nearest intersection

Crossing Name	Distance to northern/ eastern intersection (track to hold line)	Distance to southern/ western intersection (track to hold line)
Mount Isa Line: Aramac Torrens Creek Road crossing	49m	-
Mount Isa Line: Cotonvale Road crossing	87m	-
Mount Isa Line: Prairie Road crossing	35m	-
Mount Isa Line: Kennedy Energy Park Access Track crossing	77m	-
Mount Isa Line: Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) crossing	39m	-
Mount Isa Line: Thornhill Tamworth Road crossing	38m	-
Mount Isa Line: Marathon Stamford Road crossing	590m	-
Mount Isa Line: Barabon Terranburby Road crossing	735m	-

3.1.4 Locations and structures of interest

Table 31 details other locations or structures of interest that were identified during the site investigations within the Flinders Shire Council. Locations or structures of interest typically are those which may require change of proposed routes or cause an increased risk for traffic generated by the project within the study area. They include bridges, school zones, tight curves and turns, cattle grids, floodways and roads with load limits or that are B-double exempt. Note that some locations and structures of interest may have been missed, particularly culverts and the like, due to them often being difficult to see whilst driving at higher speeds. A further assessment of loading of bridge structures (bridges and culverts) should be undertaken prior to the start of construction.

Table 31: Locations and structures of interest

Road ID	Road name	Road owner	Location/ structure type	Latitude	Longitude
7	Flinders Highway	TMR	Bridge	-20.76818102	145.0327662
37	Aramac Torrens Creek Road	TMR	Railway crossing	-20.77188328	145.0147655
7	Flinders Highway	TMR	Bridge	-20.8223237	144.8171786
7	Flinders Highway	TMR	School zone	-20.87088731	144.6061855
39	Prairie Road	FSC	SWER line crossing road	-20.87223531	144.6027705
39	Prairie Road	FSC	SWER line crossing road	-20.87862431	144.6019365
39	Prairie Road	FSC	Transmission line crossing road	-20.89501331	144.5961035
39	Prairie Road	FSC	Cattle grid	-20.9214022	144.5883258
7	Flinders Highway	TMR	Culvert	-20.8767069	144.4719753
7	Flinders Highway	TMR	Culvert	-20.87620971	144.46555
7	Flinders Highway	TMR	Culvert	-20.86973832	144.4008565
7	Flinders Highway	TMR	Culvert	-20.86923375	144.3957958
7	Flinders Highway	TMR	Rail crossing	-20.86573533	144.3201515
7	Flinders Highway	TMR	Culvert	-20.86759887	144.3185899
7	Flinders Highway	TMR	Culvert	-20.87142709	144.2947931
7	Flinders Highway	TMR	Culvert	-20.87209366	144.2913426
42	Redcliffe Road	FSC	Gate	-20.878056	144.264722
7	Flinders Highway	TMR	Rail crossing	-20.86299938	144.2032117
7	Flinders Highway	TMR	Rail crossing	-20.84657134	144.1998615
45	Kennedy Developmental Road (south)	TMR	School zone (Hughenden State School - 40 zone (8am to 9am and 2:30pm to 3:30pm))	-20.84500734	144.1978025
7	Flinders Highway	TMR	Culvert	-20.84282673	144.1948405\

Road ID	Road name	Road owner	Location/ structure type	Latitude	Longitude
45	Kennedy Developmental Road (south)	TMR	Rail crossing	-20.85709034	144.1897965
7	Flinders Highway	TMR	Culvert	-20.84088859	144.1773307
7	Flinders Highway	TMR	Culvert	-20.84827126	144.1575258
7	Flinders Highway	TMR	Culvert	-20.86735678	144.0087713
7	Flinders Highway	TMR	Culvert	-20.88021928	143.7678219
7	Flinders Highway	TMR	Bridge	-20.88164399	143.7624969
7	Flinders Highway	TMR	Bridge	-20.88232007	143.7609064
7	Flinders Highway	TMR	Culvert	-20.88354241	143.7554193
7	Flinders Highway	TMR	Culvert	-20.86492235	143.5947326
7	Flinders Highway	TMR	Bridge	-20.86393779	143.5863282
7	Flinders Highway	TMR	Bridge	-20.86383312	143.5854424
48	Marathon Stamford Road	FSC	Cattle grid	-20.86305555	143.56944
7	Flinders Highway	TMR	Culvert	-20.86008225	143.5534759
7	Flinders Highway	TMR	Culvert	-20.85393095	143.5010816
7	Flinders Highway	TMR	Culvert	-20.85080381	143.4745102
7	Flinders Highway	TMR	Bridge	-20.84289101	143.4443007
49	Barabon Terranburby Road	FSC	Rail Crossing	-20.846111	143.4333
49	Barabon Terranburby Road	FSC	Cattle grid	-20.8591666	143.43221

It is expected that the vast majority of bridges and culverts on FSC roads would be sufficient for the project traffic. On roads which B-double trucks do not frequently use, all bridges, culverts and other items of interest should be inspected prior to project traffic travelling on them.

3.1.5 Crash history

Queensland Government's Queensland Globe has been utilised to investigate the most recent 10-year crash history (2013 to Mid-2021 – 2022 not available) along the Project route. All data along the proposed route was downloaded and analysed and is presented below in Table 32.

Table 32: Crash history - most recent 10-year period

Location	Road owner	Roadway feature	Crash severity	Count	Prominent crash types
Flinders Highway	TMR	Midblock	Fatal - 1 Hospitalisation - 26 Medical treatment - 7 Minor injury - 1	35	Pedestrian - 1 Off path on straight - 26
Kennedy Developmental Road (south)	TMR	Midblock	Hospitalisation - 1	1	Pedestrian - 1

A total of 36 crashes were recorded along the Project route within the FSC region during the period from the start of 2013 to Mid-2021, all of which occurred on SC roads. There is no record of crash history data for the FSC roads in the last 10 years.

A map of crashes along the Project route during the period is shown below in Figure 25.

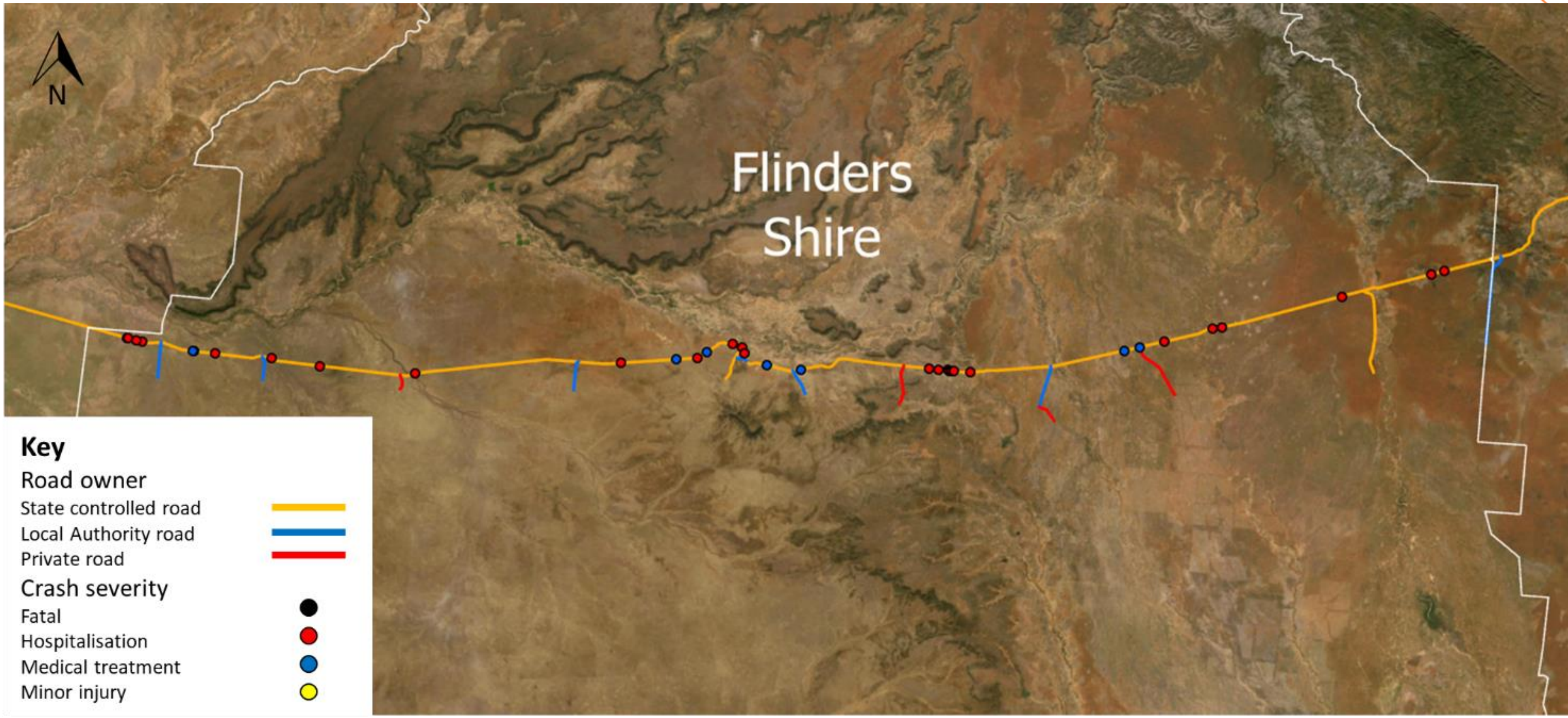


Figure 25: Crash history map

4. Proposed development traffic

4.1 Overview

Many different components of the CopperString 2032 project generate traffic onto the public road network. These include:

- Construction, operation and demobilisation of the worker camps
- Construction and operational maintenance of the transmission line; and
- Construction and operational maintenance of the substations.

The item that results in the highest traffic generation on the road network and has therefore been assessed in this report is shown in Table 33.

Table 33: Traffic generation project phases

Construction item	Construction phase traffic	Operational phase traffic
Camps		X
Transmission line	X	
Substations	X	

4.2 Camp operation traffic

4.2.1 Operational traffic information

Workforce

As discussed, there are 6 camps located along the CopperString 2032 project length. Each camp is proposed to house a maximum number of workers with those numbers differing from camp-to-camp dependent on the location of the next nearby camp and the number of transmission towers and substations in its designated area.

The Hughenden Camp Hub is located in the FSC LGA and is expected to have a maximum workforce of 410 people.

Vehicle types and use

The following vehicle types would be generated by the camps:

- Light crew vehicles
- 12-seater minibuses (to take larger crews)
- Rigid crew trucks with equipment
- Rigid delivery trucks to take materials in and out of the camps
- Truck and dog vehicles to take materials in and out of the camps
- Semi-trailers to take materials in and out of the camps; and
- B-double trucks to take materials in and out of the camps.

Workforce movement and traffic routes

All movements in and out of the camps will take the most direct route to the nearest major highway (generally either the Flinders or Barkly Highway) and travel to their destination.

Generally, all workers will depart the camp in the morning peak hour (6:30am to 7:30am) and head to their worksite on the CopperString 2032 corridor, in the afternoon peak hour (5:30pm to 6:30pm) they will return to the camp. Deliveries occur periodically throughout the day.

More detailed information regarding the operation and traffic routes used by the camps can be found in the CopperString 2032 Camps TIAs (see Section 1.6 of this report for references to the CopperString 2032 Camps TIAs).

4.2.2 Camp traffic volumes

Table 34 shows the expected traffic volumes to be generated by the Hughenden Camp Hub on the expected typical busiest day and Table 36 shows the expected traffic volumes to be generated by the Hughenden Camp Hub during the peak hour of the expected typical busiest day.

It is noted that all traffic volumes stated in the traffic generation of the works are movements, i.e. if a vehicle travels in and out of the site that would generate two movements

Table 34: Hughenden Camp Hub traffic generation – typical busiest day

General workforce traffic generation			**Deliveries/ Removing Goods Traffic Generation**		
Light vehicles	**Minibuses**	**Rigid trucks**	**Rigid trucks**	**Semi trailers/ truck and dog**	**B-doubles**
310	40	32	40	4	4

Table 35: Hughenden Camp Hub traffic generation – peak hour of typical busiest day

General workforce traffic generation			**Deliveries/ Removing Goods Traffic Generation**		
Light vehicles	**Minibuses**	**Rigid trucks**	**Rigid trucks**	**Semi trailers/ truck and dog**	**B-doubles**
155	20	16	4	-	-

4.3 Transmission lines

4.3.1 Construction traffic information

Construction activities

Construction of the transmission lines results in the following traffic generating activities:

- Site establishment (civil, earthworks)
- Tower foundation works
- Tower assembly and erection
- Line stringing
- Anti climbing device; and
- Rehabilitation.

Construction vehicles

The following vehicle types would be generated during the construction works:

- Vehicles from the camps
- Water trucks
- Rigid delivery vehicles and semi-trailers and truck and dog vehicles for other materials (i.e. fill from quarries, waste removal, cages for foundations, concrete trucks etc.); and
- B-double trucks for delivery of the tower sections from Townsville.

Construction program

A detailed construction program is included in Appendix A.

The peak of construction in the FSC LGA is generally in line with the Hughenden Camp Hub operation and is expected to occur between September 2024 and July 2026.

It is noted that the construction program is still fluid at the time of publishing this report due to ongoing changes to the permanent design scope.

4.3.2 Construction traffic volumes

Table 36 shows the expected traffic volumes to be generated in a localised area of the CopperString 2023 construction on the expected typical busiest day and Table 38 shows the expected traffic volumes to be generated in a localised area of the CopperString 2032 construction during the peak hour of the expected typical busiest day. It is noted that during the peak hours the crews travel to/ from site, with deliveries occurring periodically throughout the day.

Table 36: Transmission line construction traffic volumes (localised area) – typical busiest day

Construction Item	**Workforce traffic generation from camps**			**Deliveries/ Removing Goods Traffic Generation**			
	Light vehicles	**Minibuses**	**Rigid trucks**	**Water trucks**	**Rigid trucks**	**Semi trailers/ truck and dog**	**B-doubles**
Site Establishment, Civil and Earthworks	8	4	2	10	30	8	
Foundation Works	4		2	10	10	2	
Tower Assembly and Erection	18 (assembly)	4 (assembly)	4 (assembly)	10	10		8
Line Stringing	24	6	4	10	10	6	
Anti Climbing Device	6				10	4	
Rehabilitation	4				10	4	

Table 37: Transmission line construction traffic volumes (localised area) – peak hour of typical busiest day

Construction Item	Workforce traffic generation from camps			Deliveries/ Removing Goods Traffic Generation			
	Light vehicles	Minibuses	Rigid trucks	Water trucks	Rigid trucks	Semi trailers/ truck and dog	B-doubles
Site Establishment, Civil and Earthworks	4	2	1				
Foundation Works	2		1				
Tower Assembly and Erection	9 (assembly)	2 (assembly)	2 (assembly)				
Line Stringing	12	3	2				
Anti Climbing Device	3						
Rehabilitation	2						

Overlap of construction stages

Based on the construction program, roads and access routes which access a large number of towers may carry traffic for multiple construction stages.

Generally, the site establishment works occur well before other construction stages. For roads and access points that access few towers, this stage is likely to generate the highest traffic volumes.

Table 38 shows the overlap of crews on roads and at access points dependent on the number of towers the road or access services.

Table 38: Overlap of construction phases

No of towers being serviced by a road or access point	No. of crews on typical peak day				
	Site Establishment, Civil and Earthworks	Foundation Works	Tower Assembly and Erection	Line Stringing	Anti Climbing Device
1 tower	1				
5 towers	1				
10 towers		1	1		
20 towers		2	2		
50 towers		2	4	1	

Based on the above, the number of vehicle movements generated by overlap of construction stages for a peak day and a peak hour are shown in Table 39 and Table 40.

Table 39: Construction traffic volumes on typical busiest day based on number of towers accessed

No of towers being serviced by a road or access point	No. of movements on typical peak day					
	Site Establishment, Civil and Earthworks	**Foundation Works**	**Tower Assembly and Erection**	**Line Stringing**	**Anti Climbing Device**	**TOTAL**
1 tower	62					62
5 towers	62					62
10 towers		28	54			82
20 towers		56	108			164
50 towers		56	216	60		332

Table 40: Construction traffic volumes at peak hour of typical busiest day based on the number of towers accessed

No of towers being serviced by a road or access point	No. of movements on typical peak hour					
	Site Establishment, Civil and Earthworks	**Foundation Works**	**Tower Assembly and Erection**	**Line Stringing**	**Anti Climbing Device**	**TOTAL**
1 tower	7					7
5 towers	7					7
10 towers		3	13			16
20 towers		6	26			32
50 towers		6	52	17		75

4.4 Substations

Flinders Substation is proposed to be located in the Flinders LGA.

4.4.1 Construction traffic information

Construction activities

Construction of the substations results in the following traffic generating activities:

- Site establishment (civil, earthworks)
- Platform construction
- Drainage, conduits and cable trench
- Earth grid
- Pavements
- Landscaping
- Civil
- Oil separator tank
- Helicopter pad
- Installation of modular buildings
- Common services building; and
- Electrical work.

Construction vehicles

The following vehicle types would be generated during the construction works:

- Vehicles from the camps
- Rigid delivery vehicles and semi-trailers and truck and dog vehicles for other materials (i.e. fill from quarries, waste removal, concrete trucks etc.); and
- OSOM vehicles for the modular buildings and oversized electrical/ substation equipment.

Construction program

A detailed construction program is included in Appendix A.

It is noted that the construction program is still fluid at the time of publishing this report due to the ongoing changes to the permanent design scope.

4.4.2 Construction traffic volumes

Table 41 shows the expected traffic volumes to be generated by a substation on the expected typical busiest day and Table 42 shows the expected traffic volumes to be generated by a substation during the peak hour of the expected typical busiest day. It is noted that during the peak hours the crews travel to/ from site, with deliveries occurring periodically throughout the day.

Table 41: Substation construction traffic volumes (localised area) – typical busiest day

Construction Item	Workforce traffic generation from camps			Deliveries/ Removing Goods Traffic Generation			
	Light vehicles	**Minibuses**	**Rigid trucks**	**Water trucks**	**Rigid trucks**	**Semi trailers/ truck and dog**	**B-doubles**
Site Establishment	12		2		10		
Roadworks	12		2		10	4	
Platform	12		2		10	12	
Drainage, Conduits and Cable trench	12		2		10		
Earth Grid	12		2		10		
Pavements	12		2		10	6	
Landscaping	12		2		10	2	
Civil	12		2		10	4	
Oil tank	12		2		10	4	
Helicopter pad	12		2		10	4	
Installation of modular buildings	12		2		10	4	
Common Services Building	12		2		10	4	
Electrical work	8-16 (wiring)		2-4 (wiring)		10	4	

Table 42: Substation construction traffic volumes (localised area) – peak hour of typical busiest day

Construction Item	**Workforce traffic generation from camps**			**Deliveries/ Removing Goods Traffic Generation**			
	Light vehicles	**Minibuses**	**Rigid trucks**	**Water trucks**	**Rigid trucks**	**Semi trailers/ truck and dog**	**B-doubles**
Site Establishment	6		1		5		
Roadworks	6		1		5	2	
Platform	6		1		5	6	
Drainage, Conduits and Cable trench	6		1		5		
Earth Grid	6		1		5		
Pavements	6		1		5	3	
Landscaping	6		1		5	1	
Civil	6		1		5	2	
Oil separator tank	6		1		5	2	
Helicopter pad	6		1		5	2	
Installation of modular buildings	6		1		5	2	
Common Services Building	6		1		5	2	
Electrical work	4-8 (wiring)		1-2 (wiring)		5	2	

4.5 Overall traffic generation to roads

Based on the assessment above, the expected traffic generation to each road during the busiest period of construction for that road is shown in Table 43. The table specifies the highest daily and peak hourly traffic generation, the period in which the volumes are expected to peak and the activities that result in the highest traffic generation to that road.

Table 43: Traffic generation to public roads

Road ID	Road	Expected highest daily traffic generation	Expected highest peak hour traffic generation	Expected busiest period	Activity/ies resulting in highest traffic generation
7	Flinders Highway	Varies – up to 500	Varies – up to 200	Jun 2024-Sep 2028 (construction duration)	Overlap of: • Transport of large items from Townsville Port to camps and transmission line • Transmission line construction • Substation construction; and • Movements to/ from camps.
37	Aramac Torrens Creek Road	354	48	Jun-Sep 2025	Overlap of: • Foundation works • Tower assembly and erection; and • Line stringing.
38	Cotonvale Road	216	23	Jun-Aug 2025	Overlap of: • Foundation works; and • Tower assembly and erection.
39	Prairie Road	216	48	Jun-Aug 2025	Overlap of: • Foundation works; and • Tower assembly and erection.

Road ID	Road	Expected highest daily traffic generation	Expected highest peak hour traffic generation	Expected busiest period	Activity/ies resulting in highest traffic generation
40	Woodbine Access	216	48	Jun-Aug 2025	Overlap of: • Foundation works; and • Tower assembly and erection.
41	Kennedy Energy Park Access Track	292	75	Jun-Sep 2025	Overlap of: • Foundation works • Tower assembly and erection; and • Line stringing.
42	Redcliffe Road	134	23	Jun-Aug 2025	Overlap of: • Foundation works; and • Tower assembly and erection.
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	460	195	Sep 2024-Jul 2026	Operation of Hughenden Camp Hub
45	Kennedy Developmental Road (south)	252	55	Apr-Jun 2026	Overlap of: • Foundation works; and • Tower assembly and erection.
46	Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82)	436	95	Apr-Jul 2026	Overlap of: • Foundation works • Tower assembly and erection; and • Line stringing.
47	Thornhill Tamworth Road	216	33	Apr-Jun 2026	Overlap of: • Foundation works; and • Tower assembly and erection.
48	Marathon Stamford Road	124	14	May-Jun 2025	Site Establishment, Civil and Earthworks

Road ID	Road	Expected highest daily traffic generation	Expected highest peak hour traffic generation	Expected busiest period	Activity/ies resulting in highest traffic generation
49	Barabon Terranburby Road	176	52	May-Jul 2026	Overlap of: • Foundation works; and • Tower assembly and erection.

5. Traffic and Road Impact Assessment

The Traffic and Road Impact Assessment focuses on the construction phase of the CopperString 2032 (camps under operation) which will generate the highest volumes of traffic.

5.1 Road Operation Assessment (road width)

5.1.1 Issues and potential impacts

At midblocks

The traffic capacity for each road against the normal design domain (NDD) and extended design domain (EDD) has been calculated using the road capacity tables in Section 2.2.5 of this report. Table 44 discusses the existing traffic volumes and proposed CopperString 2032 traffic volumes for any road that is non-compliant.

Table 44 details the extent of the road which is narrower than as required by the EDD.

Table 44: Road width assessment

Road ID	Road Name	Road width (typical)	Shoulder width (typical)	Existing traffic volume (vpd)	Expected project generated traffic volume (vpd)	Complies with NDD	Complies with EDD	Reason non-compliant
37	Aramac Torrens Creek Road	7.8 to 8.1m wide	No shoulder provided	164	354	No	No	No shoulder
39	Prairie Road	5.8 to 6.5m	No shoulder provided	<100	216	No	No	Road carriageway too narrow and no shoulder
42	Redcliffe Road	Unknown	Unknown	<20	134	Unknown		-
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	3.0m	No shoulder provided	<50	460	No	No	Road carriageway too narrow and no shoulder
45	Kennedy Developmental Road (south)	6.4 to 7.6m	Typically no shoulder provided, >6m shoulder at Hughenden	926 (Hughenden) 177 (16.2km south-east of Kennedy Developmental Road (south)/ Disraeli Street intersection)	252	No (excl. Hughenden)	No (excl. Hughenden)	Road carriageway too narrow (in areas) and no shoulder
46	Unnamed Road (off Flinders Highway – to PTL-FLR_284 to FLR-DJR_82)	Unknown	Unknown	<20	436	Unknown		-
48	Marathon Stamford Road	Variable - 3.6 to 6.3m	No shoulder provided	12	124	No	No	Road carriageway too narrow and no shoulder
49	Barabon Terranburby Road	6.4 to 7.9m	No shoulder provided	12	176	No	No	Road carriageway too narrow (in areas) and no shoulder

Based on the above assessment, 6 roads do not currently comply with the TMR EDD requirements. As discussed, each of these roads has been further assessed as shown in Table 45 with the roads either being recommended for mitigation or justification as to why the current width of the road is considered suitable has been provided.

It is noted that there are three roads which were not accessible in the FSC LGA. Based on the roads that could be accessed, it is likely that the majority of these inaccessible roads would require mitigation.

Table 45: Road width suitability assessment

Road ID	Road Name	Suitability Assessment	Mitigation required	Length of road where mitigation is required
37	Aramac Torrens Creek Road	Road considered suitable without mitigation due to the following: • 7.0m road carriageway; and • Type 2 road train approved.	No	-
39	Prairie Road	Road not considered suitable without mitigation	Yes See section 5.1.3.	6.2km
42	Redcliffe Road	Road not likely to be suitable without mitigation	Yes See section 5.1.3	Unknown
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	Road not considered suitable without mitigation	Yes See section 5.1.3.	0.3km
45	Kennedy Developmental Road (south)	Road considered suitable without mitigation due to the following: • 7.0m road carriageway or close; and • Type 2 road train approved.	No	-
46	Unnamed Road (off Flinders Highway – to PTL-FLR_284 to FLR-DJR_82)	Road not likely to be suitable without mitigation	Yes See section 5.1.3	Unknown
48	Marathon Stamford Road	Road not considered suitable without mitigation	Yes See section 5.1.3.	3.4km
49	Barabon Terranburby Road	Road not considered suitable without mitigation	Yes See section 5.1.3.	5.1km

Based on the further assessment, there are 4 FSC roads which require mitigation to accommodate the expected construction vehicles and a further 2 which could not be accessed that are likely to require mitigation.

At intersections

A swept path assessment was undertaken for the largest construction-stage design vehicle, a B-double truck, at existing SC road – SC road intersections within the LGA, SC road – FSC road intersections and FSC road – FSC road intersections. TMR/ TMR intersections already accommodate B-double movements.

As B-double movements are infrequent, the swept path assessment has been undertaken with an 8.8m service vehicle travelling in the opposite lane, concurrently. This is expected to be far more likely to occur on site.

It is noted that the swept paths drawings show widening required per swept path analysis as an indication of potential widening only. Intersections will instead be designed to meet the relevant requirements of the Austroads Guide to Road Design Part 3 and the Department of Transport and Main Road's Supplement to Austroads Guide to Road Design Part 3: Geometric Design, as required. It is also noted that each turning movement is shown at most intersections, however it is understood that vehicles will not complete all turning movements shown. As such, widening of existing intersections may not be required to accommodate the swept paths for all movements.

Due to the low-resolution of the available aerial imagery and no survey data available at the time of undertaking the swept paths, the results are considered indicative.

The swept paths are provided in Appendix C and show that the following intersections within the Flinders Shire region may require mitigation to accommodate vehicles based on the swept paths:

- Flinders Highway/ Redcliffe Road
- Flinders Highway/ Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)
- Flinders Highway/ Marathon Stamford Road; and
- Flinders Highway/ Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82).

Intersections that are Type 1 or Type 2 road train approved are expected to have sufficient geometry for CopperString 2032 construction vehicles.

5.1.2 Avoidance, mitigation and management measures

Mitigation strategies have been developed for the issues identified. Table 46 shows each identified issue, a description of the issue and mitigation measures that can be applied to either remove the issue or reduce the risk.

Issues have been grouped with a minimum of one mitigation measure developed to address the issue. It is noted that mitigation measures have not been identified for items classified as "low" risk, as deemed unnecessary as per the risk assessment methodology.

The issues and management and mitigation measures in Table 46 are for all issues identified throughout the project and are shown holistically. Specific mitigation measures for each assessment type (i.e. road capacity, road safety and road condition) are identified in the relevant subsequent sections of this report.

Table 46: Avoidance, management and mitigation measures

Issue	Avoidance	Management and mitigation measures	
Insufficient road geometry (midblock sections)	Where roads do not meet the minimum widths required by the governing road authority, implement controls to mitigate the likelihood of crashes.	1	For roads between 4m and 7m in width, the following options can be considered: • Use traffic management (shuttle flow or similar) to manage traffic where the road width is less than FSC Standard Drawings. This is considered suitable due to the temporary nature of the construction work; or • Widen the road to the required width based on the FSC Standard Drawings.
		2	For roads under 4m in width, specific guidance for mitigation will depend on the road condition and location. The following options can be considered for these roads: • Consider changing the vehicle types to suit existing road geometry • Use an alternate access route; or • Carry out minor shoulder widening works in agreement with the relevant road authority.
Insufficient road geometry (sharp bends)	Where turning paths indicate insufficient road geometry on sharp bends, implement controls to mitigate the likelihood of crashes.	3	Use traffic management to manage large vehicles around tight bends where they are required to cross the centreline to complete the manoeuvre, following consultation with the relevant road authority. This is considered suitable due to the temporary nature of the construction work.
		4	In locations where the road width is not sufficient to accommodate a B-double truck around bends, the following options can be considered: • Consider changing the vehicle types to suit existing road geometry • Use an alternate access route; or • Carry out minor shoulder widening works in agreement with the relevant road authority.
	Where sharp bends require vehicles to slow to speeds significantly lower than the speed limit, implement controls to mitigate the likelihood of crashes.	5	Design and install advance warning signage (or other traffic control devices as warranted) to suitably warn drivers of the approaching sharp bend.

Issue	Avoidance	Management and mitigation measures	
Insufficient road geometry (intersections)	Where turning paths indicate insufficient road geometry at intersections, implement controls to mitigate the likelihood of crashes.	6	In locations where the intersection width is not sufficient to accommodate a B-double truck, the following options can be considered: • Carry out intersection widening works in agreement with the relevant road authority • Consider changing the vehicle types to suit existing road geometry; or • Use an alternate access route.
	Where intersections do not have the required left and right turn lanes as specified in the *Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management*, implement controls to mitigate the likelihood of crashes and congestion.	7	Install suitable left and right turn lanes as specified by the Austroads Guide.
Sight distance obstructions	Keep minimum required sight distances clear of obstructions	8	Inspect the condition of the road network being used for the construction works prior to construction and periodically during construction to identify any sight distance obstructions that can be rectified. This may commonly relate to overgrown trees/ shrubs/ grasses.
		9	Encourage drivers associated with the project to report any sight distance concerns that may impact the safety of drivers. This information will supplement/ inform any periodic inspections. Consideration may be given to more advanced reporting system such as electronic reporting systems using phones and GPS.
		10	Where specific reports and/ or periodic road condition inspections determine that vegetation maintenance is required, perform vegetation maintenance. This may include mowing grass, removing tree branches and/or clearing re-sprouting vegetation, in consultation with the relevant road authority.
		11	Where new or amended traffic arrangements are required and sight distance is insufficient due to topography (or otherwise), design and install advance warning signage (or other traffic control devices as warranted) to suitably warn of the intersection condition.
		12	Where the JV considers sight distance (existing, unchanged conditions) is obscured by signage or other road furniture, contact the relevant road authority to have them re-assess and/ or relocate the signs.

Issue	Avoidance	Management and mitigation measures	
Road deterioration (i.e. potholes, road corrugations, faded linemarking etc.)	Maintain roads, particularly gravel roads.	13	Inspect the condition of the road network being used for the construction works prior to construction to establish a baseline road standard that would need to be re-instated after completion of the construction works. Periodic inspections to be undertaken during construction to identify any road deterioration that may require repair now or in the near future.
		14	Encourage drivers associated with the project to report any road condition concerns that may impact the safety of drivers. This information will supplement/ inform the periodic inspections. Consideration may be given to more advanced reporting system such as electronic reporting systems using phones and GPS. Concerns may include: • Potholes • Loss of road traction • Corrugations in road surface • Water over the road • Faded linemarking • Missing delineators/ reflectors • Impacted safety barriers/ fences; and • Deterioration of road shoulders.
		15	Where specific reports and/ or periodic road condition inspections determine that repairs are warranted, make repairs that may include: • Filing potholes • Regrading gravel roads • Surface improvements; and • Repainting faded line marking.
Missing controls at rail crossings	Where rail signage is not provided in accordance with the relevant requirements of AS 1742.7, provide required signage.	16	Install rail crossing ahead signs, railway crossing diagrammatic warning assemblies, railway crossing on side road assemblies, rail crossing diagrammatic warning signs on side roads assemblies and stop sign ahead assemblies as required per AS 1742.7 for passive-controlled railway crossings.
		17	Install railway crossing flashing signals ahead signs, railway crossing flashing signals ahead on side road assemblies and/or active advanced warning assemblies as required per AS 1742.7 on active-controlled railway crossings.

Issue	Avoidance	Management and mitigation measures	
	Where rail pavement markings are not provided in accordance with the relevant requirements of AS 1742.7, provide required pavement marking or implement other controls.	18	Provide Rail X, stop line, give-way lines and/ or no-overtaking lines pavement marking as required per AS 1742.7
Sight distance obstructions at rail crossings	Keep minimum required sight distances clear of obstructions	19	Where sight distance is insufficient due to topography (or otherwise) the following options can be considered: • Design and install advance rail warning signage (or other traffic control devices as warranted) to suitably warn of the upcoming rail crossing • Clear obstructions such as vegetation/ signage where viable, as outlined in management and mitigation measures 8 to 12; or • Reduce the approach speed limit of road vehicles such that the sight distance meets the requirements of AS 1742.7.
Queued vehicles blocking rail crossings or nearby roads	Ensure vehicles queuing back from a rail line do not extend into an intersection	20	Inform drivers associated with the project of the location of rail crossings. In locations where a traffic queue has the possibility of extending into an intersection with high traffic speeds, instruct the drivers to drive past the intersection if there is a queue and identify a suitable location to turn around and wait (if necessary) until the train has passed.
	Ensure vehicle queues back from an intersection do not stop on the rail line	21	Inform drivers associated with the project of the location of rail crossings. Educate drivers to check the other side of the rail line before travelling over the rail line, particularly if there is a known intersection ahead that could cause queues back to the rail line.
Schools and school bus routes.	Limit heavy vehicles during school start and finish times and bus commute times where possible, generally 7-9am and 3-5pm.	22	If it is necessary to travel during the times when school buses are operating, brief the drivers of the additional risk.
General		23	Provide safety training for drivers prior to works commencing to advise of road conditions and locations of higher risk along the Project route. In this part of Queensland, heavy rain can occur, and drivers should alter their speed and/or route based on the conditions.

The following management and mitigation measures would be considered relatively low cost:

- Driver training
- Developing a process for drivers to submit concerns
- Filling potholes
- Repainting faded linemarking
- Traffic management
- Clearing vegetation; and
- Installing signs.

The following management and mitigation measures may incur higher costs:

- Shoulder widening; and
- Regrading of gravel roads.

Mitigation measures #1 and #2 are applicable to insufficient road widths at midblocks. Mitigation measures #3, #4 and #5 are applicable to management of vehicles around sharp bends. Mitigation measures #6 is applicable to road widths at intersections.

Mitigation measure #7 is applicable to the turn lanes assessment in Section 5.2.

Mitigation measures #8 to #12 and #23 are relevant to the road safety assessment in Section 5.3.

Mitigation measures #13 to #15 are relevant to the road condition assessment in Section 5.4.

Mitigation measures #16 to #21 are relevant to the rail assessment as discussed in Section 5.5.

Mitigation measure #22 regards school zones and is generic to all parts of the project.

Where advanced warning signage is recommended to be implemented as a mitigation measure at sharp horizontal curves, it is suggested to use Chevron Alignment Markers (D4-6) and Advisory Speed (W8-2, W1-3) assemblies. An example of their use is shown below in Figure 26.

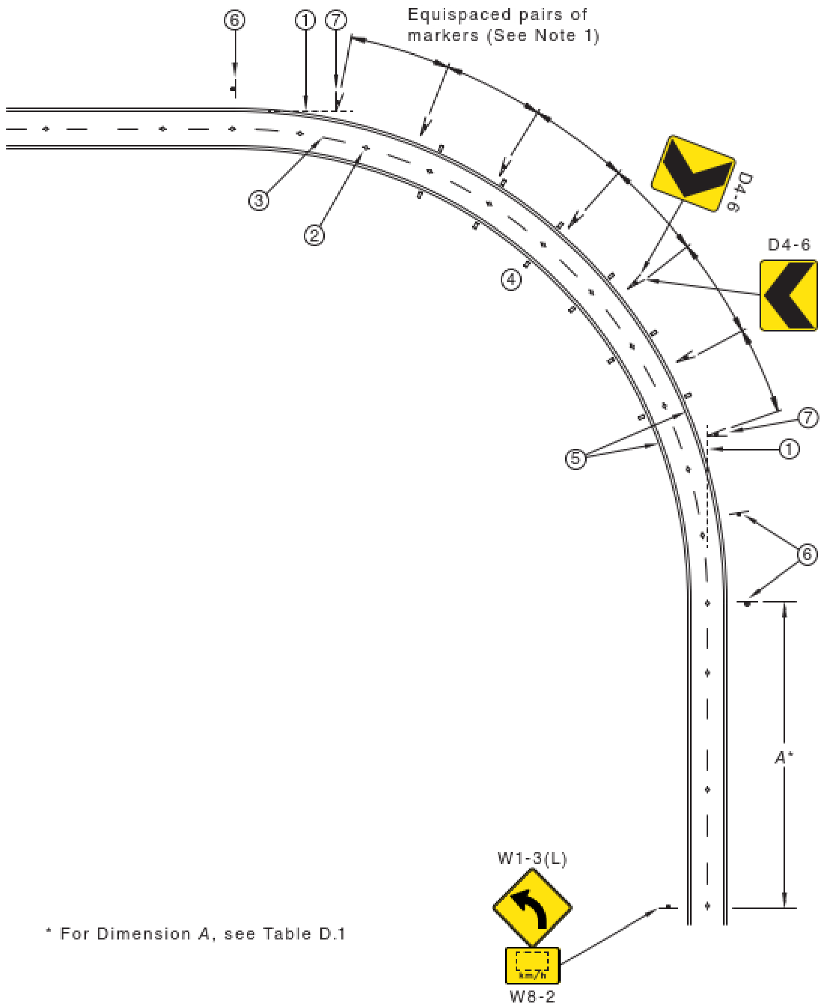


Figure 26: Example of curve warning signage (Source: AS 1742.2)

5.1.3 Residual risks

At midblocks

The assessment identified 4 roads which are of an unsuitable width for the CopperString 2032 construction traffic volumes. A further 2 roads could not be accessed but are unlikely to have a suitable road width. Proposed mitigation for each of these roads is shown in Table 47. Application of the mitigation measures is expected to mitigate the existing risk to vehicle movements and safety as a result of insufficient road width.

Table 47: Road with mitigation

Road ID	Road	Existing road width	Mitigation required	Extent of mitigation required
39	Prairie Road	5.8 to 6.5m	Apply mitigation measure #1 from Table 46	Assume entire 6.2km
42	Redcliffe Road	Unknown	Apply mitigation measure #1 from Table 46 Apply mitigation measure #2 from Table 46 where the road is less than 4m in width	Unknown
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	3.0m	Apply mitigation measure #1 from Table 46 Apply mitigation measure #2 from Table 46 where the road is less than 4m in width	Assume entire 0.3km
46	Unnamed Road (off Flinders Highway – to PTL-FLR_284 to FLR-DJR_82)	Unknown	Apply mitigation measure #1 from Table 46 Apply mitigation measure #2 from Table 46 where the road is less than 4m in width	Unknown
48	Marathon Stamford Road	Variable - 3.6 to 6.3m	Apply mitigation measure #1 from Table 46 Apply mitigation measure #2 from Table 46 where the road is less than 4m in width	Assume entire 3.4km
49	Barabon Terranburby Road	6.4 to 7.9m	Apply mitigation measure #1 from Table 46	Assume up to 3.2km

At intersections

Should mitigation measure #6 be applied to each intersection with insufficient geometry for B-double trucks, the intersections would be considered suitable for the necessary movements.

5.2 Road operation assessment (traffic congestion)

Delay and level of service at intersections

SIDRA Intersection 9 modelling software was utilised to determine the Level of Service (LOS) at selected intersections on the project route. Intersections were selected as follows:

- Along routes that access camps, whereby concentration of construction traffic movements are highest (see Section 1.6 of this report for references to the CopperString 2032 Camps TIAs for detailed assessments)
- The following intersections that have the highest overall traffic volumes along the route:
  - Flinders Highway/ Burdekin Falls Dam Road
  - Flinders Highway/ Broughton (Millchester) Road
  - Flinders Highway/ Kennedy Developmental Road (south)
  - Barkly Highway/ Burke Developmental Road
  - Barkly Highway/ Camooweal Road
  - Camooweal Road/ Rodeo Drive; and
  - Barkly Highway/ Diamantina Developmental Road.

Table 48 shows the criteria that SIDRA Intersection modelling software adopts in assessing the LOS.

Table 48: SIDRA Level of Service (LOS) criteria

LOS	Delay per vehicle (secs)		
	Signals	**Roundabout**	**Sign control**
A	10 or less	10 or less	10 or less
B	10 to 20	10 to 20	10 to 15
C	20 to 35	20 to 35	15 to 25
D	35 to 55	35 to 50	25 to 35
E	55 to 80	50 to 70	35 to 50
F	Greater than 80	Greater than 70	Greater than 50

All of the intersections modelled (including on routes to camps) are expected to operate at an overall LOS A (the best level of performance). There are some select traffic movements that are expected to operate at LOS B which is still considered a good LOS. The additional traffic expected as a result of the construction is not expected to reduce the operation of intersections significantly or to an unacceptable level. As such, there is minimal risk of the construction activity affecting the available road capacity.

Turning treatments assessment

The *Austroads Guide to Traffic Management Part 6 Intersections, Interchanges and Crossings Management* (AGTM Part 6) specifies warrants for providing left and right turn treatments at unsignalised intersections. Figure 27 is an excerpt from the AGTM Part 6 that shows the preferred treatments based on the peak hour traffic volumes. Note that Curve 1 (red) and Curve 2 (blue) represent the boundary between the treatment types.

The *Queensland Government Road Planning and Design Manual Edition 2: Volume 3 Supplement to Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (Qld V3 Supplement) also specifies warrants where installation of turning treatments is considered impractical due to low traffic volumes. These warrants apply to two-lane two-way roads only (2L2W). Figure 28 is an excerpt from the supplement, volumes that are to the left of the green line signify that turning treatments may not be necessary.

Each of the acronyms in this section are described below:

- SL Simple left turn (i.e. no turning lane)
- SR Simple right turn (i.e. no turning lane)
- BAL Basic left turn lane
- BAR Basic right turn lane
- AUL Auxiliary left turn lane
- AUL(s) Short auxiliary left turn lane
- CHL Channelised left turn lane
- CHR Channelised right turn lane; and
- CHR(s) Short channelised right turn lane.

There are several intersections and driveways in the project length that are considered suitable for SL and SR. Each of these intersections and driveways have been assessed for the following to ensure a turn lane is not required:

- Low turning traffic volumes (less than 100 vehicles per hour)
- Excellent sight distance; and
- No other nearby issues identified in this assessment that could not be mitigated to a low risk.

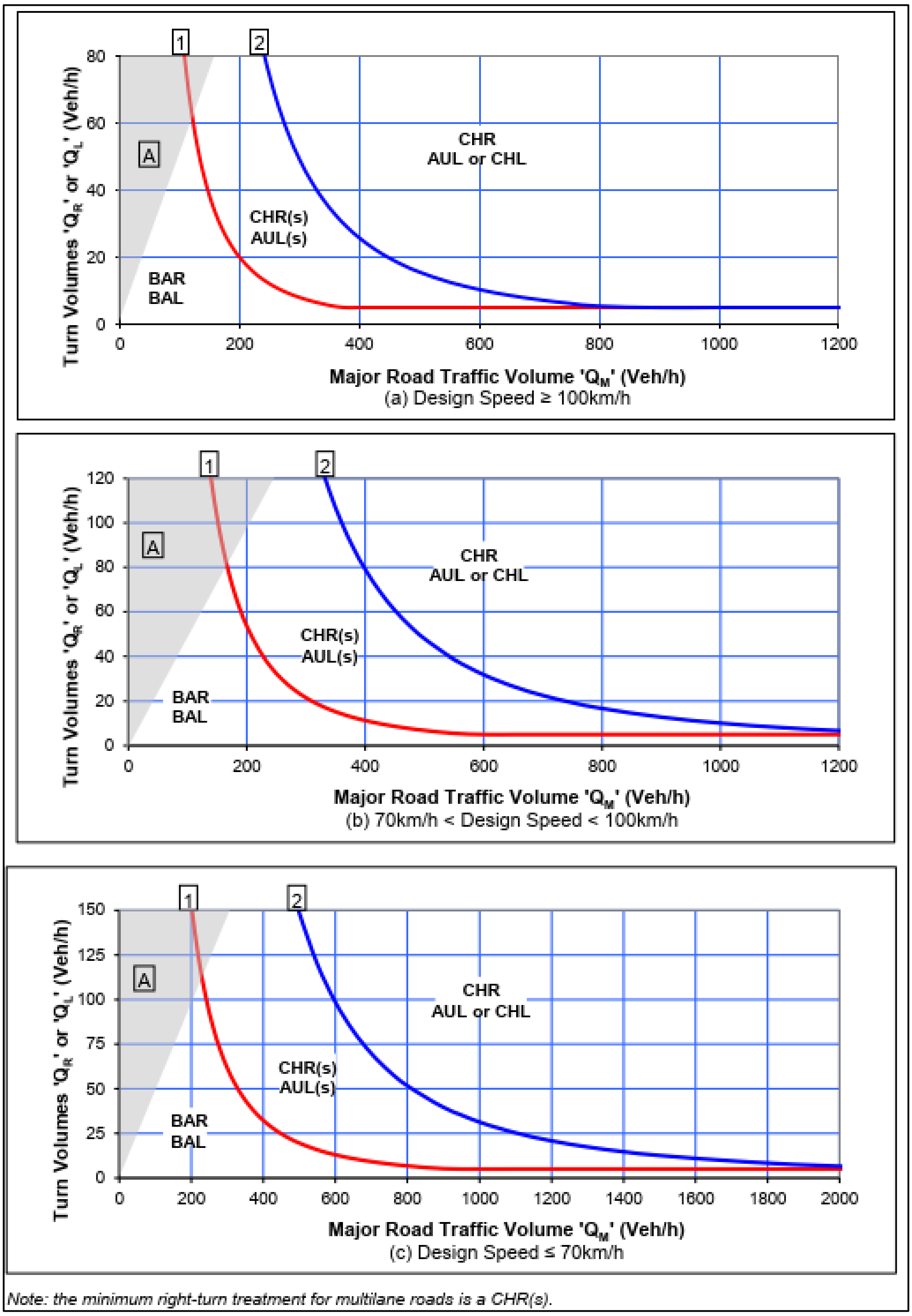
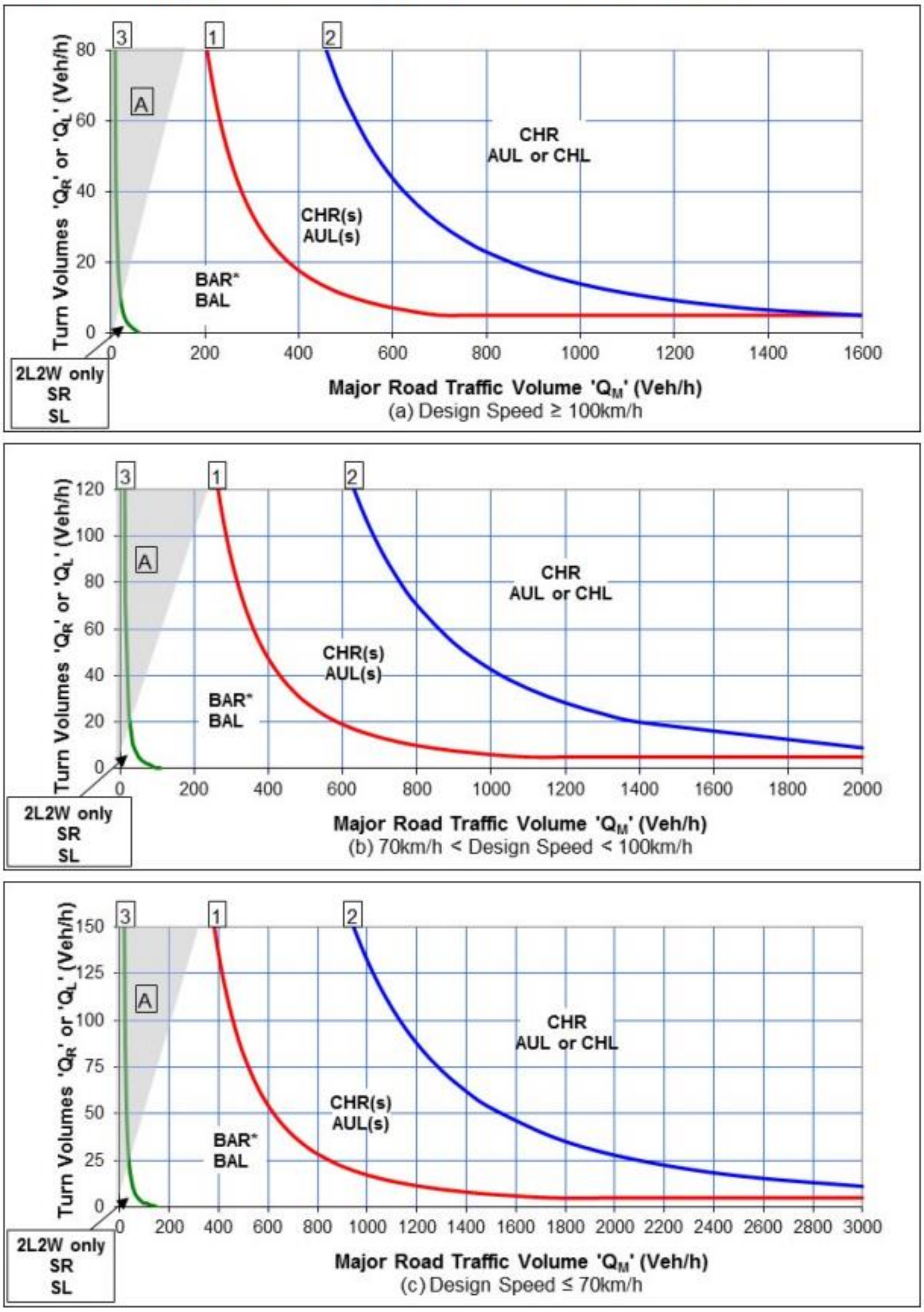


Figure 27: Warrants for turning treatments at unsignalised intersections (AGTM Part 6)

Figure 4A-A 4 - Warrants - Major road turn treatments - Extended Design Domain



* - the minimum right-turn treatment for multi-lane roads is a CHR(s)

Figures 4A-A 4(d), (e) and (f) respectively expand the view of the bottom left corner of diagrams(a), (b) and (c)

Figure 28: Warrants for turning treatments at unsignalised intersections (Qld V3 Supplement)

A summary of the existing and preferred treatments for intersections and driveways, applying mitigation measure #7 and based on peak construction traffic volumes, is shown in Table 49 and Table 50 respectively. Should the turn lanes and guidance in Table 49 and Table 50 be applied, the intersections would be considered to be minimising the risk of crashes and congestion at the project intersections and driveways.

Table 49: Turn Lane requirements at intersections

Intersection ID	Major Road	Minor Road	Turn movement	Existing peak hour traffic volumes		Existing turn treatment	Required turn treatment with existing traffic volumes	Upgrade required due to existing traffic	Construction peak hour traffic		Required turn treatment	Turn treatment upgrade required due to increased project volumes
				Major road (opposing)	Turn volume				Major road (opposing)	Turn volume		
Intersections between SC and SC roads												
7.12	Flinders Highway	Aramac Torrens Creek Road	Left	24	2	SL	SL	No	24	84	BAL	Yes
			Right	65	3	SR	BAR	No	147	3	BAR	No
7.17	Flinders Highway	Kennedy Developmental Road (south)	Left	71	7	SL	BAL	No[1]	114	62	BAL	No[2]
			Right	164	36	SR	BAR	No[1]	262	36	BAR	No[2]
7.18	Flinders Highway* (Gray Street)	Flinders Highway* (Stansfield Street)	Left	86	30	SL	BAL	No[1]	86	73	BAL	No[2]
45.1	Resolution Street	Kennedy Developmental Road (south)	Right	No data	No data	SR	-	-	-	+55	BAR	No[1 2]
Intersections between SC and FSC roads												
7.13	Flinders Highway	Prairie Road	Left	24	0	SL	SL	No	24	0	BAR	Yes
			Right	63	0	SR	SR	No	63	48	BAR	Yes
7.14	Flinders Highway	Redcliffe Road	Left	24	0	SL	SL	No	24	0	BAR	Yes
			Right	63	0	SR	SR	No	209	23	BAR	Yes
7.16	Flinders Highway	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	Left	24	0	SL	SL	No	24	98	BAL	Yes
			Right	63	0	SR	SR	No	161	98	BAR	Yes
45.2	Kennedy Developmental Road (south)	McLaren Street	Left	No data	No data	BAL	BAL	No	-	+55	BAL	No
7.19	Flinders Highway	Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82)	Left	27	0	SL	SL	No	30	95	BAL	Yes
			Right	55	0	SR	SR	No	153	0	BAR	Yes[3]
7.20	Flinders Highway	Marathon Stamford Road	Left	25	1	SL	SL	No	25	1	BAL	Yes
			Right	52	1	SR	SR	No	26	15	BAR	Yes
7.21	Flinders Highway	Barabon Terranburby Road	Left	25	1	SL	SL	No	25	1	BAL	Yes
			Right	52	1	SR	SR	No	26	53	BAR	Yes

[1] Wide carriageway at intersection, located in urban, low speed, environment with good sight distance, turn volumes are generally not high enough to warrant turn lanes as a result of congestion

[2] If required, linemarking could be used to show turn lanes

[3] Frequent turning movements are not anticipated at this location. As a minimum pitt&sherry has recommended BAL/BAR treatments on the Flinders Highway however if this movement is confirmed as not required for the CopperString 2032 construction traffic, the turning treatment is not necessary

Table 50: Turn Lane requirements at driveways

Driveway ID	Driveway	Turn movement	Existing turn treatment	Construction peak hour traffic		Required turn treatment	Turn treatment upgrade required due to increased project volumes
				Major road (opposing)	Turn volume		
37.A	Aramac Torrens Creek Road and Western Access to PTL-FLR-T89_118	Right	SR	0	7	SR	No
37.B	Aramac Torrens Creek Road and Eastern Access to PTL-FLR-T119_168	Left	SL	0	16	SL	No
7.A	Flinders Highway and Cotonvale Road	Right	SR	63	23	BAR	Yes
39.A	Prairie Road and Woodbine Access	Left	SL	0	48	SL	No
7.B	Flinders Highway and Kennedy Energy Park Access Track	Left	SL	63	0	BAL	Yes
		Right	SR	134	75	BAR	Yes
42.A	Redcliffe Road and Western Access to PTL-FLR-T239_263	Right	SR	0	16	SR	No
42.B	Redcliffe Road and Eastern Access to PTL-FLR-T264_283	Left	SL	0	7	SL	No
44.A	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp) and Hughenden Camp Access	Left, Right	SL, SR	0,0	98, 98	BAL, BAR	Yes
45.A	Kennedy Developmental Road (south) and Western Access to PTL-FLR-T264_283	Right	SR	Unknown	32	BAR	Yes
45.B	Kennedy Developmental Road (south) and Eastern Access to PTL-FLR-T284_FLR-DJR-38	Left	SL	Unknown	32	BAL	Yes
46.A	Unnamed Road (off Flinders Highway) and Western Access to PTL-FLR-T284_FLR-DJR-38	Right	SR	0	69	SR	No
46.B	Unnamed Road (off Flinders Highway) and Eastern Access to FLR-DJR-39_82	Left	SL	0	26	SL	No
7.C	Flinders Highway and Thornhill Tamworth Road	Left	SL	25	34	BAL	Yes
		Right	SR	85	1	BAR	Yes[4]
48.A	Marathon Stamford Road and Western Access to FLR-DJR-T83_116	Right	SR	4	69	SR	No
48.B	Marathon Stamford Road and Eastern Access to FLR-DJR-T117_142	Left	SL	2	7	SL	No
49.A	Barabon Terranburby Road and Western Access to FLR-DJR-T117_142	Right	SR	4	26	SR	No
49.B	Barabon Terranburby Road and Eastern Access to FLR-DJR-143_179	Left	SL	2	26	SL	No

[4] Frequent turning movements are not anticipated at this location. As a minimum pitt&sherry has recommended BAL/BAR treatments on the Flinders Highway however if this movement is confirmed as not required for the CopperString 2032 construction traffic, the turning treatment is not necessary

5.3 Road safety assessment

The level of risk for each road has been determined with respect to the identified hazards.

Mitigation measures #8 to #12 and #23 from Table 46 are relevant for the road safety assessment.

Where advance warning signage is recommended for mitigation, as per mitigation measure 11, we suggest use of warning signs from the W2 list as detailed in the Australian Standard AS1742.2-2009 Manual of uniform traffic control devices – Part 2: Traffic control devices for general use. Sign W2-4(R) as shown in Figure 29 is an example of a sign in the class which would be used on a major road to warn of an upcoming T-intersection on the right, typically utilised when sight distance to the intersection is limited due to road works.

Figure 29: Example W2 class signage

The initial identified risks, and residual risks for road condition after applying avoidance, management and mitigation measures are shown in Table 51.

Table 51: Road safety risks

Road ID	Road Section	Location	Issue	Pre Mitigated Risk			Additional management measures	Residual risk		
				Likelihood	Consequence	Level of risk		Likelihood	Consequence	Level of risk
7	Flinders Highway	Intersection 7.14 Flinders Highway and Redcliffe Road	Measured ASD: 135m Required ASD: 233m Insufficient approach sight distance, limited by crest. Note that vehicles would likely be travelling slower than the 100km/h rural default speed limit. This has the potential to result in a moderate-speed side-on collision with another vehicle, or a single car collision with infrastructure opposite the minor road.	Improbable	Serious	Medium	Apply mitigation measure #11 from Table 46.	Improbable	Serious	Medium
		Intersection 7.21 Flinders Highway and Barabon Terranburby	Measured SISD: 270m Required SISD: 367m Insufficient SISD to east, limited by vegetation, horizontal curve and minor dip. This has the potential to result in a high-speed collision between two vehicles causing serious injury.	Occasional	Serious	High	Apply mitigation measures #8 to #11 from Table 46.	Improbable	Serious	Medium
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp) (Public Access Road)	Driveway 44.A Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp) and Hughenden Camp Access	Measured SD: 150m Required SD: 222m Insufficient sight distance to west, limited by vegetation. This has the potential to result in a high-speed collision causing death or serious injury.	Occasional	Serious	High	Apply mitigation measures #8 to #10 from Table 46.	Expected to have sufficient approach sight distance with removal of vegetation		
45	Kennedy Developmental Road (south)	Driveway 45.A Kennedy Developmental Road (south) and Western Access to PTL-FLR-T264_283	Measured SD: 160m Required SD: 222m Insufficient sight distance to south, limited by crest. This has the potential to result in a high-speed collision between two vehicles causing serious injury.	Occasional	Serious	High	Apply mitigation measure #11 from Table 46.	Improbable	Serious	Medium
		Driveway 45.B Kennedy Developmental Road (south) and Eastern Access to PTL-FLR-T284_FLR-DJR-38	Measured SD: 160m Required SD: 222m Insufficient sight distance to south, limited by crest. This has the potential to result in a high-speed collision between two vehicles causing serious injury.	Occasional	Serious	High	Apply mitigation measure #11 from Table 46.	Improbable	Serious	Medium

Post implementation of the mitigation measures, it is expected that there will be 4 medium risks and one instance in which very limited risk would be present as the sight distance will meet the relevant requirement. This is a reduction in 4 risks from high to medium.

It is further noted that one improbable likelihood risk has remained as there is not a lower risk likelihood. Although the likelihood has not changed in this rating table, the risk of a crash is further decreased through the additional management measures.

There remains an ongoing operational risk due to any planned major maintenance or capital works programs along sections of the access route. This may increase short term safety risks for road users due to diverted traffic, congestion, and temporary traffic management.

5.4 Road condition risk assessment

The level of risk for each road has been determined with respect to the identified hazards.

Mitigation measures #13 to #15 from Table 46 are relevant for the road condition. The initial identified risks, and residual risks for road condition after applying avoidance, management and mitigation measures are shown in Table 52.

Table 52: Road condition risks

Road ID	Road name	Road surface type	Road condition	Speed limit	Visibility (general)	Initial risk			Additional management measures	Residual risk		
						Likelihood	Consequence	Level of risk		Likelihood	Consequence	Level of risk
7	Flinders Highway	Sealed	Good condition Various minor defects present along the extent including patching, cracking, surface wear and bleeding, polishing, delamination, shoving, corrugations and depressions. Infrequent more significant defects present at very infrequent intervals, such as wide filled cracking west of Maxwelton.	Typically 100 to 110km/h, slowing at towns along the extent	More than SSD	Improbable	Minor	Low	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
37	Aramac Torrens Creek Road	Sealed	Good condition Significant pothole at Mount Isa Line	Unposted - Assume 100km/h Queensland rural speed limit	More than SSD	Improbable	Minor	Low	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
38	Cotonvale Road	Gravel	Inaccessible per advice from JV	-	Unknown	Improbable	-	Unknown	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
39	Prairie Road	Sealed	Good condition Rutting present for initial 500m south from Flinders Highway. Minor infrequent potholing, cracking and delamination present.	60km/h	More than SSD	Improbable	Limited	Low	Apply mitigation measures #13 to #15 from Table 46	Improbable	Limited	Low
40	Woodbine Access	-	Inaccessible per advice from JV	-	Unknown	Improbable	-	Unknown	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
41	Kennedy Energy Park Access Track	Sealed	Inaccessible per advice from JV	-	Unknown	Improbable	-	Unknown	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
42	Redcliffe Road	Gravel	Inaccessible due to existing gate	Not posted - assume 100km/h rural default speed limit	Unknown	Improbable	-	Unknown	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp) (Public Access Road)	Dirt	Reasonable condition Unformed tyre track	Not posted - Assume 100km/h rural default speed limit. Note vehicles would travel much slower than this due to the road condition Not posted - Assume 100km/h rural default speed limit. Note vehicles would travel much slower than this due to the road condition	More than SSD	Occasional	Minor	Medium	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
45	Kennedy Developmental Road (south)	Sealed	Good condition Minor infrequent shoving, rutting, delineation, edge break and longitudinal cracking present. Minor rutting and depressions also present.	Typically 100km/h, slowing to 80km/h and then 50km/h approaching Hughenden	More than SSD	Improbable	Minor	Low	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low

Road ID	Road name	Road surface type	Road condition	Speed limit	Visibility (general)	Initial risk			Additional management measures	Residual risk		
						Likelihood	Consequence	Level of risk		Likelihood	Consequence	Level of risk
46	Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82)	Dirt	Inaccessible per advice from JV	-	Unknown	Improbable	-	Unknown	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
47	Thornhill Tamworth Road	Gravel	Inaccessible per advice from JV	-	Unknown	Improbable	-	Unknown	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
48	Marathon Stamford Road	Gravel	Reasonable condition Minor corrugations, shoving and rutting present.	Not posted - assume 100km/h urban rural speed limit	More than SSD	Occasional	Minor	Medium	Apply mitigation measures #13 to #15 from Table 46	Improbable	Minor	Low
49	Barabon Terranburby Road	Gravel	Average condition Corrugations and rutting present, as well as minor crests and dips.	60km/h	More than SSD	Occasional	Limited	Low	Apply mitigation measures #13 to #15 from Table 46	Improbable	Limited	Low

Applying the mitigation measures are not expected to change the consequence of a crash but should measures be applied, it would become improbable that the crash would occur as there would be minimal or no hazards.

Post mitigation, there are 13 low risks, a reduction in 2 roads from medium to low risk.

5.5 Rail safety risk assessment

The rail assessment using the Australian Standards from Section 3.1.3 of this report has considered where there are identified issues or missing signage and linemarking at rail crossings.

In addition, SIDRA Intersection traffic modelling has been completed for the AM and PM peak hours for rail crossings to determine whether issues could arise as a result of:

- Vehicle queues as a result of stopping for a train to pass extending into an intersection; and
- Vehicle queues back from an intersection extending to a rail line.

Information about the trains using the Mount Isa Rail Line has been sourced from the *Queensland Rail – Mount Isa System Information Pack (2017)* and details:

- The maximum train length is 1009m
- Trains between Stuart (Townsville) and Hughenden travel at 80km/h (i.e. 45 seconds to pass through a point); and
- Trains between Hughenden and Mount Isa travel at 60km/h (i.e. 60 seconds to pass through a point).

Based on the above, the following conservative assumptions have been included in the traffic models:

- Between Stuart (Townsville) and Hughenden vehicles stop for a train for 75 seconds (to allow for speed variation of the train plus wait time before the train arrives and after the train departs)
- Between Hughenden and Mount Isa vehicles stop for a train for 90 seconds; and
- Due to the nature of traffic movements from camps being condensed, the models assume all vehicles pass through the rail line in a 15 minute period.

Mitigation measures #16 to #21 are relevant for the rail assessment.

Where there is potential for drivers to queue across a rail line due to a downstream intersection, as per mitigation measure #21, we suggest use of KEEP TRACKS CLEAR signs from the Australian Standard AS1742.7-2016 Manual of uniform traffic control devices – Part 7: Railway crossings. The signs shown in Figure 30 are suitable options.

Figure 30: Keep tracks clear signage

The initial identified risks, and residual risks at rail crossings after applying avoidance, management and mitigation measures are shown in Table 53.

Table 53: Rail crossing risks

Rail crossing name	Issue	Initial risk			Additional management measures	Residual risk		
		Likelihood	Consequence	Level of risk		Likelihood	Consequence	Level of risk
Mount Isa Line: Aramac Torrens Creek Road crossing	There is potential for the queue back from the rail line to extend to the Flinders Highway	Occasional	Serious	High	Apply mitigation measure #20 from Table 46.	Improbable	Serious	Medium
	It is unknown whether RAIL X pavement markings are provided on the northbound approach to the rail crossing. The lack of RAIL X pavement marking may reduce a drivers awareness of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #18 from Table 46.	Improbable	Serious	Medium
	A stop line is not provided in the northbound direction and a give-way line in the southbound direction at the rail crossing. This has the potential to result in vehicles stopping too close to the rail line, resulting in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	No-overtaking lines are not provided within the centreline on approach to the rail crossing in the southbound direction. Should no overtaking lines be provided, the lack of no-overtaking lines enables drivers to overtake on approach to rail crossings, reducing their ability to stop during times in which a train may be approaching. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #18 from Table 46.	Improbable	Serious	Medium
Mount Isa Line: Cotonvale Road crossing	Rail crossing ahead signage is not provided on the northern approach to the crossing. It is unknown as to whether it is provided on the southern approach to the crossing. Should no rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Rail crossing diagrammatic warning assemblies are not provided on the northern approach to the crossing. It is unknown as to whether it is provided on the southern approach to the crossing. As such, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Measured S1: Road not accessible Required S1: 180m As Cotonvale Road was unable to be accessed, S1 from the northbound direction was not able to be measured. Should S1 not meet the requirements, there is increased potential of a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Improbable	Serious	Unknown	Potentially apply mitigation measure #19 from Table 46.	Improbable	Serious	Unknown
Mount Isa Line: Prairie Road crossing	There is potential for the queue back from the rail line to extend to the Flinders Highway	Occasional	Serious	High	Apply mitigation measure #20 from Table 46.	Improbable	Serious	Medium
	Rail crossing ahead signage is not provided on both approaches to the crossing. Should no rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Rail crossing diagrammatic warning assemblies are not provided on the southern approach to the crossing. As such, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	No-overtaking lines are not provided within the centreline on the northbound and southbound approaches to the rail crossing. Should no-overtaking lines not be provided, drivers may overtake on approach to rail crossings, reducing their ability to stop during times in which a train may be approaching. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #18 from Table 46.	Improbable	Serious	Medium

Rail crossing name	Issue	Initial risk			Additional management measures	Residual risk		
		Likelihood	Consequence	Level of risk		Likelihood	Consequence	Level of risk
Mount Isa Line: Kennedy Energy Park Access Track crossing	There is potential for the queue back from the rail line to extend to the Flinders Highway	Occasional	Serious	High	Apply mitigation measure #20 from Table 46.	Improbable	Serious	Medium
	Rail crossing ahead signage is not provided on the northern approach to the crossing. It is unknown as to whether it is provided on the southern approach to the crossing. Should no rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Rail crossing diagrammatic warning assemblies are not provided on the northern approach to the crossing. It is unknown as to whether it is provided on the southern approach to the crossing. As such, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Measured S1: Road not accessible Required S1: 173m As Kennedy Energy Park Access Track was unable to be accessed, S1 from the northbound direction was not able to be measured. Should S1 not meet the requirements, there is increased potential of a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Unknown	Serious	Unknown	Potentially apply mitigation measure #19 from Table 46.	Improbable	Serious	Unknown
Mount Isa Line: Flinders Highway (east of Redcliffe Road) crossing	Rail crossing flashing signals ahead signage is not provided on the northbound approach to the rail crossing. As such, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #17 from Table 46.	Improbable	Serious	Medium
Mount Isa Line: Kennedy Developmental Road (south) crossing	Rail crossing ahead signage is not provided on the southbound approach to the rail crossing. It is unknown as to whether rail crossing ahead signage is provided on the northbound approach to the rail crossing. Should no rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Rail crossing diagrammatic warning assemblies are not provided on the southbound approach to the rail crossing. It is unknown as to whether they are provided in the northbound approach to the rail crossing. Should no diagrammatic warning assemblies and rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	A give-way line is not provided on the southbound approach at the rail crossing. This has the potential to result in vehicles stopping too close to the rail line, resulting in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #18 from Table 46.	Improbable	Serious	Medium
	It is unknown as to whether no-overtaking lines are provided within the centreline on the northbound and southbound approaches to the rail crossing. Should no-overtaking lines not be provided, drivers may overtake on approach to rail crossings, reducing their ability to stop during times in which a train may be approaching. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #18 from Table 46.	Improbable	Serious	Medium
	Measured S1: Road not accessible Required S1: 138m As Kennedy Developmental Road was unable to be accessed, S1 from the northbound direction was not able to be measured. Should S1 not meet the requirements, there is increased potential of a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Unknown	Serious	Unknown	Potentially apply mitigation measure #19 from Table 46.	Improbable	Serious	Unknown

Rail crossing name	Issue	Initial risk			Additional management measures	Residual risk		
		Likelihood	Consequence	Level of risk		Likelihood	Consequence	Level of risk
Mount Isa Line: Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) crossing	There is potential for the queue back from the rail line to extend to the Flinders Highway	Occasional	Serious	High	Apply mitigation measure #20 from Table 46.	Improbable	Serious	Medium
	There is potential for the queue back from the Flinders Highway/ Unnamed Road (off Flinders Highway - to PTL-FLR_284 to FLR-DJR_82) intersection to reach the rail line	Occasional	Serious	High	Apply mitigation measure #21 from Table 46.	Improbable	Serious	Medium
	Rail crossing ahead signage is not provided on both approaches to the crossing. Should no rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Rail crossing diagrammatic warning assemblies are not provided on both approaches to the crossing. As such, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Measured S1: Road not accessible Required S1: 180m As the Unnamed Road (off Flinders Highway – to PTL-FLR_284 to FLR-DJR_82) was unable to be accessed, S1 from the northbound direction was not able to be measured. Should S1 not meet the requirements, there is increased potential of a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Unknown	Serious	Unknown	Potentially apply mitigation measure #19 from Table 46.	Improbable	Serious	Unknown
Mount Isa Line: Thornhill Tamworth Road crossing	There is potential for the queue back from the rail line to extend to the Flinders Highway	Occasional	Serious	High	Apply mitigation measure #20 from Table 46.	Improbable	Serious	Medium
	Rail crossing ahead signage is not provided on the northern approach to the crossing. It is unknown as to whether it is provided on the southern approach to the crossing. Should no rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Rail crossing diagrammatic warning assemblies are not provided on the northern approach to the crossing. It is unknown as to whether it is provided on the southern approach to the crossing. As such, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Measured S1: Road not accessible Required S1: 180m As Thornhill Tamworth Road was unable to be accessed, S1 from the northbound direction was not able to be measured. Should S1 not meet the requirements, there is increased potential of a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Unknown	Serious	Unknown	Potentially apply mitigation measure #19 from Table 46.	Improbable	Serious	Unknown
Mount Isa Line: Marathon Stamford Road crossing	Rail crossing ahead signage is not provided on both the northbound and southbound approaches to the rail crossing. Drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Rail crossing diagrammatic warning assemblies are not provided on both the northbound and southbound approaches to the rail crossing. Should no diagrammatic warning assemblies and rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium

Rail crossing name	Issue	Initial risk			Additional management measures	Residual risk		
		Likelihood	Consequence	Level of risk		Likelihood	Consequence	Level of risk
Mount Isa Line: Barabon Terranburby Road crossing	Rail crossing ahead signage is not provided on both approaches to the crossing. Should no rail crossing ahead signage be provided, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium
	Rail crossing diagrammatic warning assemblies are not provided on both approaches to the crossing. As such, drivers may be unaware of an upcoming rail crossing, reducing the time in which they have to stop at a rail crossing. This has the potential to result in a moderate-speed collision between a vehicle and a train, causing death or serious injury.	Occasional	Serious	High	Apply mitigation measure #16 from Table 46.	Improbable	Serious	Medium

Please note that despite no RAIL X pavement markings being located on Kennedy Energy Park Access Track on approach to the rail crossing, as the road is privately owned, it is expected that this is not required, and thus has not been included in Table 53.

Post mitigation, there are 30 medium risks.

5.6 Traffic and road impacts during the operational and maintenance phase

Inspections of the transmission lines will be completed periodically, generating very low traffic volumes. The substations would also have low operational traffic volumes, expected to be less than one vehicle per day. Additional light and heavy vehicle movements may occur during minor and major maintenance outages.

Based on this, the traffic and road risks during the operation and maintenance phase are lower than the construction traffic risks due to the significantly lower traffic volumes.

5.7 Inspection and monitoring

There are many cases where additional monitoring will be required during the life of the project, these can be broken down into maintenance of vegetation to maintain adequate sight distances, adequate maintenance of gravel roads, monitoring all roads for deterioration of road condition, and reporting crashes.

5.7.1 Vegetation growth

During the site investigations there were various locations where the sight distances at intersections could be greatly increased by regular maintenance of the surrounding vegetation. The required maintenance includes cutting grass and/or removal of tree branches. It is recommended that prior to construction phase commencing, in consultation with the relevant road authority, vegetation is cleared at the locations identified as having poor sight distances by the JV. It is recommended that these locations are then checked periodically, and vegetation cleared where necessary in consultation with the road owner.

Once construction commences, the periodic checks are to be undertaken by the JV. The JV should consult with the road owner to determine whether they would like a representative present at the periodic checks.

5.7.2 Road monitoring

While the road defects that were observed during the site investigations may be rectified prior to the project's construction phase commencing, they show the general condition of the roads and what could be expected during the project. None of the contacted Councils have future works programmes for the proposed project period, with the proposed works only programmed one year ahead.

It is recommended that prior to construction, a detailed dilapidation survey be performed. Areas of particular concern should be rectified and recorded as such in negotiation with the relevant road authority.

It is recommended that the access routes are continually monitored by construction work drivers, with poor/ degrading conditions reported as part of their daily driver records. Any specific issues should be closely monitored and rectified where necessary. Periodic surveys from the construction contractor should be undertaken to mitigate the risk of drivers not reporting issues.

5.7.3 Gravel road maintenance

Many of the gravel roads that were visited were in poor condition with rutting and potholes being prevalent. The increase in heavy vehicle traffic on these roads will increase the rate of degradation. Close monitoring of the gravel roads will give early warning to enable early intervention and prevent further damage to the pavement condition.

It is recommended that prior to construction, all gravel roads along the access route are assessed for areas of poor condition and recorded as part of a dilapidation survey. Areas of particular concern should be rectified and recorded as such in negotiation with relevant road authority.

It is recommended that the gravel roads are continually monitored by drivers, with poor/ degrading conditions reported as part of their daily driver records. Any specific issues should be closely monitored and rectified where necessary. Additional surveys by the contractor should be undertaken to mitigate the risk of drivers not reporting issues.

5.7.4 Crash reporting

Project-related crashes along the project routes are to be reported to the relevant authorities and to the responsible project personnel. The potential causes of the accident should be investigated, and where appropriate action(s) taken such as those recommended in this report (road maintenance, vegetation clearance, additional signage).

5.7.5 Construction worker driver consultation

Drivers of both heavy and light vehicles should be consulted during the life of the project to determine if they have any concerns along the route. Drivers are a valuable resource for condition monitoring as they can enable early detection of problem areas that may need further assessment.

Drivers should also be regularly briefed of risks or issues associated with particular sections of the route they will be driving as part of their upcoming shift(s).

It is also recommended that heavy and light vehicle drivers are regularly consulted regarding risks and issues with the access routes being used.

5.7.6 Post construction inspection

Inspections should be completed post construction in conjunction with the road owner. The mitigation measures in Table 46 are relevant to any post construction remediation for public roads. Remediation should be carried out in a timely manner post construction completion.

5.7.7 Traffic management plan

A traffic management plan provides the means of planning and implementing a road work operation that will ensure that first and foremost road workers and road users are safe during construction works. A traffic management plan aims to minimise risk to workers and road users as a result of construction.

A traffic management plan also provides guidance through or around a construction site, advises drivers of changing conditions and ensures that the performance of the road network is not unduly impacted and that inconvenience to road users is minimised.

It is expected that the Contractor(s) delivering the Project implement a Traffic Management Plan prepared in accordance with the requirements of Australian Standard AS1742.3-2019 Manual of uniform traffic control devices – Part 3: Traffic Control for Works on Roads. This will be required to manage safety risks, particularly at access points to construction sites and within construction sites.

Traffic management plans should include:

- Proposed vehicle routes
- Works times
- Traffic volumes
- Signage (speed and regulatory)
- Delineation (bollards, cones, markers)
- Pavement markings
- Detours
- Traffic control (electronic devices, human controllers, controlled site entry)
- Driver training
- Consideration for vulnerable road users (pedestrians, bicycles, motorcycles); and
- Lighting.

5.8 Special permit vehicles

OSOM vehicles which require a special permit will be required for transportation of the modular buildings at the substations and other oversized electrical and substation equipment. The size of these vehicles is currently unknown; and therefore, the following is recommended:

- Once the size of the vehicle(s) is known, the exact route of the vehicle is assessed and specified based on road geometry, condition, and safety considerations
- The oversized vehicle travels to site with escort vehicle(s); and
- Appropriate traffic management is in place when the vehicle is accessing / egressing the site, in accordance with the requirements of Australian Standard AS1742.7-2016 Manual of uniform traffic control devices – Part 7: Railway crossings.

6. Summary

An assessment of the CopperString 2032 project-related vehicle impacts on the operation, condition and safety of the public road network has been undertaken with reference to relevant Australian Standards and Guidelines.

The analysis presented in this report is summarised as follows:

Traffic assessment

- The completed assessment concludes that the increase in traffic volumes would not reduce the road network operation to unacceptable levels. However, there are some roads where the traffic volumes are above the practical capacity based on the road width. Mitigation has been proposed for some of these roads where appropriate
- There are several locations throughout the route with insufficient existing sight distances. With increased traffic volumes, there is an increased risk of crashes. Through vegetation clearance and signage installation, both prior to construction and ongoing maintenance during construction, this risk can be reduced to an acceptable level
- There are a small number of areas with local schools, which introduces a crash risk associated with additional traffic volumes and heavy vehicles. The recommendation is to limit travel during peak school drop-off and pick-up times and brief the community and drivers of the construction traffic and associated risks
- Construction access suitability is predominantly impacted by the condition of the road, which is variable across the proposed access routes. With regular monitoring and maintenance and during construction, the risk of crashes due to poor road condition can be appropriately managed; and
- The operation and maintenance phase risk is negligible, with no recommended actions required for implementation.

A summary of the required mitigations is shown in Table 54, noting that where the initial risk due to the road condition was considered low, it was not included. Please also note that where S1 to a rail crossing was not measured, it has not been included below.

Table 54: Summary of required mitigations

Road ID	Road Name	Existing Issue Summary	Required mitigation summary
7	Flinders Highway	Sight distances at various approaches/ intersections do not meet relevant requirements.	Inspect the road prior to construction works, encourage drivers to report concerns, maintain vegetation where limiting, design and install advanced warning signage, where Council/ TMR-owned road furniture is obstructing sight distance.
		Missing turn treatments at several intersections.	Add turn treatments that are sufficient for the proposed peak construction traffic volumes.
		Turn treatments are required to be added at several driveway entries to the proposed construction access road.	Add turn treatments that are sufficient for the proposed peak construction traffic volumes.
		Rail crossings do not meet relevant standards.	Install relevant rail crossing signage and linemarking.
		Potential queuing back onto Flinders Highway due to rail crossings on side roads.	Inform drivers as to the location of rail crossings and instruct them to avoid queuing when trains are crossing, by continuing ahead on the Flinders Highway and turning around, or by other means.

Road ID	Road Name	Existing Issue Summary	Required mitigation summary
38	Cotonvale Road	A turn treatment is required to be added at a driveway entry to the proposed construction access road.	Add a turn treatment that is sufficient for the proposed peak construction traffic volumes.
		Rail crossing does not meet relevant standards.	Install relevant rail crossing signage and linemarking.
39	Prairie Road	Road width too narrow for two-way traffic.	Use traffic management OR complete road/ shoulder widening.
		Rail crossing does not meet relevant standards.	Install relevant rail crossing signage and linemarking.
42	Redcliffe Road	Road width likely too narrow for two-way traffic.	Potentially use traffic management OR complete road/ shoulder widening.
		Existing intersection geometry may not be suitable to accommodate construction vehicles.	Upgrade intersection to ensure there is sufficient space for vehicles to safely manoeuvre.
44	Unnamed Road (off Flinders Highway at Hughenden - to Hughenden Camp)	Road width too narrow for two-way traffic.	Use traffic management OR complete road/ shoulder widening.
		Existing intersection geometry may not be suitable to accommodate construction vehicles.	Upgrade intersection to ensure there is sufficient space for vehicles to safely manoeuvre.
		Turn treatments are required to be added at the entry to the Hughenden Camp Hub.	Add turn treatments that are sufficient for the proposed peak construction traffic volumes.
		Sight distances at one driveway does not meet relevant requirements.	Inspect the road prior to construction works, encourage drivers to report concerns, maintain vegetation where limiting, design and install advanced warning signage, where Council/ TMR-owned road furniture is obstructing sight distance.
		Road in reasonable condition.	Inspect the condition of the road prior to construction works, encourage drivers to report road condition concerns, make road repairs where warranted.
45	Kennedy Developmental Road (south)	Turn treatments are required to be added at driveway entries to the proposed construction access road.	Add turn treatments that are sufficient for the proposed peak construction traffic volumes.
		Sight distances at various driveways do not meet relevant requirements.	Inspect the road prior to construction works, encourage drivers to report concerns, maintain vegetation where limiting, design and install advanced warning signage, where Council/ TMR-owned road furniture is obstructing sight distance.
		Rail crossing does not meet relevant standards.	Install relevant rail crossing signage and linemarking.
46	Unnamed Road (off Flinders	Existing intersection geometry may not be suitable to accommodate construction vehicles.	Upgrade intersection to ensure there is sufficient space for vehicles to safely manoeuvre.

Road ID	Road Name	Existing Issue Summary	Required mitigation summary
	Highway - to PTL-FLR_284 to FLR-DJR_82)	Road width likely too narrow for two-way traffic.	Potentially use traffic management OR complete road/ shoulder widening.
		Existing intersection geometry may not be suitable to accommodate construction vehicles.	Upgrade intersection to ensure there is sufficient space for vehicles to safely manoeuvre.
		Rail crossing does not meet relevant standards.	Install relevant rail crossing signage and linemarking.
47	Thornhill Tamworth Road	Rail crossing does not meet relevant standards.	Install relevant rail crossing signage and linemarking.
48	Marathon Stamford Road	Road width too narrow for two-way traffic.	Use traffic management OR complete road/ shoulder widening.
		Existing intersection geometry may not be suitable to accommodate construction vehicles.	Upgrade intersection to ensure there is sufficient space for vehicles to safely manoeuvre.
		Road in reasonable condition.	Inspect the condition of the road prior to construction works, encourage drivers to report road condition concerns, make road repairs where warranted.
		Rail crossing does not meet relevant standards.	Install relevant rail crossing signage and linemarking.
49	Barabon Terranburby Road	Road width too narrow for two-way traffic.	Use traffic management OR complete road/ shoulder widening.
		Existing intersection geometry may not be suitable to accommodate construction vehicles.	Upgrade intersection to ensure there is sufficient space for vehicles to safely manoeuvre.
		Road in average condition.	Inspect the condition of the road prior to construction works, encourage drivers to report road condition concerns, make road repairs where warranted.
		Rail crossing does not meet relevant standards.	Install relevant rail crossing signage and linemarking.

7. Certification

As a professional engineer registered by the Board of Professional Engineers of Queensland pursuant to the Professional Engineers Act 2002 as competent in my areas of nominated expertise, I understand and recognise:

- The significant role of engineering as a profession
- The community has a legitimate expectation that my certification affixed to this engineering work can be trusted; and
- I am responsible for ensuring its preparation has satisfied all necessary standards, conduct and contemporary practice.

As the responsible RPEQ, I certify:

- I am satisfied that all submitted components comprising this Traffic Impact Assessment, listed in the following table, have been completed in accordance with the *Guide to Traffic Impact Assessment* published by the Queensland Department of Transport and Main Roads and using sound engineering principles
- Where specialised areas of work have not been under my direct supervision, I have reviewed the outcomes of the work and consider the work and its outcomes as suitable for the purposes of this Traffic Impact Assessment
- The outcomes of this Traffic Impact Assessment are a true reflection of results of assessment; and
- I believe the strategies recommended for mitigating impacts by this Traffic Impact Assessment embrace contemporary practice initiatives and will deliver the desired outcomes.

Name:	Rebekah Ramm	Registration Number	29697
RPEQ Competency:	Civil		
Signature:	RRamm	Date:	16/02/2024
Postal Address:	199 Macquarie Street, HOBART TAS 7000	Email:	rramm@pittsh.com.au

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CopperString 2032 Detailed Project Program

Appendix A

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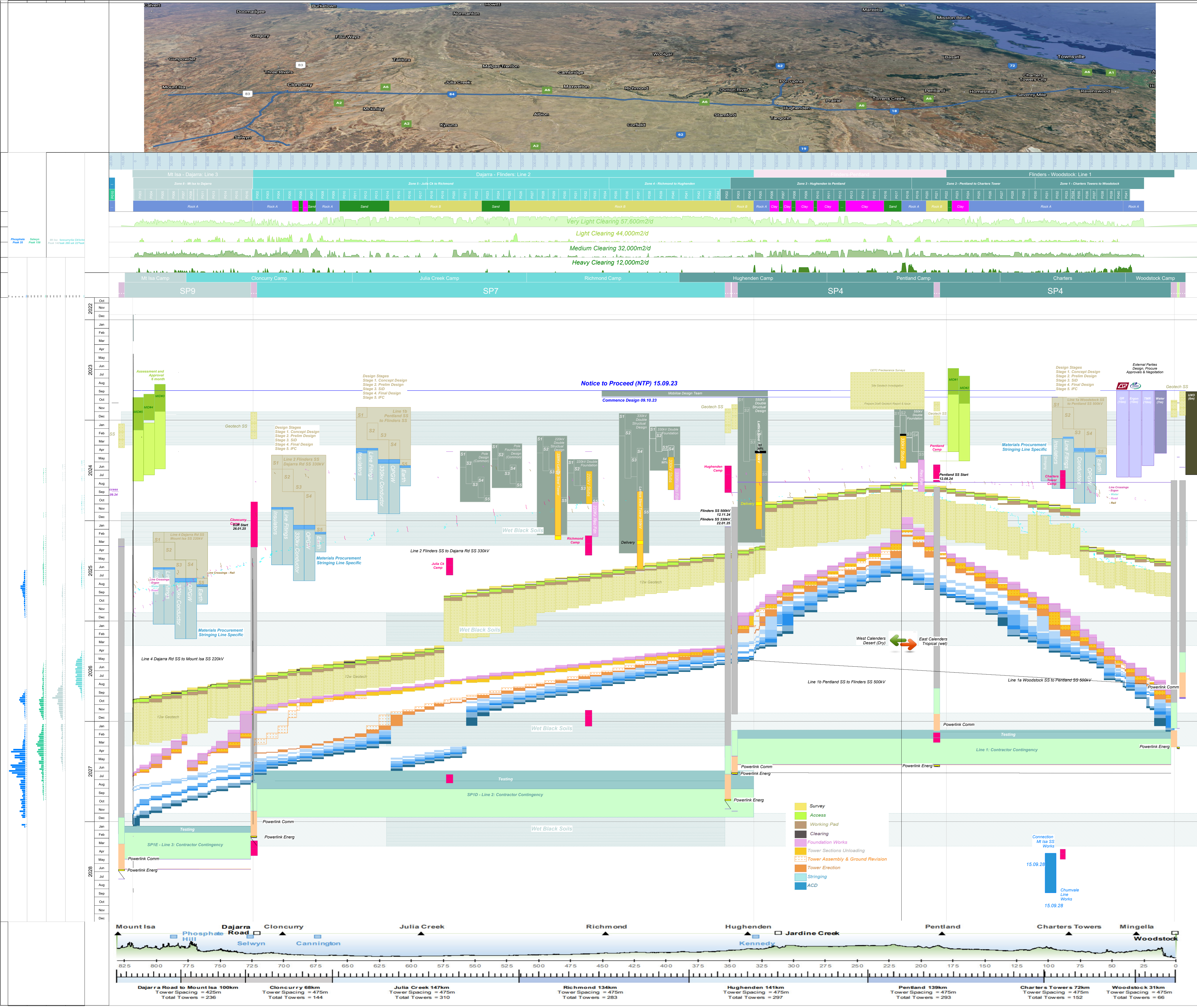
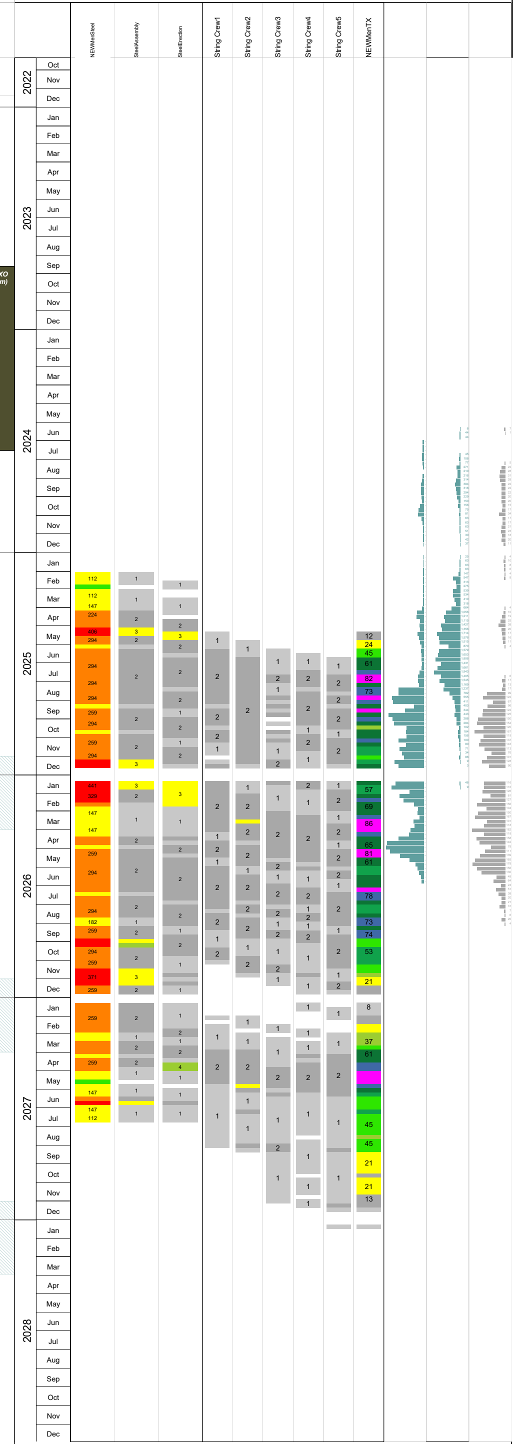
CopperString 2.0
Final ECI Submission

TILOS

Print Date: 17.07.2023

Produced Luke Charet





Swept Paths at TMR Intersections

Appendix B

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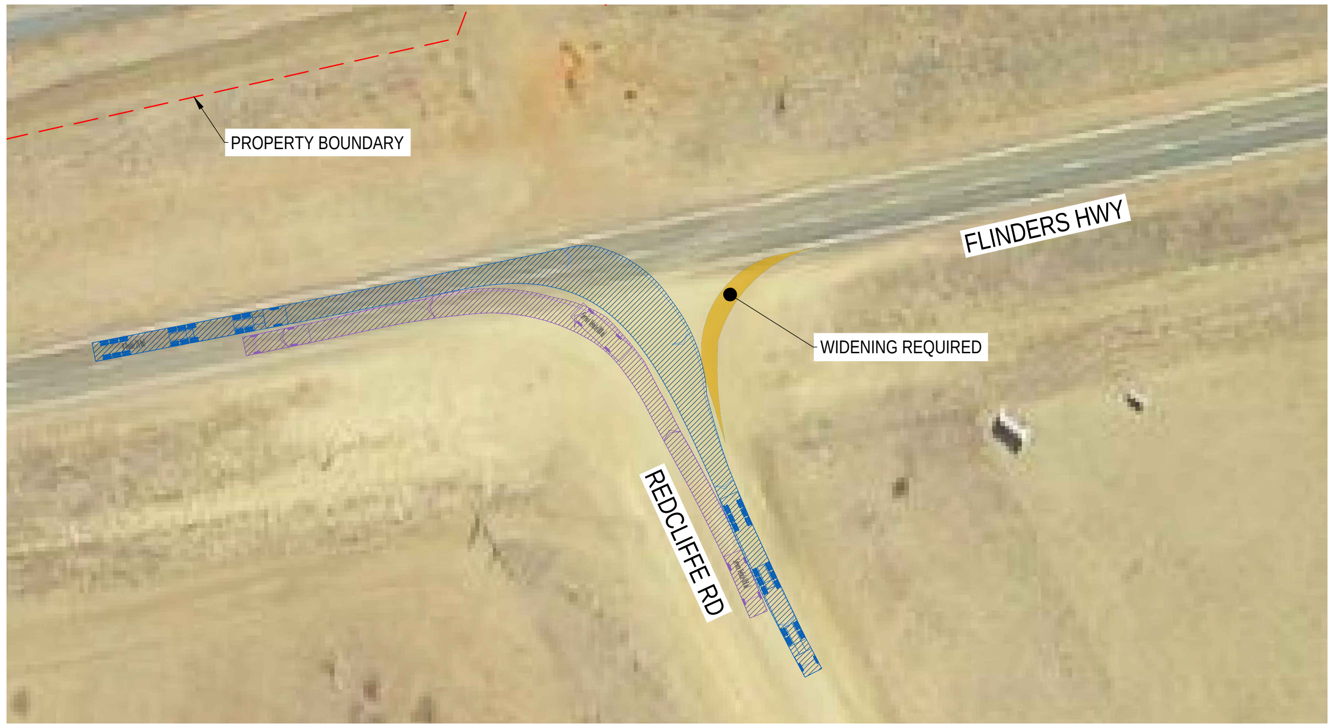

26m B-DOUBLE ENTERING WEST/
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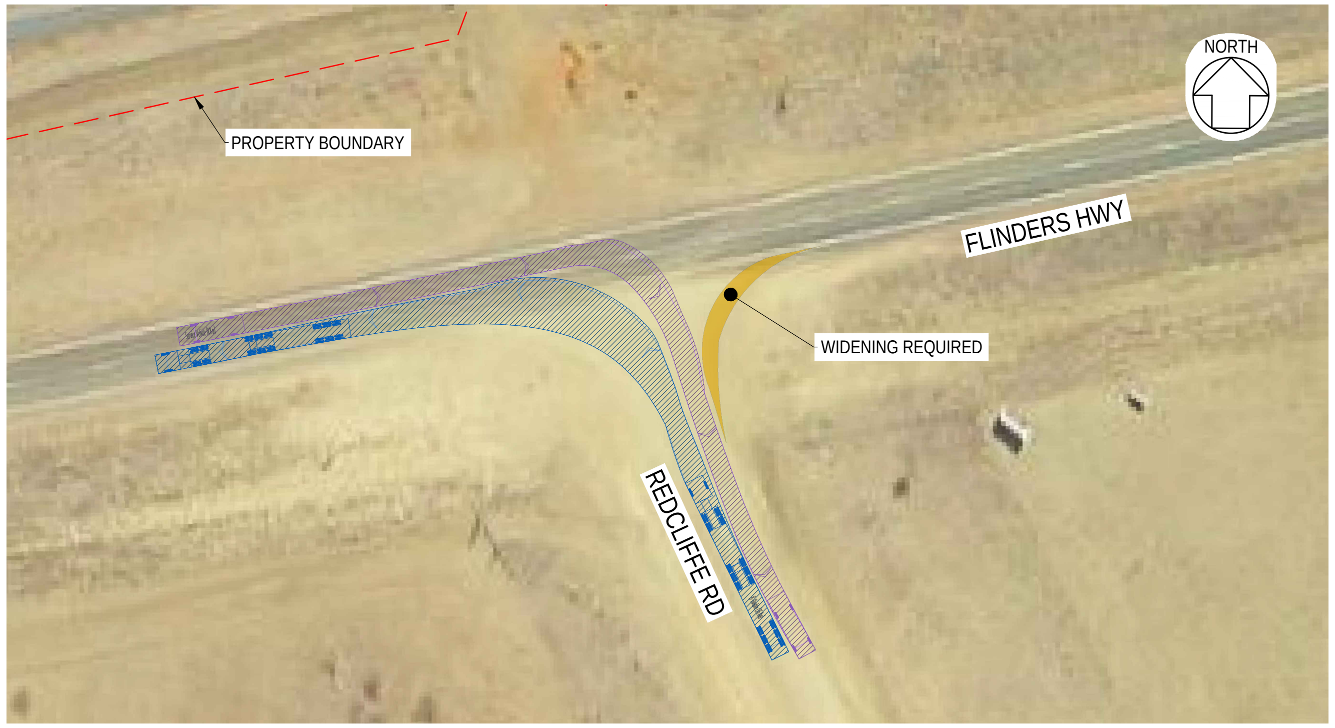
SCALE 1:500 (m)



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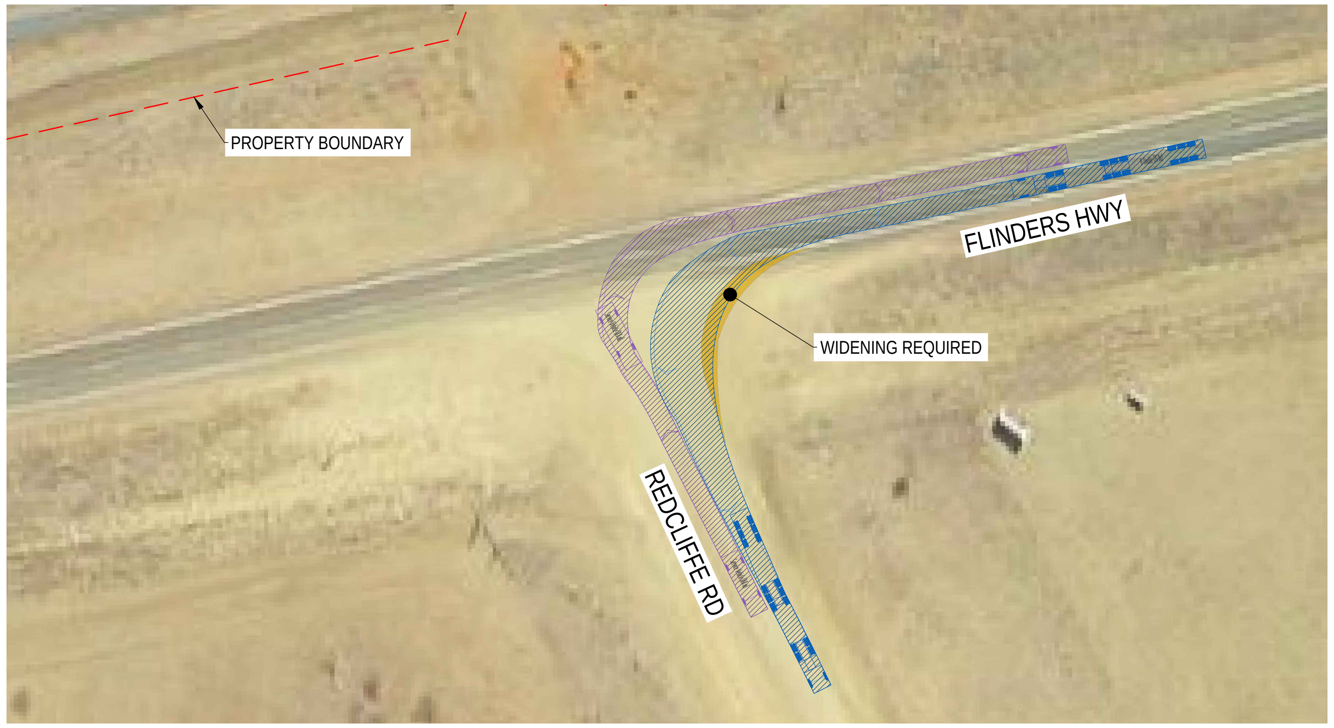

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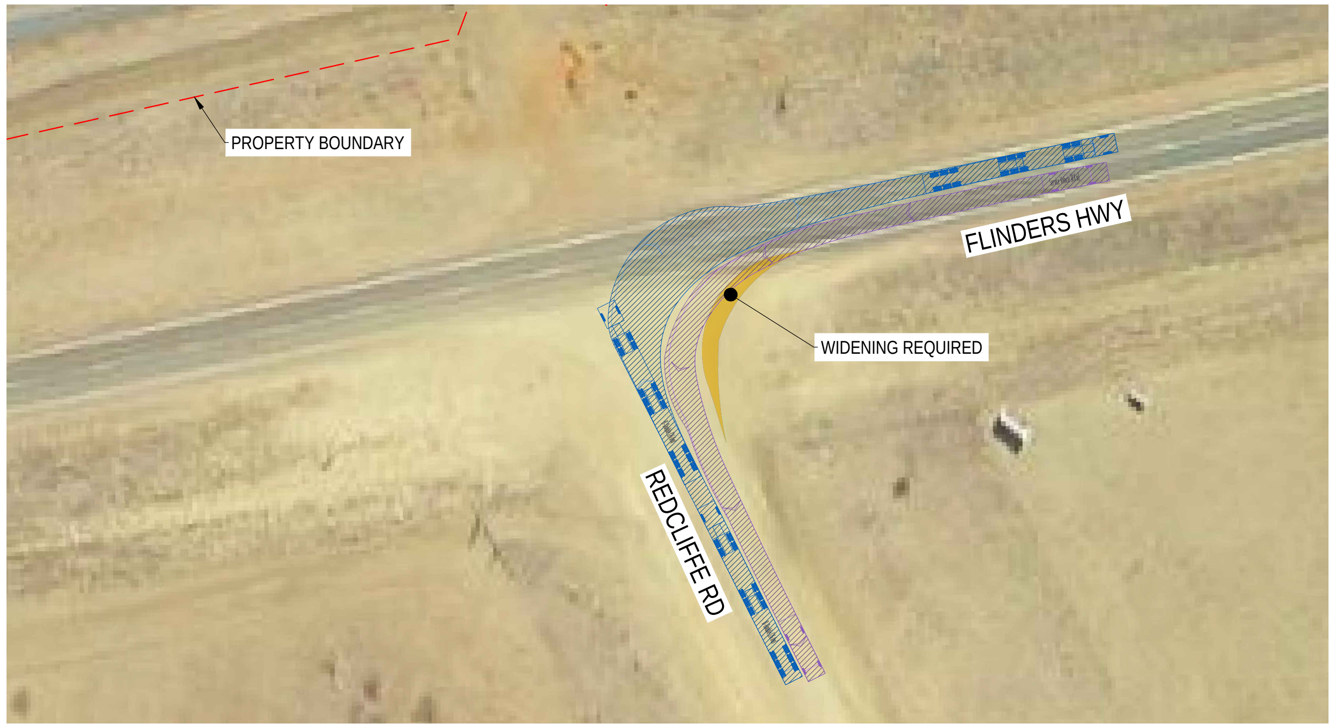
8.8m SERVICE VEHICLE EXITING EAST
SCALE 1:500 (m)

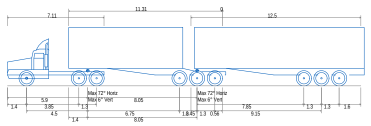


8.8m SERVICE VEHICLE ENTERING EAST/
26m B-DOUBLE EXITING EAST
SCALE 1:500 (m)

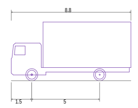
NOTES
- AERIAL IMAGERY: QLD GLOBE

VEHICLES LEGEND:

B-DOUBLE (26m)



SERVICE VEHICLE (8.8m)



10 0 10 20 30 40
SCALE IN METRES - 1:500

REFERENCE FILES ATTACHED: TS-GDA20_Z55; CU2-PW00-XRF-PAS-200-1850-GDA20_55; CU2-PW00-XRF-PAS-090-1950-GDA20_Z55

P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE	APPROVED
A	FOR INFORMATION ONLY	CJV		RLR	22/01/2024	

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SIGNED
DATE

SCALE (PLOTTED FULL SIZE): 1:500 (m)
SHEET SIZE: A1

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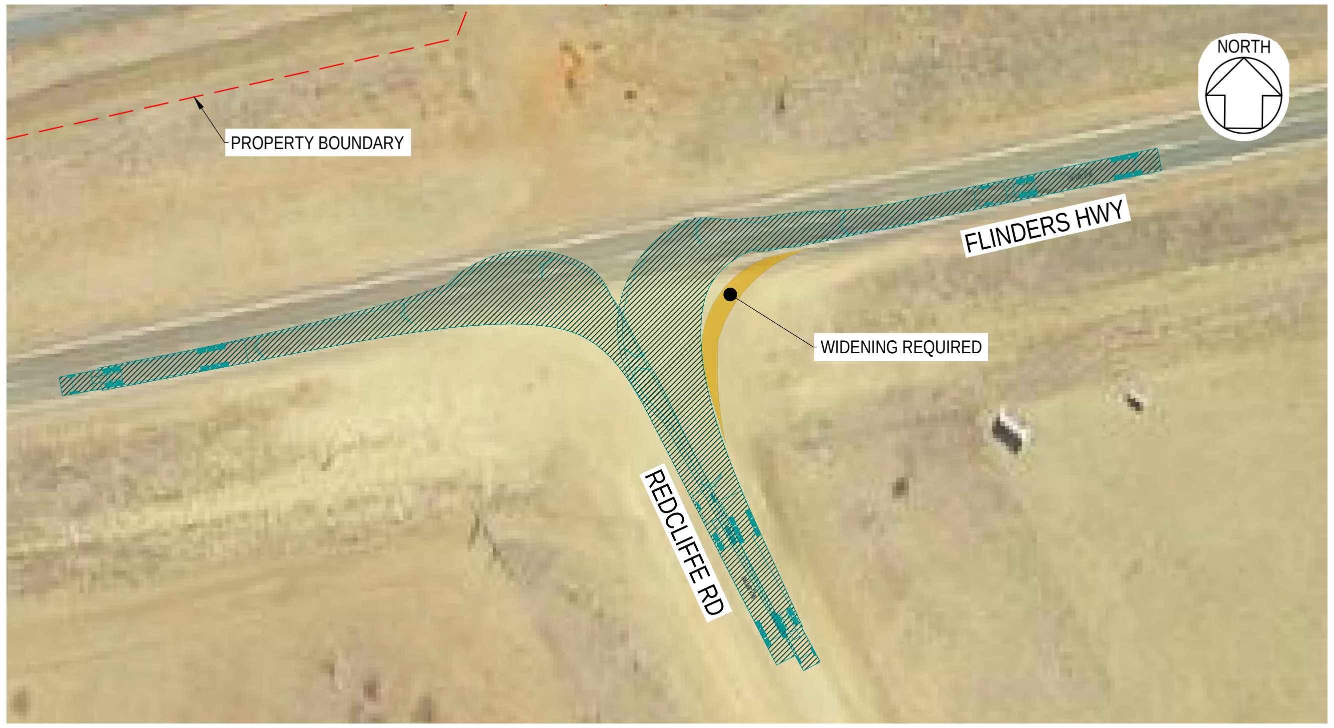
CLIENT: CPB UGL JV
CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES
STATUS: INFORMATION ONLY

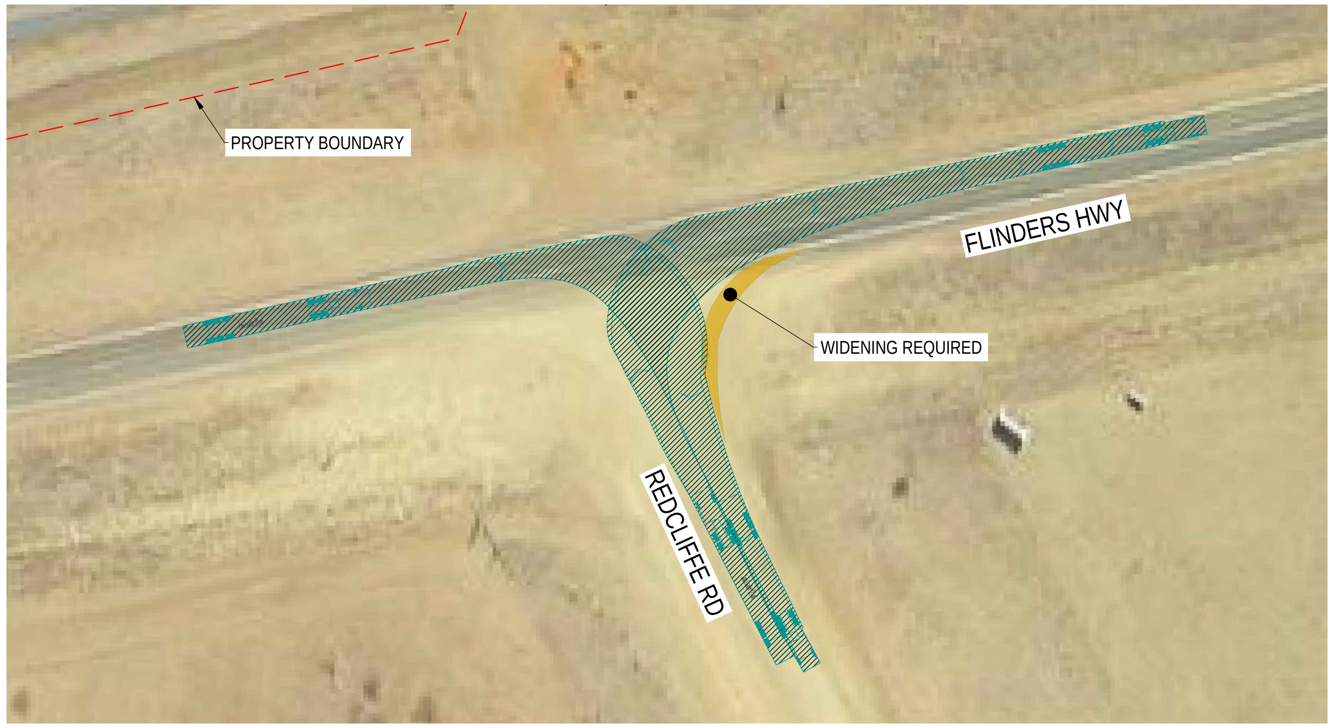
DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT
FLNDERS HIGHWAY / REDCLIFFE ROAD (INTERSECTION ID 7.14) - SHEET 1 OF 2
DATUMS: GDA20 - MGA55
CLIENT No. CU2
DRAWING No. CU2-HU00-SKT-PAS-090-0003
REVISION A
PRINT IN COLOUR

Jan. 23, 24 - 09:10:25 Name: CU2-HU00-SKT-PAS-090-0003-0004.dwg Updated By: David McKenzie



25m LOW LOADER VEHICLE SWEPT PATH - INSET 2

SCALE 1:500 (m)

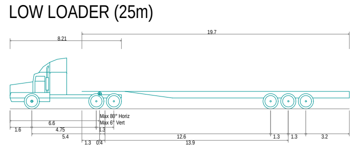


25m LOW LOADER VEHICLE SWEPT PATH - INSET 2

SCALE 1:500 (m)

VEHICLES LEGEND:

LOW LOADER (25m)



NOTES

- AERIAL IMAGERY: QLD GLOBE

10 0 10 20 30 40

SCALE IN METRES - 1:500

REFERENCE FILES ATTACHED: TS-GDA20_Z55; CU2-PW00-XRF-PAS-200-1850-GDA20_55; CU2-PW00-XRF-PAS-090-1950-GDA20_Z55

P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE	APPROVED
A	FOR INFORMATION ONLY	CJV		RLR	22/01/2024	ORIGINAL COPY ON FILE "e" SIGNED BY

SIGNED

DATE

SCALE (PLOTTED FULL SIZE) 1:500 (m)

SHEET SIZE A1

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CLIENT: CPB UGL JV

CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES

STATUS: INFORMATION ONLY

DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT

FLNDERS HIGHWAY / REDCLIFFE ROAD (INTERSECTION ID 7.14) - SHEET 2 OF 2

DATUMS: GDA20 - MGA55

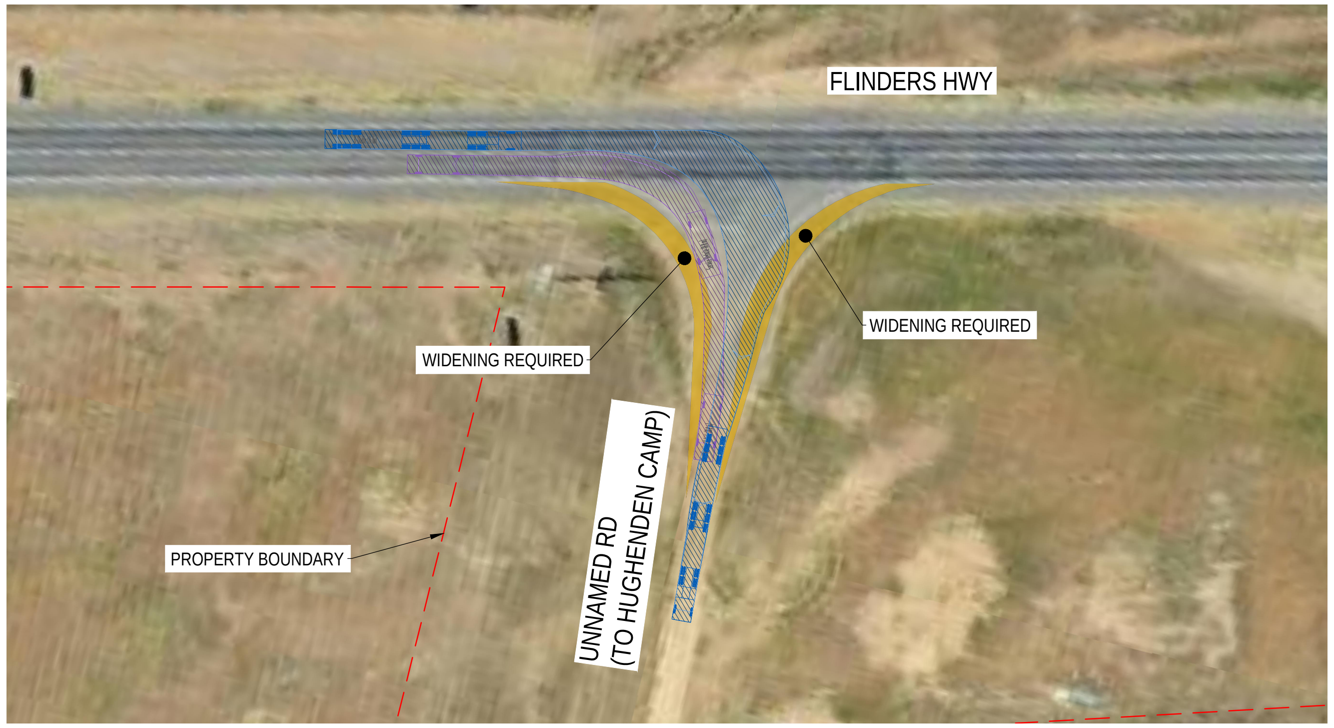
CLIENT No. CU2

DRAWING No. CU2-HU00-SKT-PAS-090-0004

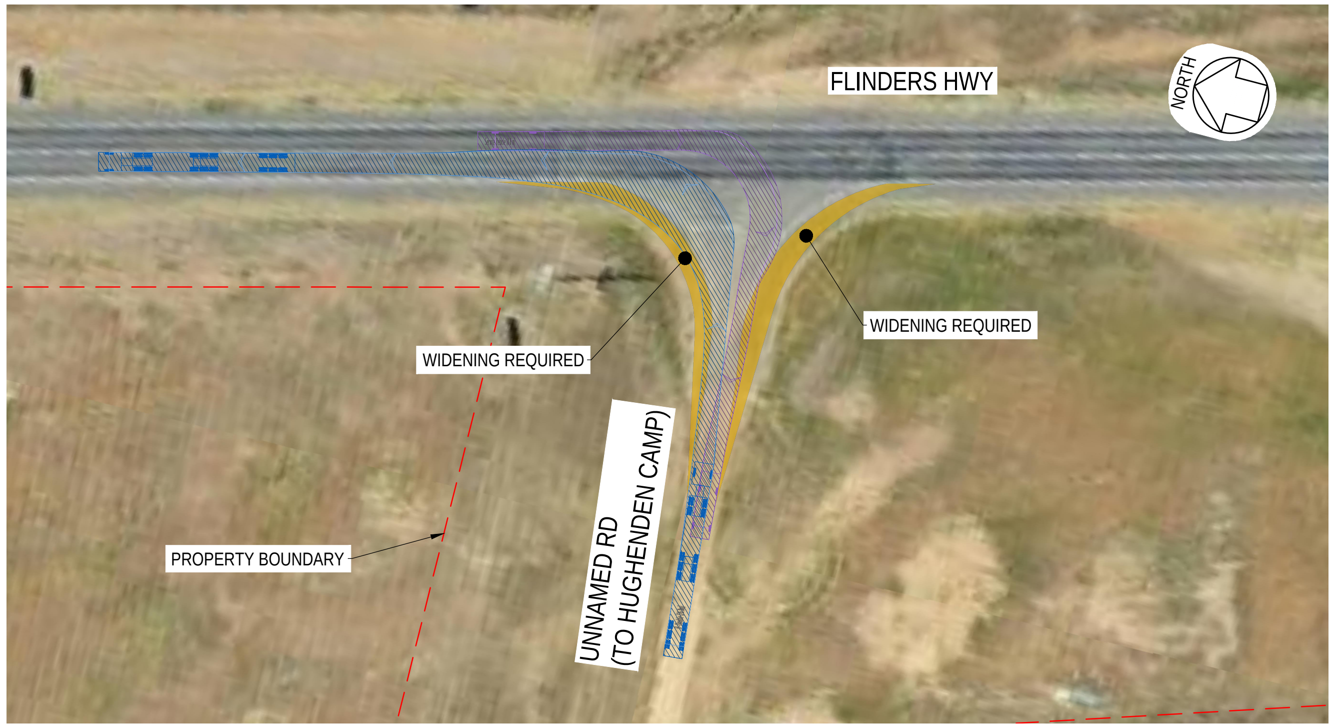
REVISION A

PRINT IN COLOUR

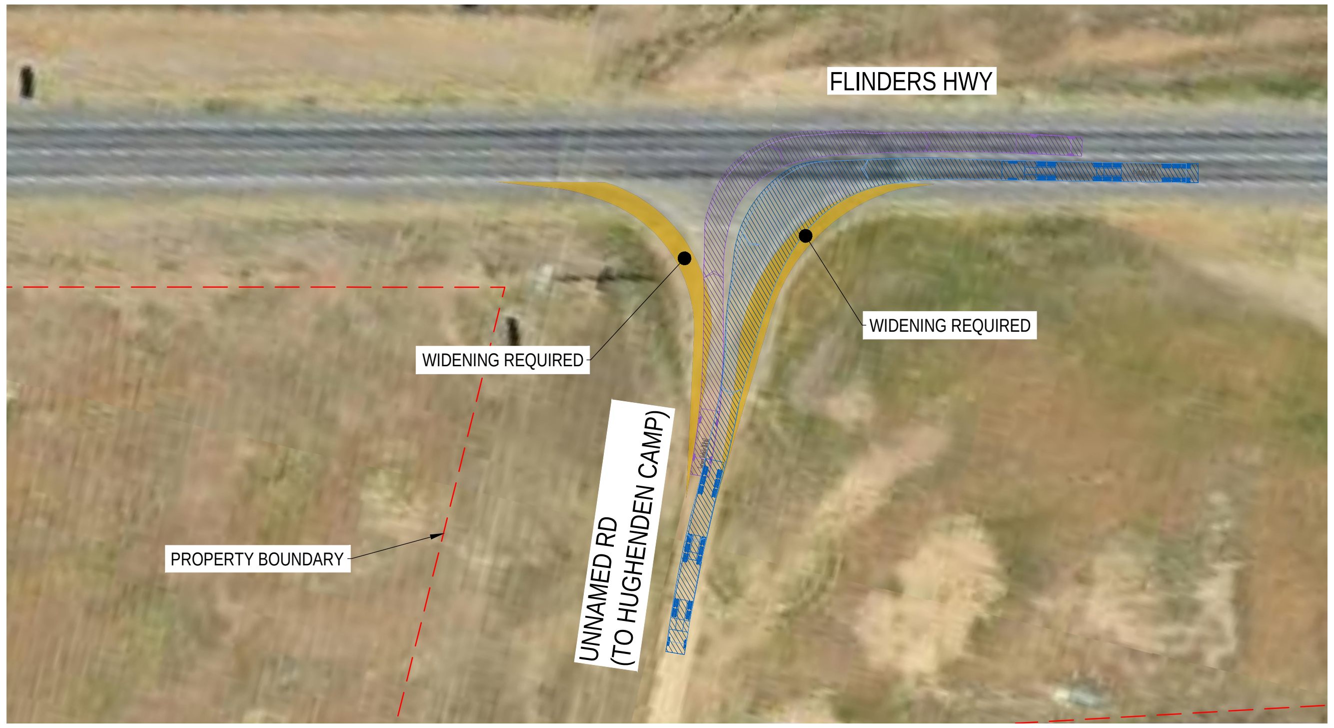
Jan. 23, 24 - 09:10:36 Name: CU2-HU00-SKT-PAS-090-0003-0004.dwg Updated By: David McKenzie



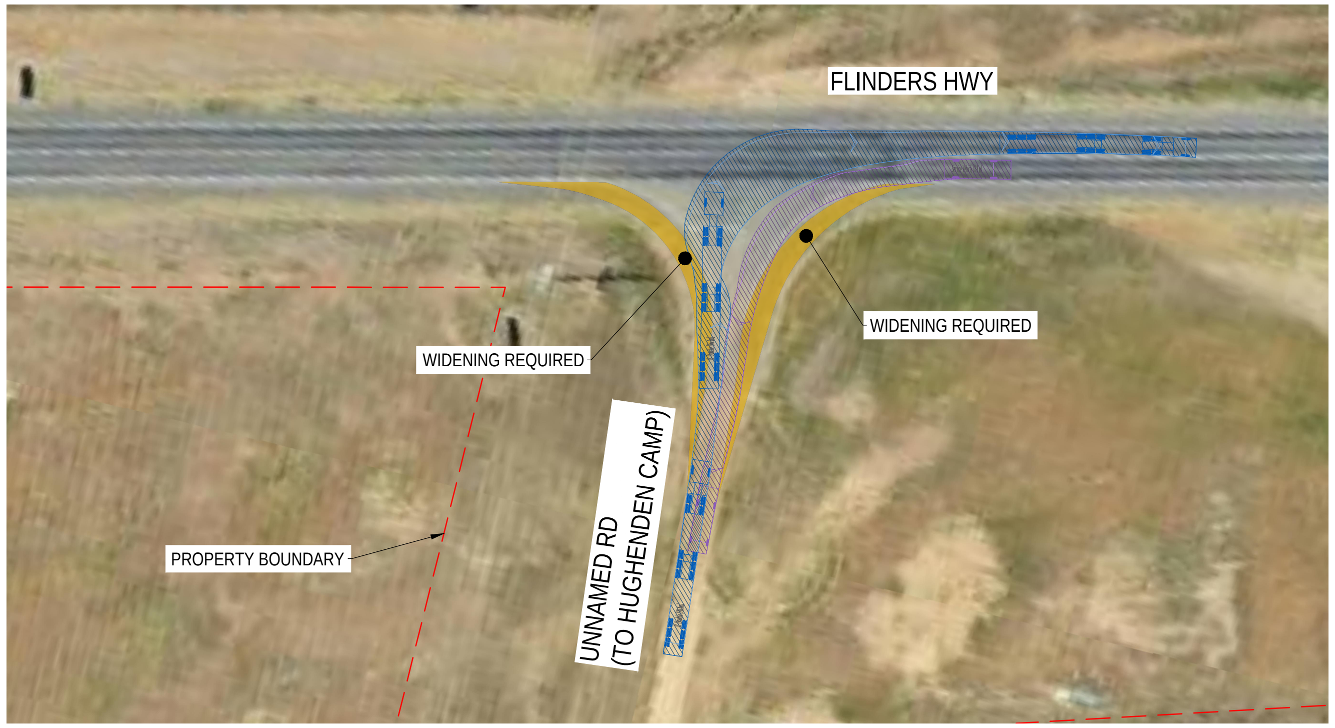
26m B-DOUBLE ENTERING WEST/
8.8m SERVICE VEHICLE EXITING WEST
SCALE 1:500 (m)



8.8m SERVICE VEHICLE ENTERING WEST/
26m B-DOUBLE EXITING WEST
SCALE 1:500 (m)



26m B-DOUBLE ENTERING EAST/
8.8m SERVICE VEHICLE EXITING EAST
SCALE 1:500 (m)

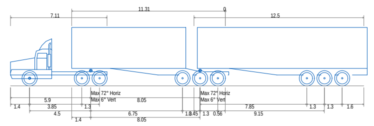


8.8m SERVICE VEHICLE ENTERING EAST/
26m B-DOUBLE EXITING EAST
SCALE 1:500 (m)

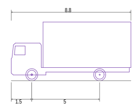
NOTES
- AERIAL IMAGERY: QLD GLOBE

VEHICLES LEGEND:

B-DOUBLE (26m)



SERVICE VEHICLE (8.8m)



10 0 10 20 30 40
SCALE IN METRES - 1:500

REFERENCE FILES ATTACHED: CU2-PW00-XRF-PAS-090-1125-GDA20_Z55; CU2-PW00-XRF-PAS-090-1850-GDA20_Z55; CU2-PW00-XRF-PAS-090-1950-GDA20_Z55

P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE	APPROVED
A	FOR INFORMATION ONLY	CJV		RLR	22/01/2024	ORIGINAL COPY ON FILE "e" SIGNED BY

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DATE

SCALE (PLOTTED FULL SIZE): 1:500 (m)
SHEET SIZE: A1

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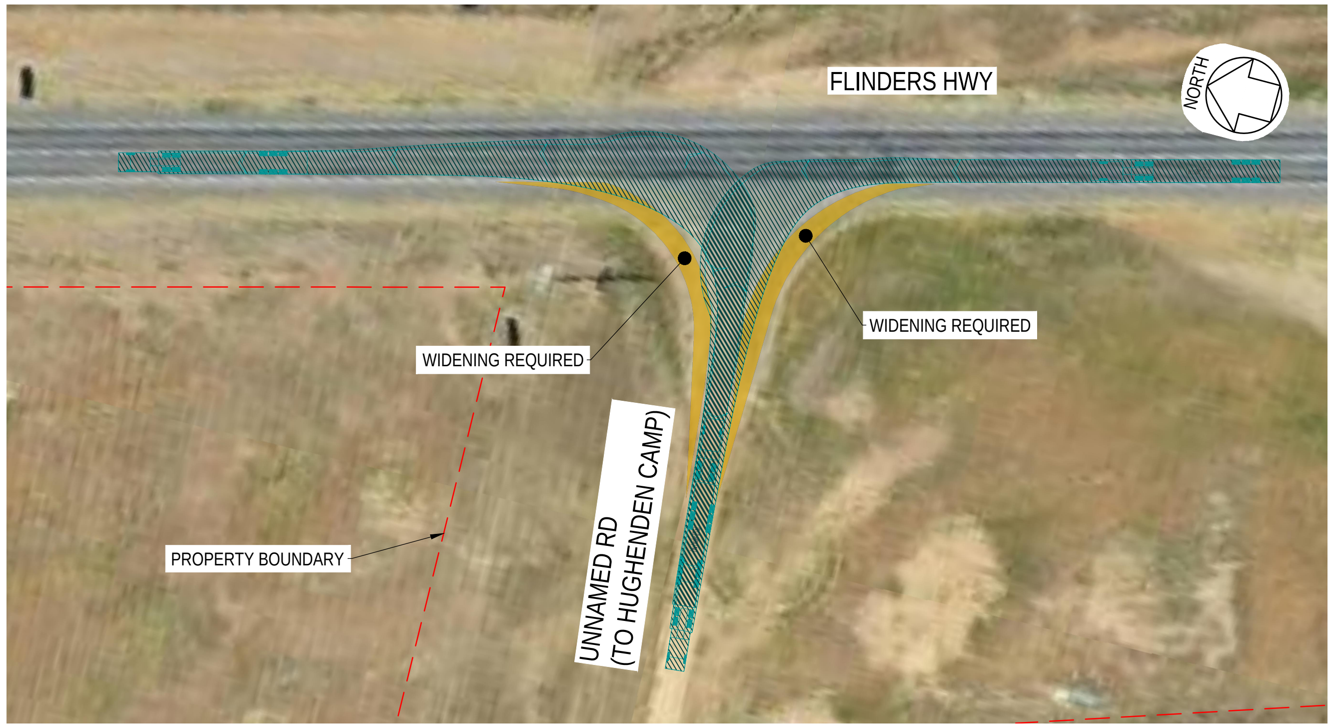
CLIENT: CPB UGL JV
CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES
STATUS: INFORMATION ONLY

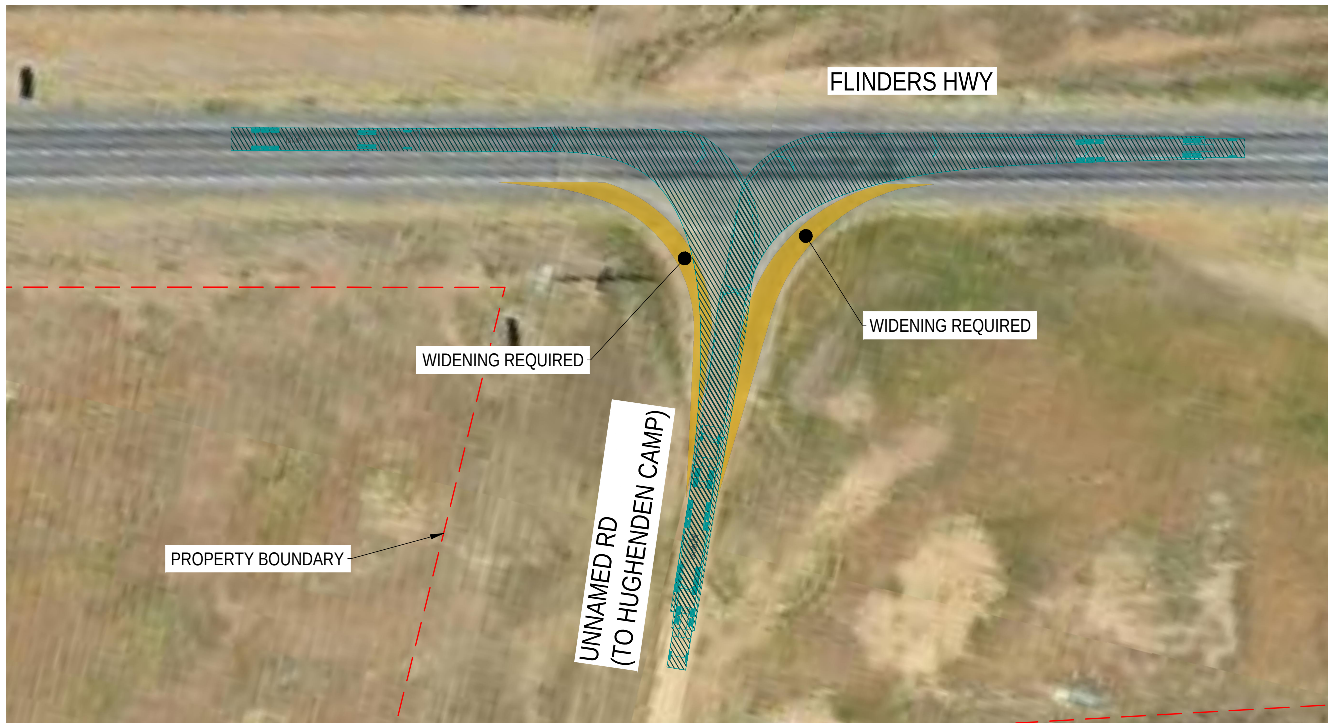
DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT
FLINDERS HIGHWAY / UNNAMED ROAD (TO HUGHENDEN CAMP) (INTERSECTION ID 7.16) - SHEET 1 OF 2
DATUMS: GDA20 - MGA55
CLIENT No. CU2
DRAWING No. CU2-HU00-SKT-PAS-090-0009
REVISION A
PRINT IN COLOUR

Jan. 23, 24 - 09:06:09 Name: CU2-HU00-SKT-PAS-090-0009-0010.dwg Updated By: David McKenzie



25m LOW LOADER VEHICLE SWEPT PATH - INSET 2

SCALE 1:500 (m)

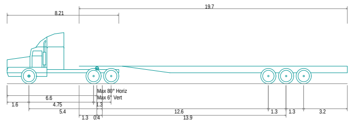


25m LOW LOADER VEHICLE SWEPT PATH - INSET 2

SCALE 1:500 (m)

VEHICLES LEGEND:

LOW LOADER (25m)



NOTES

- AERIAL IMAGERY: QLD GLOBE

10 0 10 20 30 40

SCALE IN METRES - 1:500

REFERENCE FILES ATTACHED: CU2-PW00-XRF-PAS-090-1125-GDA20_Z55; CU2-PW00-XRF-PAS-090-1850-GDA20_Z55; CU2-PW00-XRF-PAS-090-1950-GDA20_Z55

P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE
A	FOR INFORMATION ONLY	CJV		RLR	22/01/2024

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DATE

SCALE (PLOTTED FULL SIZE): 1:500 (m)

SHEET SIZE: A1

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CLIENT: CPB UGL JV

CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES

STATUS: INFORMATION ONLY

DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT

FLINDERS HIGHWAY / UNNAMED ROAD (TO HUGHENDEN CAMP) (INTERSECTION ID 7.16) - SHEET 2 OF 2

DATUMS: GDA20 - MGA55

CLIENT No. CU2

DRAWING No. CU2-HU00-SKT-PAS-090-0010

REVISION A

PRINT IN COLOUR

Jan. 23, 24 - 09:06:21 Name: CU2-HU00-SKT-PAS-090-0009-0010.dwg Updated By: David McKenzie

26m B-DOUBLE ENTERING WEST/
8.8m SERVICE VEHICLE EXITING WEST
SCALE 1:500 (m)

8.8m SERVICE VEHICLE ENTERING WEST/
26m B-DOUBLE EXITING WEST
SCALE 1:500 (m)

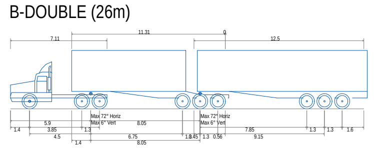
26m B-DOUBLE ENTERING EAST/
8.8m SERVICE VEHICLE EXITING EAST
SCALE 1:500 (m)

8.8m SERVICE VEHICLE ENTERING EAST/
26m B-DOUBLE EXITING EAST
SCALE 1:500 (m)

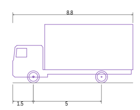
NOTES
- AERIAL IMAGERY: GOOGLE MAPS

VEHICLES LEGEND:

B-DOUBLE (26m)



SERVICE VEHICLE (8.8m)



10 0 10 20 30 40
SCALE IN METRES - 1:500

REFERENCE FILES ATTACHED: CU2-PW00-XRF-PAS-090-1125-GDA20_Z55; CU2-PW00-XRF-PAS-090-1850-GDA20_Z55; CU2-PW00-XRF-PAS-090-1950-GDA20_Z55

P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE
A	FOR INFORMATION ONLY	CJV		RLR	22/01/2024

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DATE

SCALE (PLOTTED FULL SIZE): 1:500 (m)
SHEET SIZE: A1

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CLIENT: CPB UGL JV
CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES
STATUS: INFORMATION ONLY

DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT
FLINDERS HIGHWAY / PRAIRIE ROAD (INTERSECTION ID 7.13) - SHEET 1 OF 2
DATUMS: GDA20 - MGA55
CLIENT No. CU2
DRAWING No. CU2-HU00-SKT-PAS-090-0013
REVISION A
PRINT IN COLOUR

Jan. 23, 24 - 09:03:17 Name: CU2-HU00-SKT-PAS-090-0013-0014.dwg Updated By: David McKenzie

25m LOW LOADER VEHICLE SWEPT PATH - INSET 2

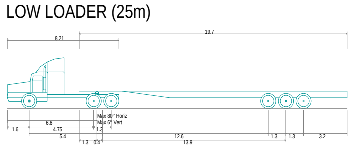
SCALE 1:500 (m)

25m LOW LOADER VEHICLE SWEPT PATH - INSET 2

SCALE 1:500 (m)

VEHICLES LEGEND:

LOW LOADER (25m)



NOTES

- AERIAL IMAGERY: GOOGLE MAPS

10 0 10 20 30 40

SCALE IN METRES - 1:500

REFERENCE FILES ATTACHED: CU2-PW00-XRF-PAS-090-1125-GDA20_Z55; CU2-PW00-XRF-PAS-090-1850-GDA20_Z55; CU2-PW00-XRF-PAS-090-1950-GDA20_Z55

P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE	APPROVED
						ORIGINAL COPY ON FILE "e" SIGNED BY
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SCALE (PLOTTED FULL SIZE): 1:500 (m)

SHEET SIZE: A1

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CLIENT: CPB UGL JV

CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES

STATUS: INFORMATION ONLY

DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT

FLINDERS HIGHWAY / PRAIRIE ROAD (INTERSECTION ID 7.13) - SHEET 2 OF 2

DATUMS: GDA20 - MGA55

CLIENT No. CU2

DRAWING No. CU2-HU00-SKT-PAS-090-0014

REVISION A

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Jan. 23, 24 - 09:03:29 Name: CU2-HU00-SKT-PAS-090-0013-0014.dwg Updated By: David McKenzie

26m B-DOUBLE ENTERING WEST
8.8m SERVICE VEHICLE EXITING WEST
SCALE 1:500 (m)

8.8m SERVICE VEHICLE ENTERING WEST
26m B-DOUBLE EXITING WEST
SCALE 1:500 (m)

26m B-DOUBLE ENTERING EAST
8.8m SERVICE VEHICLE EXITING EAST
SCALE 1:500 (m)

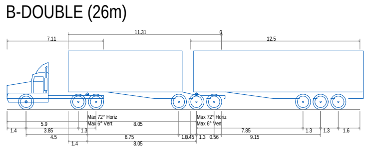
8.8m SERVICE VEHICLE ENTERING EAST
26m B-DOUBLE EXITING EAST
SCALE 1:500 (m)

NOTES
- AERIAL IMAGERY IS OUT OF DATE
- AERIAL IMAGERY SOURCE GOOGLE MAPS

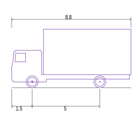
10 0 10 20 30 40
SCALE IN METRES - 1:500

VEHICLES LEGEND:

B-DOUBLE (26m)



SERVICE VEHICLE (8.8m)



P&S FORM DRG-A1 REV 29

REFERENCE FILES ATTACHED: CU2-PW00-XRF-PAS-090-1850-GDA20_Z54; CU2-PW00-XRF-PAS-090-1125-GDA20_Z54; CU2-PW00-XRF-PAS-090-1950-GDA20_Z54

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE	APPROVED
A	FOR INFORMATION ONLY	CJV		RLR	22/01/2024	ORIGINAL COPY ON FILE "e" SIGNED BY SIGNED DATE

SCALE (PLOTTED FULL SIZE) 1:500 (m)
SHEET SIZE A1

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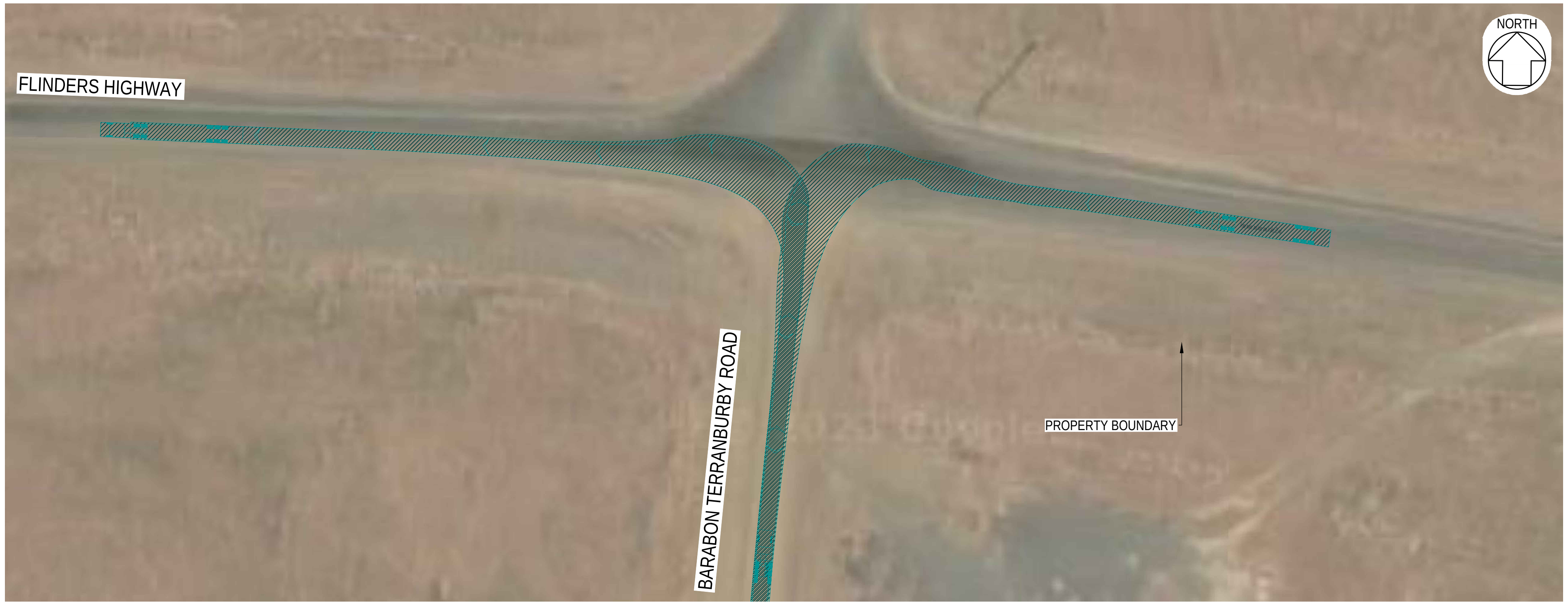
CLIENT: CPB UGL JV
CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES
STATUS: INFORMATION ONLY

DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT
FLINDERS HIGHWAY / BARABON TERRANBURBY ROAD (INTERSECTION ID 7.21) - SHEET 1 OF 2
DATUMS: GDA20 - MGA54
CLIENT No. CU2
DRAWING No. CU2-RI00-SKT-PAS-090-0003
REVISION A
PRINT IN COLOUR

Jan. 23, 24 - 10:22:53 Name: CU2-RI00-SKT-PAS-090-0003-0004.dwg Updated By: David McKenzie



25m LOW LOADER SWEPT PATH - INSET 2

SCALE 1:500 (m)

25m LOW LOADER SWEPT PATH - INSET 1

SCALE 1:500 (m)

NOTES

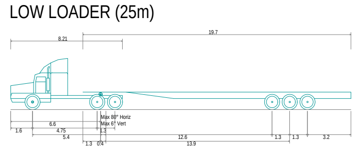
- AERIAL IMAGERY IS OUT OF DATE
- AERIAL IMAGERY SOURCE GOOGLE MAPS

10 0 10 20 30 40

SCALE IN METRES - 1:500

VEHICLES LEGEND:

LOW LOADER (25m)



REFERENCE FILES ATTACHED: CU2-PW00-XRF-PAS-090-1850-GDA20_Z54; CU2-PW00-XRF-PAS-090-1125-GDA20_Z54; CU2-PW00-XRF-PAS-090-1950-GDA20_Z54

P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE	APPROVED
						ORIGINAL COPY ON FILE "e" SIGNED BY
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SCALE (PLOTTED FULL SIZE): 1:500 (m)

SHEET SIZE: A1

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CLIENT: CPB UGL JV

CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES

STATUS: INFORMATION ONLY

DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT

FLINDERS HIGHWAY / BARABON TERRANBURBY ROAD (INTERSECTION ID 7.21) - SHEET 2 OF 2

DATUMS: GDA20 - MGA54

CLIENT No. CU2

DRAWING No. CU2-RI00-SKT-PAS-090-0004

REVISION A

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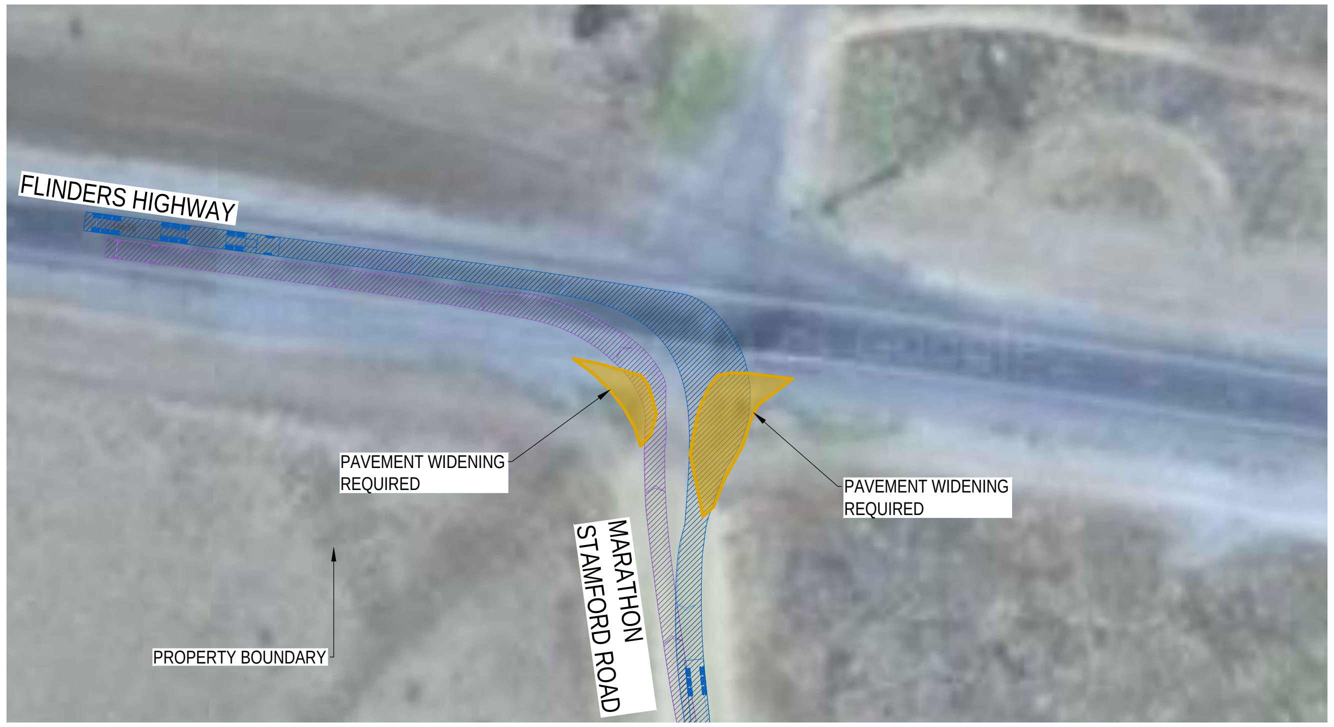
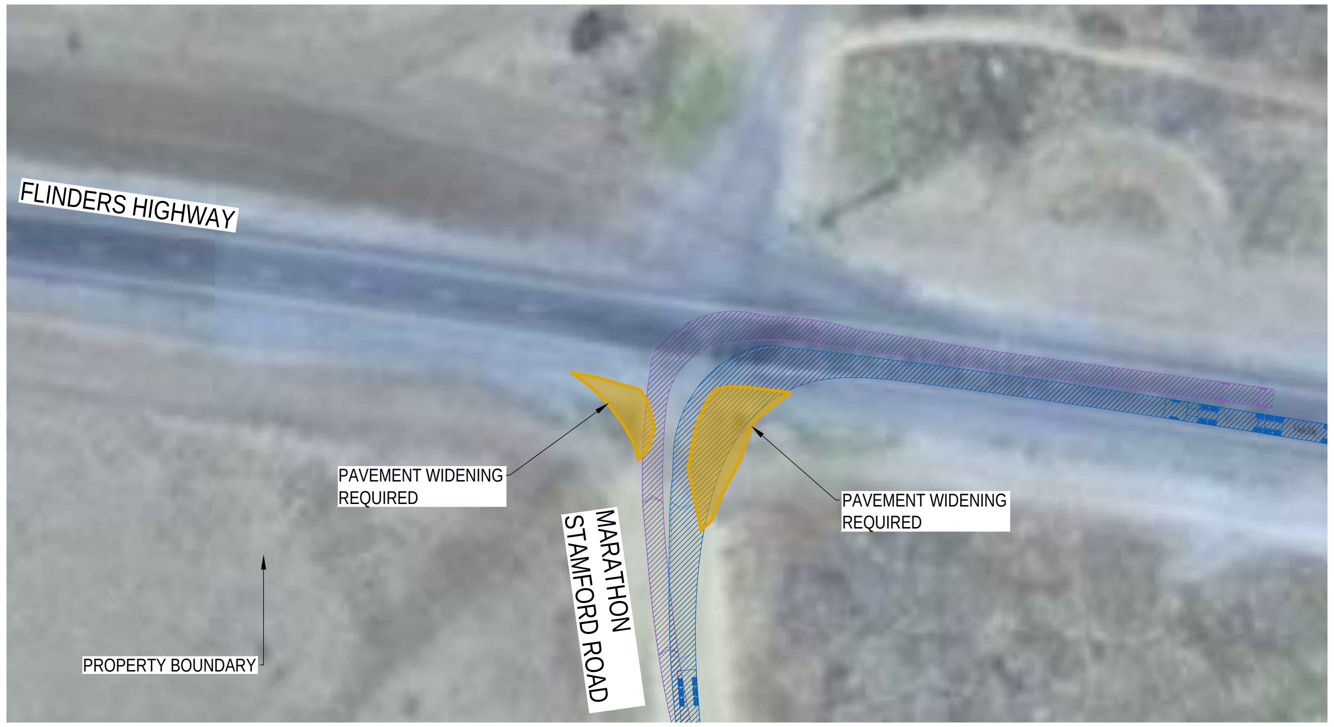
Jan. 23, 24 - 10:22:58 Name: CU2-RI00-SKT-PAS-090-0003-0004.dwg Updated By: David McKenzie

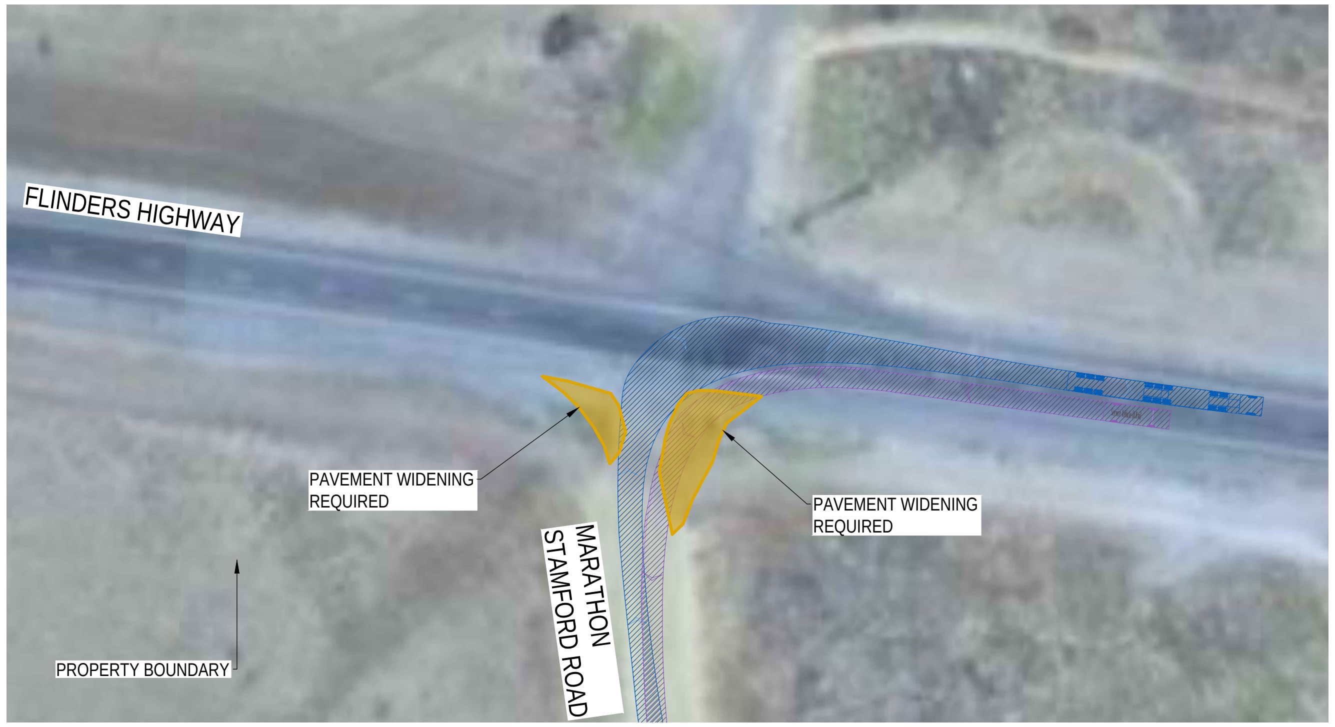


26m B-DOUBLE ENTERING WEST
8.8m SERVICE VEHICLE EXITING WEST
SCALE 1:500 (m)

8.8m SERVICE VEHICLE ENTERING WEST
26m B-DOUBLE EXITING WEST
SCALE 1:500 (m)



26m B-DOUBLE ENTERING EAST
8.8m SERVICE VEHICLE EXITING EAST
SCALE 1:500 (m)



8.8m SERVICE VEHICLE ENTERING EAST
26m B-DOUBLE EXITING EAST
SCALE 1:500 (m)

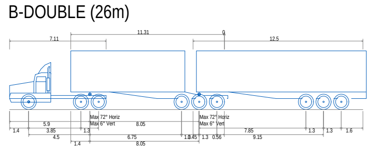
NOTES

- AERIAL IMAGERY IS OUT OF DATE
- AERIAL IMAGERY SOURCE GOOGLE MAPS

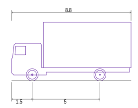
10 0 10 20 30 40
SCALE IN METRES - 1:500

VEHICLES LEGEND:

B-DOUBLE (26m)



SERVICE VEHICLE (8.8m)



P&S FORM DRG-A1 REV 29

REFERENCE FILES ATTACHED: CU2-PW00-XRF-PAS-090-1850-GDA20_Z54; CU2-PW00-XRF-PAS-090-1125-GDA20_Z54; CU2-PW00-XRF-PAS-090-1950-GDA20_Z54

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE
A	FOR INFORMATION ONLY	CJV		RLR	22/01/2024

APPROVED: ORIGINAL COPY ON FILE "e" SIGNED BY
SIGNED
DATE

SCALE (PLOTTED FULL SIZE): 1:500 (m)
SHEET SIZE: A1

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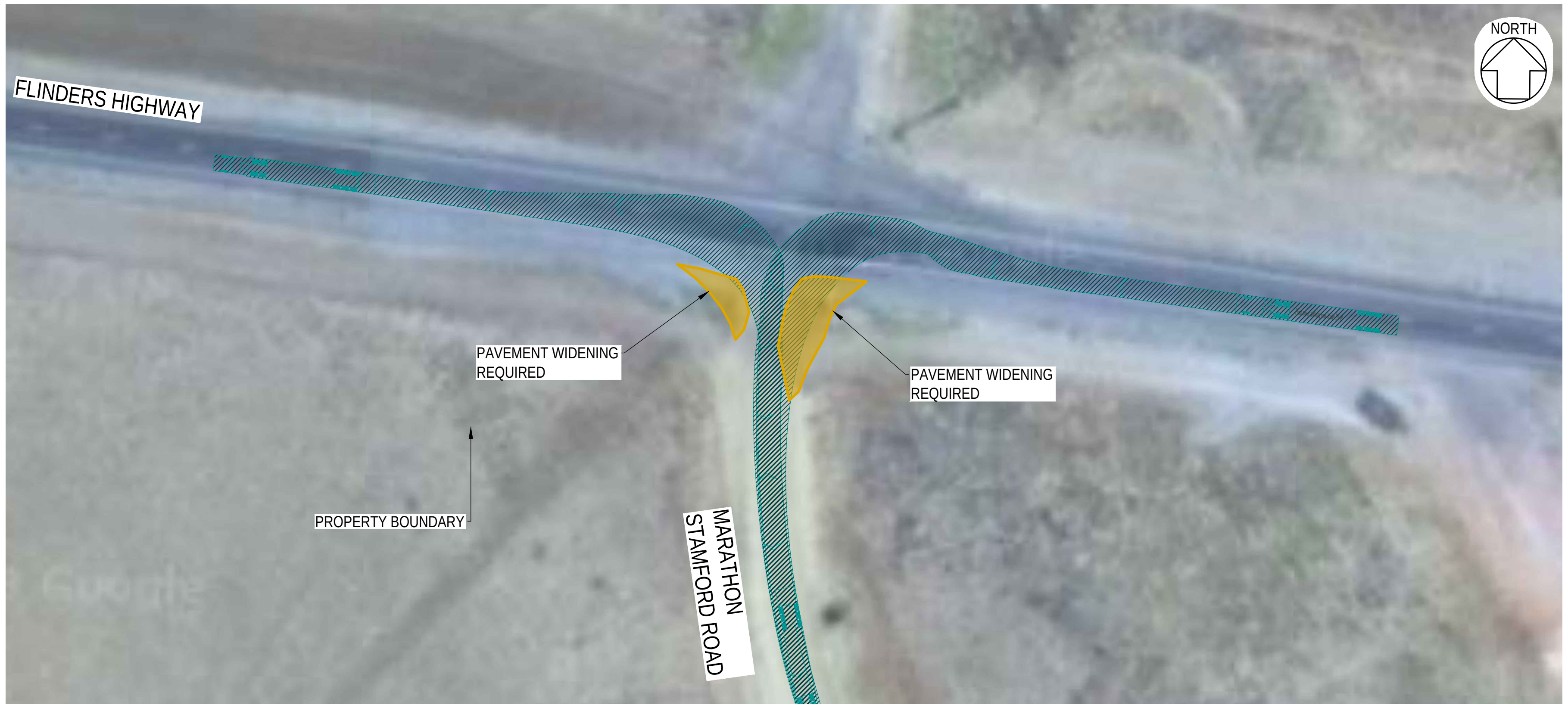
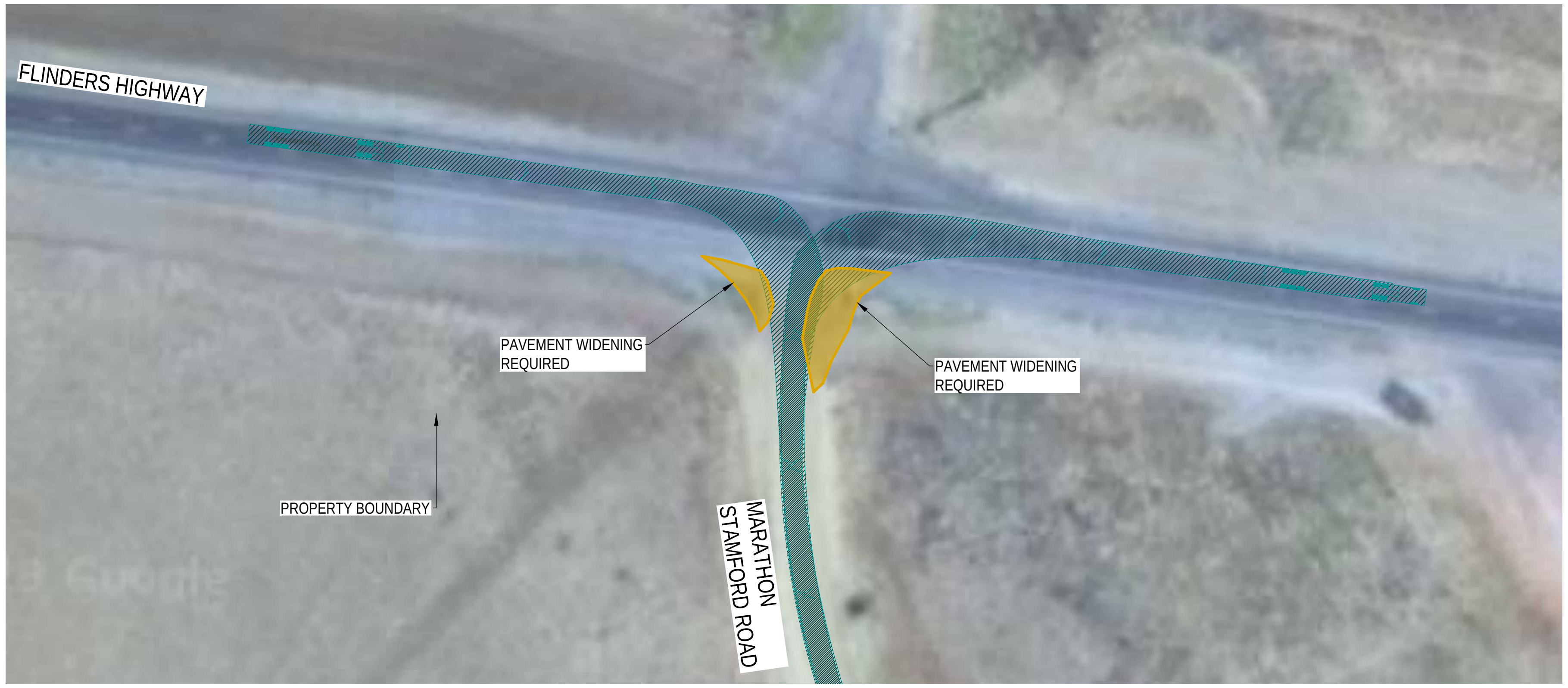
CLIENT: CPB UGL JV
CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES
STATUS: INFORMATION ONLY

DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT
FLINDERS HIGHWAY / MARATHON STAMFORD ROAD (INTERSECTION ID 7.20) - SHEET 1 OF 2
DATUMS: GDA20 - MGA54
CLIENT No. CU2
DRAWING No. CU2-RI00-SKT-PAS-090-0005
REVISION A
PRINT IN COLOUR

Jan. 23, 24 - 11:07:26 Name: CU2-RI00-SKT-PAS-090-0005-0006.dwg Updated By: David McKenzie



25m LOW LOADER SWEPT PATH - INSET 2
SCALE 1:500 (m)

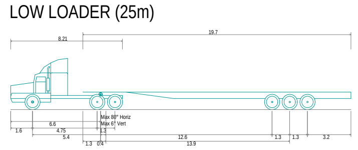


25m LOW LOADER SWEPT PATH - INSET 1
SCALE 1:500 (m)

NOTES
- AERIAL IMAGERY IS OUT OF DATE
- AERIAL IMAGERY SOURCE GOOGLE MAPS

10 0 10 20 30 40
SCALE IN METRES - 1:500

VEHICLES LEGEND:
LOW LOADER (25m)



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P&S FORM DRG-A1 REV 29

DRAWING REVISION HISTORY

No.	DESCRIPTION	DRAWN	DESIGNED	REVIEWED	DATE	APPROVED
A	FOR INFORMATION ONLY	CJV		RLR	22/01/2024	ORIGINAL COPY ON FILE "e" SIGNED BY

SIGNED
DATE

SCALE (PLOTTED FULL SIZE) 1:500 (m)
SHEET SIZE A1

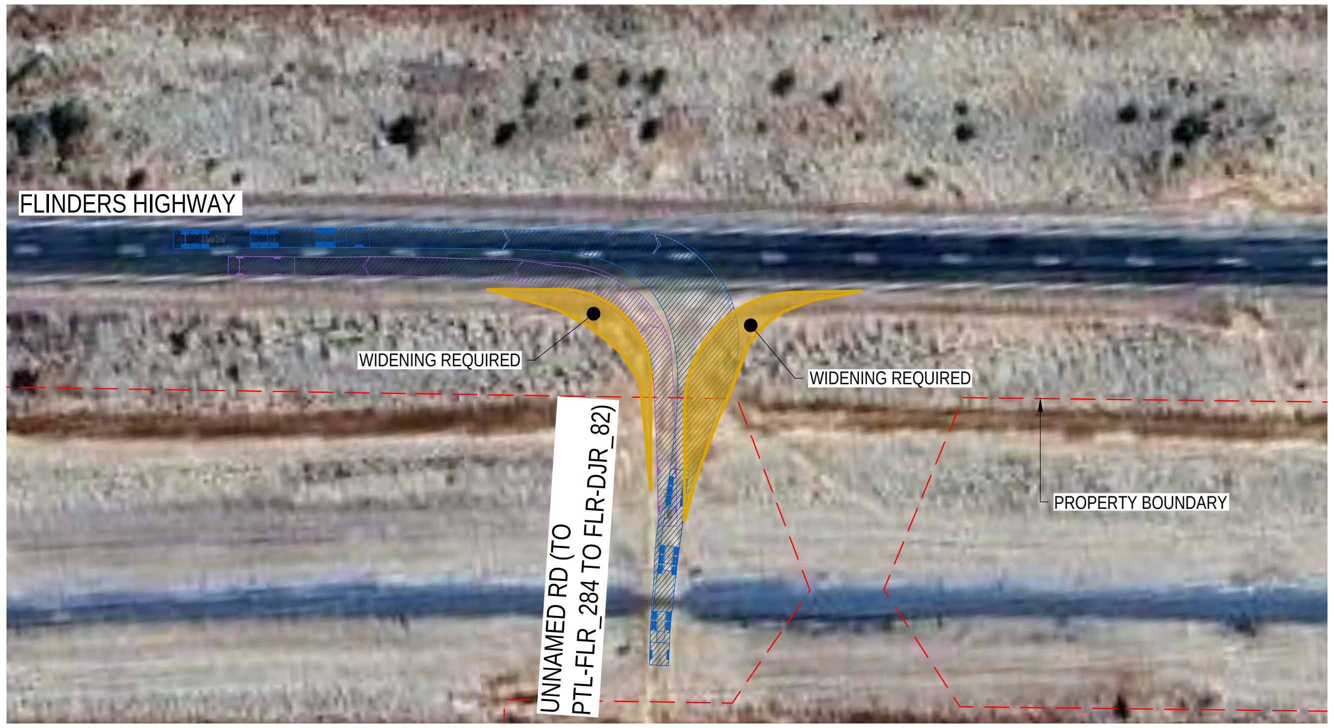
CPB CONTRACTORS UGL

pitt&sherry
pittsh.com.au Phone 1300 748 874 ABN 67 140 184 309

CLIENT: CPB UGL JV
CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES
STATUS: INFORMATION ONLY

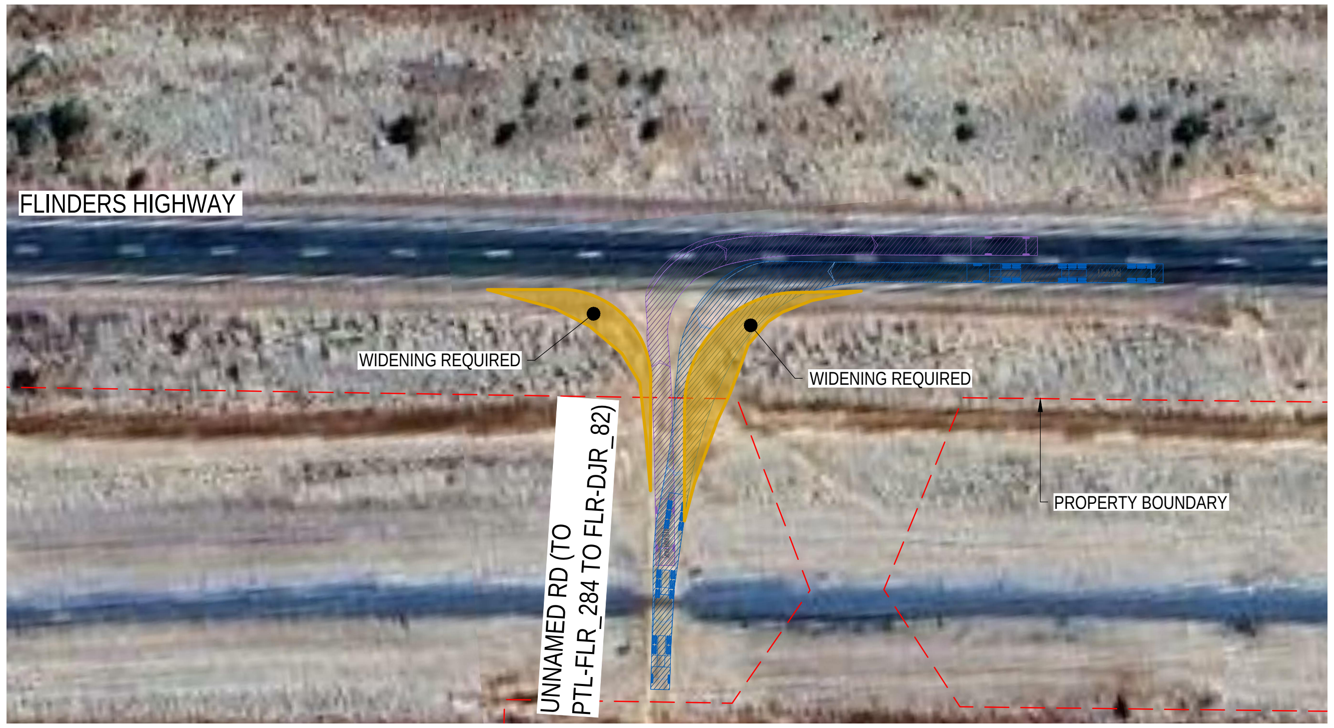
DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT
FLINDERS HIGHWAY / MARATHON STAMFORD ROAD (INTERSECTION ID 7.20) - SHEET 2 OF 2
DATUMS: GDA20 - MGA54
CLIENT No. CU2
DRAWING No. CU2-RI00-SKT-PAS-090-0006
REVISION A
PRINT IN COLOUR

Jan. 23, 24 - 11:07:30 Name: CU2-RI00-SKT-PAS-090-0005-0006.dwg Updated By: David McKenzie



26m B-DOUBLE ENTERING EAST/
8.8m SERVICE VEHICLE EXITING EAST
SCALE 1:500 (m)

8.8m SERVICE VEHICLE ENTERING EAST/
26m B-DOUBLE EXITING EAST
SCALE 1:500 (m)



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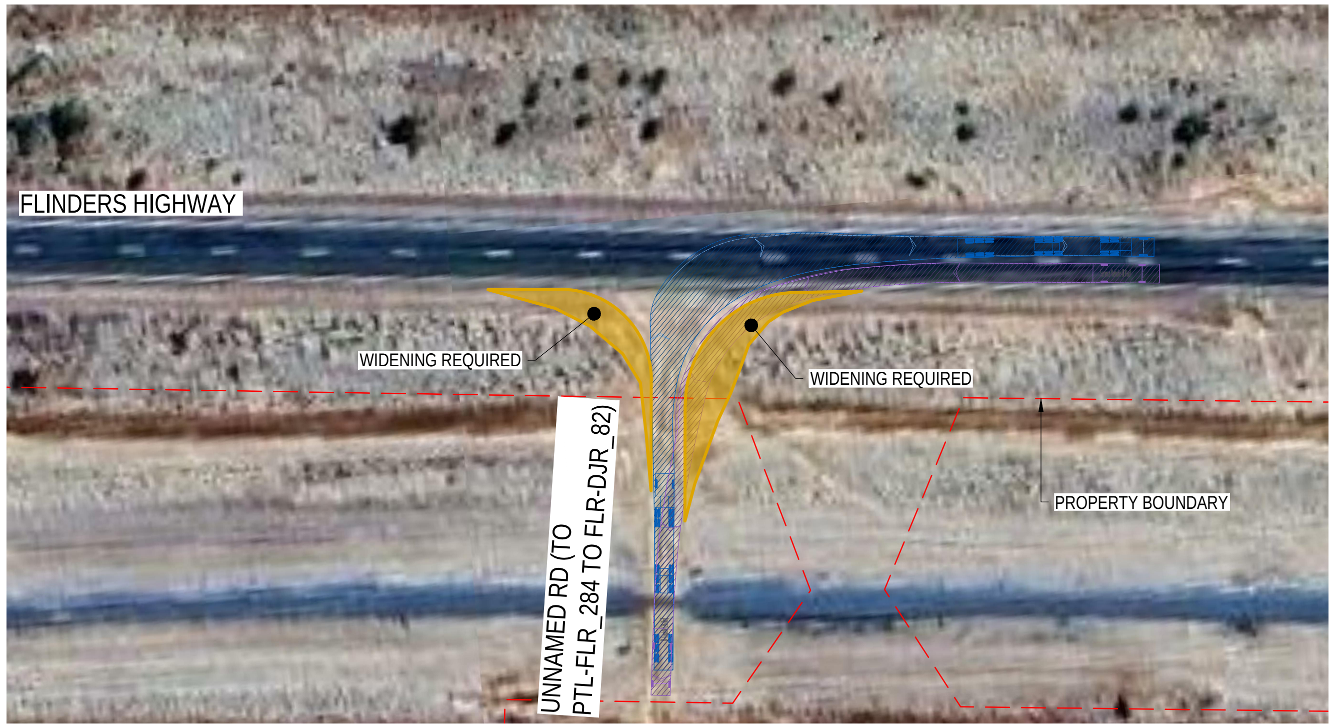
SCALE 1:500 (m)



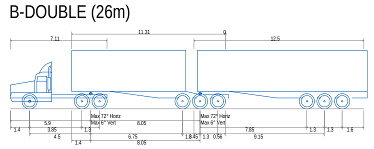
8.8m SERVICE VEHICLE ENTERING WEST/
26m B-DOUBLE EXITING WEST
SCALE 1:500 (m)

NOTES
- AERIAL IMAGERY: GOOGLE MAPS

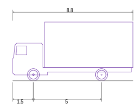
10 0 10 20 30 40
SCALE IN METRES - 1:500

VEHICLES LEGEND:

B-DOUBLE (26m)



SERVICE VEHICLE (8.8m)



P&S FORM DRG-A1 REV 29

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SCALE (PLOTTED FULL SIZE): 1:500 (m)
SHEET SIZE: A1

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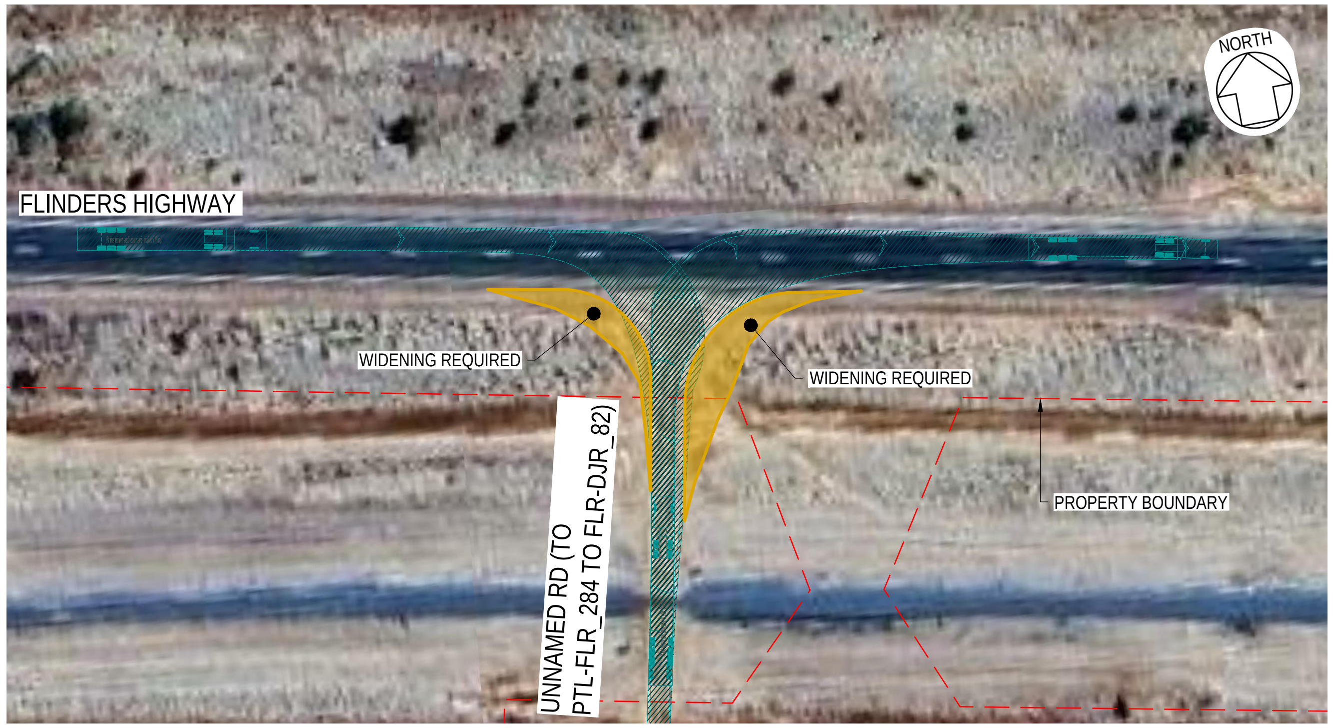
CONTRACT TITLE: COPPERSTRING 2032 TRAFFIC STUDIES
STATUS: INFORMATION ONLY

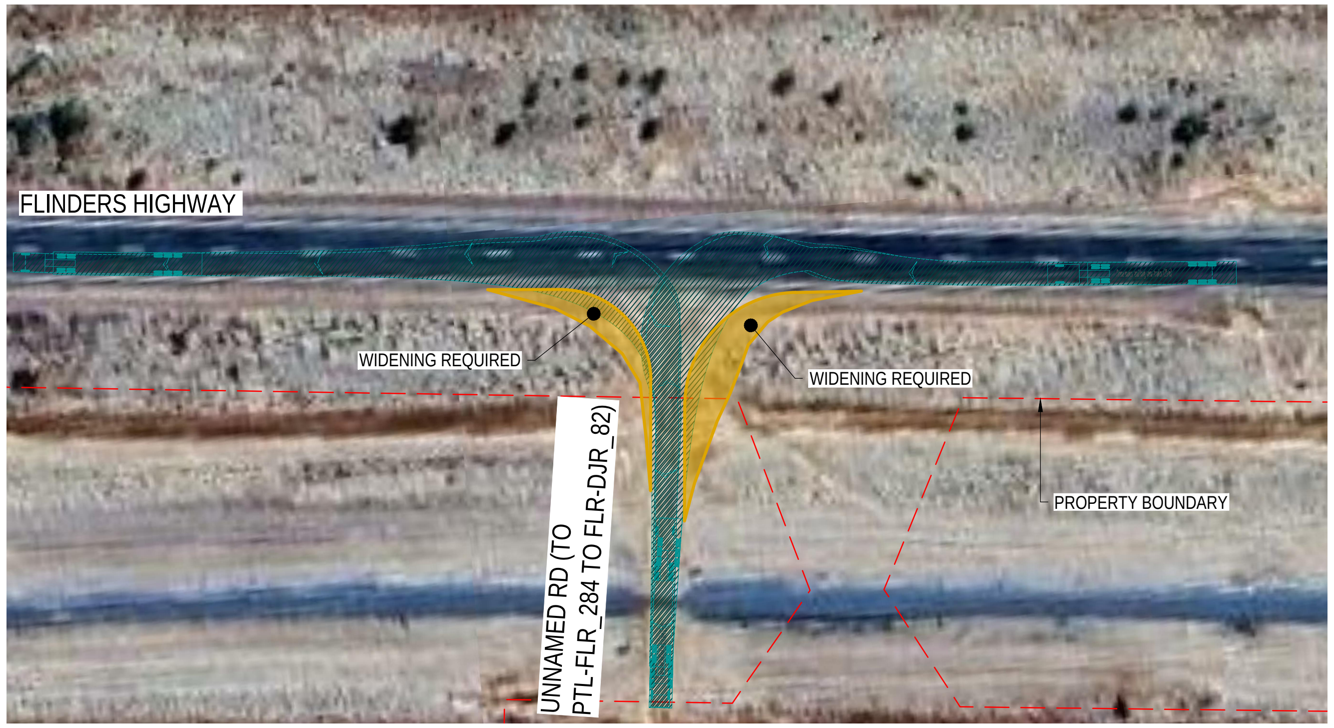
DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT
FLINDERS HWY / UNNAMED RD (OFF FLINDERS HWY TO PTL-FLR_284 TO FLR-DJR_82) (INTERSECTION ID 7.19) - SHEET 1 OF 2

DATUMS: GDA20 - MGA54
CLIENT No. CU2
DRAWING No. CU2-RI00-SKT-PAS-090-0016
REVISION A
PRINT IN COLOUR

Jan. 23, 24 - 10:58:04 Name: CU2-RI00-SKT-PAS-090-0016-0017.dwg Updated By: David McKenzie

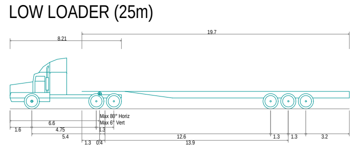


25m LOW LOADER VEHICLE SWEPT PATH - INSET 1
SCALE 1:500 (m)



25m LOW LOADER VEHICLE SWEPT PATH - INSET 2
SCALE 1:500 (m)

VEHICLES LEGEND:
LOW LOADER (25m)



NOTES
- AERIAL IMAGERY: GOOGLE MAPS

10 0 10 20 30 40
SCALE IN METRES - 1:500

REFERENCE FILES ATTACHED: CU2-PW00-XRF-PAS-090-1950-GDA20_Z54; CU2-PW00-XRF-PAS-090-1125-GDA20_Z54; CU2-PW00-XRF-PAS-090-1850-GDA20_Z54

P&S FORM DRG-A1 REV 29

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STATUS: INFORMATION ONLY

DRAWING TITLE: TRAFFIC IMPACT ASSESSMENT
FLINDERS HWY / UNNAMED RD (OFF FLINDERS HWY TO PTL-FLR_284 TO FLR-DJR_82) (INTERSECTION ID 7.19) - SHEET 2 OF 2
DATUMS: GDA20 - MGA54
CLIENT No. CU2
DRAWING No. CU2-RI00-SKT-PAS-090-0017
REVISION A
PRINT IN COLOUR

Jan. 23, 24 - 10:58:18 Name: CU2-RI00-SKT-PAS-090-0016-0017.dwg Updated By: David McKenzie

Road Condition Photos

Appendix C

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Traffic Impact Assessment – FSC

Road condition photos

Prepared for

CPB Contractors Pty Ltd

Client representative

Nick Poon

Date

26 September 2023

Rev00

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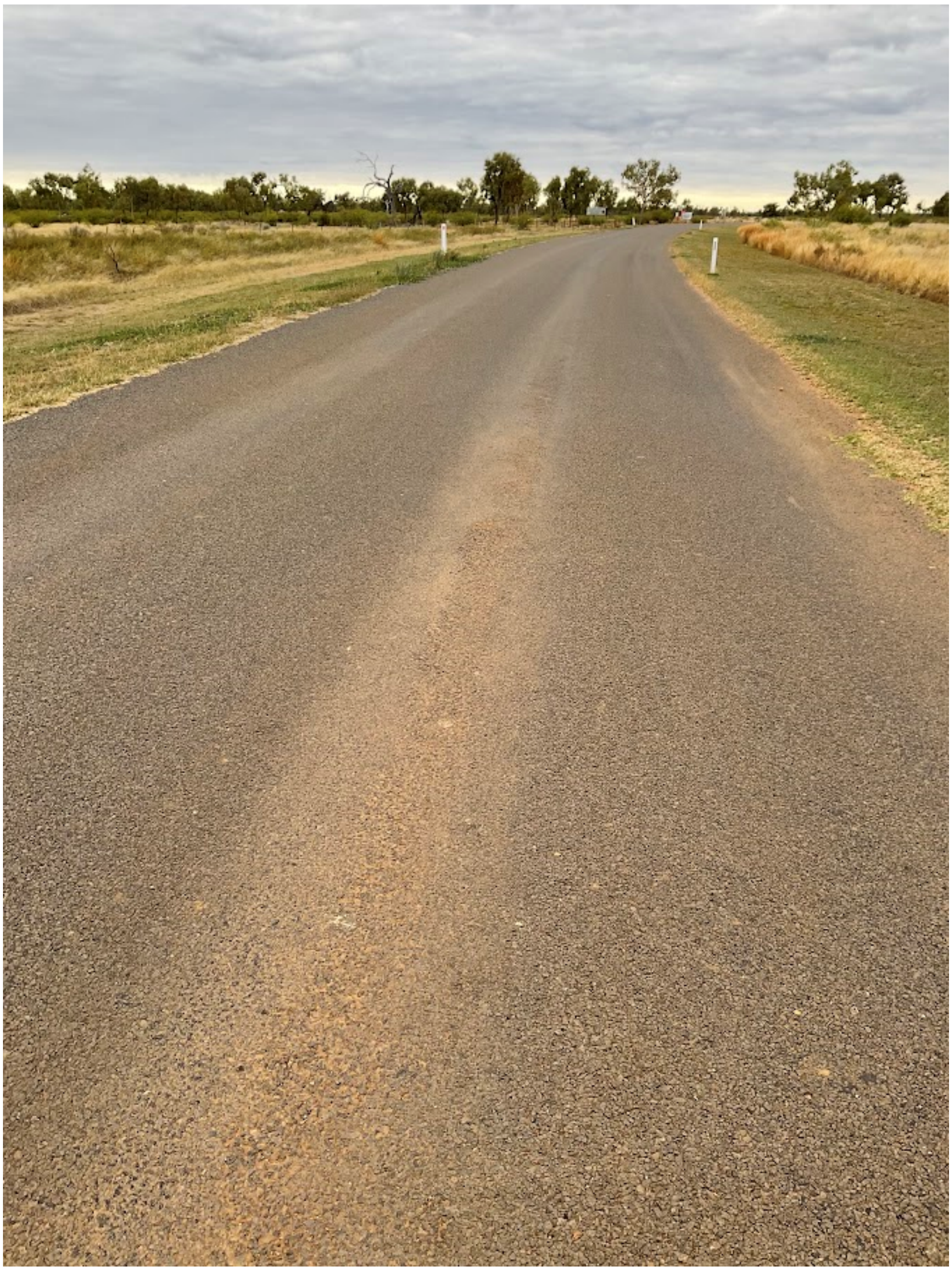

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Traffic Impact Assessment – FSC

Road condition photos

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Responses to Powerlink Comments

Appendix D

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Flinders Shire Council

Document	Page	Part	Powerlink Comment	JV Response
T-P.22.1676-TRA-REP-001-FSC-Rev00	4	1.3	"The Project traverses 7 Local Government Areas (LGAs): · Burdekin Shire ~~City of Townsville~~ … It is noted that the project also traverses through the City of Townsville ~~Burdekin Shire Council~~ LGA but only uses TMR roads through this LGA."	The below is correct. Within the Townsville City Council LGA, the Project route includes: Archer Street (Council road) Benwell Street (Council road) Hubert Street (Council road) Townsville Port Road (TMR road) Flinders Highway (TMR road) Within Burdekin Shire Council, the Project route includes: Bruce Highway (TMR road) Ayr Dalbeg Road (TMR road) Ayr Ravenswood Road (TMR road)
T-P.22.1676-TRA-REP-001-FSC-Rev00	5	Table 2	Should remove reference to "Woodstock Substation" … now integrated with Mulgrave Substation	Updates were made in the Rev01 TIA report
T-P.22.1676-TRA-REP-001-FSC-Rev00	5	Table 3	Should normalise use of "Mt Isa" and "Mount Isa" … just use "Mount Isa"	Updated the Rev01 TIA reports
T-P.22.1676-TRA-REP-001-FSC-Rev00	18	2.2.13	Are the data referenced in "Data supplied by the JV or third parties is assumed to be correct, unless otherwise stated" listed anywhere?	A list of supplied data was added to the Rev01 TIA report
T-P.22.1676-TRA-REP-001-FSC-Rev00	63-65	Table 43	Dates appear to be based on July 2023 non-binding iterim submission … how valid are these … what is the impact if they vary?	The dates have no influence on the traffic assessment and are purely for informational purposes for local Councils with regards to timing, these can be amended as required.
T-P.22.1676-TRA-REP-001-FSC-Rev00	84-85	Table 50	Driveway 43.A missing from table	Added in the Rev01 report
T-P.22.1676-TRA-REP-001-FSC-Rev00	90-91	Table 52	Includes a column "Additional management measures" which is not included in the "Road condition risk assessment" in any of the other LGA or TMR TIA reports	Additional management measures were added in most TIA reports by the Rev01 version. It is acknowledged that the column is in different locations in the table, these have been streamlined for consistency in the Rev02 TIA reports.
T-P.22.1676-TRA-REP-001-FSC-Rev00	97	5.7.1	"It is recommended that prior to construction phase commencing, in consultation with the relevant road authority, vegetation is cleared at the locations identified as having poor sight distances by the JV. It is recommended that these locations are then checked periodically, and vegetation cleared where necessary in consultation with the road owner. Once construction commences, the periodic checks are to be undertaken by the JV. The JV should consult with the road owner to determine whether they would like a representative present at the periodic checks." Is this interfacing captured anywhere?	Road Authority and Stakeholder interfacing is captured within the Management Plans for the project, which include the Road Use Management Plan.
T-P.22.1676-TRA-REP-001-FSC-Rev00	97	5.7.2	"It is recommended that prior to construction, a detailed dilapidation survey be performed. Areas of particular concern should be rectified and recorded as such in negotiation with the relevant road authority. It is recommended that the access routes are continually monitored by construction work drivers, with poor/ degrading conditions reported as part of their daily driver records. Any specific issues should be closely monitored and rectified where necessary. Periodic surveys from the construction contractor should be undertaken to mitigate the risk of drivers not reporting issues." Is this interfacing captured anywhere?	Road Authority and Stakeholder interfacing is captured within the Management Plans for the project, which include the Road Use Management Plan.
T-P.22.1676-TRA-REP-001-FSC-Rev00	98	5.7.3	"It is recommended that prior to construction, all gravel roads along the access route are assessed for areas of poor condition and recorded as part of a dilapidation survey. Areas of particular concern should be rectified and recorded as such in negotiation with relevant road authority. It is recommended that the gravel roads are continually monitored by drivers, with poor/ degrading conditions reported as part of their daily driver records. Any specific issues should be closely monitored and rectified where necessary. Additional surveys by the contractor should be undertaken to mitigate the risk of drivers not reporting issues." Is this interfacing captured anywhere?	Road Authority and Stakeholder interfacing is captured within the Management Plans for the project, which include the Road Use Management Plan.
T-P.22.1676-TRA-REP-001-FSC-Rev00	99	5.8	"OSOM vehicles which require a special permit will be required for transportation and delivery of the modular buildings and other oversized electrical equipment at the substations." Different wording to FSC and RSC… this is more appropriate. Is this interfacing captured anywhere? Is this enough for DTMR and OCG to approve MID? What do we need to do to find out if any of those Points of Interest (3.1.4) need upgrading … and have those upgrade done before they impact/ delay the project	OSOM wording has been updated in the Rev00 TIA. Discussion with Councils regarding ability to drive over structures or structural inspection will be required. Road Authority and Stakeholder interfacing is captured within the Management Plans for the project, which include the Road Use Management Plan. The JV will commence the review of OSOM routes vs existing structures as soon as practical i.e. once design is mature enough to understand dimensions/ weights of OSOM elements, the locations (destinations) of these elements, to then inform route selection, OSOM vehicle selection and review against capacities/ dimensions of existing structures.
T-P.22.1676-TRA-REP-001-FSC-Rev00		App C	many drawings show pavement widening required at interscetion … not mentioned anywhere in body of report	This is included in the "At intersections" heading in section 5.1.1
T-P.22.1676-TRA-REP-001-FSC-Rev00		App C	includes intersections not listed in 5.1.1 Prairie Nuttaburra Road - Woodbine Access Flinders Highway/ Unnamed Road (FID 7) Flinders Highway/ Maxwelton Kynuna Road	Wording has been updated in the Rev02 TIA report and Appendix C so that the report content at the appendix are matching.
T-P.22.1676-TRA-REP-001-FSC-Rev00		App C	report marked as "For Submission" but all drawings stamped "UNDER REVIEW"	"UNDER REVIEW" has been removed from the Appendix C drawings the Rev02 TIA report

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Traffic Impact Assessment – FSC

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