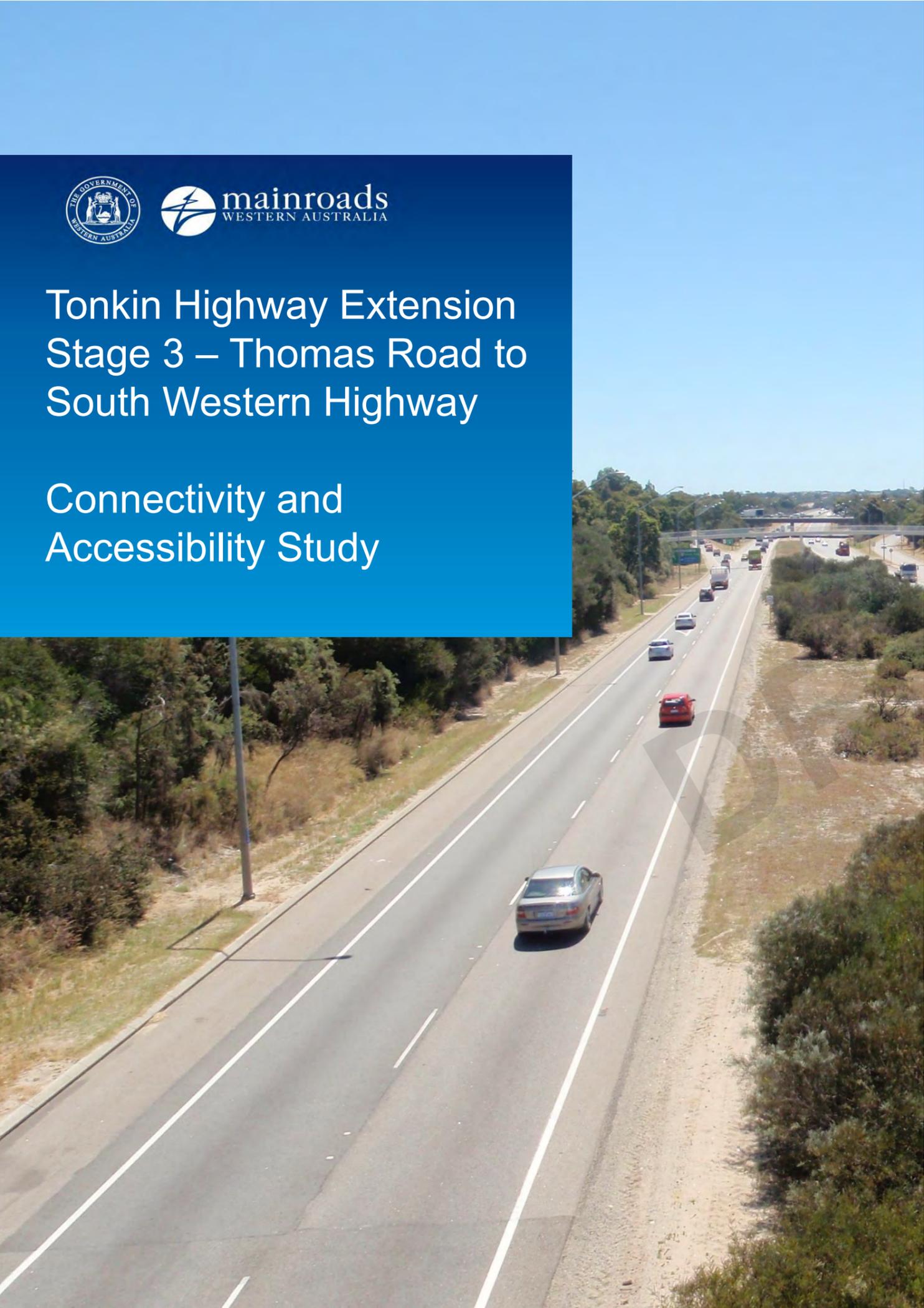




# Tonkin Highway Extension Stage 3 – Thomas Road to South Western Highway

## Connectivity and Accessibility Study



### Document Control

This document has the following amendment history:

Version	Date	Author	Amendment
DRAFT 1	02/07/2021	JH, SL, DB, BR, TS	First Draft

### Approvals

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# Executive summary

The *Tonkin Highway Extension Stage 3* has long been identified as a future project to create a high standard north-south transport link and improve freight efficiencies in Perth's Eastern corridor. With the implementation of the project, connectivity and accessibility is expected to be impacted for residents and visitors accessing both local and regional destinations. Impacts to the movement network are expected in the form of the closure of local access roads and regional distributors adjacent to the Extension, impediments to existing desire lines to key destinations and barriers to recreational and equestrian trails.

The purpose of the Connectivity and Accessibility Study is to identify measures or interventions for the Tonkin Extension project that will meet the project objectives outlined below.

## Objectives

- Maintain and improve connectivity and travel time where possible to key local and regional destinations
- Facilitate existing and proposed public transport operations within the study area
- Provide safe, convenient and comfortable access for active transport users while reducing potential conflict points with vehicles
- Retain existing connectivity to support regular recreational and equestrian activity.



In order to meet these objectives for the project, a six phase approach was undertaken to assess the existing context, establish the baseline (do nothing) scenario, develop options and then agree on the final options to be recommended. This is outlined in the flow diagram (left).

Throughout the development of the study, a total of four workshops were held across the project phases with stakeholders from Main Roads, Department of Transport, the Shire of Serpentine Jarrahdale and DFES. These workshops were held to generate, assess and agree the options for the study.

In total, 84 long list options were generated. This was filtered to 57 short list options through a fatal flaws analysis process. Using a multi-criteria assessment and accessibility modelling, a final 32 options were selected for recommendation. These options are to either be incorporated into the THE Stage 3 design, or developed as part of a separate project – this is summarised in the table (right).

Option #	Incorporate into Tonkin Extension Project Case design	Incorporate into Tonkin Extension Ultimate Case design	Incorporate into Thomas Road Duplication design	Incorporate into Freight & Rail realignment design	To be determined
1.2			✓		
1.4	✓	✓	✓		
2.7	✓	✓			
3.4		✓	✓		
3.8	✓	✓			
3.9			✓		
4.5		✓			
5.1	✓	✓			
6.2	✓	✓			
6.3	✓	✓			
7.2	✓				
7.3	✓				
8.2		✓			
8.5		✓			
9.2	✓	✓			
10.2	✓	✓			
11.2	✓	✓			
11.3	✓	✓			
12.1					✓
13.2	✓	✓			
14.4	✓	✓			
14.5	✓	✓			
15.1				✓	
16.4				✓	
17.2	✓	✓			
17.5	✓	✓			
18.2	✓	✓			
19.2	✓	✓			
20.1	✓	✓			

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## Abbreviations

Main Roads	Main Roads Western Australia
DoT	Department of Transport
DPLH	Department of Planning, Lands and Heritage
PTA	Public Transport Authority
SoSJ	Shire of Serpentine-Jarrahdale
MCA	Multi-Criteria Analysis
RAV	Restricted Access Vehicle
LPS	Local Planning Strategy
DSP	District Structure Plan
DIA	Development Investigation Area
LGA	Local Government Area
SA2	Statistical Area Level 2
GIS	Geographic Information System
PSP	Principal Shared Path
BTC	Byford Town Centre

# 1 Introduction

Main Roads WA is planning to extend Tonkin Highway (H017) from Thomas Road (H038) in Oakford to South Western Highway (H009) in Mundijong. The extension of the highway includes 5 intersections including Thomas Road, Orton Road, Bishop Road, Mundijong Road and South Western Highway and the potential closure of a number of existing intersections and accesses along the corridor. The project study area is located within the Shire of Serpentine Jarrahdale (SoSJ) in entirety.

In addition to these works, it has also been proposed to investigate the extension of Tonkin Highway further south of Mundijong Road to intersect with Lowlands Road, as well as consideration of the Kwinana South Western Line 13 Freight Rail Realignment (Freight Rail Realignment).

Current planning includes upgrading of the existing highway to a freeway standard. The extension of Tonkin Highway south of Thomas Road currently considers two stages, an intermediate project case and a final ultimate case, as defined below:

- The project case design consists of 2 lanes in each direction from Thomas Road to South Western Highway. Current planning for the project case proposes at-grade intersection treatments at Thomas Road, Orton Road, Mundijong Road and South Western Highway, and interchange treatment (grade separated) at Bishop Road. This has been confirmed by the Main Roads Steering Committee at the meeting on 28<sup>th</sup> May 2021.
- A grade separation is proposed over the

existing Perth to Bunbury (South West Main Line) railway line south of Mundijong Road.

- The ultimate case consists of 3 lanes in each direction between Thomas Road and Mundijong Road, and 2 lanes in each direction between Mundijong Road and South Western Highway. In the ultimate case all intersections will be grade separated. An additional grade separation is also proposed over the existing Perth to Bunbury (South West Main Line) railway line south of Mundijong Road.

Arup have been engaged to undertake a Connectivity and Accessibility Study to analyse impacts caused by the Project Case and the Ultimate Case Tonkin Highway Extension. This review aims to identify and propose solutions to improve accessibility for all transport modes within the local area.

This Connectivity and Accessibility Study will build on, and be informed by, the recently completed Tonkin Highway Extension Ultimate Case Multi-Criteria Analysis (MCA) and currently in progress Tonkin Highway Project Case MCA.

## 1.1 Purpose of study

The Tonkin Highway Extension has long been identified as a future project to create a high standard north-south transport link and improve freight efficiencies in Perth's Eastern corridor. With the implementation of the project, connectivity and accessibility is expected to be impacted for residents and visitors accessing both local and regional destinations. Impacts to the movement network are expected in the form of the closure of local access roads and regional distributors adjacent to the extension,

impediments to existing desire lines to key destinations and barriers to recreational and equestrian trails.

The purpose of the Connectivity and Accessibility Study is to identify measures or interventions for the Tonkin Extension project that will meet the project objectives through the following outcomes.

## Objectives

- Maintain and improve connectivity and travel time where possible to key local and regional destinations
- Facilitate existing and proposed public transport operations within the study area
- Provide safe, convenient and comfortable access for active transport users while reducing potential conflict points with vehicles
- Retain existing connectivity to support regular recreational and equestrian activity.

## Outcomes

- A rigorous assessment of connectivity and accessibility impacts, options for improvement and recommended treatments for vehicle, pedestrian, cyclist and equestrian movements for the Tonkin Highway Extension Stage 3 project; utilising geospatial analysis, fatal flaw assessments and multi-criteria analysis.
- An agreed list of solutions to be recommended for further investigation.
- Robust engagement with relevant Main Roads personnel and other stakeholders throughout the development of the analysis to ensure strong buy-in, and agreement on how connectivity and accessibility will be addressed for the project.
- The thoroughness of the analysis at this earlier design stage will minimise rework and redesign at later design stages, which are highly likely to impact budget and programme if deferred.
- Analysis and reporting that can be presented to the public in engagement sessions to demonstrate that a thorough and considered analysis has been conducted for the connectivity and accessibility outcomes for all modes of transport, and how the decisions and solutions were determined.

### 1.2 Study area

The study area, as shown in Figure 1, is bordered by South Western Highway to the east and interfaces with Mundijong Road at its southern tie-in extents. The area comprises district centres in Byford and Mundijong and emerging residential expansion/ investigation area in Cardup.

The wider Local Government Area (LGA) of Shire of Serpentine-Jarrahdale (SoSJ) was home to just over 26,000 people as recorded by the 2016 census (ABS, 2016). Based on the same data, the population of the Byford Statistical Area Level 2 (SA2) was close to 15,000 people, with an additional 6,300 people living within the Mundijong SA2. With Cardup lying within the Mundijong SA2 area, the approximate population at the time of this Census was around 21,300 people.

Servicing the residents of the study area are a number of community facilities and destinations such as employment centres, schools, retail centres, emergency services, equestrian centres and recreational centres/trails. The study will focus around the local areas adjacent to the proposed extension, while considering connections to key destinations; and wider linkages to regional employment hubs and activity centres.



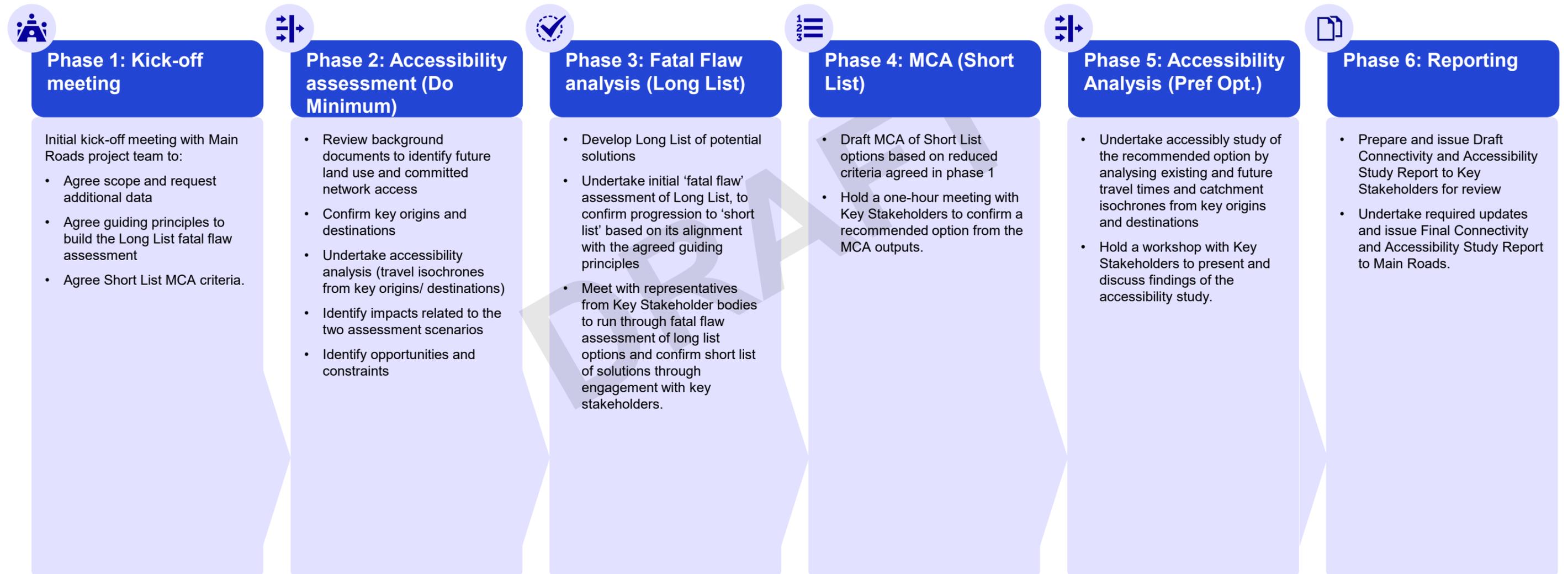
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**Figure 1** ▶  
Study area

## 2 Project approach

### 2.1 Methodology

The project methodology is outlined in Figure 2 below.



**Figure 2**   
Methodology

## 3 Background documents and stakeholder engagement

### 3.1 Background documents

In order to ensure that the assessment, outcomes and recommendations of the study are cognisant of strategic and local planning documentations, policy and plans, a review of existing documents was conducted. A summary of the relevant sections from local planning documents are provided in this section. The strategies and policies reviewed include:

- The Shire of Serpentine-Jarrahdale (SoSJ) Local Planning Strategy (LPS)
- Byford District Structure Plan (DSP)
- Mundijong DSP
- SoSJ Walking and Cycling Plan
- SoSJ Equine Strategy
- SoSJ Horse Trails Maps for Tonkin Highway Extension.
- Department of Transport (DoT) Long Term Cycling Network Plan

#### 3.1.1 SoSJ LPS

The Shire of Serpentine-Jarrahdale Local Planning Strategy (LPS) was prepared in 2019 and provides a coordinated strategic planning framework to summarise the long-term vision and guidance for future growth and development of the Shire's Local Government boundary. The strategy identifies issues, constraints and objectives for the future development of the shire, with a key focus on the settlements of Byford, Mundijong, Serpentine and Jarrahdale, in facilitating an expected population of approximately 68,000 people in 2036 and 110,000 people in 2050.

This would translate into an additional 42,000 people over the next 15 years and an additional 84,000 people over the next 29 years.

The proposed Tonkin Highway extension traverses the northern section of the LPS area, intersecting the Oakford/ Oldbury areas on the west and the Byford/ Mundijong areas on the east before connecting with South Western Highway at Jarrahdale Road. The extension is highlighted by the LPS as an encouraged improvement to the existing transport network in the area, minimising the impact of freight on urban areas and sensitive land uses while also improving regional connections for residents to major employment opportunities and activity centres.

While the LPS is a strategy viewing the area holistically, focussing on largely regional issues and constraints between settlements, improving the amenity and efficiency of short trips by public transport and active transport is an additional objective of the plan. On a local level, the Tonkin Highway extension is anticipated to create a constraint to creating an interconnected and accessible cycling and pedestrian network, while also severing popular equine trails. These possible impacts are not highlighted as a constraint to achieving the strategies transport objectives and should be considered in this study in conjunction with other key objectives from the LPS.

#### 3.1.2 Byford DSP

The Byford DSP was prepared in 2018 to replace the original 2009 DSP and provides high-level strategic guidance on future planning and development in the locality of Byford. The DSP considers a number of LSP and Development Investigation Areas (DIA) that provide more detailed guidance on planning local areas. The proposed Tonkin Highway Extension traverses the DSP area between the landholdings of Oakford and Byford, intersecting the western portion of Cardup.

The plan proposes an outlook for future development in facilitating the growth intended by the Shire's long-term growth targets of approximately 50,000 people by 2050 in Byford. Proposed development highlighted by the plan, concentrates activity and density within and around the Byford Town Centre (BTC) to R40-100 within the immediate town centre, including an additional increase in area of the centre. This is shown by the situation of all existing LSPs within the suburb of Byford, on the east of Hopkinson Road and the proposed Tonkin Highway extension. Identified DIA's are also situated on the eastern portion of the DSP area, in relation to the alignment of the Tonkin Highway extension.

While the extension of the Tonkin Highway will release the concentration of heavy vehicles within the BTC, connections from Oakford and the western portion of Cardup will be greatly impacted. In line with the South Metropolitan Peel Sub-Regional Framework, the DSP recommends upgrades to the future regional road network, including upgrading the hierarchy of east-west route Abernathy Road to a local distributor on the west of the extension.

This is however the only improvement to capacity for all transport modes on the west of the extension, increasing the risk of isolating these largely residential and equine areas from the BTC and existing equestrian and trotting areas.

For the purpose of this accessibility study, proposed development guidance of the Byford DSP will be considered with a key focus on recommending improved access for residents on the west of the extension in providing access for all transport modes to major destinations.

#### 3.1.3 Mundijong DSP

The Mundijong DSP was prepared in 2018 to replace the original 2011 DSP following the release of the South Metropolitan and Peel Sub-Regional Framework, and provides high-level strategic guidance on future planning and development in the locality of Mundijong. The DSP considers a number of Local Structure Plans (LSP) and Development Investigation Areas (DIA) that provide more detailed guidance on planning and development within existing and future local areas. The proposed Tonkin Highway Extension severs the landholding of Mundijong between Bishop Road and Mundijong Road just east of Adams Street, while also intersects part of Mardella, severing a northern section, north of Lampiter Drive, from the south.

The plan proposes an outlook for future development in facilitating the growth intended by the Shire's long-term growth targets of approximately 50,000 people by 2050 in Mundijong. Proposed development highlighted by the plan, concentrates density of up to R40-100 around the area's two district centres in Mundijong and Whitby, with further density surrounding two neighbourhood centres. In addition, a development framework for the Mundijong Industrial Area situated on the west of the Tonkin Highway extension reserve between Bishop Road and Mundijong Road is included in the plan. Three DIA's have also been included in the plan, with two areas situated north of Bishop Road on both sides of the Tonkin Highway and the remainder located south of Watkins Road and north of Stanley Road.

The proposed Mundijong Industrial Area is set to leverage off the extension of the Tonkin Highway by providing direct access to a considerable range of destinations regionally. Yet, the plan also recognises the challenge of implementing access improvements and amenity buffers on the western edge of the Mundijong landholding while also investigating the impacts of the future Freight Rail Realignment.

### 3.1.4 SoSJ Walking and Cycling Plan

The Shire of Serpentine-Jarrahdale's Walking and Cycling Plan was prepared in 2020 and provides an aspirational interim and long-term active transport network for the LGA with an attached implementation program for individual projects. The Plan was developed in alignment with the DoT's Perth & Peel Long-Term Cycle Network Plan and suggests generally the same recommendations.

The key objectives of the plan were to:

- Complete key missing links
- Avoid duplication of infrastructure
- Ensure works by others contribute to the development of the network
- Focus on local improvements close to major trip attractors and generators (i.e. schools, town centres, employment hubs and key tourism/ activity nodes).

Routes have been recommended comprising three categories: primary, secondary and local; distinguishing the type of investment and giving an indication of the amenity provided. Primary routes have been recommended adjacent to major distributors, secondary routes between urban centres and local routes have been given a recreational and short commute focus between community facilities, shops and residential areas. It has been recommended that all new cycling infrastructure is to be constructed off-road but within the road reserve to both increase safety for users and avoid/mitigate the purchase of privately owned land. This also ensures users benefit from direct connectivity, as well as a legible outcome.

Primary routes have been recommended along the north-south distributor of Soldiers Road, with another primary route along the Tonkin Highway extension connecting with the existing PSP which currently terminates at Thomas Road. Secondary routes have been recommended along the east-west distributors of Thomas Road, Orton Road, Gossage Road and Mundijong Road, all intersecting with the Tonkin Highway extension. Local routes have been recommended along numerous links within the area, intersecting with the Tonkin Highway extension at Abernathy Road, Orton Road, Learmouth Turn and Karbro Drive, with a number of routes on yet to be constructed links.

As summarised, a number of walking and cycling routes have been recommended in the plan that intersect with or be severed by the proposed Tonkin Highway extension, including four secondary routes. This study will consider the locations identified in the plan, and make recommendations regarding potential progression of links as part of the project works.

### 3.1.5 SoSJ Equine Strategy

The Shire of Serpentine-Jarrahdale's Equine Strategy was prepared in 2018 and seeks to both highlight the rich and diverse equine culture felt throughout the region and ensure continued support and development of the sector into the future. At the time of writing, the strategy found that the Shire had 3,876 registered horses and an additional estimated 4,499 unregistered horses. As part of the strategy, a community survey was undertaken asking respondents to indicate their horse riding patterns, including ownership, stabling location, most frequently used trail networks and ride distance. Of the responses, only 14% of residents didn't own a horse, with 47% of residents owning 3 or more horses, and 27% owning 2. Of those who owned a horse, 80% kept it on their property within the Shire, which suggests that most rides originate from numerous unique locations within the study area and not from pinpoint locations.

Trail, recreational and cross country riding on horse trails was indicated as the most popular involvement in equine disciplines over the 12 months prior to the strategy, with 62% and 54% of respondents indicating they undertook this kind of activity respectively. Up to 49% of people indicated they were involved in activities that required equestrian centres such as dressage, show jumping and horse clubs.

In supporting the sector, the Shire has a

comprehensive trail network totalling more than 150km, which attracts both residents of the immediate LGA and from regional locations. The trail network is split at Bishop Road into a northern and southern hub. The three most popular networks included the Darling Downs Trail Network, Jarrahdale Trails and Oakford Trails Network (North), with 57% of riders preferring a ride that is over 6km in distance. As indicated by the strategy, planning that considers an underpass at Tonkin Highway and Thomas Road to connect the north and south trails is recommended.

For the purpose of this study, the strategy suggests that the origin of rides is specific to residential addresses, and not only from stables. It is also highlighted that, consideration of both connections to equestrian centres and generally to horse trails is a key focus for the review.

**3.1.6 WACN**

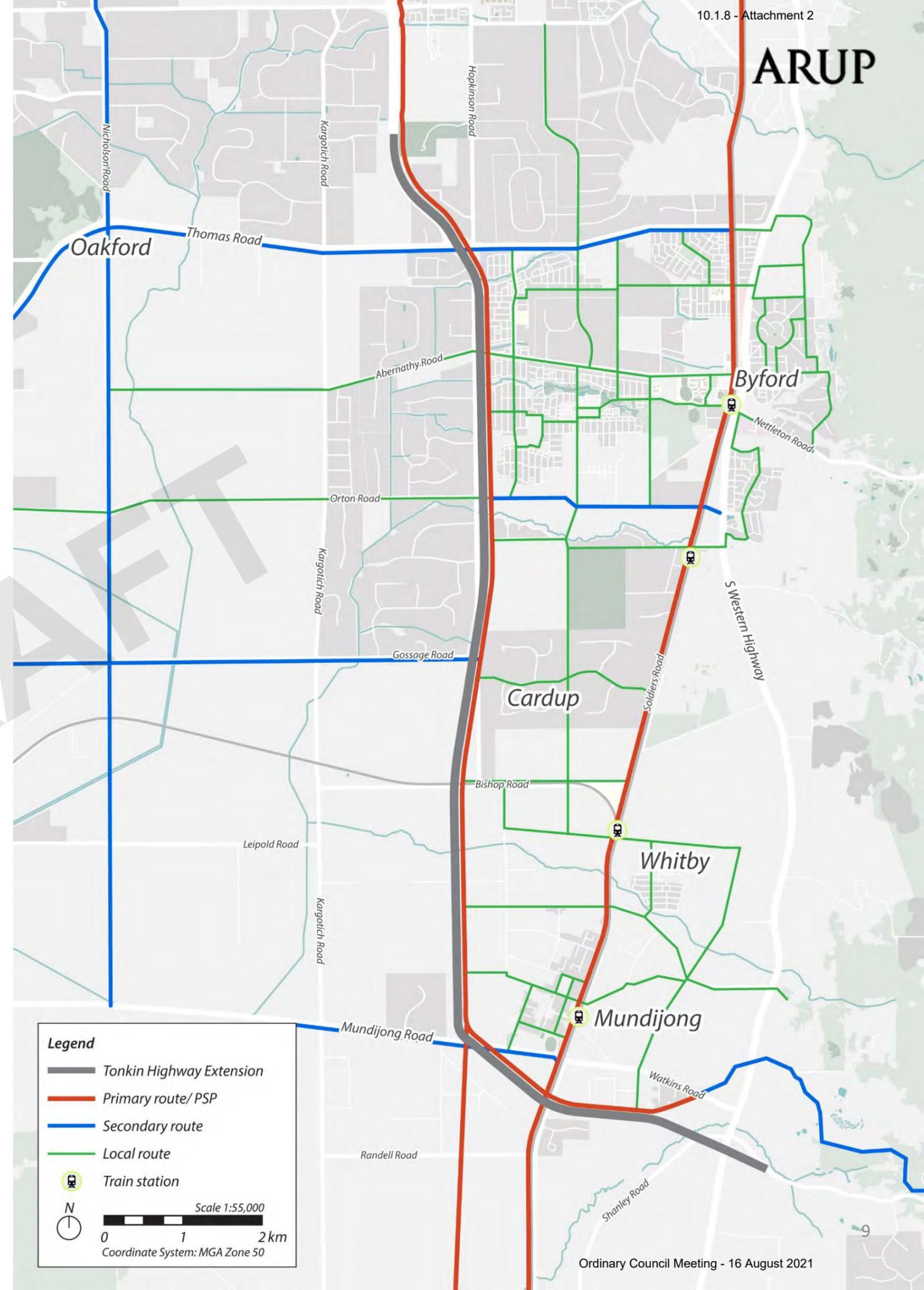
The Department of Transport's (DoT) Long Term Cycling Network (LTCN) is a plan of key planned cycling routes defined by the Western Australian Cycling Network Hierarchy. The hierarchy is arranged by route function and defines the types of activities that are anticipated to occur on those routes.

In December 2020, DoT prepared a LTCN for the Byford-Mundijong area comprising numerous strategic primary, secondary and local routes, as illustrated in Figure 3.

As shown, the strategic cycling vision for the area includes the extension of the Tonkin Highway PSP through to Watkins Road in Byford, including the provision of a PSP continuing southbound from Mundijong Road dissecting Randell Road, and a PSP heading southbound down the Byford Rail Extension. A number of secondary routes are also included providing east-west connectivity along Thomas Road, Orton Road, Gossage Road and Mundijong Road.

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**Figure 3** ▶  
LTCN for the Byford-Mundijong area (DoT, 2020)

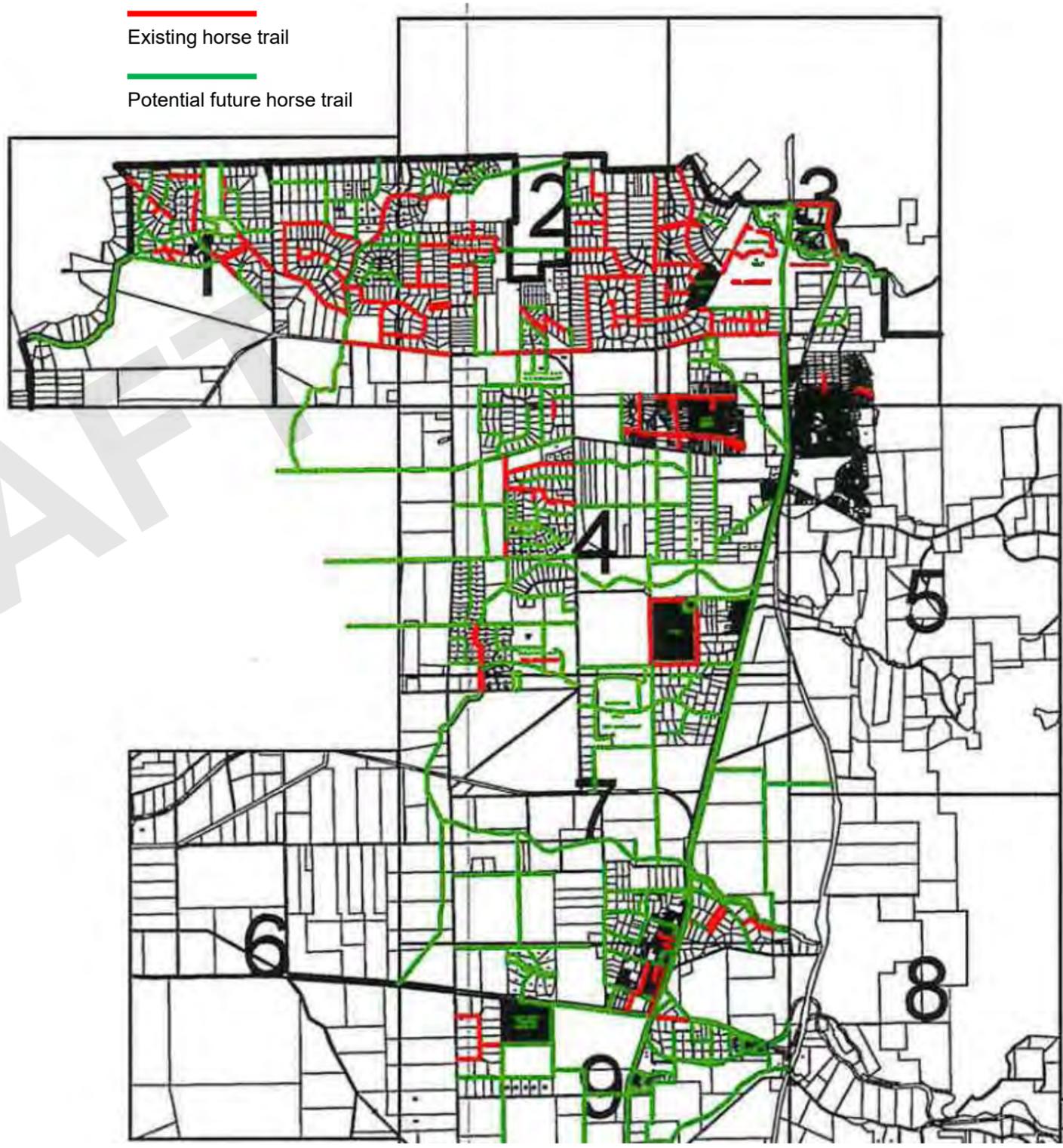


### 3.1.6 SoSJ Horse Trails Maps for Tonkin Highway Extension

In February 2020, SoSJ provided maps of existing and potential future horse trails to Main Roads to be considered as part of the Tonkin Highway Extension design and associated studies. It is the intention of this study to consider each of these proposed horse trails and assess them alongside additional solutions.

A map of the existing and potential future horse trails is provided in Figure 4 (adjacent). Key recommendations to note include proposed horse trails connecting with/ crossing the extension at:

- | West of extension  | West and east of extension   | East of extension  |
|--|--|--|
| <ul style="list-style-type: none"> <li>• Abernathy Road</li> <li>• Charolais Court</li> <li>• Orton Road</li> <li>• South of Cavanagh Close</li> <li>• North of Gossage Road</li> <li>• Scott Road.</li> </ul> | <ul style="list-style-type: none"> <li>• North of Leaver Road along waterway</li> <li>• North of Lang Road along waterway</li> <li>• Mundijong Road</li> <li>• Wright Road.</li> </ul> | <ul style="list-style-type: none"> <li>• Continuation of existing trail north of Stockmans Close</li> <li>• Continuation of existing trail north of Bullock Drive</li> <li>• Karbro Drive</li> <li>• Between extension and Cardup Nature Reserve</li> <li>• Bilya Road.</li> </ul> |



**Figure 4** ▶ Existing and potential future horse trails as recommended by SoSJ

### 3.2 Key opportunities and constraints

Below summarises an understanding of constraints and opportunities that may influence possible solutions and the extent of their impact. Figure 5 (adjacent) identifies major opportunities and constraints to feed into the guiding principles of the project.

These were also assessed in relation to their key impacts on future accessibility improvements for residents and visitors.

#### 3.2.1 Key opportunities

Given high growth and density projections for the study area, particularly within Byford and Mundijong town centres, key opportunities relate to providing safe, efficient and accessible connectivity to centres, community facilities and residential areas where possible. The following key opportunities have been identified:

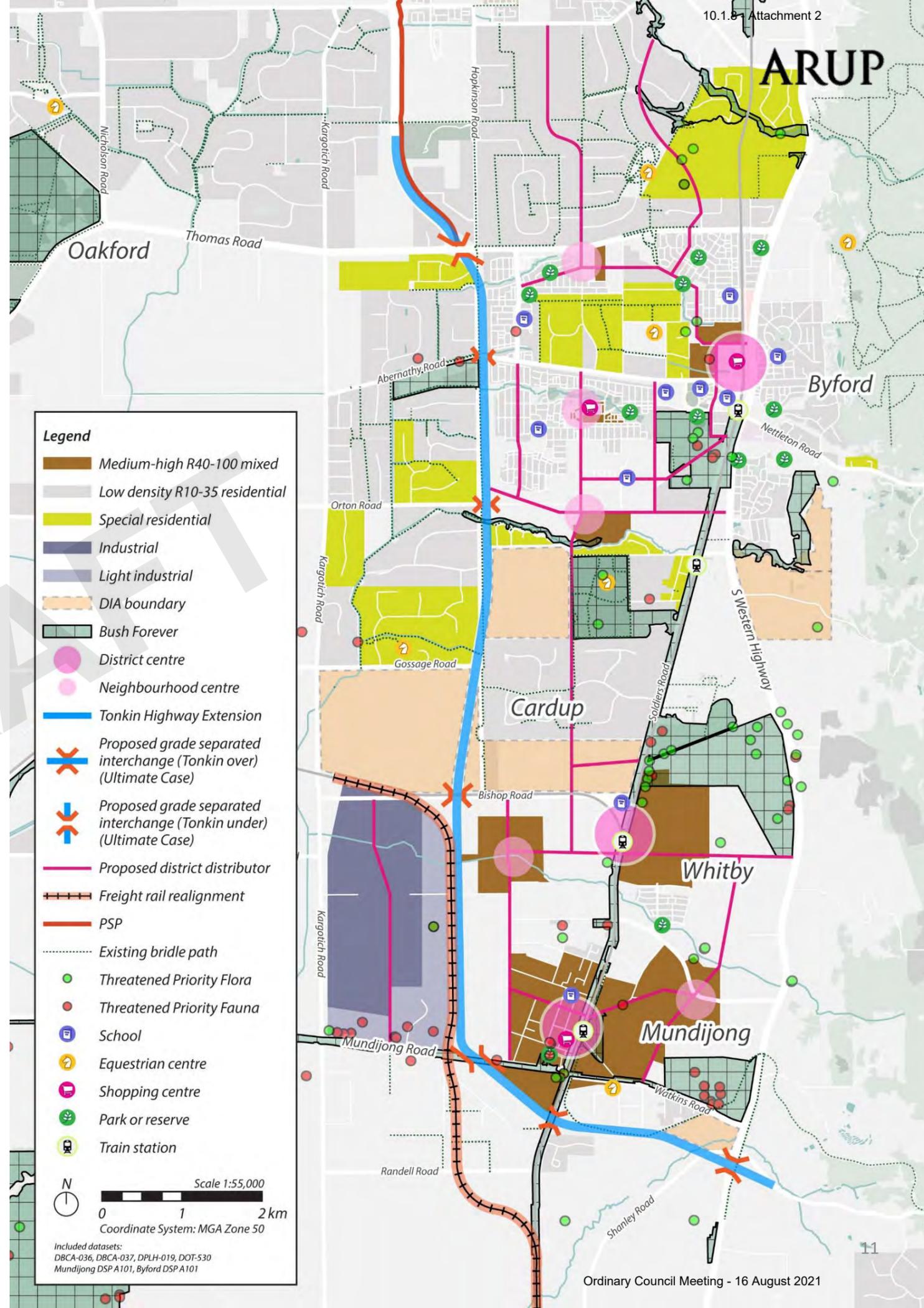
- Significant urban development has undergone planning in Byford and Mundijong, including the introduction of new district centres. The presence of a number of DIAs abutting the proposed extension will increase the likelihood of residents being located in proximity to a diverse range of facilities
- The rural to semi-rural environment allows a wide range of solutions to be investigated, including consolidated crossing points between interchanges for all modes where practical
- High potential to integrate with existing and proposed planning undertaken by the Shire, allowing solutions to be scored based on their potential to improve the wider network

#### 3.2.1 Key constraints

The key constraints to future connectivity above all is the Tonkin Highway Extension and Freight Rail Realignment. The following constraints have been identified:

- Given vehicle height constraints (10x10m High Wide Loads) along the majority of the extension, crossings for all modes must be achieved through an underpass of Tonkin Highway
- Between interchanges, at-grade crossings are restricted for active transport and equine users
- Proposed infrastructure corridors will leave residential catchments isolated from the surrounding network.

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**Figure 5**   
Key opportunities and constraints

### 3.2 Community engagement

As part of the wider engagement for the Project, the community provided comment on the extension design proposals through two different platforms; one reaching the general public via a Facebook advertisement for the project and the other through a 'BangTheTable' online survey.

A limitation of the Facebook comments was a lack of categorisation into user types (i.e. road users, cyclists, pedestrians, equine), however assumptions could be drawn based on their concerns. The BangTheTable survey on the other hand asked specifically for respondents interests in the project. This indicated that the highest proportions of respondents were road users, residents and/ or landowners.

While respondents to the BangTheTable survey were generally in favour of the extension (322 in favour, 28 not in favour and 51 undecided), numerous concerns were raised about the potential impacts to accessibility and connectivity, particularly local connections to residential and commercial areas. Other priorities for respondents were in regards to the proposed intersection upgrade plans and safety.

Figure 6 (adjacent) shows the comments spatially, pinpointing each community comment to a location on a map. This highlights key 'issue areas' as indicated by the public and the locations that should be considered as part of the accessibility study.

Community concerns are evident at:

- The existing Hopkinson Road/ Abernathy Road intersection
- Hopkinson Road/ Thomas Road intersection
- Hopkinson Road/ Orton Road intersection

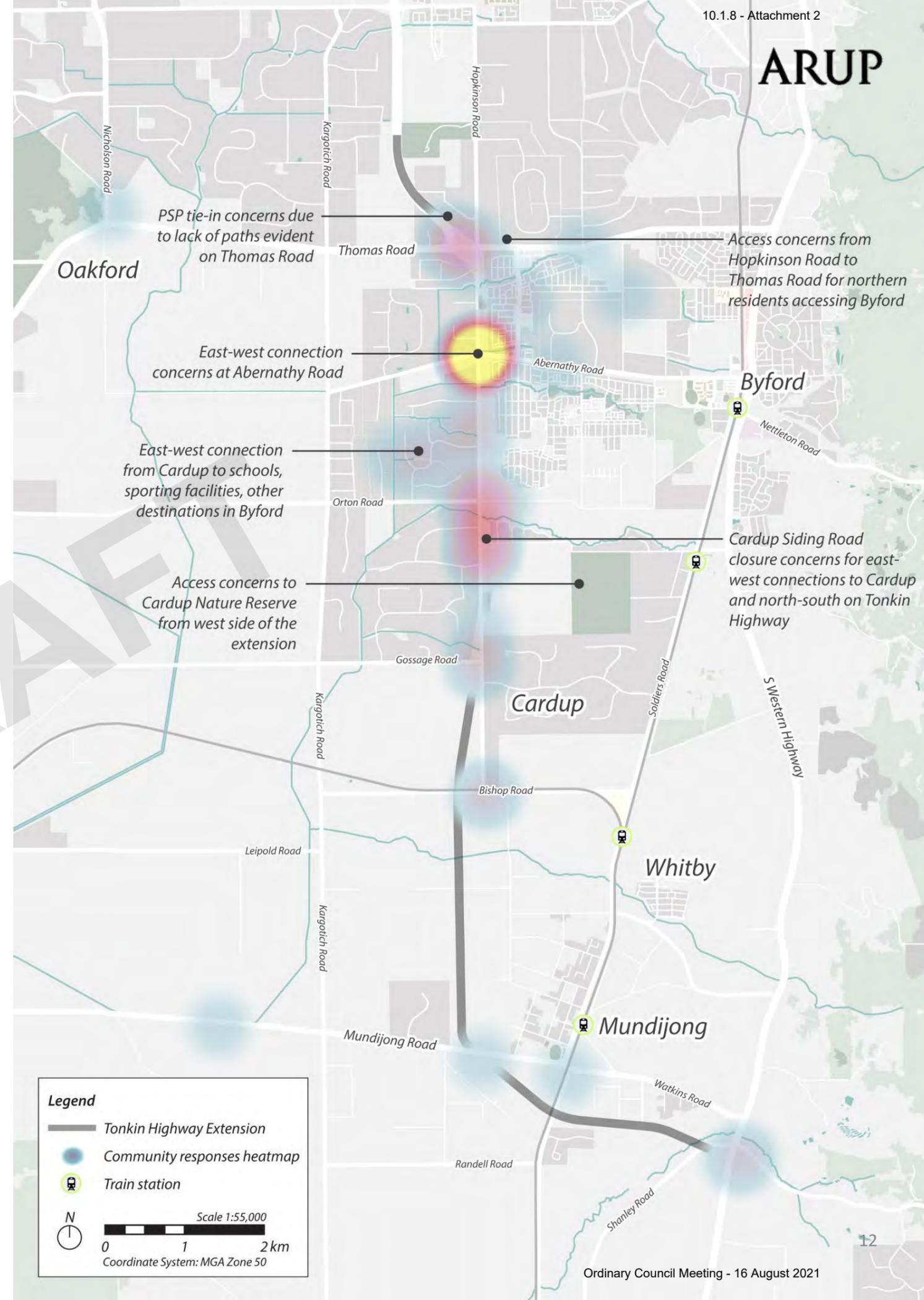
- East/ west links between Orton Road and Gossage Road
- Hopkinson Road/ Bishop Road intersection
- Along Mundijong Road in Oakford
- Within the built up residential areas of Byford.

The majority of these concerns were in reference to connectivity concerns at cul-de-sacs adjacent to the extension and safety concerns on lower order roads anticipated to receive higher traffic volumes under a modified network.

While the representation from pedestrians, cyclists and equestrian users was relatively low (53 out of 401 responses indicated active modes as an interest to their involvement in the survey) a high number of concerns were submitted, with 170 out of 401 responses with relevance to active transport. Indicating that active transport users had on average between 3 and 4 independent concerns. The majority of responses were in regard to:

- Lost east/ west connectivity between Thomas Road and Mundijong Road
- Obstruction to existing horse trail routes and popular equestrian centres
- Future connectivity to the PSP running along the east side of the extension.

**Figure 6**  Community engagement responses and concerns hotspot



## 4 Guiding principles

Informed by the project's objectives, opportunities and constraints, a set of guiding principles were developed, to assess the Long List options. The guiding principles considered all modes, split into 'must haves' and 'key considerations' in order to both align options under a fatal flaw assessment but then further assess options in their ability to facilitate additional benefits.

Options will be reviewed against the guiding principles in a fatal flaw assessment. Options that are most aligned with the principles will be progressed through to a Short List for assessment against the agreed MCA and accessibility study.

The agreed guiding principles are shown in the adjacent table.

**Table 1**  Guiding principles

Mode	Must have	Key considerations
Active transport	<ul style="list-style-type: none"> <li><input type="checkbox"/> Are paths designed in accordance with accessibility standards in terms of minimum widths, maximum grades, etc. (Guide to Road Design, Austroads 2015; DDA, 1992; Australian Standard AS1428)?</li> <li><input type="checkbox"/> Do paths follow a clear movement network along key desire lines to discourage dangerous crossing manoeuvres in unallocated/ uncontrolled locations (in line with DoT Planning and designing for pedestrians guidelines, DoT 2016)?</li> <li><input type="checkbox"/> Does the network enable use of underpasses within the original Tonkin Highway Extension design at a minimum?</li> <li><input type="checkbox"/> Does the network provide high quality infrastructure (signalised, under/ overpass) connecting key town centres and community facilities to residential estates?</li> <li><input type="checkbox"/> Does the network facilitate local connections to the PSP?</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Does the network provide direct routes without creating significant detours?</li> <li><input type="checkbox"/> Do routes cater for all skill levels, ages and abilities, avoiding challenging topography, conflicts with vehicles and respite areas?</li> <li><input type="checkbox"/> Will the corridor feel safe at all times of the day?</li> <li><input type="checkbox"/> Does the network prioritise high quality access to schools, town centres, public transport and recreational facilities?</li> <li><input type="checkbox"/> Does the network avoid hazardous locations such as heavy vehicle routes and roads with high traffic and speed?</li> </ul>
Equestrian	<ul style="list-style-type: none"> <li><input type="checkbox"/> Does the network retain existing bridle paths to support regular equestrian activity?</li> <li><input type="checkbox"/> Can dedicated crossing facilities be introduced at controlled intersections/ underpasses along the corridor?</li> <li><input type="checkbox"/> Can the route provide additional width to allow riders to give way to pedestrians?</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Can additional kerbside protection be provided between existing bridle paths and parallel roads to be used as future higher order connections (Malarkey Road, Briggs Road, etc.)?</li> <li><input type="checkbox"/> Does the network avoid hazardous locations such as heavy vehicle routes and roads with high traffic and speed?</li> </ul>
Private vehicles	<ul style="list-style-type: none"> <li><input type="checkbox"/> Does the network ensure that all residents have reasonable and convenient access to a similar level of service provided prior to the extension?</li> <li><input type="checkbox"/> Does the network retain east/ west connection to Byford Town Centre and north/ south connection to Mundijong Town Centre?</li> <li><input type="checkbox"/> Does the network provide alternative connections to higher order roads (Orton Road, Gossage Road, Abernathy Road) where connection to Hopkinson Road has been removed?</li> <li><input type="checkbox"/> Does the network ensure no residents are left isolated between the extension and the Freight Rail Realignment?</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Does the network provide/ unlock future access to identified urban growth areas?</li> <li><input type="checkbox"/> Is network legibility retained?</li> </ul>

## 5 Future connectivity impacts

Future connectivity impacts were assessed using the GIS-based Network Analyst plug-in, examining both the existing network (business-as-usual) and the modified network under the interim and ultimate Tonkin Highway Extension designs. This section will summarise the inputs into the assessment and provide outcomes.

### 5.1 Method

To assess future connectivity impacts, first, the existing network was assessed in order to build a baseline to test potential solutions. This examined approximate travel times for each mode under the existing network either from an agreed set of origins or, to an agreed set of destinations.

The network was then modified to create two additional scenarios:

- The Project Case; this included the interim Tonkin Extension design only, and
- The Ultimate Case; this included the ultimate Tonkin Extension design and the proposed Freight Rail Realignment.

Both scenarios were then tested using the same origins and destinations to examine the change in travel time and highlight travel directions in which accessibility was clearly affected and instances where the guiding principles were not satisfied.

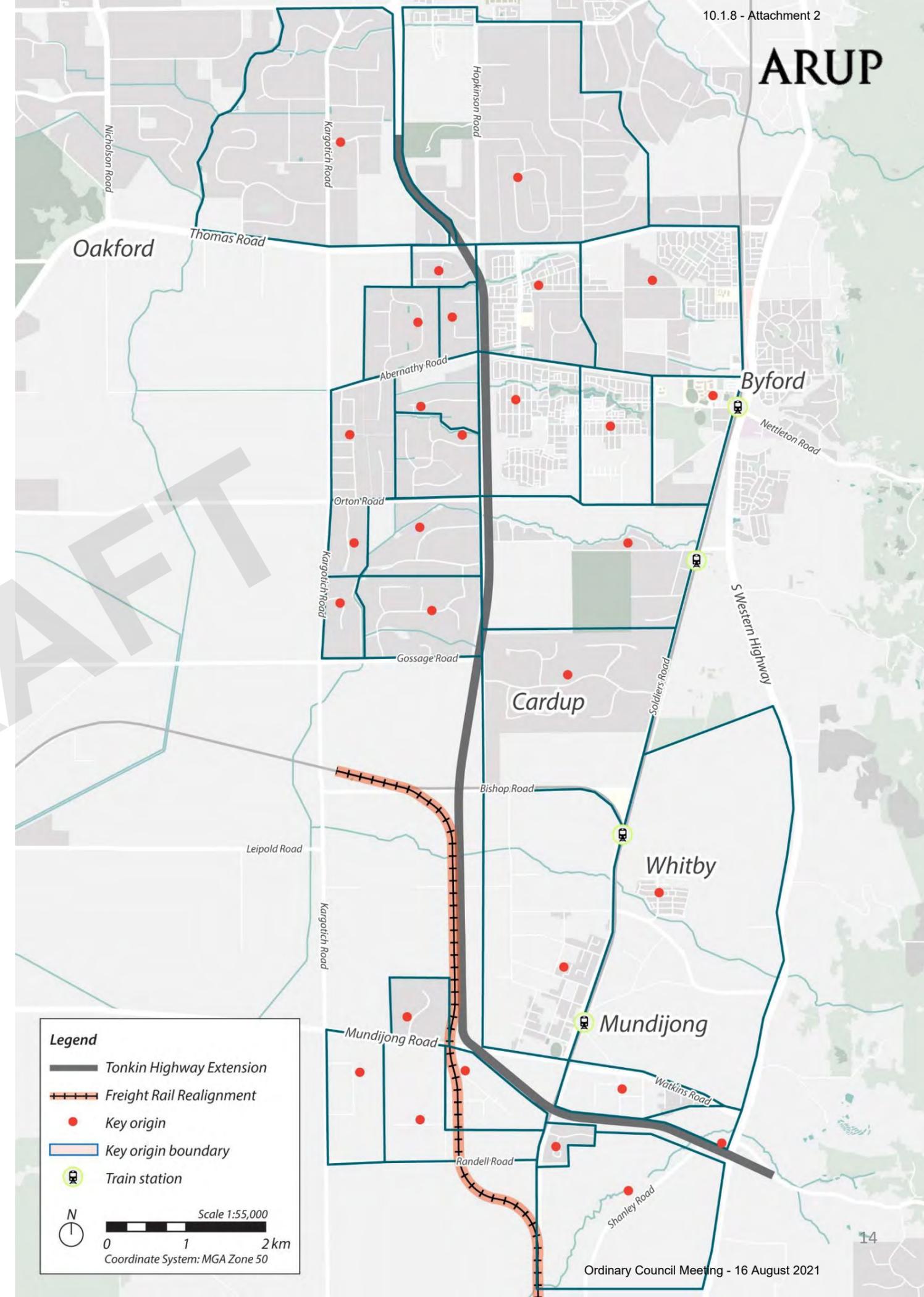
The outcomes of this assessment informed a Long List of potential solutions to minimise the extent of adverse impacts from the Tonkin Highway Extension and potentially improve connectivity where possible.

#### 5.1.1 Origins

Origins, as shown in Figure 7 (adjacent), have been identified using development boundaries defined by residential areas with one shared access to the wider network. The origin addresses, shown as an orange point, have been identified as typical addresses within each development boundary. A number of West Cardup addresses were also selected based on their location as the most 'at risk' by proposed road closures.

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**Figure 7**  Origins used in the accessibility analysis



**5.1.2 Destinations**

Destinations, as shown in Figure 8 (adjacent), included numerous community facilities that would attract and generate various local trips for a range of modes. This includes, but is not limited to, schools and other education facilities, equestrian centres, retail centres and parks and recreational reserves. Other destinations and points of interest that can not be represented by a point, such as popular horse trails, PSPs and primary distributor roads were also considered.

**5.1.3 Modes and method of use**

Mode type informed the accessibility analysis undertaken using travel time isochrones from each origin or travel time isochrones to each destination. The following methods of use:

**Pedestrians**

It was assumed that the majority of trips undertaken by walking occurred when residents were within appropriate walking distances to key destinations. The accessibility analysis for pedestrians was determined by travel time isochrones **to** each destination. This highlights catchments to each destination for various walking distances.

**Cyclists**

It was assumed that trips by bike, while consisting of a combination of trips for commute and recreational purposes, were undertaken in order to reach defined destinations (commute) and more intangible points of interest (recreational). It was therefore agreed that the accessibility analysis for cyclists was determined by travel time isochrones **from** each origin.

This would then highlight catchments from each origin for various cycling distances.

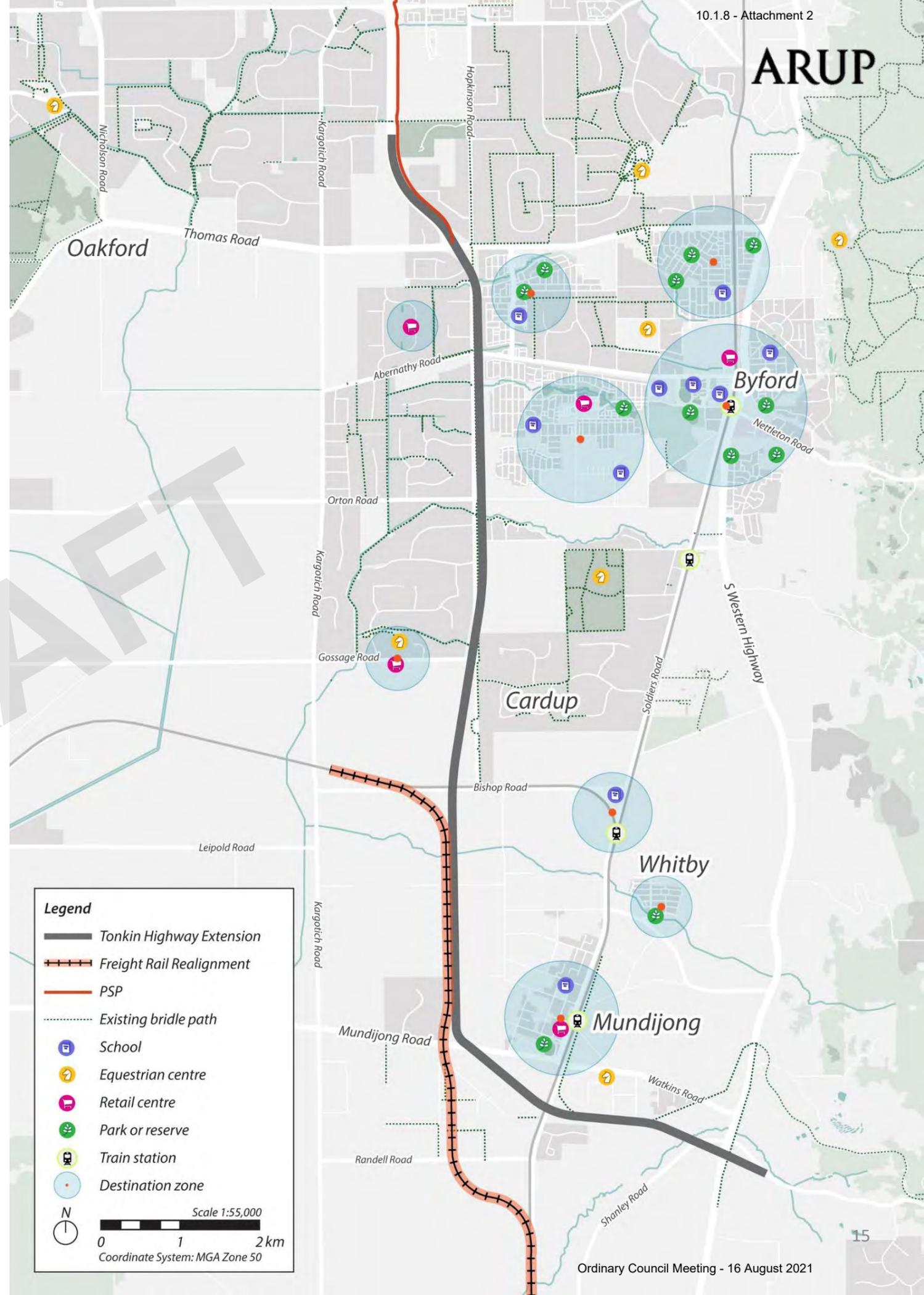
**Equestrian**

As discussed in Section 3.1.5, the SoSJ Equine Strategy found that the most popular form of trip for horse riders involved recreational riding and cross country riding, while a number of equestrian centres were also accessed via vehicle. It was therefore assumed that the majority of trips were not for the purpose of accessing a destination and consisted of primarily convoluted journeys along existing bridle trails and informal/unmapped paths. Where a destination, in this case an equestrian centre, was the purpose of the journey, it was assumed this was either undertaken via horse or via vehicle. The analysis was then undertaken by honouring the existing network and overlaying the key constraints to overall equestrian movement. These constraints would then act as 'barriers' to the overall movement of horse riders.

**Private vehicles**

Given the rural to semi-rural environment of the study area, it was assumed that the majority of trips were undertaken by private vehicle to reach destinations both internal and external to the study area. The accessibility analysis for private vehicles was determined by travel time isochrones **from** each origin. This highlights catchments from each origin for various driving distances.

**Figure 8** ►  
 Destinations used in the accessibility analysis



## 5.2 Key assumptions

The following assumptions have been made.

Pedestrians	Cyclists	Equestrian	Vehicles	Other
<ul style="list-style-type: none"> <li>No delay at intersections or road crossing points i.e. pedestrians have been prioritised</li> <li>Pedestrians can walk alongside any road and on any path in the existing and future network, excluding Tonkin Highway</li> <li>Average speed of 1.2 m/s</li> <li>Pedestrians can cross Tonkin Highway at the proposed intersections/ interchanges</li> <li>Walking times of 5-minutes, 10-minutes and 30-minutes have been investigated, considering the rural setting and the tendencies to accept longer walks to destinations</li> <li>Analysis informed by defined destinations.</li> </ul>	<ul style="list-style-type: none"> <li>No delay at intersections or road crossing points</li> <li>Cyclists can ride on any road or path in the existing and future network, excluding Tonkin Highway</li> <li>Average speed of 4.2 m/s</li> <li>Cyclists can cross Tonkin Highway at the proposed intersections/ interchanges</li> <li>Cycling times of 5-minutes, 10-minutes and 15-minutes have been investigated, considering the rural setting and the tendencies to accept longer rides to destinations</li> <li>Analysis informed by key origins.</li> </ul>	<ul style="list-style-type: none"> <li>Can utilise the local road network and trails</li> <li>Can not cross over Tonkin Highway</li> <li>The underpasses at Abernethy Road and Wright Road are not currently designed to allow for equestrian use</li> </ul>	<ul style="list-style-type: none"> <li>No delay at intersections</li> <li>Project Case and Ultimate Case speed limits on access roads remain unchanged</li> <li>Tonkin Highway speed limit 100 km/h, reduces to 70 km/h through at-grade intersections</li> <li>Driving times of 2-minutes, 5-minutes and 10-minutes have been investigated</li> <li>Analysis informed by key origins.</li> </ul>	<ul style="list-style-type: none"> <li>Orton Road, Mundijong Road and South Western Highway intersections with Tonkin Highway are at grade for the Project Case. Note that Orton Road may be grade separated at Project Case subject to the outcome of the Main Roads Steering Committee findings</li> <li>Freight rail is realigned in the Ultimate Case.</li> </ul>

### 5.3 Connectivity analysis

Figure 9 to Figure 13 summarise outputs from the accessibility analysis, showing impacts to travel time from origins and to destinations across each mode. The following provides a summary of the key issues and trends highlighted by the analysis, including justifications for the impacts. A more in-depth analysis of impacts to each origin and destination is provided in Appendix A.

#### 5.3.1 Impacts to pedestrian connectivity

A sample of the pedestrian connectivity analysis is provided on Figure 9, showing pedestrian connectivity for 30-minute combined walking catchments from Schools within the study area.

A 30-minute walking catchment, which is typically high for an exclusively urban environment, has been utilised to account for maximum walking times in the mix of urban and rural environments within the broader study area. It is understood that due to the characteristics of this environment consisting of larger blocks, relatively low vehicle volumes and limited potential delays at road crossing points, people in rural areas are more likely to walk longer distances to reach specific destinations.

The analysis shows that the impacts to school catchments is relatively minor, with minimal difference between the existing, project case and ultimate case. This is due to all schools within the study area being located to the east of Tonkin Highway Extension corridor and a lack of proposed pedestrian infrastructure.

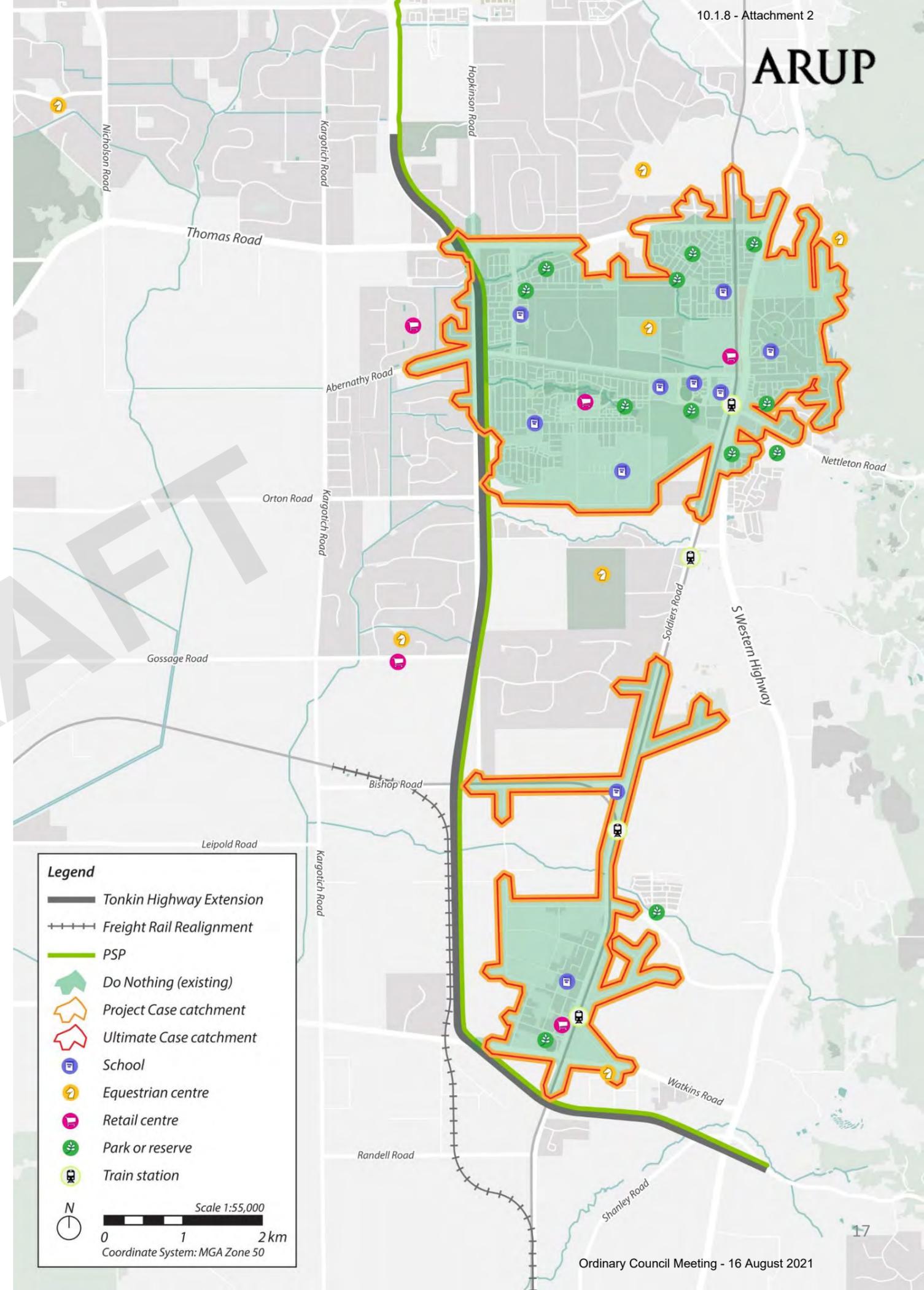
It should be noted that while impacts to connectivity for schools are relatively minor, this analysis does not take into account pedestrians undertaking more direct trips

through properties or crossing roads where there are not formal pedestrian crossings. This is likely to slightly increase walking catchments in comparison to what is shown.

Further analysis for 5-minute, 10-minute and 30-minute walking catchments from each destination has been provided in Appendix A.

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**Figure 9** ▶  
Sample demonstration of impact to pedestrian connectivity (30-minute walking catchment)



5.3.2 Impacts to cyclist connectivity

A sample of the cyclist connectivity analysis is provided in Figure 10, showing cyclist connectivity for 15-minute cycling catchments.

As shown, properties to the north and east of the Tonkin Highway Extension are likely to have minimal impacts to their accessibility to the existing destinations within the study area. This is due to limited modifications identified to the surrounding network and most destinations being located on the eastern side of the Tonkin Highway corridor.

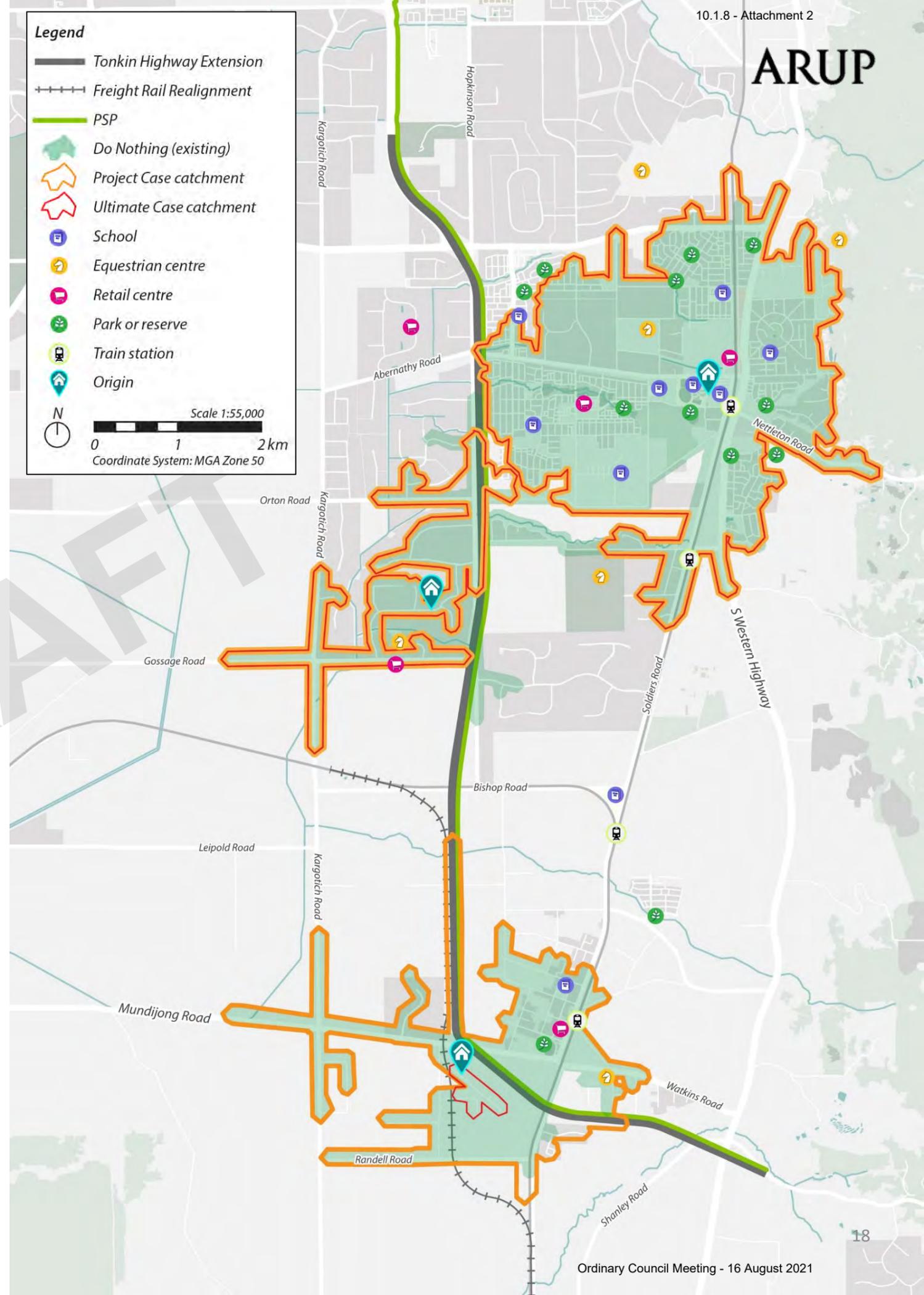
Properties to the south and west of Tonkin Highway Extension, namely in West Cardup and south of Mundijong Road, are likely to have significant accessibility impacts as Tonkin Highway will cause severance to key destinations to the east and north. Key points of interest that the catchment analysis has highlighted are:

- Jersey Road connectivity to the broader transport network is severed at Project Case and Ultimate Case
- East-west connectivity at Karbro Drive, Gossage Road and Cardup Siding Road is reduced at the Project Case and Ultimate Case

- Lampiter Drive connectivity to the broader transport network is severed at the Ultimate Case which is caused by the combination of Tonkin Highway and the Freight Rail Realignment
- Hopkinson Road north of Thomas Road connectivity to the south is severed at the Project Case and Ultimate Case
- Crossing is assumed to be provided at each key intersection/ interchange locations (Thomas Road, Orton Road, Bishop Road, Mundijong Road and South Western Highway), however the level of protection provided and amenity will be determined as part of the long list optioneering phase. Delay by these crossings is not captured as part of this analysis.

Further analysis for 5-minute, 10-minute and 15-minute cycling catchments from each origin has been provided in Appendix A.

**Figure 10** ▶  
Sample demonstration of impact to cyclist connectivity (15-minute cycling catchment)



**5.3.3 Impacts to equestrian connectivity**

The equestrian connectivity analysis is provided in Figure 11, showing the key constraints to overall equestrian movement following the implementation of the Project and Ultimate Cases.

As shown, the existing bridge paths provide formal equestrian links to all equestrian centres from the majority of properties, with an existing equestrian underpass provided north of Thomas Road facilitating east-west connections under the Tonkin Highway. It is understood that horse riders are currently provided the freedom to move east-west across major roads while also use the Tonkin Highway road reserve to move uninterrupted for the majority of its length. It is however acknowledged that the network shown does not reflect the entire movement network offered to horse riders, given that they are able to

follow informal and unmapped tracks through properties, grasslands and along waterways in the current network.

Following the construction of Tonkin Highway, the equestrian network will be significantly impacted. As shown, all connectivity across the Tonkin Highway (currently Hopkinson Road) will be severed from Thomas Road to South Western Highway. With no proposed equestrian underpasses as part of the design, horse riders will be forced to go around the full length of the highway, if travelling by horse, to access areas on the other side of the highway. This is a similar conclusion for the Ultimate Case, where the rail alignment will also serve as a barrier to all equestrian movement.

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**Figure 11**  Equestrian connectivity constraints



**5.3.4 Impacts to vehicle connectivity**

A sample of the vehicle connectivity analysis is provided in Figure 12, showing vehicle connectivity for 5-minute driving catchments. Driving catchments of 5-minutes have been used in this sample to highlight potential impacts to exclusively local trips within the study area.

Properties to the north and east of the Tonkin Highway Extension are likely to have minimal impacts to their accessibility to the existing destinations within the study area. This is due to most destinations being located on the eastern side of the Tonkin Highway corridor and limited impacts proposed to east-west connections on Abernathy Road.

Properties to the south and west of Tonkin Highway Extension are likely to have significant accessibility impacts as Tonkin Highway will cause severance to the key destinations to the east, while also limiting opportunities to access north-south routes. The key points of interest that the catchment analysis has highlighted are:

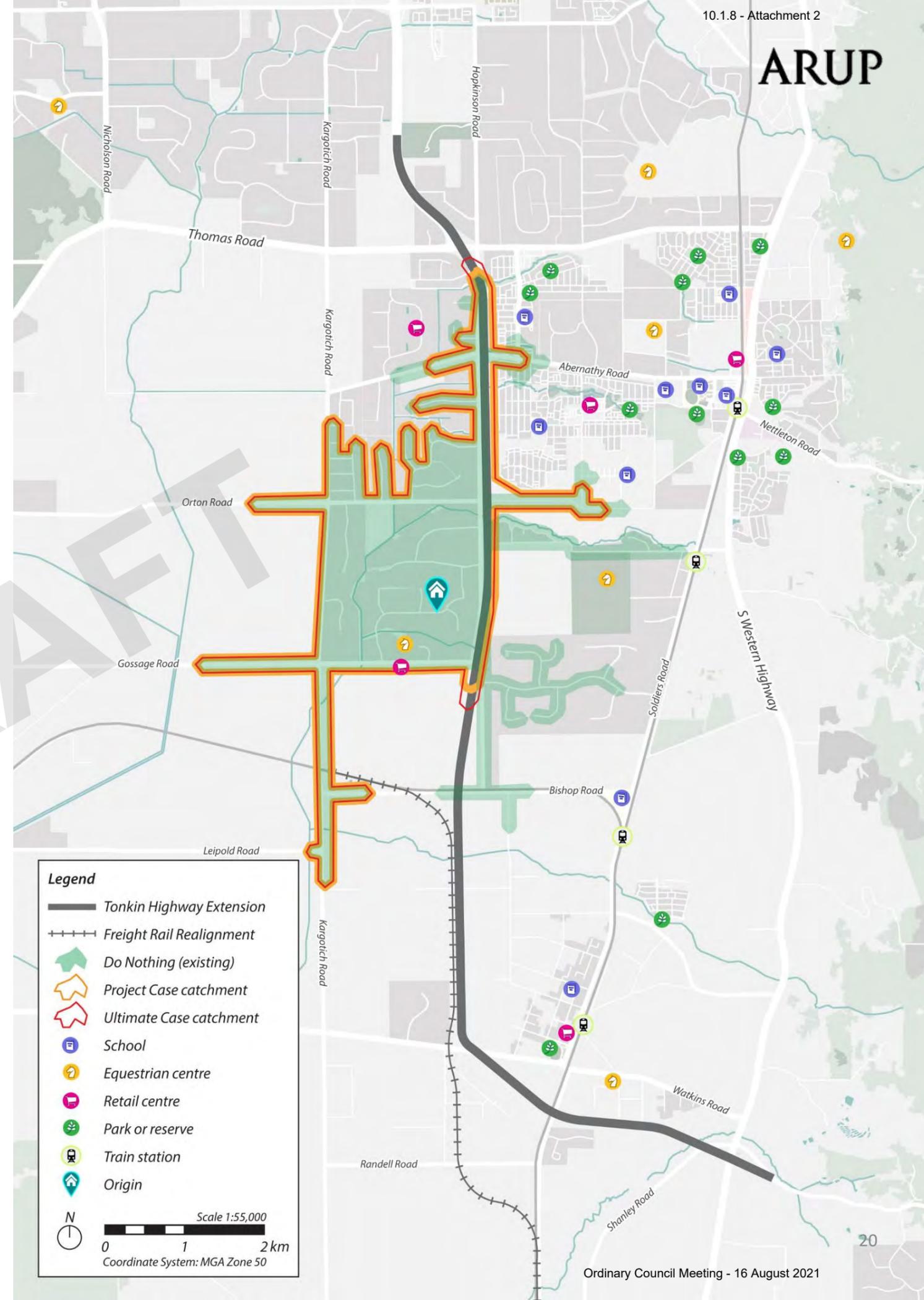
- Jersey Road connectivity to the broader transport network is severed at Project Case and Ultimate Case
- East-west connectivity at Karbro Drive, Gossage Road and Cardup Siding Road is reduced at the Project Case and Ultimate Case

- Lampiter Drive connectivity to the broader transport network is severed at the Ultimate Case which is caused by the combination of Tonkin Highway and the Freight Rail Realignment
- Hopkinson Road north of Thomas Road connectivity to the south is severed at the Project Case and Ultimate Case
- Stanley Road south of Tonkin Highway Extension is severed resulting in reduced connectivity in the Project Case and Ultimate Case
- In general, the adverse impacts to the broader road network are relatively minor.

Further analysis for 2-minute, 5-minute and 10-minute cycling catchments from each origin has been provided in Appendix A.

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**Figure 12** ▶  
Sample demonstration of impact to vehicle connectivity (5-minute driving catchment)

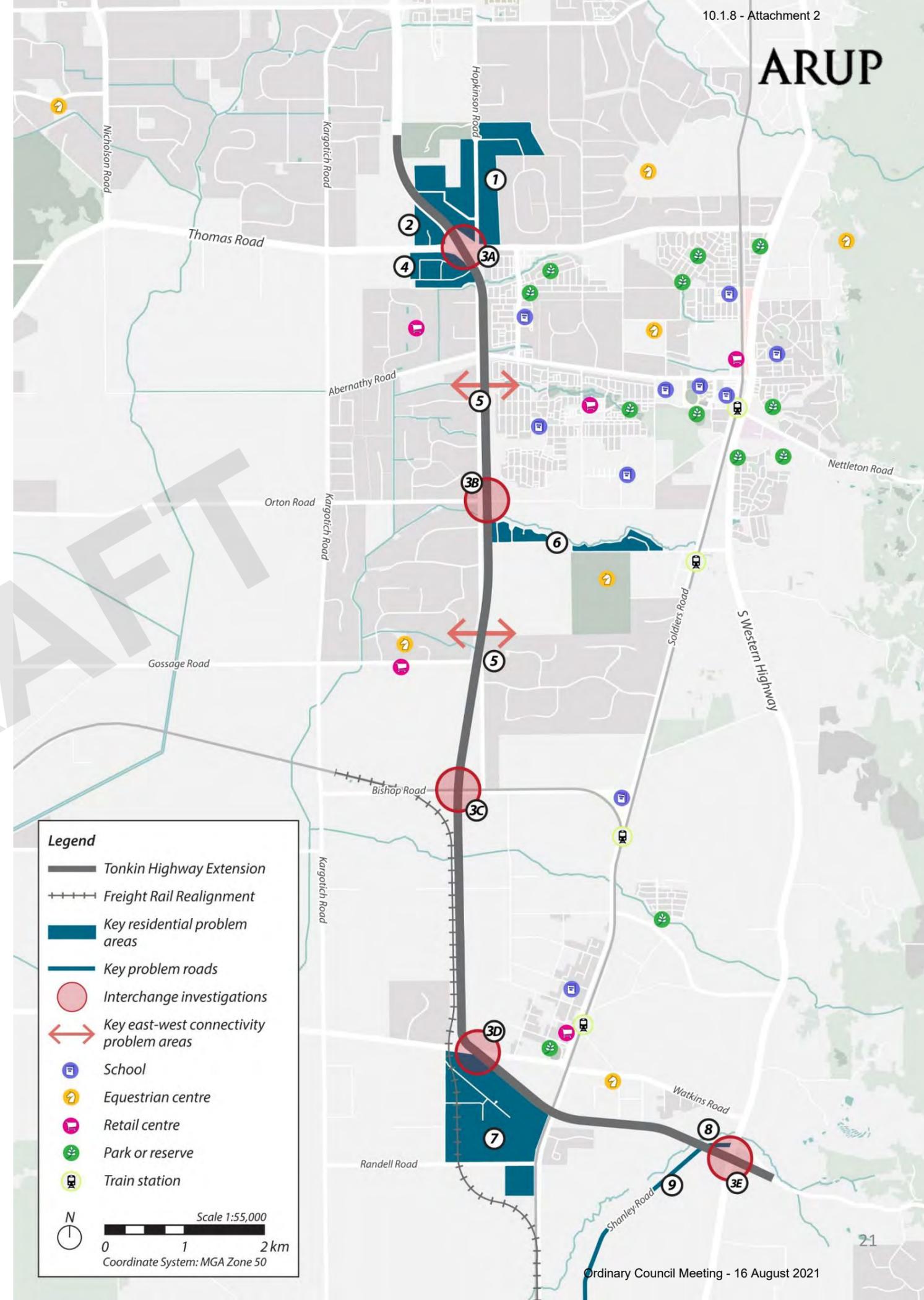


### 5.4 Key accessibility problem areas

The catchment analysis has identified the following key focus areas for investigation (shown on Figure 13).

Focus area	Accessibility impacts
1. Hopkinson Road north of Thomas Road	❑ Closure of Hopkinson Road/ Thomas Road intersection to sever access to Thomas Road from the north, forcing residents to use Rowley Road.
2. Ballak Place	❑ Closure of Ballak Place/ Thomas Road intersection to completely sever access to properties on Ballak Place
3. Thomas Road (A), Orton Road (B), Bishop Road (C), Mundijong Road (D) and South Western Highway (E) interchanges	❑ Active travel and equine connectivity to be investigated at interchanges for both the interim and ultimate treatments.
4. Jersey Road residential catchment	❑ Access to/ from the residential catchment is completely severed by the closure of Jersey Road. Closure of access to Hopkinson Road impacts the Bushfire Management Plan.
5. Underpasses at midblock locations along Tonkin Highway Extension	❑ East-west active transport connectivity significantly impacted at midblock locations between Thomas Road and Mundijong Road.
6. Cardup Siding Road residential catchment	❑ Potential evacuation risk with closure of Cardup Siding Road/ Hopkinson Road intersection removing alternative access out of catchment. Closure of access to Hopkinson Road impacts the Bushfire Management Plan.
7. Lampiter Drive residential catchment	❑ Access to/ from Lots 1-6 Lampiter Drive is completely severed by the closure of Lampiter Drive following the Freight Rail Realignment.
8. Shanley Road north of Tonkin Highway Extension	❑ Closure of Shanley Road/ South Western Highway intersection isolates property between Tonkin Highway Extension, South Western Highway and Shanley Road.
9. Shanley Road south of Tonkin Highway Extension	❑ Access to South Western Highway from Shanley Road severed west of Property 11, significantly impacting current and future Stanley Road residents from accessing Byford and other regional centres.

**Figure 13**  Key accessibility problem areas



## 6 Long list process and fatal flaw analysis

### 6.1 Development of fatal flaw analysis criteria

In developing a Fatal Flaw Analysis (FFA) criteria to be used for evaluating the Long List options, the project team considered that the criteria should be developed in line with the guiding principles of the project, assessing each option on a pass/ fail rating scoring system.

The seven pass/ fail criteria utilised were:

- Network Connectivity
- Safety
- Constructability
- Alignment with ultimate planning
- Impact to the Environment
- Impact to Heritage
- Impact to zoning/ land impact/ MRS boundary.

Each criteria were made up of 1-4 queries that the Long List option had to satisfy in order to pass the FFA. If an option failed against one of the criteria, it was not progressed through to the Short List stage.

### 6.2 Development of long list options

To focus the Long List options considered, a first sieve of criteria was developed which deemed options unviable from the offset, prior to the long list stage. This criteria included:

- No options can include a bridge over Tonkin Highway unless at an interchange where a bridge structure is already provided
- No at-grade crossings can be provided over Tonkin Highway at midblock locations.

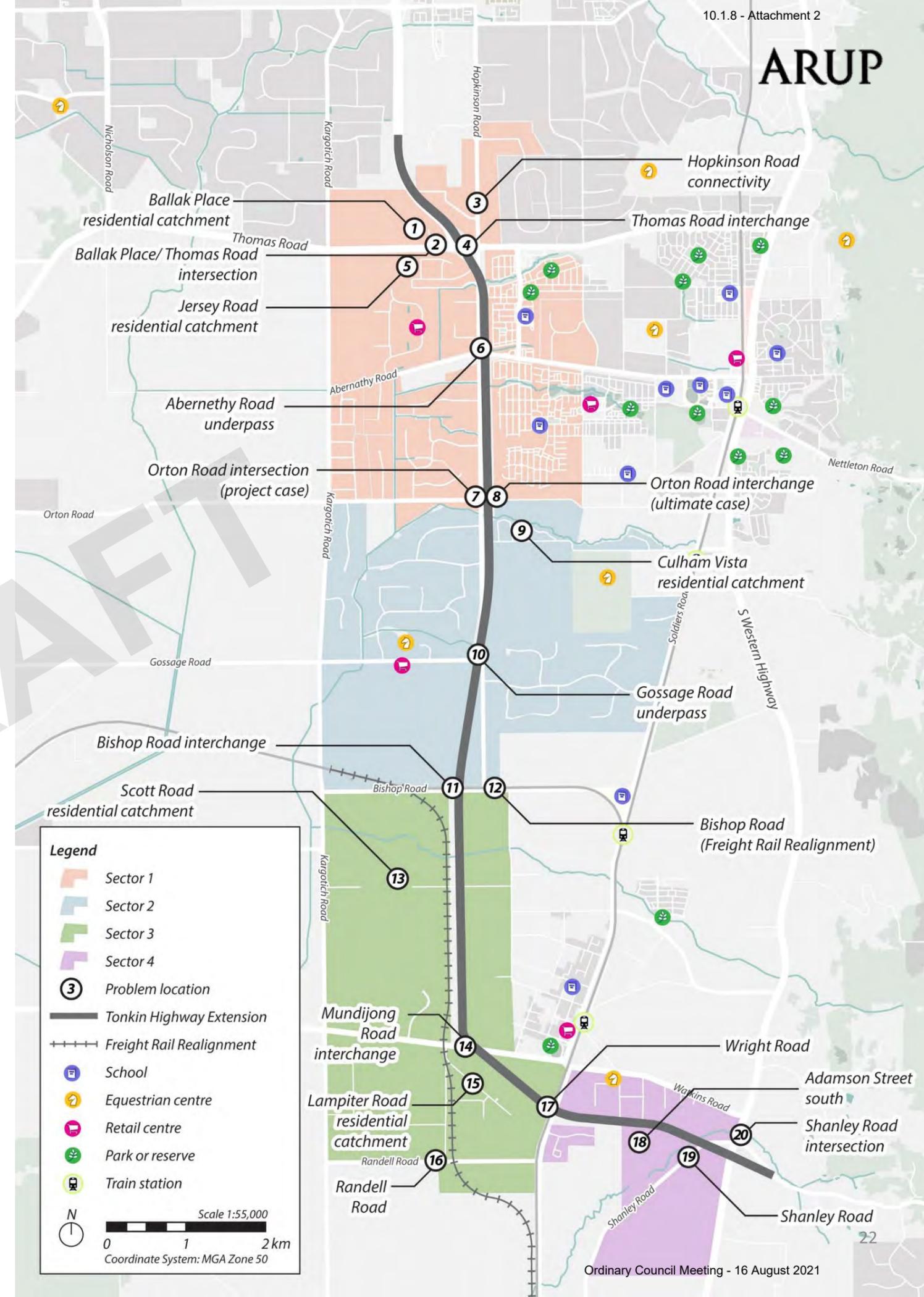
To further streamline the Long List process, the study area was divided into four sectors:

- **Sector 1:** Thomas Road to south of Orton Road
- **Sector 2:** Orton Road to Bishop Road
- **Sector 3:** Bishop Road to Wright Road
- **Sector 4:** Wright Road to South Western Highway.

Each sector contained a number of locations representing each problem area as shown in Figure 14.

The project team then developed an initial Long List of potential solutions and FFA to be workshopped with stakeholders.

**Figure 14** ▶  
 Long List options  
 Sectors and locations



### 6.2.1 Long list stakeholder workshop

The outcomes of the initial Long List FFA were presented and workshopped with Main Roads WA and relevant stakeholders on 12 March 2021. In the workshop, the project team went through each Sector and described each Long List option to attendees. Following the presentation of each Sector, attendees were given the opportunity to discuss, amend and offer additional options for assessment. Outcomes of the workshop session was captured on sticky notes on printed aerial plans of the Tonkin Extension and Freight Rail Realignment design plots. These outcomes have been shown in Figure 15.

The Long List and FFA was then agreed by stakeholders in this session, arriving at a final Long List.

A total number of 85 Long List options were assessed against the defined Fatal Flaw Analysis (FFA) criteria, with the remaining options progressing through to the Short List options stage.

A summary of the FFA of each of the Long List options is provided in Appendix A.



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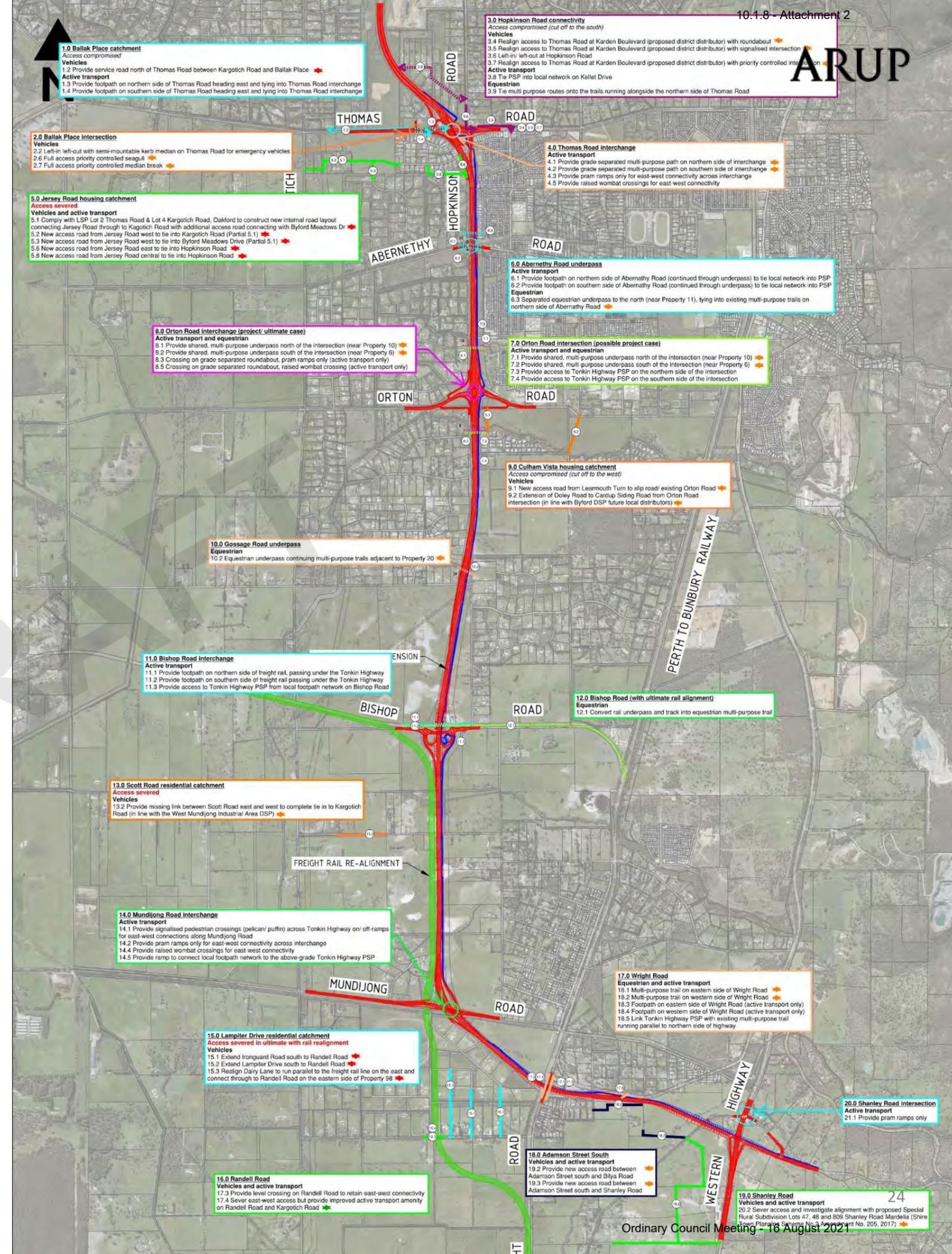
**Figure 15** ▶  
Long List workshop outcomes

## 7 Short list options

Following completion of the FFA of the Long List options summarised in Section 6 and Appendix A, a total of 58 Short List options were confirmed for scoring through the MCA process. The subsequent assessment of these options was undertaken by the internal project team and subsequently workshopped and endorsed by Main Roads WA on 22/04/2021.

A summary of the options is shown in Figure 16 and provided in Appendix B.

**Figure 16** ▶  
 Short List workshop outcomes



## 8 Preferred options

### 8.1 Location 1 – Ballak Place residential catchment

The proximity of the Ballak Place residential catchment to the Tonkin Highway/ Thomas Road interchange means that access will likely be impacted due to intersection spacing requirements.

To facilitate vehicle connectivity from Ballak Place, the preferred option is to provide a service road to the west for vehicles that ties into Kargotich Road. This option facilitates vehicles wanting to travel westbound from the Ballak Place residential catchment.

It is important to note that this service road will be located on or adjacent to an open drainage channel owned by Water Corporation. The feasibility of this option will need to be investigated further as part of the Thomas Road duplication project including stakeholder engagement with the Water Corporation. The proposed location of the service road is shown in Figure 17.

To allow for pedestrian and cyclist connectivity to the PSP running on the eastern side of Tonkin Highway, it is proposed that a footpath is provided on the southern side of Thomas Road. It is proposed that a staged crossing north-south on Thomas Road with pram ramps is provided to allow for pedestrians and cyclists to access the footpath.

The proposed crossing location and footpath is shown in Figure 17.

This pedestrian crossing and footpath design would require to be further resolved in the Thomas Road duplication project

Construction timings of the service road and footpath needs to be further resolved, however would be preferable at opening year.

#### Preferred option

**1.2** Provide service road north of Thomas Road between Kargotich Road and Ballak Place

**1.4** Provide footpath on southern side of Thomas Road heading east and tying into Thomas Road interchange

### 8.2 Location 2 – Ballak Place/ Thomas Road intersection

Ballak Place has full priority controlled access onto Thomas Road. The Tonkin Highway Extension interchange footprint is proximate to the existing intersection, which will likely impact the potential design options into and out of the residential catchment.

The duplication of Thomas Road is also a key consideration that will likely impact the intersection configuration options.

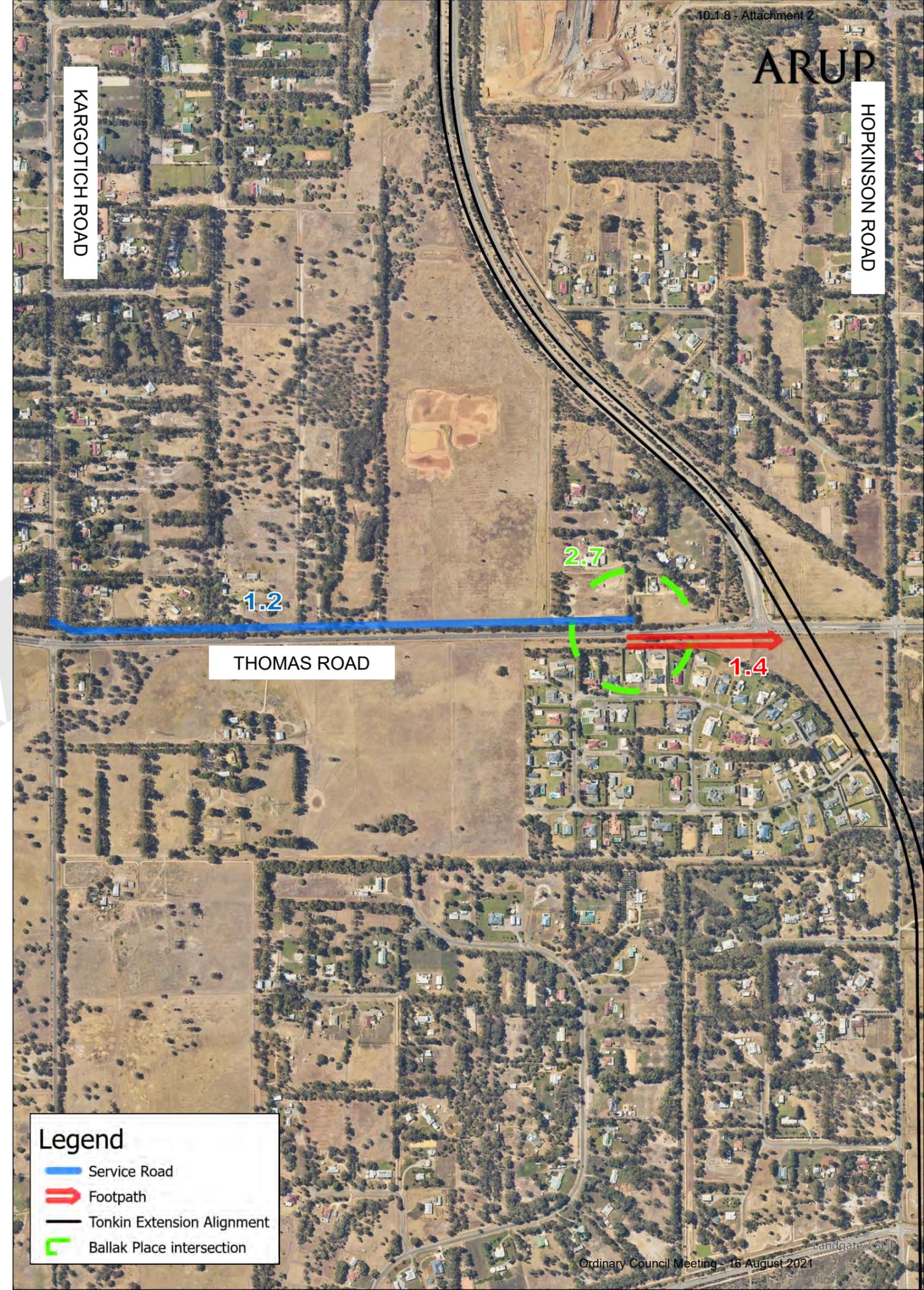
The preferred option is to provide a left-in left-out treatment, with a semi-mountable kerb median to allow for emergency vehicle access.

There is minimal construction costs associated with this option, which will be completed as part of the works delivered for opening year. It should be noted that there may be future works to the intersection subject to the Thomas Road Duplication Project staging.

#### Preferred option

**2.7** Left-in left-out with semi-mountable kerb median on Thomas Road for emergency vehicles

**Figure 17**   
 Ballak Place preferred options



**8.3 Location 3 – Hopkinson Road connectivity**

The proximity of Hopkinson Road to the Tonkin Highway/ Thomas Road interchange means that existing vehicle access to the north is severed.

As part of the Thomas Road duplication project, the Thomas Road/ Karden Boulevard intersection will be upgraded to a dual lane roundabout.

The preferred option for vehicles is to realign Hopkinson Road to the east, as shown on Figure 18, which would tie into the existing intersection of Thomas Road/ Karden Boulevard as a fourth leg. This will facilitate all movements at the proposed four way roundabout. This will ensure access is maintained for residents on Hopkinson Road north of Thomas Road, which is shown in Figure 19.

The approach and circulation lane configurations of the roundabout will be required to be resolved as part of the design in the Thomas Road duplication project.

To support cyclist and pedestrian connectivity,

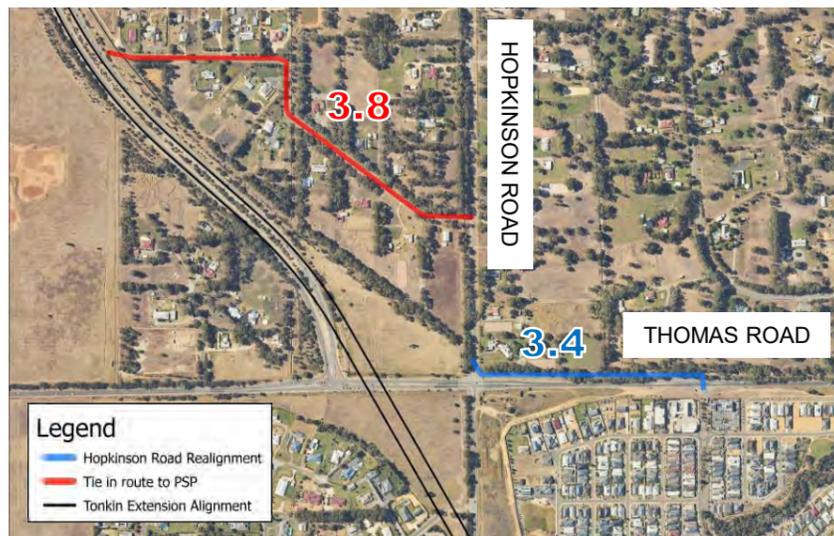
the Tonkin Highway PSP should tie into Kellet Drive providing local access.

The multi purpose trails on the northern side of Thomas Road should be retained for equestrian users, maintaining the linkage into Hopkinson Road to the north.

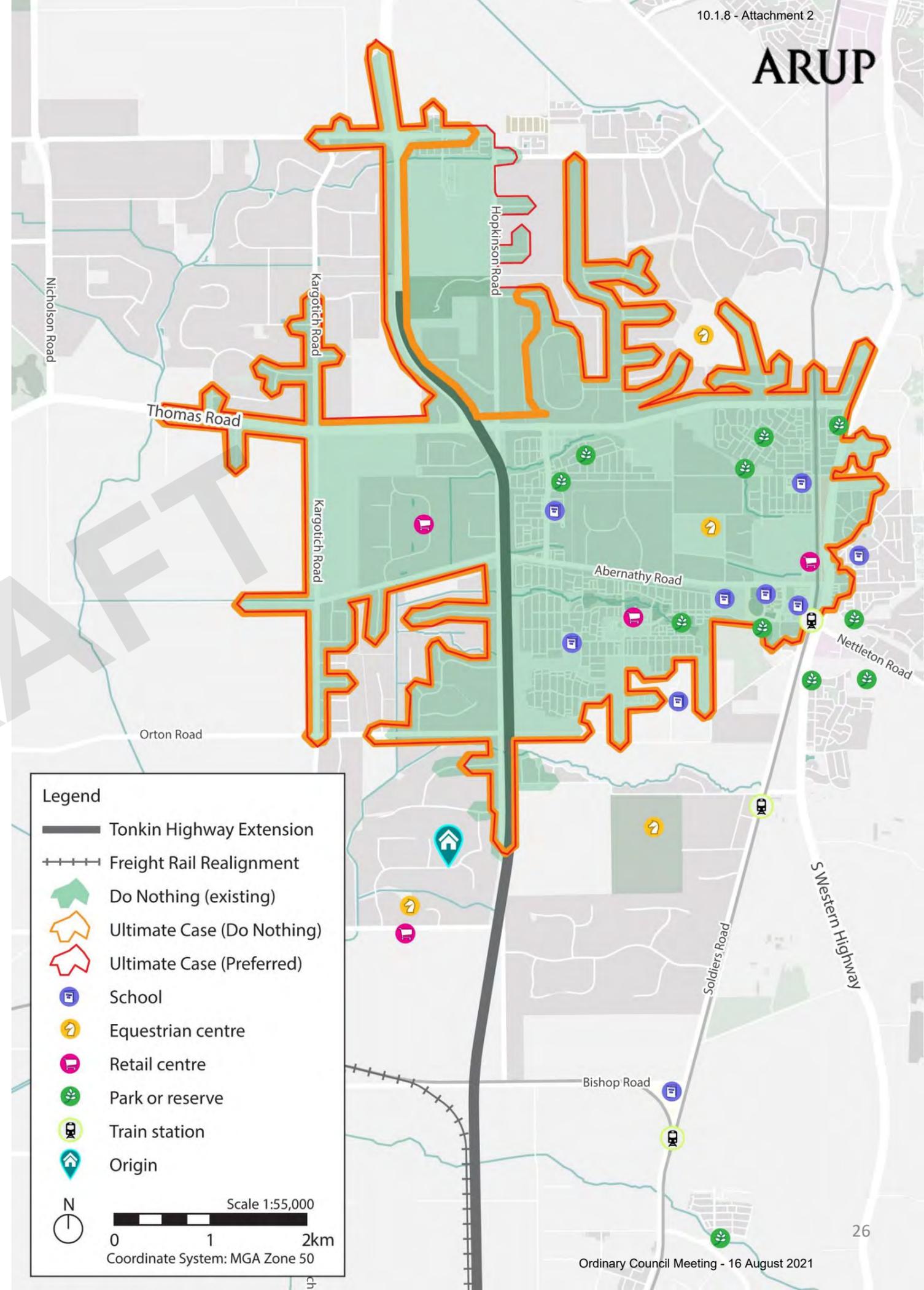
Construction of the Hopkinson Road realignment should be completed prior to the closure of the existing access. The upgrade also needs to align with the Thomas Road duplication project staging.

The PSP link into Kellet Drive should be built in line with the construction of the PSP section between Thomas Road and Rowley Road.

- Preferred option**
- 3.4** Realign access to Thomas Road at Karden Boulevard (proposed district distributor) with roundabout
  - 3.8** Tie PSP into local network on Kellet Drive
  - 3.9** Tie multi purpose routes onto the trails running alongside the northern side of Thomas Road



**Figure 18** ▲  
 Hopkinson Road connectivity



**Figure 19** ▶  
 Hopkinson Road vehicle accessibility diagram

### 8.4 Location 4 – Thomas Road interchange

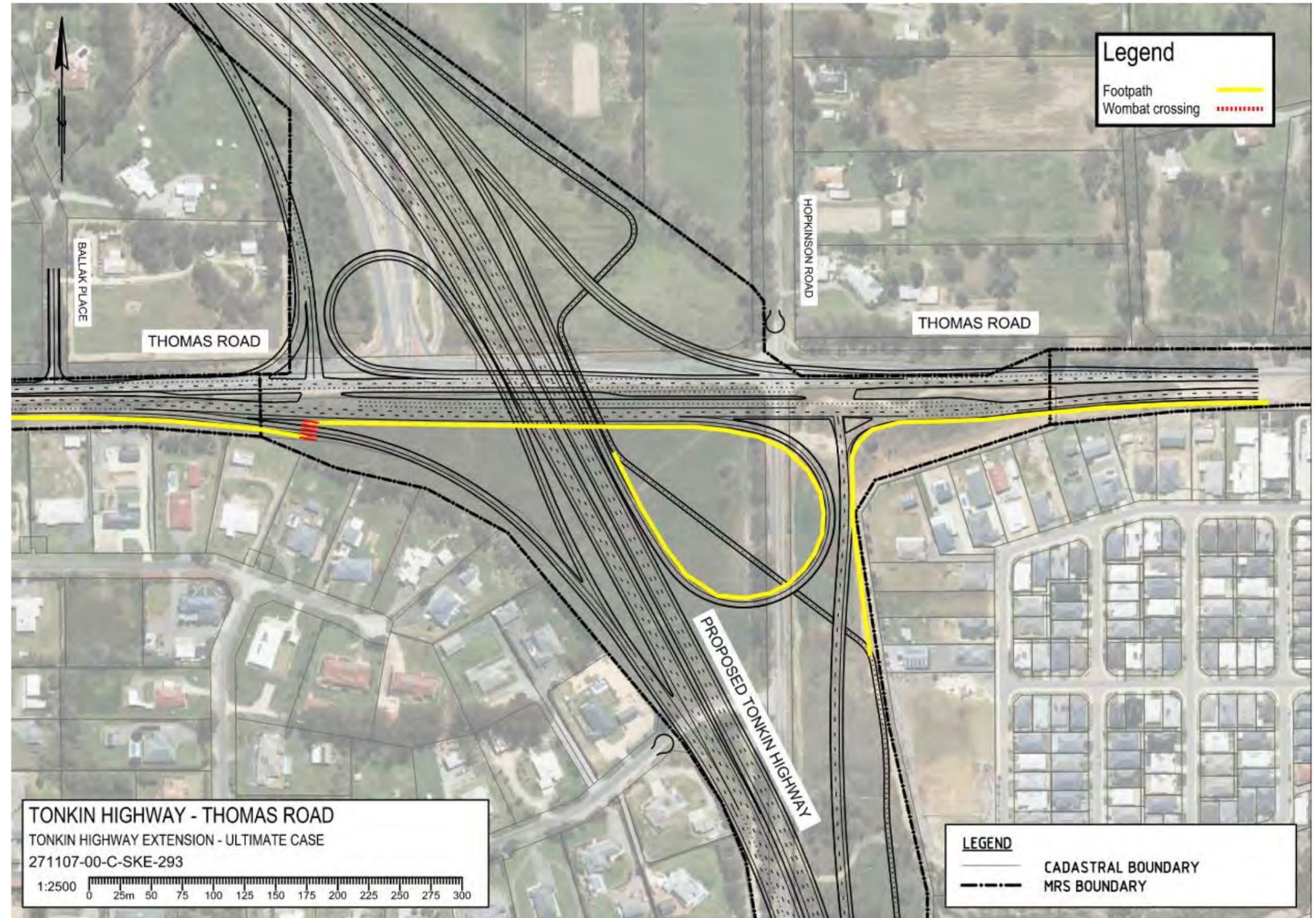
The preferred option of the Thomas Road interchange is a diamond interchange with two loop ramps. This configuration is shown in Figure 20, along with the connecting footpath and shared path networks.

To facilitate east-west connectivity for pedestrians and cyclists, a footpath on the southern side of Thomas Road is proposed with a wombat crossing provided on the northbound left slip lane. The path will follow the alignment of Thomas Road and tie into the north-south PSP. The PSP is grade separated from the road and therefore there is no other interfaces between vehicles and pedestrians and cyclist.

Construction of the crossing and footpath should be in line with the construction of the interchange.

It should be noted that during the course of undertaking this study it was determined that an interim (at-grade) intersection would be constructed in the interim (project case). See section 10.3 for further details and recommended treatments.

**Preferred option**  
**4.5** Provide raised wombat crossings for east-west connectivity



**Figure 20** Thomas Road interchange configuration

**8.5 Location 5 – Jersey Road residential catchment**

The Jersey Road residential catchment currently has vehicle access to the east onto Hopkinson Road. The Tonkin Highway Extension completely severs this access and therefore removes all access for residents to the broader road network.

To provide vehicle connectivity, access roads extending Jersey Road to the west tying into Kargotich Road and Byford Meadows Drive are proposed in line with the Local Structure Plan as shown in Figure 21.

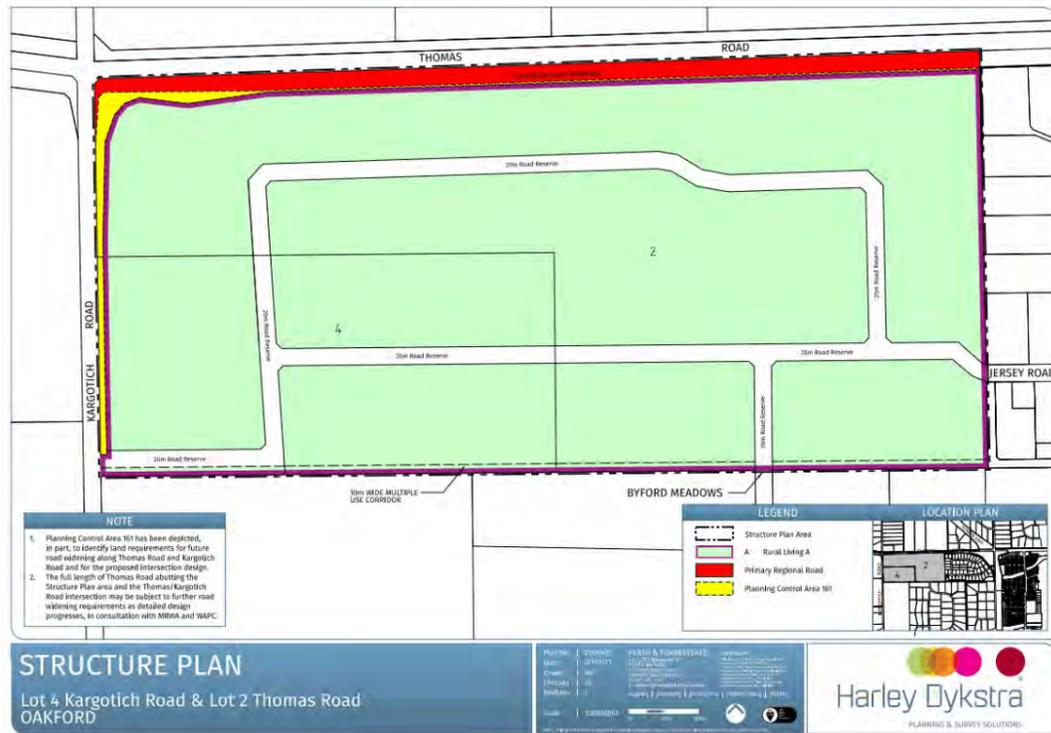
To show the accessibility impacts, the 5 minute vehicle accessibility catchments for the existing, ultimate do nothing and ultimate preferred option is shown in Figure 22.

It highlights how the severance to Hopkinson

Road reduces access to the north, east and south relative to the existing conditions, as access out of the Jersey Road residential catchment is redistributed to Kargotich Road.

The extension of Jersey Road to Kargotich Road needs to be completed prior to closure of Jersey Road to the east to prevent severing all access to the current residents.

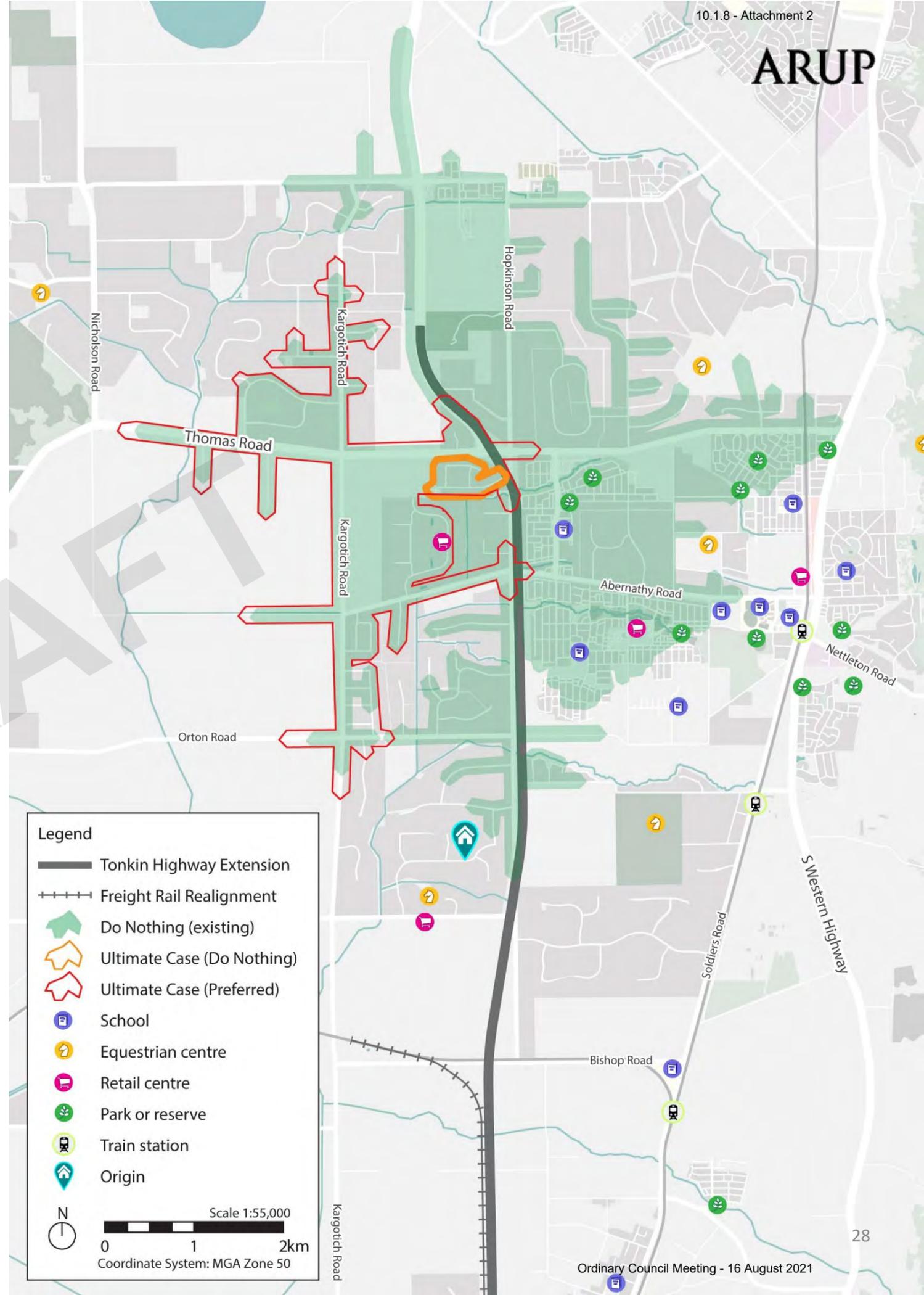
**Preferred option**  
**5.1** Comply with LSP Lot 2 Thomas Road & Lot 4 Kargotich Road, Oakford to construct new internal road layout connecting Jersey Road through to Kargotich Road with additional access road connecting with Byford Meadows Dr



**Figure 21** ▲

Jersey Road subdivision (Source: Local Structure Plan Lot 2 Thomas Road & Lot 4 Kargotich Road, Oakford)

**Figure 22** ▶  
 Jersey Road vehicle accessibility diagram



**8.6 Location 6 – Abernethy Road underpass**

Abernethy Road currently intersects Hopkinson Road as a four-way at-grade priority-controlled intersection.

The Tonkin Highway Extension will sever the east-west connectivity, however the design has always accommodated a vehicle underpass of Tonkin Highway at Abernethy Road.

To leverage off the height clearance provided for the vehicle underpass, provision for active transport and equestrian access has been considered at this location.

A footpath on the southern side of Abernethy Road is recommended to allow for pedestrian and cyclist connectivity between the residents to the west of Hopkinson Road and Byford. The footpath on the southern side would tie into the existing path network to the east providing connectivity to the broader active transport network.

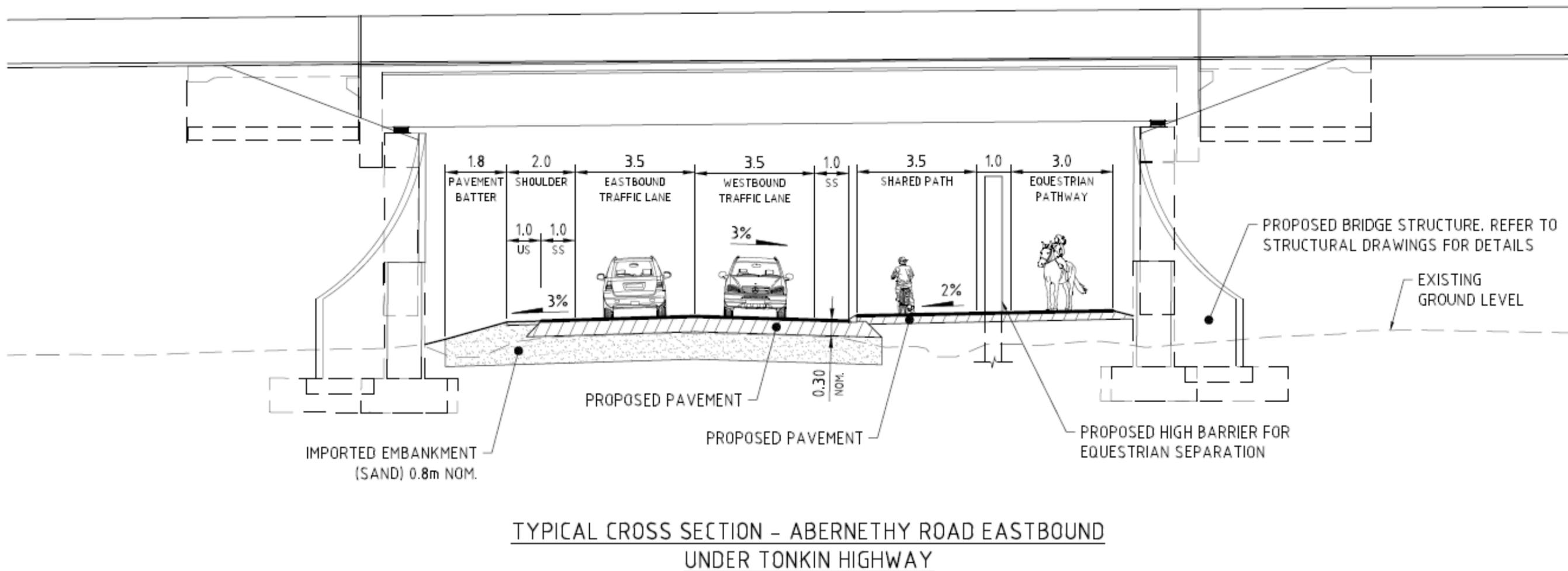
To support the east-west connectivity for equestrian users, it is recommended a multi-purpose underpass is provided on the northern side of Abernethy Road, to utilise the clearance height provided for the vehicle underpass.

 The footpath and multi-purpose path should be provided at opening year of Tonkin Highway Extension to ensure the cyclist, pedestrian and equine access is maintained.

A draft of the Abernethy Road underpass design is shown in Figure 23, showing how the equestrian and shared path can be accommodated in the underpass. It should be noted that it is proposed that the equestrian underpass is proposed to be on the northern side of the traffic lanes, not the southern side as depicted on the figure.

**Preferred option**  
**6.2** Provide footpath on southern side of Abernethy Road (continued through underpass) to tie local network into PSP  
**6.3** Separated equestrian underpass to the north (near Property 11), tying into existing multi-purpose trails on northern side of Abernethy Road

**Figure 23** ▽ Abernethy Road underpass draft design



**Figure 26** ▶  
 Orton Road intersection treatments

**8.7 Location 7 – Orton Road intersection (possible project case)**

At opening year, the Orton Road intersection is proposed to be an at-grade dual lane roundabout; note that prior to this accessibility assessment the preferred Project Case was a grade separated option.

At Project Case, it has been confirmed a footbridge will be provided over the eastern leg to allow for continuous PSP connectivity.

To facilitate east-west connectivity, a footpath with wombat crossings on the northern leg should be provided which ties into the Tonkin Highway PSP on the eastern side.

A multi-purpose underpass to the south of Orton Road should be provided to allow equestrian access east-west under Tonkin Highway, see Figure 26.

A footpath to the east at Copper Road should be provided to tie into the Tonkin Highway PSP, providing access into Byford.

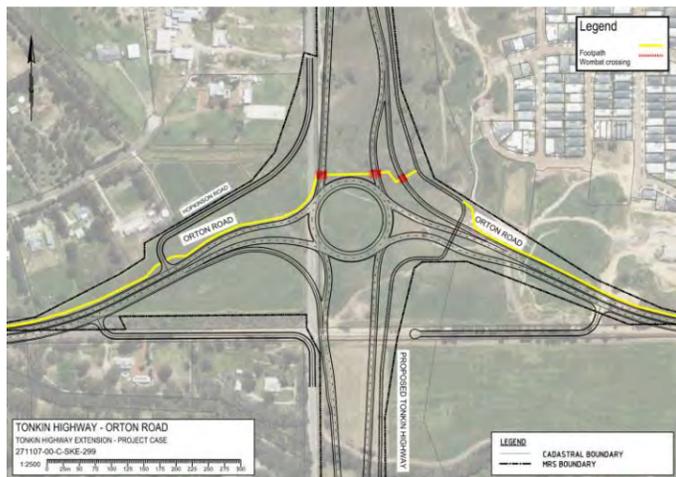
Construction of all items should be completed for opening year. It should be noted that if funding is limited, there is potential to provide the equestrian underpass for the Ultimate Case once the Tonkin Highway alignment is elevated.

- Preferred option**
- 7.2 Provide shared, multi-purpose underpass south of the intersection (near Property 6)
  - 7.3 Provide access to Tonkin Highway PSP on the northern side of the intersection

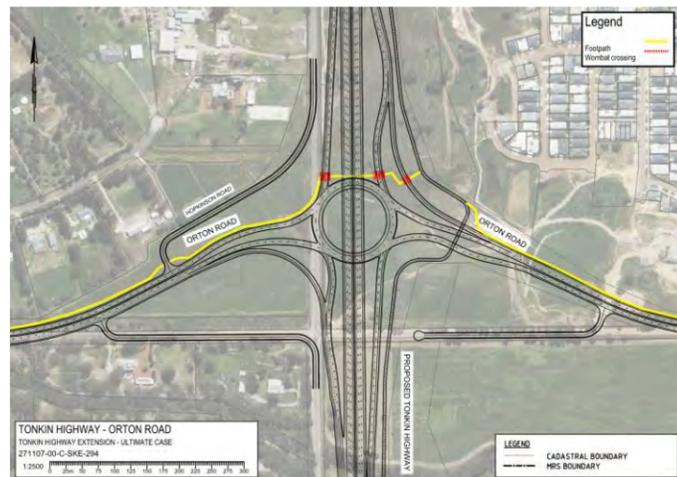
**8.8 Location 8 – Orton Road interchange (project/ ultimate case)**

At Ultimate Case, Orton Road intersection will be a grade-separated roundabout. The wombat crossings and footpaths, and multi-purpose underpass from the Project Case should be maintained.

- Preferred option**
- 8.2 Provide shared, multi-purpose underpass south of the intersection (near Property 6)
  - 8.5 Crossing on grade separated roundabout, raised wombat crossing (active transport only)



**Figure 24** ▲  
 Orton Road Project Case  
 Connectivity and Accessibility Study



**Figure 25** ▲  
 Orton Road Ultimate Case



**Legend**

- Footpath connection
- - - Underpass
- Tonkin Extension Alignment

**8.9 Location 9 – Culham Vista residential catchment**

Cardup Siding Road is currently an east-west corridor between Hopkinson Road and Soldiers Road. The Tonkin Highway Extension severs vehicle access to the west of Cardup Siding Road to Hopkinson Road.

To minimise the impact of severance, the north-south connection between Cardup Siding Road and Orton Road should be built in line with the Byford District Structure Plan, see Figure 27.



**Figure 27** ▲

Cardup Siding Road Connection (Source: Byford District Structure Plan)

To show the accessibility impacts, the 5 minute vehicle accessibility catchments for the existing, ultimate do nothing and ultimate preferred option is shown in Figure 28.

With the proposed upgrades, the analysis shows:

- Increased access to the north
- Comparable access to the east and west
- Reduced access to the south

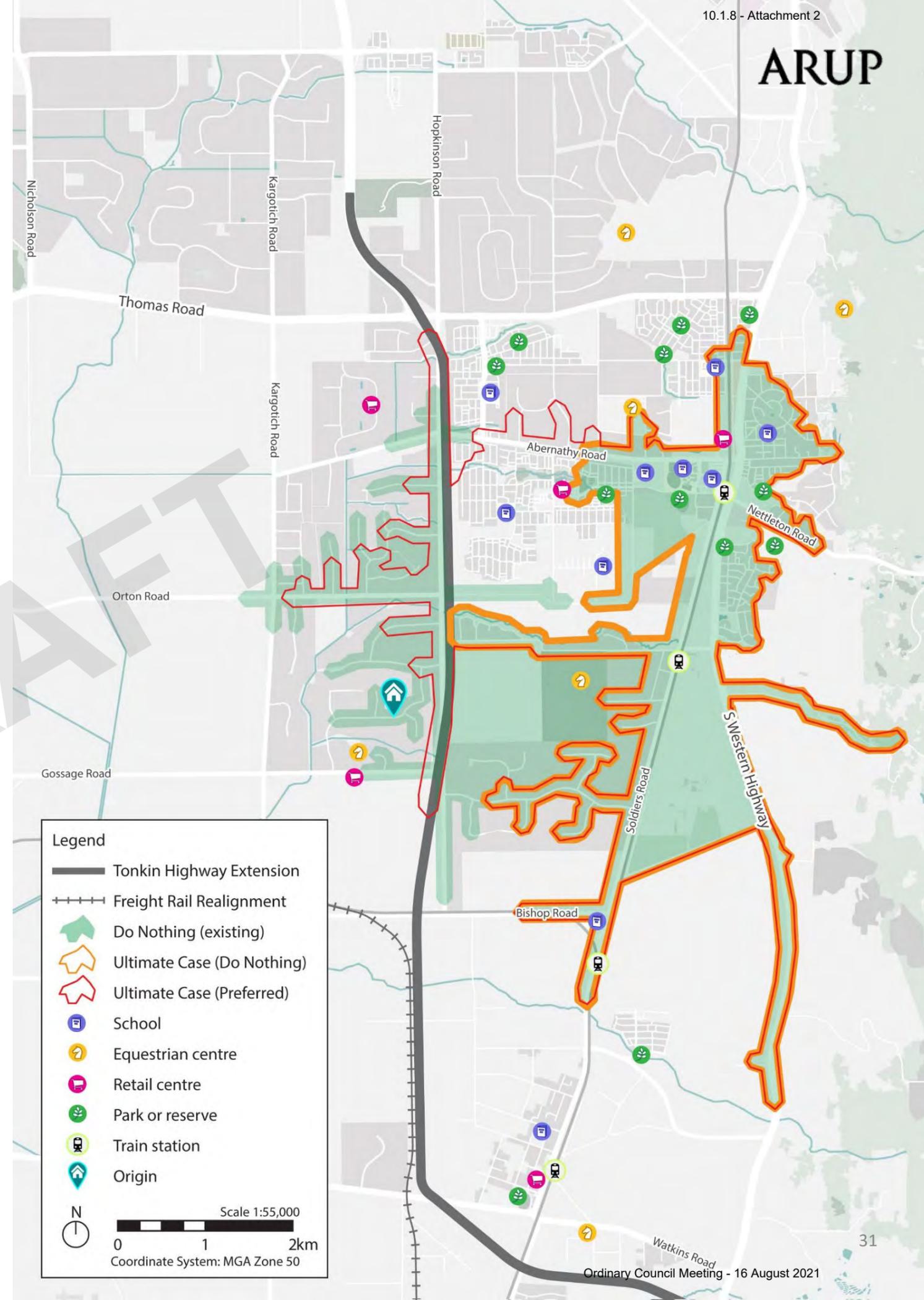
**Preferred option**

**9.2** Extension of Doley Road to Cardup Siding Road from Orton Road intersection (in line with Byford DSP future local distributors)

DRAFT

**Figure 28** ▶

Culham Vista residential catchment accessibility



### 8.10 Location 10 – Gossage Road underpass

The community has expressed that the informal equestrian trail adjacent Property 20 on Gossage Road is a key route. Crossing over Hopkinson Road at this location is fundamental in providing access between the residents that live in the special residential area to the west of Hopkinson Road and the Cardup Nature Reserve to the east of Hopkinson Road, which is used for recreational equine activity.

Tonkin Highway Extension will sever this route causing significant rerouting for equine users, restricting access to the Cardup Nature Reserve.

An equestrian underpass, similar to what is provided north of Thomas Road, see Figure 29, is proposed to facilitate the east-west connectivity under Tonkin Highway. The underpass location is shown on Figure 30.

 The construction of the Gossage Road underpass should be completed in line with the Tonkin Highway Extension to ensure connectivity is maintained.

A key design consideration for providing the Gossage Road underpass is that it is located at a midblock between the Bishop Road and Mundijong Road intersections. To achieve the minimum height clearances of the proposed underpass, it is likely that significant earthworks would need to be completed, and therefore there is a risk for significant additional costs.

**Preferred option**  
**10.2 Equestrian underpass continuing multi-purpose trails adjacent to Property 20**



**Figure 29**  Existing Tonkin Highway equestrian underpass north of Thomas Road

**Figure 30**  Gossage Road underpass location



**8.11 Location 11 – Bishop Road interchange**

The opening year treatment of the Bishop Road interchange is consistent with the ultimate design. The grade separation of Tonkin Highway over Bishop Road allows for the provision of a footpath on the northern side of Bishop Road, south of the existing freight rail.

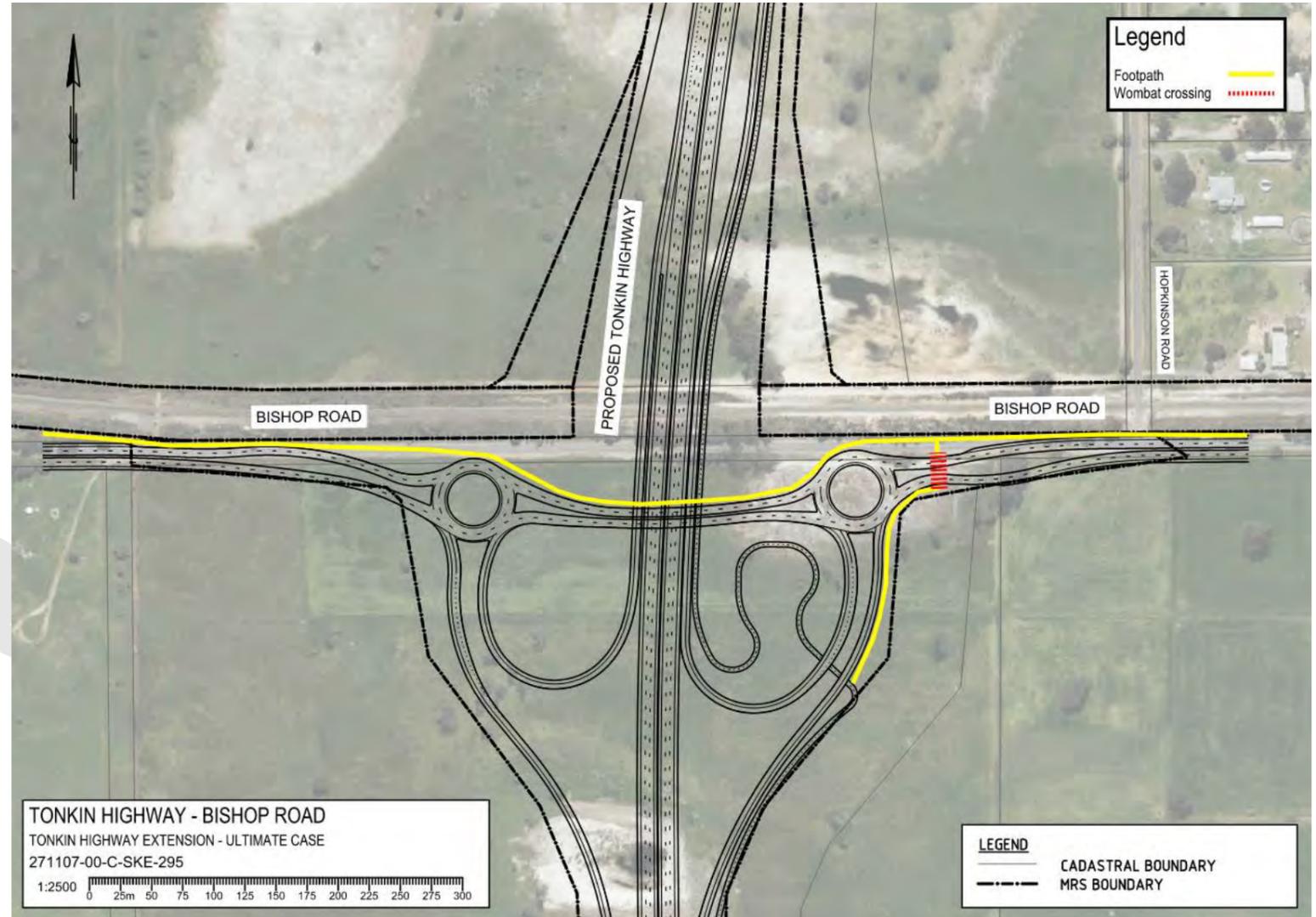
A footpath will facilitate pedestrian and cyclist connectivity along Bishop Road, therefore facilitating safe access to Court Grammar School to the east. It should be noted that this option will still require utilisation of the existing at-grade freight rail crossing on Bishop Road to the east.

To connect the PSP into the local footpath network, a connection east of Tonkin Highway is proposed, as shown on Figure 31. To cross Bishop Road north-south, it is proposed that a staged wombat crossing is provided to enhance active transport safety and amenity.

The footpath and PSP connection should be constructed in line with Tonkin Highway Extension opening year to facilitate the east-west pedestrian and cyclist connectivity, and ensure users are safe, notably the students on Bishop Road travelling to Court Grammar School.

- Preferred option**
- 11.2** Provide footpath on southern side of freight rail passing under the Tonkin Highway
  - 11.3** Provide access to Tonkin Highway PSP from local footpath network on Bishop Road

**Figure 31** Bishop Road Interchange



### 8.12 Location 12 – Bishop Road interchange (with ultimate rail realignment)

A key opportunity of the realignment of the existing freight rail is to convert the track into a rail trail. The relatively inexpensive conversion will benefit the equestrian community and has potential to attract tourism to the area as part of Rail Trails Australia.

Construction of the rail trail should be in line with the decommissioning of the use of the rail line after the freight rail realignment project is completed. This project would likely be completed through a combination of local and state government.

#### Preferred option

**12.1** Convert rail underpass and track into equestrian multi-purpose trail



**Figure 32**   
Freight rail east of Bishop Road (Source: Google Maps, 2021)

**8.13 Location 13 – Scott Road residential catchment**

Scott Road currently has two access points, Kargotich Road to the west and Taylor Road to the east, however there is a section in the centre of the corridor that is not connected.

When the Tonkin Highway Extension is constructed, the access to the east onto Taylor Road will be severed meaning that the properties to the east lose access to the broader road network.

To ensure access is not lost, the preferred option is to construct the central section of Scott Road to tie into the western section, and therefore provide access to the broader road network via Kargotich Road.

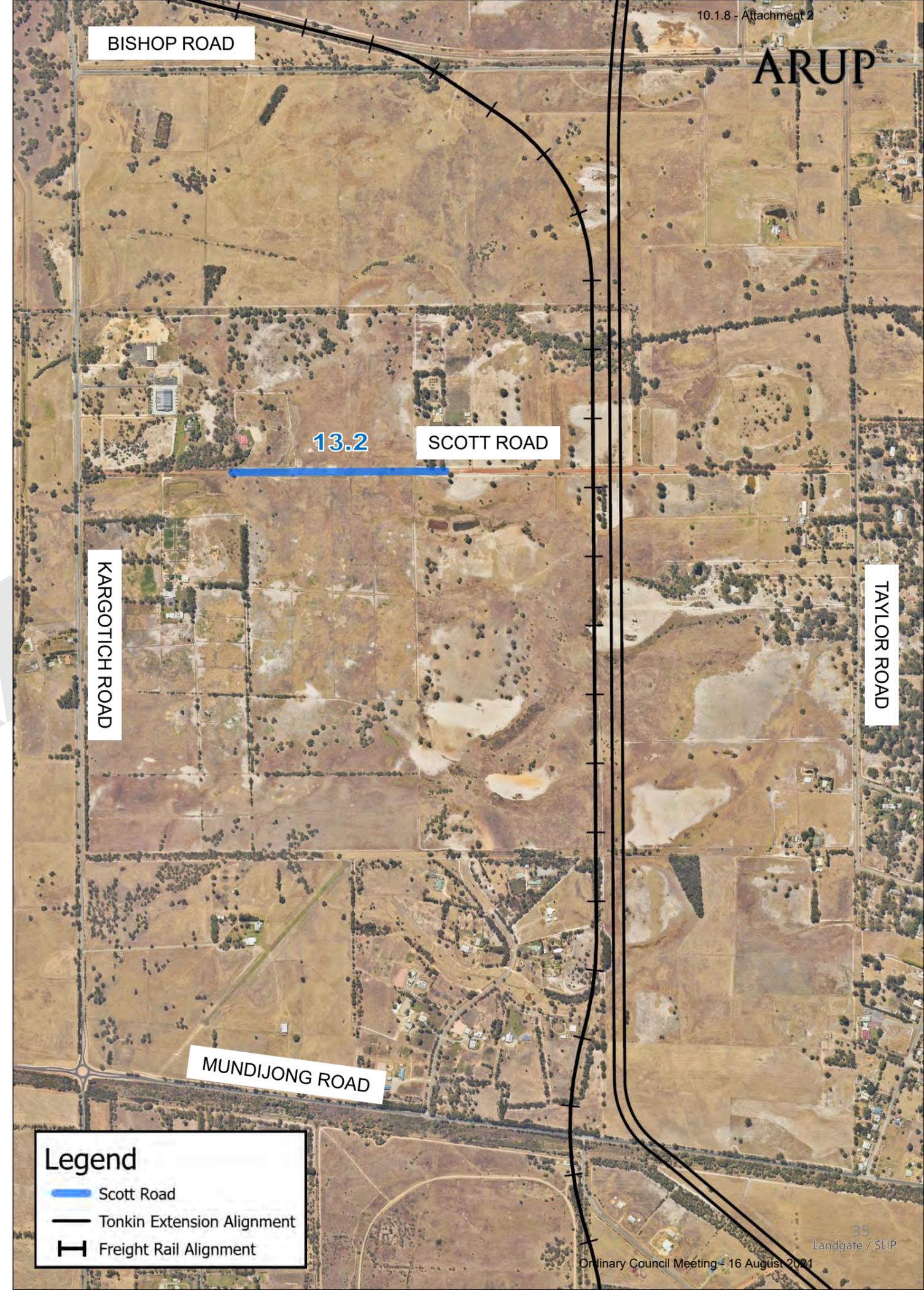
The land use of the Scott Road catchment is zoned for Industrial development and therefore to futureproof it, the road should be designed to industrial standard.

**Preferred option**

**13.2** Provide missing link between Scott Road east and west to complete tie in to Kargotich Road (in line with the West Mundijong Industrial Area DSP)

DRY

**Figure 33**  Scott Road catchment upgrades



**Legend**

-  Scott Road
-  Tonkin Extension Alignment
-  Freight Rail Alignment

### 8.14 Location 14 – Mundijong Road interchange

The Mundijong Road intersection is designed to be a dual lane roundabout at Project Case, and a diamond interchange at Ultimate Case.

To facilitate east-west pedestrian and cyclist access, in the Project Case wombat crossings should be provided over the northern legs of the intersection connected by a footpath, as shown in Figure 34. At the Ultimate Case, the major east-west crossings will be protected by signalised crossings, and the left slip lanes should have wombat crossings, as shown in Figure 35.

At the Ultimate Case the east-west footpath should tie into the PSP on the eastern side of Tonkin Highway adjacent to the off ramp.

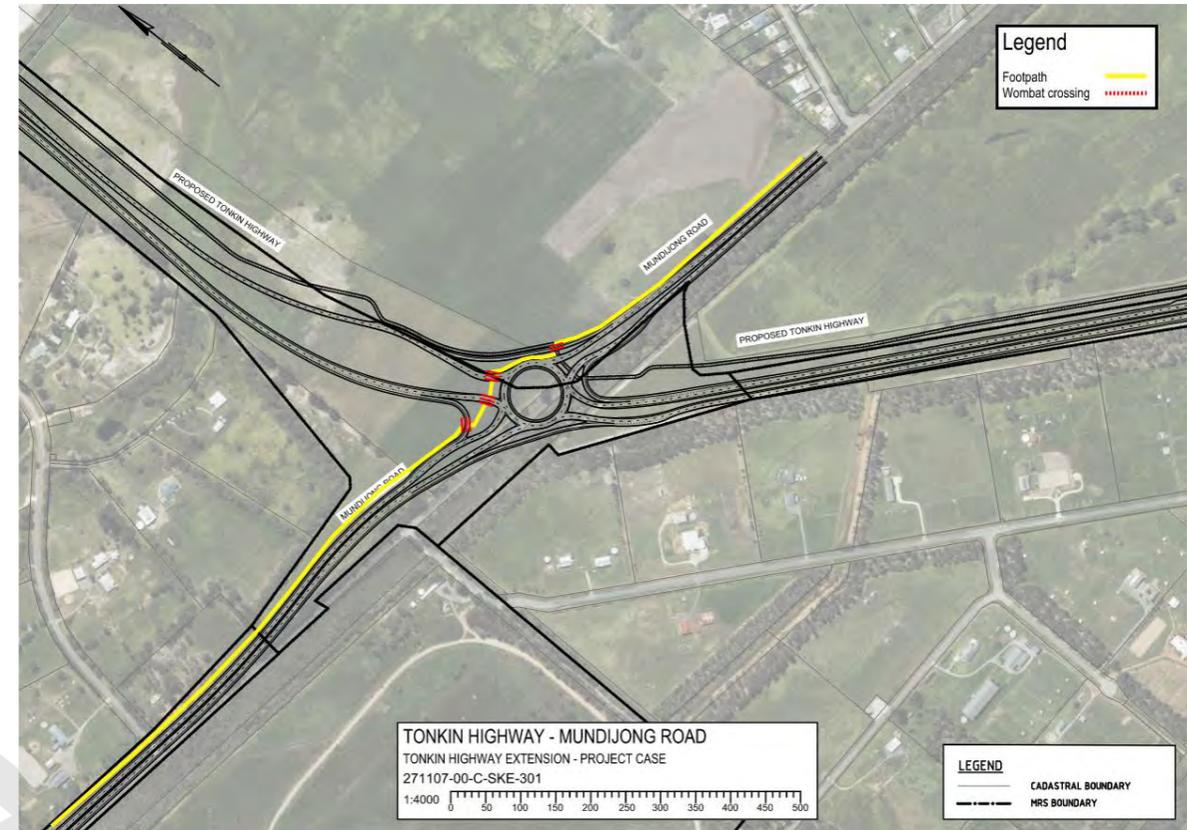
The construction of the wombat crossings and footpaths should be in line with the Project Case and Ultimate Case respectively.

**Preferred option**

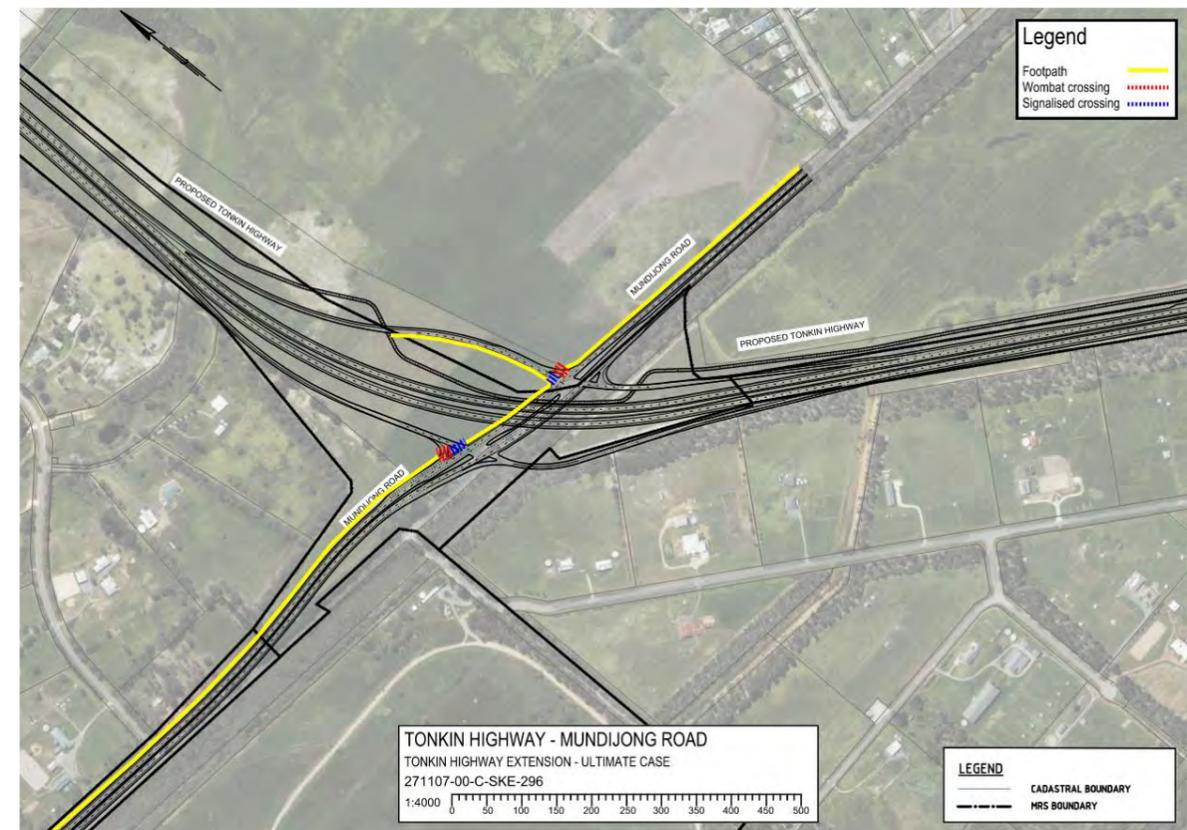
**14.4** Provide raised wombat crossings for east-west connectivity

**14.5** Provide ramp to connect local footpath network to the above-grade Tonkin Highway PSP

**Figure 34** ▶  
Shanley Road Project Case east-west connectivity



**Figure 35** ▶  
Shanley Road Ultimate Case east-west connectivity



**8.15 Location 15 – Lampiter Road residential catchment**

*Note: The preferred option is in line with the current preferred freight rail alignment, which is under further development.*

The existing access from Lampiter Road residential catchment is to the north on Mundijong Road and south on Dairy Lane to Randell Road.

At the Project Case, there is no changes to the network, however at Ultimate Case when the Freight Rail is realigned, there is some severance of the local network which needs to be addressed.

The preferred freight rail alignment is located on the eastern side of Dairy Lane which completely severs vehicle access out of Lampiter Road residential catchment.

To maintain vehicle access, Ironguard Road should be extended south to Randell Road, providing vehicle, pedestrian and cyclist access.

This extension should be completed prior to the construction of the freight rail realignment to ensure resident vehicle access is not completely severed at any point.

It should be noted that subject to the preferred alignment of the freight rail and spacing requirements of Mundijong Road interchange, there may be opportunity to maintain the existing access to the north at Lampiter Road.

**Preferred option**  
**15.1** Extend Ironguard Road south to Randell Road

**8.16 Location 16 – Randell Road**

*Note: The preferred option is in line with the current preferred freight rail alignment, which is under further development.*

The existing access for Randell Road is east-west between Kargotich Road and Wright Road.

The construction of the freight rail will sever Randell Road east of the Randell Road/ Dairy Lane intersection.

The severance of Randell Road is not deemed to have significant vehicle accessibility impacts and therefore a grade separation was not deemed required.

To support active transport, it is proposed that the general amenity along Randell Road should be improved to support active modes in connecting to the Tonkin PSP.

The active transport improvements should be constructed in line with the Freight Rail realignment project.

**Preferred option**  
**16.4** Sever east-west access but provide improved active transport amenity on Randell Road and Kargotich Road

**Figure 36** ▶  
 Lampiter Road catchment upgrades



**Legend**

- Ironguard Road Extension
- Randell Road improvements
- Tonkin Extension Alignment
- Freight Rail Alignment

**8.17 Location 17 – Wright Road**

The Wright Road corridor runs parallel to the existing freight rail corridor south of Watkins Road. The Tonkin Highway Extension overpasses the freight rail and Wright Road corridor maintaining vehicle access north-south.

To accommodate equestrian access, a multi-purpose trail on the western side of Wright Road, east of the freight rail. The cross-sectional space requirements needs to be further investigated between the road and freight rail. Leasing space within the freight rail easement on a temporary basis could be an option.

The construction of the multi-purpose trail should be completed in line with the opening year of Tonkin Highway Extension.

**Preferred option**

**17.2** Multi-purpose trail on western side of Wright Road

**17.5** Link Tonkin Highway PSP with existing multi-purpose trail running parallel to northern side of highway

DRY

**Figure 37** ▶  
Wright Road upgrades



**8.18 Location 18 – Adamson Street south**

The Tonkin Highway Extension severs the driveway access of Lot 200 Adamson Street. The existing driveway extends north over the proposed Tonkin Highway alignment.

This severance has been known to the landowner since the early concept stage of the Tonkin Highway Extension Project and the realignment of the driveway to the west has been approved prior. The realignment of the driveway as agreed by the landowner is shown in Figure 38.

 Construction of the realigned driveway should be completed prior to Tonkin Highway Extension.

**Preferred option**  
**18.2** Provide new access road between Adamson Street south and Bilya Road



**Figure 38**   
Adamson Street driveway realignment (Source: Letter to Lot 2 Hicks Street, Mundijong)

### 8.19 Location 19 – Shanley Road

The Tonkin Highway Extension severs Shanley Road to the north creating a cul-de-sac therefore restricting access to the north.

The owners from Lot 809 have expressed their want for an underpass of Tonkin Highway to the north of Shanley Road, however cost constraints of the Tonkin Extension Project means an underpass at Shanley Road is not likely possible to accommodate.

The option to construct the local road network in alignment with SOSJ Town Planning Scheme No.2 Amendment No. 205 is the preferred option to minimise the accessibility impact, including the east-west road to the south of Lot 47, as shown on Figure 39.

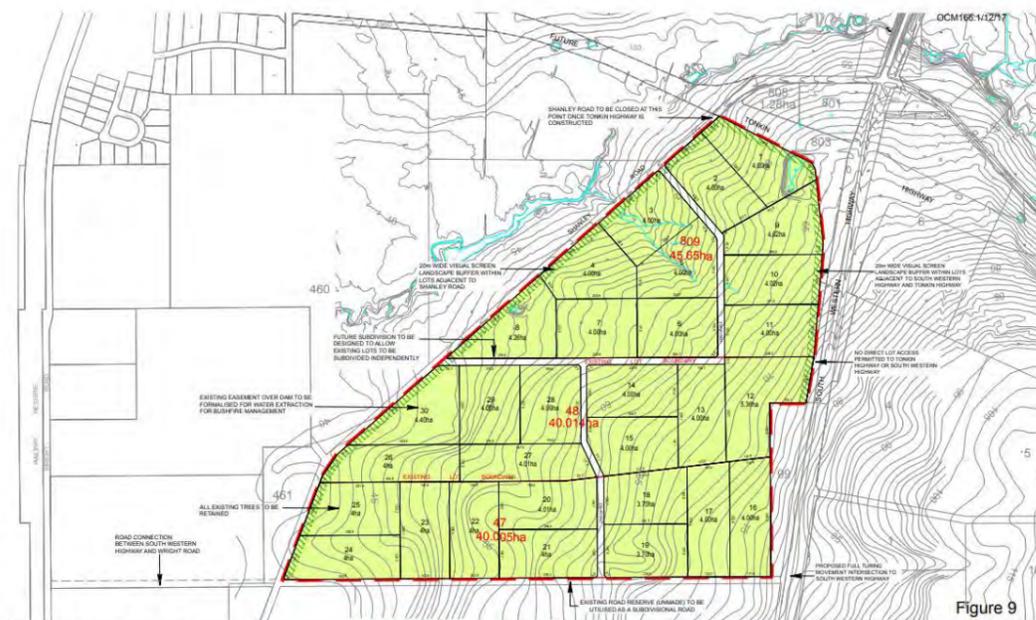
To show the accessibility impacts, the 5 minute vehicle accessibility catchments for the

existing, ultimate do nothing and ultimate preferred option is shown in Figure 40. The diagram shows accessibility to the south is similar between the existing and ultimate preferred option, however accessibility to the north on South Western Highway, Jarrahdale Road and Watkins Road (Tonkin Highway) is reduced.

Construction of the access road should be completed for Tonkin Highway Extension opening year.

#### Preferred option

**19.2** Sever access and investigate alignment with proposed Special Rural Subdivision Lots 47, 48 and 809 Shanley Road Mardella (SoSJ Town Planning Scheme No.2 Amendment No. 205, 2017)



**CONCEPT PLAN**  
 PROPOSED SPECIAL RURAL SUBDIVISION  
 LOTS 47, 48 & 809 SHANLEY ROAD  
 MARDELLA

NOTES:  
 • ALL ROADS TO BE DESIGNED AS 20m WIDE WITH TABLE DRAINS  
 WITH VERGE  
 • LOT SIZES TO BE MINIMUM AND A 5m MINIMUM AVERAGE  
 • ALL LOTS TO BE PROVIDED WITH UNDERGROUND POWER  
 • POTABLE WATER SUPPLY TO BE ACHIEVED THROUGH ROOF  
 CATCHMENT AND RAINWATER TANKS 120,000 LITRES CAPACITY

LEGEND:  
 Subject Land  
 NOTE:  
 Areas and dimensions subject to survey

SCALE 1:7500 @ A3

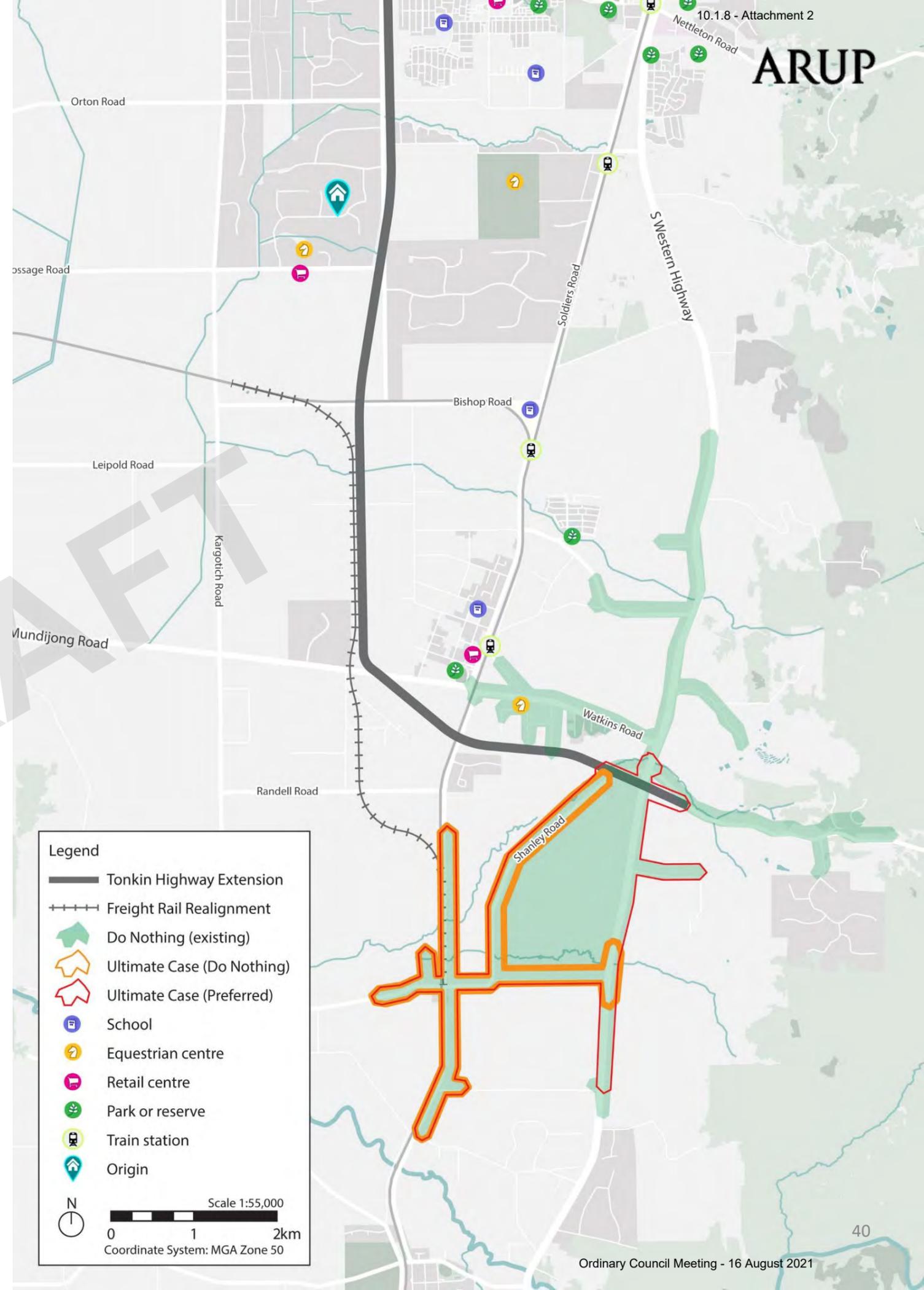
GRAY & LEWIS  
 LAND USE PLANNERS  
 Suite 2, Trinity Centre  
 South Perth, WA 6151  
 P 08 9474 1122  
 F 08 9474 1172  
 perl@graymls.com.au  
 OCM 18 December 2017

**Figure 39**

Shanley Road subdivision (Source: Serpentine Jarrahdale Shire Town Planning Scheme No. 2 Amendment No. 205, 2017)

**Figure 40**

Shanley Road vehicle accessibility diagram



### 8.20 Location 20 – Shanley Road intersection

To address east-west connectivity of pedestrians and cyclists on South Western Highway, several options were investigated for assessment.

It was found that the likely requirement for east-west crossing of South Western Highway is minimal as most of the residential land use is on the western side of the corridor. In addition, the PSP is proposed for the western side of South Western Highway.

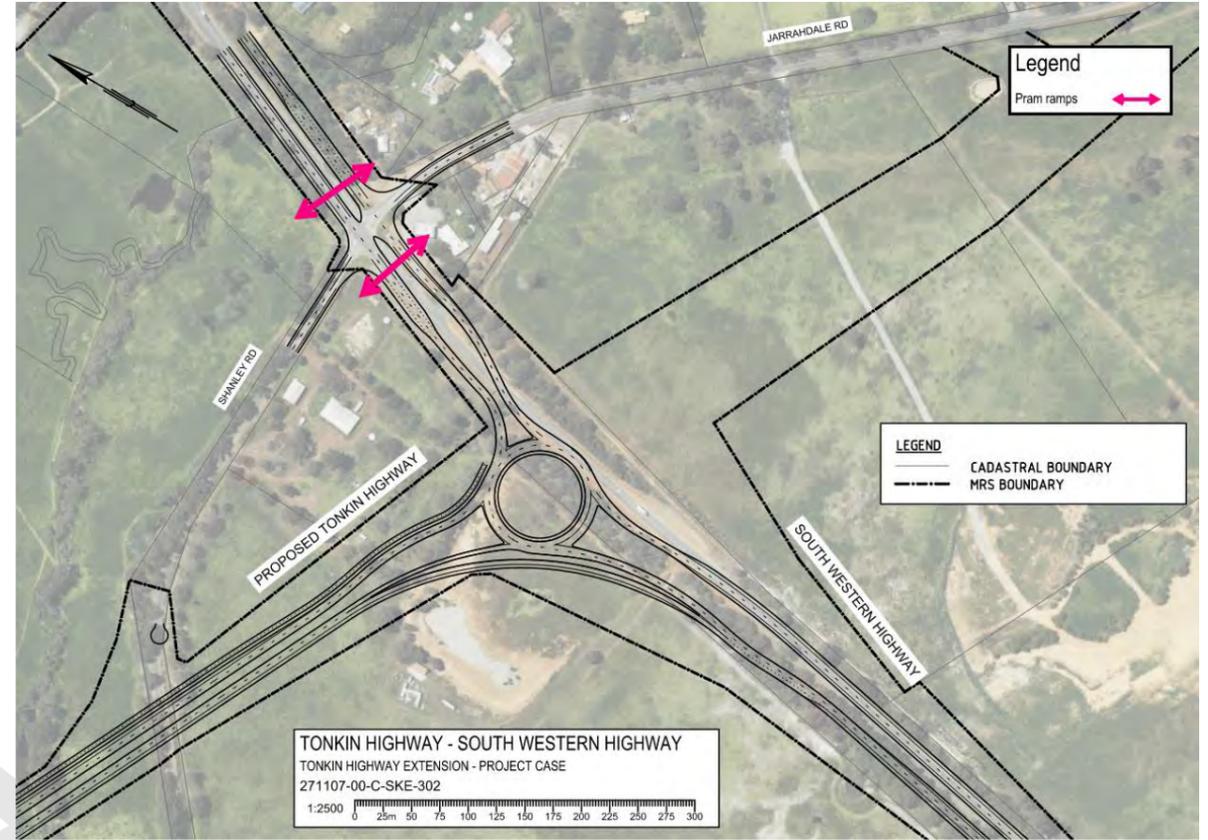
It is therefore proposed that pram ramps will be sufficient to service the east-west pedestrian and cyclist connectivity. This is shown on Figure 41 and 42.

This should be incorporated into the design of Shanley Road/ South Western Highway intersection.

**Preferred option**

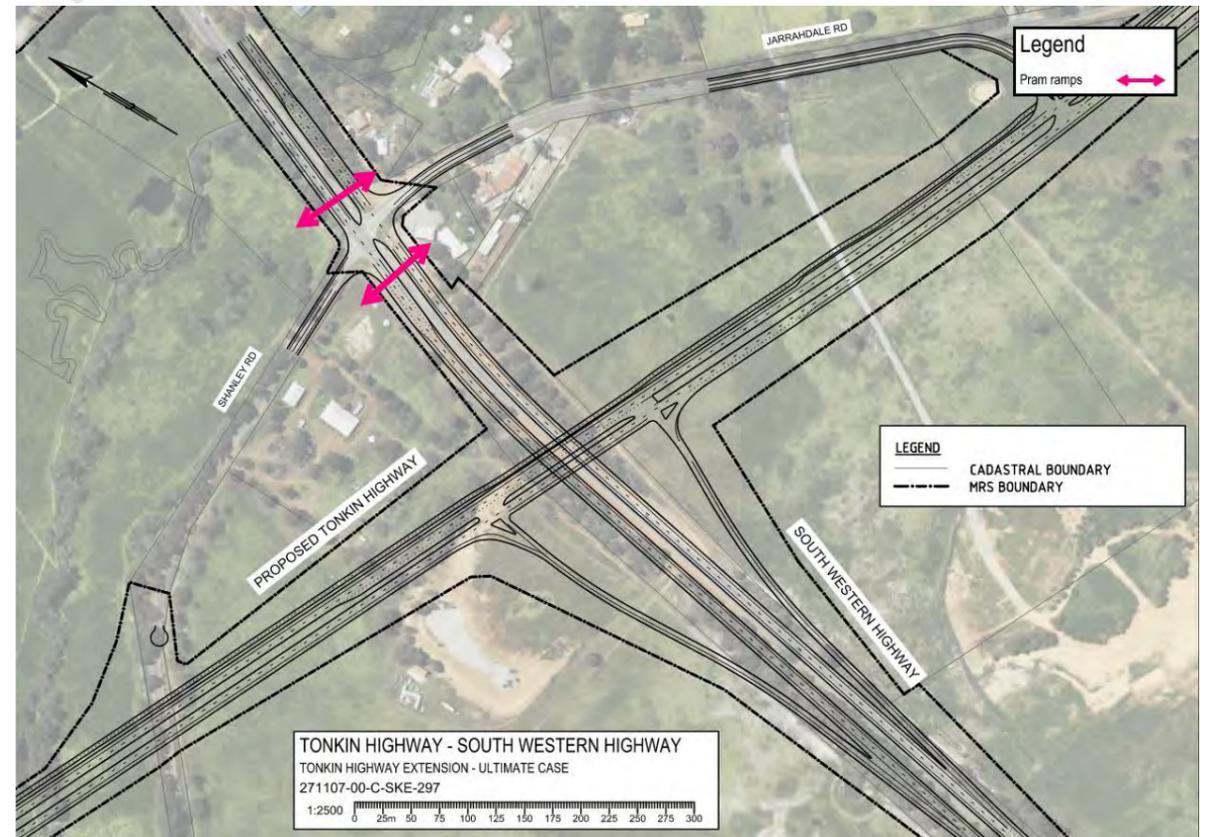
**20.1** Provide pram ramps only

**Figure 41** ▶  
Shanley Road Project Case east-west connectivity



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**Figure 42** ▶  
Shanley Road Ultimate Case east-west connectivity



## 9 Bushfire management plan considerations

Arup met with fire management representatives from SoSJ on 14<sup>th</sup> May 2021 to understand the revised accessibility requirements for evacuation as a result of the severance caused by Tonkin Highway Extension.

The impacted catchments that were identified for consideration are the Jersey Road Residential Catchment and Cardup Siding Road cul-de-sac.

### 9.1 Jersey Road Residential Catchment

There are three additional accessibility options for consideration to support evacuation from the Jersey Road Residential Catchment, as shown in Figure 42.

- **Option 1:** Maintain gated access from the north-west of Holstein Court connecting to Thomas Road, see Figure 41.



Figure 41 ▲

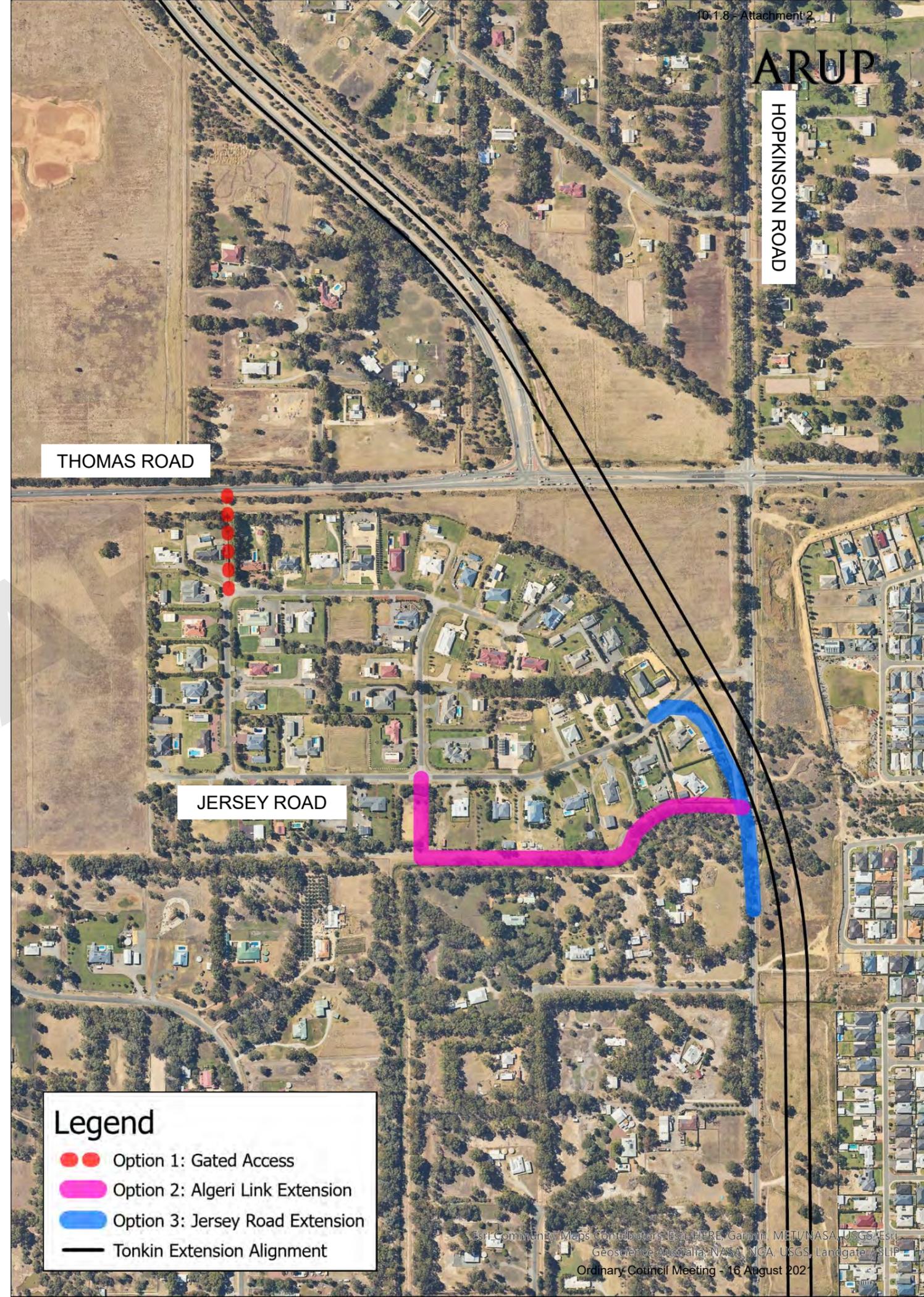
Existing gated access from Holstein Court

- **Option 2:** Extend Algeri Link to the south then extending east into Hopkinson Road.

- **Option 3:** Extend Jersey Road to the east tying into Hopkinson Road to the south. Note that this option is only be feasible at Project Case due to the footprint of the Ultimate Case interchange at Thomas Road. This option will likely require land acquisition of Lots 42 and 43 at the Project Case.

Figure 42 ▶

Jersey Road evacuation options



**Legend**

- ● Option 1: Gated Access
- █ Option 2: Algeri Link Extension
- █ Option 3: Jersey Road Extension
- Tonkin Extension Alignment

**9.2 Cardup Siding Road cul-de-sac**

The cul-de-sac created at Cardup Siding Road was identified as a potential risk. The risk area and confirmed on the meeting 14<sup>th</sup> May with the proposed option presented in section 8.9 found to provide suitable access for bushfire management purposes. This access arrangement is in line with the DSP, which shows the existing western access severed by the Tonkin Highway extension, see Figure 27.

The current proposed access locations out of Cardup Siding Road in line with section 8.9 is shown in Figure 43.

DRY



**Figure 43**  Cardup Siding Road evacuation

**Legend**

-  Doley Road Extension
-  Tonkin Highway Alignment

## 10 Further considerations

The Accessibility Study options development stage was developed at the end of 2020 and early 2021 which aligned with the preferred interchange options at the time.

Due to funding constraints at the Project Case stage, additional optioneering for at grade solutions at the interchange locations was undertaken. These options were presented at the Steering Committee Meeting on the 28<sup>th</sup> May 2021 where changes to the preferred Project Case options at Thomas Road and Orton Road were agreed

The following sections outline the additional options developed as a result of changes to design.

### 10.1 Location 2 – Ballak Place/ Thomas Road intersection

The intersection at Ballak Place is proposed to be left-in left-out at the Project Case to allow for the displaced through right turn intersections.

Outbound vehicles from Ballak Place can turn left, however if they require to travel westbound, the eastern intersection of the displaced through right turn allows for light vehicles to U-turn.

Inbound vehicles will have reduced access, and will require to enter Ballak Place from the west and turn left in. Not allowing for the right turn into Ballak Place, noting that it is a significant detour, may be a risk as the residents may attempt to mount the kerb to gain access.

Minimal additional construction is required to accommodate the left-in left-out treatment.

### 10.2 Location 3 – Hopkinson Road connectivity

The Project Case design for the Thomas Road/ Tonkin Highway intersection was changed at the Steering Committee Meeting. The preferred option is now an at-grade displaced through-right turn option, see Figure 44. The change to the preferred Project Case design has allowed for an additional option to be developed for Hopkinson Road connectivity from the north.

A left-in left-out treatment from Hopkinson Road onto Thomas Road is now proposed, which is a lower cost option than the option identified in Section 8.3, and therefore the revised preferred option at the Project Case.

Vehicles are able to U-turn at the roundabout, which will be constructed as part of the Thomas Road duplication project, at Thomas Road/ Kardan Boulevard to access Tonkin Highway if required. This has minimal impact to the overall vehicle accessibility for the catchment.

This connection should be built in line with the construction of the eastern intersection.

At the ultimate case, it is recommended that the preferred option identified in Section 8.3 is built.

### 10.3 Location 4 – Thomas Road interchange

The change to the preferred option for the Thomas Road/ Tonkin Highway intersection at the Project Case has resulted in a slight amendment to the proposed east-west connectivity.

The footpath is still proposed to be provided on the southern side of Thomas Road, however

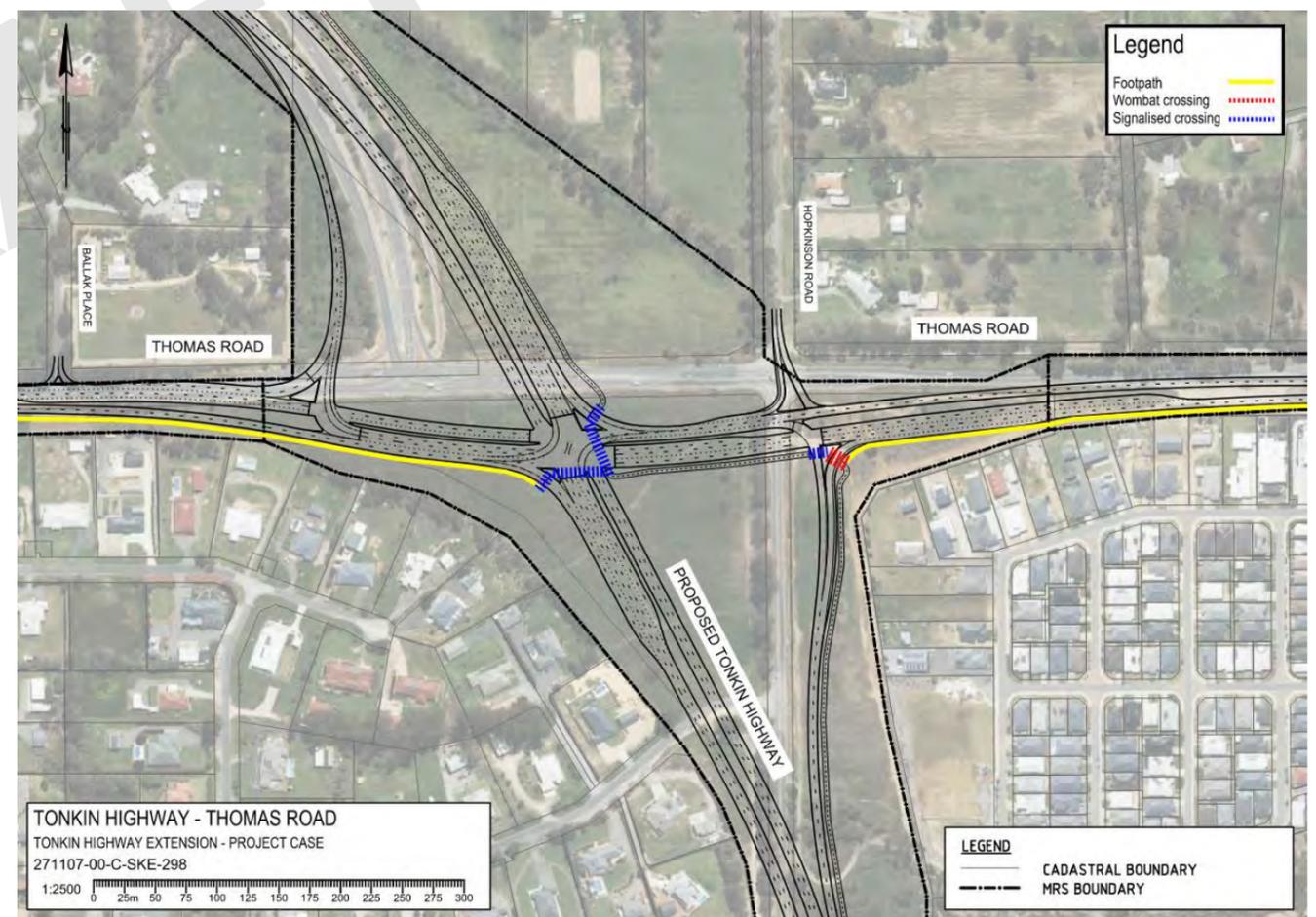
the interface with vehicles has changed from the diamond interchange with loop ramps option as there is no longer grade separation.

As shown on Figure 44, the central intersection will have protected signalised staged-crossings on the southern and eastern leg providing fully protected crossings for pedestrians and cyclists. This connection ties into the proposed PSP route down the eastern side of Tonkin Highway Extension.

At the eastern intersection, there is a staged crossing on the southern leg, the first is a

protected signalised crossing, however the westbound slip lane is free flow and therefore a wombat crossing is proposed to be provided. The footpath would then extend further east, south of Thomas Road.

The construction of these crossings should be built in line with the intersections.



**Figure 44** Thomas Road Displaced Through Right Turn

## 11 Conclusion

The accessibility study has provided a strategy for implementation to limit the extent to which the Tonkin Highway Extension severs existing access for the vehicle, pedestrian, cyclist and equestrian networks.

The preferred options represent the solution that most aligns with the project objectives, supporting accessibility outcomes. Some of the options will require to be delivered by Main Roads for opening year, project case and ultimate case.

Some of the preferred recommendations will enhance connectivity, however Main Roads may not be required to undertake delivery directly. Further engagement with the Shire of Serpentine Jarrahdale, developers and landowners should be completed to determine who is responsible.

### Next steps

The strategy is currently developed in line with the preferred intersection treatments at Thomas Road, Orton Road, Bishop Road, Mundijong Road and South Western Highway, the Thomas Road Duplication Project, and the Freight Rail Realignment Project. If the preferred options are subject to change, this strategy should be revisited to assess the suitability of the preferred options.

Table 2 provides summary of the preferred options and whether they should be incorporated into either the Tonkin Highway Extension Stage 3 design/project responsibility, or where they will be delivered as part of other projects.

**Table 2** ▾  
Next steps for preferred options

Option	Incorporate into Tonkin Extension Project Case design	Incorporate into Tonkin Extension Ultimate Case design	Incorporate into Thomas Road Duplication design	Incorporate into Freight Rail realignment design	To be determined
1.2 Provide service road north of Thomas Road between Kargotich Road and Ballak Place			✓		
1.4 Provide footpath on southern side of Thomas Road heading east and tying into Thomas Road interchange	✓	✓	✓		
2.7 Left-in left-out with semi-mountable kerb median on Thomas Road for emergency vehicles	✓	✓			
3.4 Realign access to Thomas Road at Karden Boulevard (proposed district distributor) with roundabout		✓	✓		
3.8 Tie PSP into local network on Kellet Drive	✓	✓			
3.9 Tie multi purpose routes onto the trails running alongside the northern side of Thomas Road			✓		
4.5 Provide raised wombat crossings for east-west connectivity		✓			
5.1 Comply with LSP Lot 2 Thomas Road & Lot 4 Kargotich Road, Oakford to construct new internal road layout connecting Jersey Road through to Kargotich Road with additional access road connecting with Byford Meadows Dr	✓	✓			
6.2 Provide footpath on southern side of Abernethy Road (continued through underpass) to tie local network into PSP	✓	✓			
6.3 Separated equestrian underpass to the north (near Prop11), tying into existing multi-purpose trails on northern side of Abernethy Rd	✓	✓			
7.2 Provide shared, multi-purpose underpass south of the intersection (near Property 6)	✓				
7.3 Provide access to Tonkin Highway PSP on the northern side of the intersection	✓				
8.2 Provide shared, multi-purpose underpass south of the intersection (near Property 6)		✓			
8.5 Crossing on grade separated roundabout, raised wombat crossing (active transport only)		✓			
9.2 Extension of Doley Road to Cardup Siding Road from Orton Road intersection (in line with Byford DSP future local distributors)	✓	✓			
10.2 Equestrian underpass continuing multi-purpose trails adjacent to Property 20	✓	✓			
11.2 Provide footpath on southern side of freight rail passing under the Tonkin Highway	✓	✓			
11.3 Provide access to Tonkin Highway PSP from local footpath network on Bishop Road	✓	✓			
12.1 Convert rail underpass and track into equestrian multi-purpose trail					✓
13.2 Provide missing link between Scott Road east and west to complete tie in to Kargotich Road (in line with the West Mundijong Industrial Area DSP)	✓	✓			
14.4 Provide raised wombat crossings for east-west connectivity	✓	✓			
14.5 Provide ramp to connect local footpath network to the above-grade Tonkin Highway PSP	✓	✓			
15.1 Extend Ironguard Road south to Randell Road				✓	
16.4 Sever east-west access but provide improved active transport amenity on Randell Road and Kargotich Road				✓	
17.2 Multi-purpose trail on western side of Wright Road	✓	✓			
17.5 Link Tonkin Highway PSP with existing multi-purpose trail running parallel to northern side of highway	✓	✓			
18.2 Provide new access road between Adamson Street south and Bilya Road	✓	✓			
19.2 Sever access and investigate alignment with proposed Special Rural Subdivision Lots 47, 48 and 809 Shanley Road Mardella (SoSJ Town Planning Scheme No.2 Amendment No. 205, 2017)	✓	✓			
20.1 Provide pram ramps only	✓	✓			

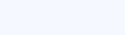
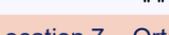
## Appendix A

### Long list options and fatal flaw analysis

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## Long list options and fatal flaw analysis

Mode	#	Shortlisted (Y/N)	Option description
<b>Sector 1 – Thomas Road to south of Orton Road</b>			
<b>Location 1 – Ballak Place residential catchment</b>			
	1.1	N	Purchase properties and remove access
	1.2	Y	Provide service road north of Thomas Road between Kargotich Road and Ballak Place
	1.3	Y	Provide footpath on northern side of Thomas Road heading east and tying into Thomas Road interchange
	1.4	Y	Provide footpath on southern side of Thomas Road heading east and tying into Thomas Road interchange
<b>Location 2 – Ballak Place/ Thomas Road intersection</b>			
	2.1	N	Left-in left-out only with barrier kerb raised median on Thomas Road
	2.2	Y	Left-in left-out with semi-mountable kerb median on Thomas Road for emergency vehicles
	2.3	N	Left-in left-out with painted median on Thomas Road for emergency vehicles
	2.4	N	Full access roundabout
	2.5	N	Full access signalised
	2.6	Y	Full access priority-controlled seagull
	2.7	Y	Full access priority-controlled median break
	2.8	N	Realign Ballak Place to Holstein Court and provide a 4-way intersection
<b>Location 3 – Hopkinson Road connectivity</b>			
	3.1	N	Realign access to Thomas Road at a new roundabout
	3.2	N	Realign access to Thomas Road at a new signalised intersection
	3.3	N	Realign access to Thomas Road at a new priority-controlled intersection
	3.4	Y	Realign access to Thomas Road at Karden Boulevard (proposed District Distributor) with roundabout
	3.5	Y	Realign access to Thomas Road at Karden Boulevard (proposed District Distributor) with signalised intersection
	3.6	Y	Left-in/ left-out at Hopkinson Road
	3.7	Y	Realign access to Thomas Road at Karden Boulevard (proposed District Distributor) with priority controlled intersection
	3.8	Y	Tie PSP into local network on Kellet Drive
	3.9	Y	Tie multi-purpose routes onto the trails running alongside the northern side of Thomas Road

Mode	#	Shortlisted (Y/N)	Option description
<b>Sector 1 – Thomas Road to south of Orton Road</b>			
<b>Location 4 – Thomas Road interchange</b>			
	4.1	Y	Provide grade separated multi-purpose path on northern side of interchange
	4.2	Y	Provide grade separated multi-purpose path on southern side of interchange
	4.3	Y	Provide pram ramps only for east-west connectivity across interchange
	4.4	N	Provide zebra crossings for east-west connectivity across interchange
	4.5	Y	Provide raised wombat crossings for east-west connectivity
	4.6	N	Provide signalised pedestrian crossings (pelican/ puffin) for east-west connectivity across interchange
<b>Location 5 – Jersey Road residential catchment</b>			
	5.1	Y	Comply with LSP Lot 2 Thomas Road & Lot 4 Kargotich Road, Oakford to construct new internal road layout connecting Jersey Road through to Kargotich Road with additional access road connecting with Byford Meadows Drive
	5.2	Y	New access road from Jersey Road west to tie into Kargotich Road (partial 5.1)
	5.3	Y	New access road from Jersey Road west to tie into Byford Meadows Drive (partial 5.1)
	5.4	N	New access road from Jersey Road west to tie into Thomas Road
	5.5	N	New access road from Jersey Road central to tie into Abernethy Road
	5.6	Y	New access road from Jersey Road east to tie into Hopkinson Road
	5.7	N	New access road from Holstein Court north west to tie into Thomas Road
	5.8	Y	New access road from Jersey Road central to tie into Hopkinson Road
<b>Location 6 – Abernethy Road underpass</b>			
	6.1	Y	Provide footpath on northern side of Abernathy Road (continued through underpass) to tie local network into PSP on northern side of Abernethy Road
	6.2	Y	Provide footpath on southern side of Abernathy Road (continued through underpass) to tie local network into PSP on southern side of Abernethy Road
	6.3	Y	Separated equestrian underpass to the north (near Property 11), tying into existing multi-purpose trails on northern side of Abernathy Road
<b>Location 7 – Orton Road intersection (project case)</b>			
	7.1	Y	Provide shared, multi-purpose underpass north of the intersection (near Property 10)
	7.2	Y	Provide shared, multi-purpose underpass south of the intersection (near Property 6)
	7.3	Y	Provide access to Tonkin Highway PSP on the northern side of the intersection
	7.4	Y	Provide access to Tonkin Highway PSP on the southern side of the intersection

Mode	#	Shortlisted (Y/N)	Option description
<b>Sector 1 – Thomas Road to south of Orton Road</b>			
Location 8 – Orton Road interchange (ultimate case)			
	8.1	Y	Provide shared, multi-purpose underpass north of the intersection (near Property 10)
	8.2	Y	Provide shared, multi-purpose underpass south of the intersection (near Property 6)
	8.3	Y	Crossing on grade separated roundabout, pram ramps only
	8.4	N	Crossing on grade separated roundabout, zebra crossings
	8.5	Y	Crossing on grade separated roundabout, raised wombat crossing
	8.6	N	Crossing on grade separated roundabout, signals
<b>Sector 2 – Orton Road to Bishop Road</b>			
Location 9 – Culham Vista residential catchment			
	9.1	Y	New access road from Learmouth Turn to slip road/ existing Orton Road
	9.2	Y	Extension of Doley Road to Cardup Siding Road from Orton Road intersection (in line with Byford DSP future local distributors)
	9.3	N	Underpass on Cardup Siding Road
Location 10 – Gossage Road underpass			
	10.1	N	Vehicle underpass retaining connection between Gossage Road and Hopkinson Road
	10.2	Y	Multi-purpose underpass continuing multi-purpose trails adjacent to Property 20
Location 11 – Bishop Road interchange			
	11.1	Y	Provide footpath on northern side of freight rail, passing under the Tonkin Highway
	11.2	Y	Provide footpath on southern side of freight rail, passing under the Tonkin Highway
	11.3	Y	Provide access to Tonkin Highway PSP from local footpath network on Bishop Road
Location 12 – Bishop Road (with Freight Rail Realignment)			
	12.1	Y	Convert rail underpass and track into equestrian (multi-purpose) trail

Mode	#	Shortlisted (Y/N)	Option description
<b>Sector 3 – Bishop Road to Wright Road</b>			
<b>Location 13 – Scott Road residential catchment</b>			
	13.1	N	Retain access on Scott Road by providing underpass under Tonkin Highway in the project case and under freight rail in the ultimate case
	13.2	Y	Provide missing link between Scott Road east and west to complete tie in to Kargotich Road (in line with the West Mundijong Industrial Area DSP)
	13.3	N	Purchase property and remove access
<b>Location 14 – Mundijong Road interchange</b>			
	14.1	Y	Provide signalised pedestrian crossings (pelican/ puffin) across Tonkin Highway on/ off-ramps for east-west connections along Mundijong Road
	14.2	Y	Provide pram ramps only for east-west connectivity across interchange
	14.3	N	Provide zebra crossings for east-west connectivity across interchange
	14.4	Y	Provide raised wombat crossings for east-west connectivity
	14.5	Y	Provide ramp to connect local footpath network to the above-grade Tonkin Highway PSP
<b>Location 15 – Lampiter Road residential catchment</b>			
	15.1	Y	Extend Ironguard Road south to Randell Road
	15.2	Y	Extend Lampiter Drive south to Randell Road
	15.3	Y	Realign Dairy Lane to run parallel to the freight rail line on the east and connect through to Randell Road on the eastern side of Property 98
<b>Location 16 – Randell Road</b>			
	16.1	N	Provide underpass under freight rail line
	16.2	N	Provide overpass over freight rail line
	16.3	Y	Provide level crossing on Randell Road to retain east-west connectivity.
	16.4	Y	Sever east-west access but provide improved active transport amenity on Randell Road and Kargotich Road

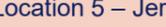
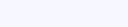
Mode	#	Shortlisted (Y/N)	Option description
<b>Sector 4 – Wright Road to South Western Highway</b>			
<b>Location 17 – Wright Road</b>			
  	17.1	Y	Multi-purpose trail on eastern side of Wright Road
  	17.2	Y	Multi-purpose trail on western side of Wright Road
  	17.3	Y	Footpath on eastern side of Wright Road
  	17.4	Y	Footpath on western side of Wright Road
  	17.5	Y	Link Tonkin Highway PSP with existing multi-purpose trail running parallel to northern side of highway
<b>Location 18 – Adamson Street South</b>			
  	18.1	N	Provide underpass connecting Adamson Street south with Adamson Street north to provide north-south connectivity across Tonkin Highway
  	18.2	Y	Provide new access road between Adamson Street south and Bilya Road
  	18.3	Y	Provide new access road between Adamson Street south and Shanley Road
  	18.4	N	Purchase property and remove access
<b>Location 19 – Shanley Road</b>			
  	19.1	N	Provide underpass to retain access from Shanley Road to South Western Highway
  	19.2	Y	Sever access and investigate alignment with proposed Special Rural Subdivision Lots 47, 48 and 809 Shanley Road Mardella (Shire Town Planning Scheme No.2 Amendment No. 205, 2017)
<b>Location 20 – Shanley Road intersection</b>			
 	20.1	Y	Provide pram ramps only
 	20.2	N	Provide signalised active transport crossing (pelican/ puffin)

## Appendix B

### Short list and multi criteria analysis

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## Short list options and multi criteria analysis

Mode	#	MCA score	Option description
<b>Sector 1 – Thomas Road to south of Orton Road</b>			
<b>Location 1 – Ballak Place residential catchment</b>			
	1.2	4	Provide service road north of Thomas Road between Kargotich Road and Ballak Place
	1.3	7	Provide footpath on northern side of Thomas Road heading east and tying into Thomas Road interchange
	1.4	8	Provide footpath on southern side of Thomas Road heading east and tying into Thomas Road interchange
<b>Location 2 – Ballak Place/ Thomas Road intersection</b>			
	2.2	8	Left-in left-out with semi-mountable kerb median on Thomas Road for emergency vehicles
	2.6	4	Full access priority-controlled seagull
	2.7	7	Full access priority-controlled median break
<b>Location 3 – Hopkinson Road connectivity</b>			
	3.4	8	Realign access to Thomas Road at Karden Boulevard (proposed District Distributor) with roundabout
	3.5	4	Realign access to Thomas Road at Karden Boulevard (proposed District Distributor) with signalised intersection
	3.6	-2	Left-in/ left-out at Hopkinson Road
	3.7	2	Realign access to Thomas Road at Karden Boulevard (proposed District Distributor) with priority controlled intersection
	3.8	10	Tie PSP into local network on Kellet Drive
	3.9	7	Tie multi-purpose routes onto the trails running alongside the northern side of Thomas Road
<b>Location 4 – Thomas Road interchange</b>			
	4.1	1	Provide grade separated multi-purpose path on northern side of interchange
	4.2	3	Provide grade separated multi-purpose path on southern side of interchange
	4.3	4	Provide pram ramps only for east-west connectivity across interchange
	4.5	6	Provide raised wombat crossings for east-west connectivity
<b>Location 5 – Jersey Road residential catchment</b>			
	5.1	6	Comply with LSP Lot 2 Thomas Road & Lot 4 Kargotich Road, Oakford to construct new internal road layout connecting Jersey Road through to Kargotich Road with additional access road connecting with Byford Meadows Drive
	5.2	5	New access road from Jersey Road west to tie into Kargotich Road (partial 5.1)
	5.3	5	New access road from Jersey Road west to tie into Byford Meadows Drive (partial 5.1)
	5.6	-2	New access road from Jersey Road east to tie into Hopkinson Road
	5.8	-1	New access road from Jersey Road central to tie into Hopkinson Road

Mode	#	MCA score	Option description
<b>Sector 1 – Thomas Road to south of Orton Road</b>			
<b>Location 6 – Abernethy Road underpass</b>			
	6.1	8	Provide footpath on northern side of Abernethy Road (continued through underpass) to tie local network into PSP on northern side of Abernethy Road
	6.2	11	Provide footpath on southern side of Abernethy Road (continued through underpass) to tie local network into PSP on southern side of Abernethy Road
	6.3	4	Separated equestrian underpass to the north (near Property 11), tying into existing multi-purpose trails on northern side of Abernethy Road
<b>Location 7 – Orton Road intersection (project case)</b>			
	7.1	1	Provide shared, multi-purpose underpass north of the intersection (near Property 10)
	7.2	2	Provide shared, multi-purpose underpass south of the intersection (near Property 6)
	7.3	12	Provide access to Tonkin Highway PSP on the northern side of the intersection
	7.4	9	Provide access to Tonkin Highway PSP on the southern side of the intersection
<b>Location 8 – Orton Road interchange (ultimate case)</b>			
	8.1	1	Provide shared, multi-purpose underpass north of the intersection (near Property 10)
	8.2	2	Provide shared, multi-purpose underpass south of the intersection (near Property 6)
	8.3	5	Crossing on grade separated roundabout, pram ramps only
	8.5	6	Crossing on grade separated roundabout, raised wombat crossing
<b>Sector 2 – Orton Road to Bishop Road</b>			
<b>Location 9 – Culham Vista residential catchment</b>			
	9.1	-1	New access road from Learmouth Turn to slip road/ existing Orton Road
	9.2	4	Extension of Doley Road to Cardup Siding Road from Orton Road intersection (in line with Byford DSP future local distributors)
<b>Location 10 – Gossage Road underpass</b>			
	10.2	2	Multi-purpose underpass continuing multi-purpose trails adjacent to Property 20
<b>Location 11 – Bishop Road interchange</b>			
	11.1	8	Provide footpath on northern side of freight rail, passing under the Tonkin Highway
	11.2	12	Provide footpath on southern side of freight rail, passing under the Tonkin Highway
	11.3	9	Provide access to Tonkin Highway PSP from local footpath network on Bishop Road
<b>Location 12 – Bishop Road (with Freight Rail Realignment)</b>			
	12.1	10	Convert rail underpass and track into equestrian (multi-purpose) trail

Mode	#	MCA score	Option description
<b>Sector 3 – Bishop Road to Wright Road</b>			
Location 13 – Scott Road residential catchment			
	13.2	10	Provide missing link between Scott Road east and west to complete tie in to Kargotich Road (in line with the West Mundijong Industrial Area DSP)
Location 14 – Mundijong Road interchange			
	14.1	2	Provide signalised pedestrian crossings (pelican/ puffin) across Tonkin Highway on/ off-ramps for east-west connections along Mundijong Road
	14.2	5	Provide pram ramps only for east-west connectivity across interchange
	14.4	8	Provide raised wombat crossings for east-west connectivity
	14.5	9	Provide ramp to connect local footpath network to the above-grade Tonkin Highway PSP
Location 15 – Lampiter Road residential catchment			
	15.1	6	Extend Ironguard Road south to Randell Road
	15.2	2	Extend Lampiter Drive south to Randell Road
	15.3	1	Realign Dairy Lane to run parallel to the freight rail line on the east and connect through to Randell Road on the eastern side of Property 98
Location 16 – Randell Road			
	16.3	5	Provide level crossing on Randell Road to retain east-west connectivity.
	16.4	6	Sever east-west access but provide improved active transport amenity on Randell Road and Kargotich Road

Mode	#	MCA score	Option description
<b>Sector 4 – Wright Road to South Western Highway</b>			
<b>Location 17 – Wright Road</b>			
	17.1	5	Multi-purpose trail on eastern side of Wright Road
	17.2	8	Multi-purpose trail on western side of Wright Road
	17.3	6	Footpath on eastern side of Wright Road
	17.4	6	Footpath on western side of Wright Road
	17.5	10	Link Tonkin Highway PSP with existing multi-purpose trail running parallel to northern side of highway
<b>Location 18 – Adamson Street South</b>			
	18.2	8	Provide new access road between Adamson Street south and Bilya Road
	18.3	3	Provide new access road between Adamson Street south and Shanley Road
<b>Location 19 – Shanley Road</b>			
	19.2	3	Sever access and investigate alignment with proposed Special Rural Subdivision Lots 47, 48 and 809 Shanley Road Mardella (Shire Town Planning Scheme No.2 Amendment No. 205, 2017)
<b>Location 20 – Shanley Road intersection</b>			
	20.1	5	Provide pram ramps only

## Appendix C

### Do nothing interactive PDFs

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## Appendix D

### Do something interactive PDFs

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## Appendix E

### MCA Spreadsheets

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