



Australian Government



Transport
Roads & Maritime
Services

Tenterfield Heavy Vehicle Bypass

Assessment of Route Options

Preliminary Route Options Report

MAY 2014

Executive summary

Tenterfield is in the New England region of New South Wales and is situated on the New England Highway, approximately 18 kilometres south of the Queensland border. The New England Highway is a major interstate freight route and is part of the National Land Transport Network. The town is situated on the Great Dividing Range at the northern end of the New England tablelands, where the east-west Bruxner Highway meets the New England Highway.

The existing New England Highway is the main street of Tenterfield (Rouse Street) as it passes through the town. Rouse Street experiences road safety and local congestion problems associated with central business district traffic - mixing of local, regional and long distance traffic, including large heavy vehicles.

Rouse Street is relatively narrow, carrying two traffic lanes (one lane in each direction) with parallel parking on each side. It provides access to the town's retail and commercial sector. There are three pedestrian crossings in the commercial area and the speed limit is 50 km/h.

The Australian Government has committed funding to identify a heavy vehicle bypass route for Tenterfield. Roads and Maritime Services (Roads and Maritime) is currently undertaking a range of planning investigations for the development and assessment of various route options for a heavy vehicle bypass of Tenterfield. Roads and Maritime engaged GHD in 2012 to assist with the development of route options for a heavy vehicle bypass of Tenterfield.

Project objectives

The objectives of the project are as follows:

- Improve road safety
- Improve road transport productivity, efficiency and reliability of travel
- Minimise the impact on the natural, cultural and built environment
- Provide sustainable economic outcomes for the local community
- Minimise the social impact on the local community
- Provide value for money.

Route options development

A total of 22 preliminary route options were initially identified for further consideration. The preliminary route options were displayed for community feedback in March 2013 and September 2013. The key issues raised by the community include:

- Need for a bypass to be implemented to reduce heavy vehicle traffic volumes along the main street of Tenterfield
- Concern that bypass options will impact negatively on residential areas and the local economy
- The need to ensure that the bypass addresses traffic from the New England Highway as well as the Bruxner Highway and Mt Lindesay Road
- Community and Tenterfield Shire Council need to work together to improve the tourist potential of the town to offset any economic impact
- Concern about the economic impact of the proposed heavy vehicle bypass on the community and local businesses
- Current safety concerns along Rouse Street and maximising safety on any future bypass.

Since the display of the preliminary route options, the project team has undertaken further field investigations and held a technical assessment workshop to shortlist the preliminary route options to four. Community feedback on the long list of route options was an important consideration in the process.

Possible combinations of preliminary route options were identified as part of the assessment process. The shortlisted corridors identified are all to the west of Tenterfield and are described as follows:

Blue corridor option - starts south of Saddlers Road, aligns with the railway line east of Currys Gap State Conservation Area, passes to the west of the Tenterfield cemetery and connects to the existing highway north of Cowper Street.

Purple corridor option - starts south of Saddlers Road, follows the railway line east of Currys Gap State Conservation Area, runs along Western Street and recrosses the railway north of Sunnyside Loop Road. Connects to the existing highway at Cowper Street via the existing Western Boundary Street, alongside the industrial sub-division. Of the shortlisted route options this is the most direct route.

Orange corridor option - starts north of Tenterfield Creek Bridge, crosses the railway line north of Currys Gap State Conservation Area and travels west of the railway along Western Street. Option recrosses the railway line to Western Boundary Street connecting to the highway at Cowper Street.

Yellow corridor option - starts north of Tenterfield Creek Bridge, aligns with Railway Avenue east of the railway line, connects to Western Boundary Street and then back to the existing highway at Cowper Street. This is the shortest option.

Roads and Maritime acknowledges the high level of community support for an eastern option to address the traffic from the Bruxner Highway and Mount Lindesay Road passing through the town centre. However, none of the eastern preliminary route options ranked highly across the assessment criteria and all ranked poorly in terms of value for money.

This report focuses on the development of the preliminary route options and the assessment process used to shortlist route options for further development and evaluation.

Next steps

Further field investigations are proposed on the four shortlisted preliminary route options described in this report. These will include geotechnical investigations, additional heritage studies, noise monitoring and evaluation and a preliminary visual impact assessment. A preliminary concept design and a more detailed cost estimate (including cost benefit analysis) will be prepared for each shortlisted route option.

The next major output will be a route options development report which would be used as briefing information for a Value Management Workshop (VMW).

The route options development report will be displayed to the community later in 2014. This report will include more detailed information obtained from the field investigations and the preliminary concept design for each option.

Community feedback on the route options report, the outcomes of the VMW and the technical studies will be considered prior to selecting a preferred route option in late 2014.

Planning action will then be undertaken to reserve the corridor in the Council's local environment plan to provide planning certainty for the Council and the local community.

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1. Introduction

1.1 Project overview

Roads and Maritime Services (Roads and Maritime) has engaged GHD to undertake a detailed investigation into a potential heavy vehicle bypass of the town of Tenterfield in northern New South Wales.

Tenterfield is in the New England region of New South Wales and is situated on the New England Highway, approximately 18 kilometres south of the Queensland border. The New England Highway is a major interstate freight route and is part of the National Land Transport Network. The town is situated on the Great Dividing Range at the northern end of the New England tablelands, where the north-south New England Highway meets the east-west Bruxner Highway. It has a town population of 3966 (2011 census) residents from a total of approximately 6800 throughout the Shire.

The existing New England Highway is the main street (Rouse Street) of Tenterfield and this street experiences common traffic and safety problems associated with central business district traffic - mixing of local, regional and long distance traffic, including large heavy vehicles. Rouse Street is relatively narrow, carrying two traffic lanes (one lane in each direction) with parallel parking on each side. It provides linear access to the town's retail and commercial sector. There are three pedestrian crossings in the Rouse Street commercial area. The urban speed limit is currently 50km/h, but there are proposals to reduce this to 40km/h on some sections of Rouse Street in early 2014.

A map of Tenterfield and its location in northern New South Wales is provided as Figure 1. Key features of the map are the large water supply dam to the south of Tenterfield and the disused railway corridor passing along the western fringe of the town area.

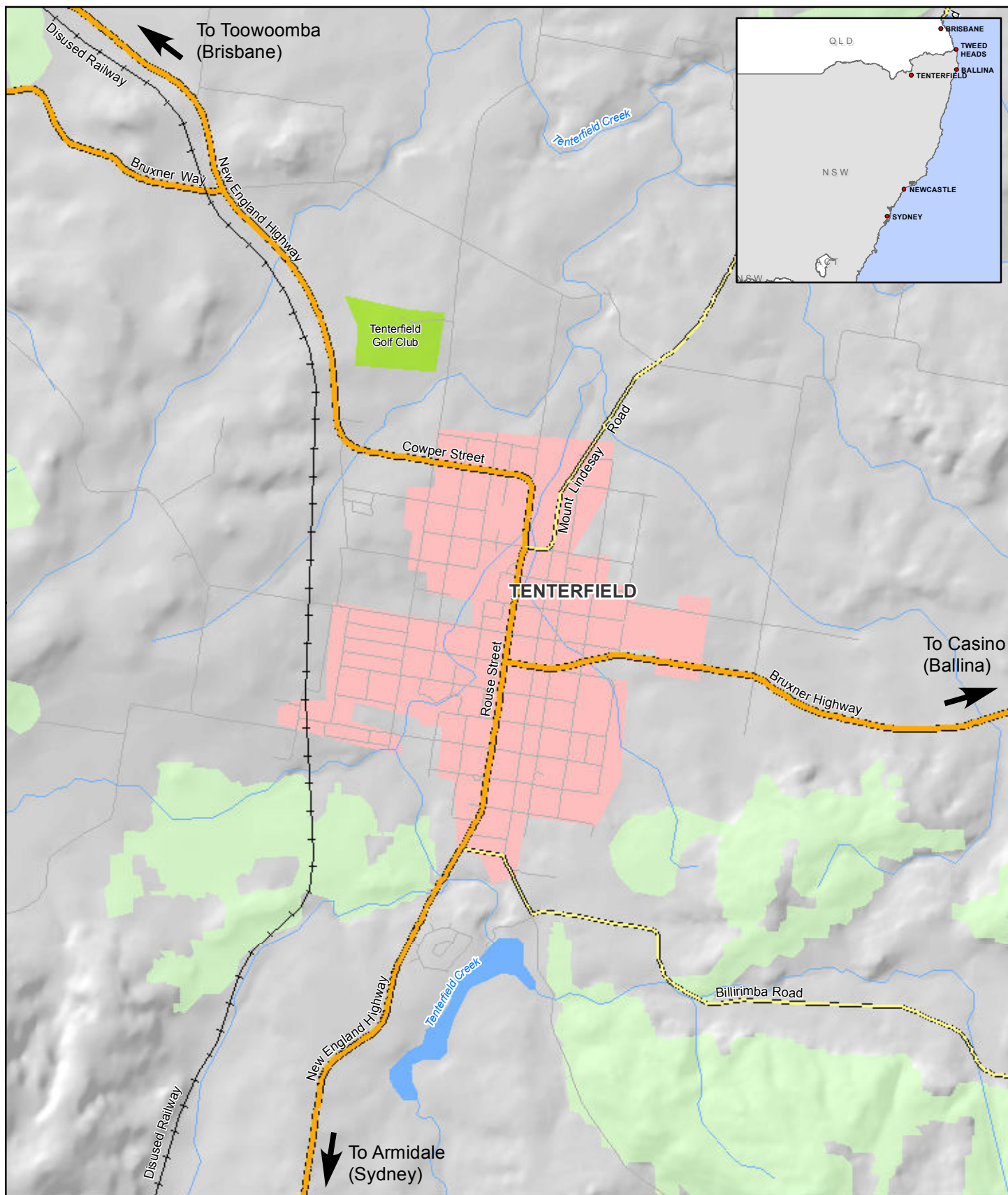
A recent study commissioned by Tenterfield Shire Council (PEECE Report, 2009) examined a number of different options for a heavy vehicle alternative route at Tenterfield. These route options were identified as improving safety and amenity for the residents of Tenterfield. However, the Council study was not progressed further due to funding limitations.

This heavy vehicle bypass investigation has initially focused on identifying potential route options and understanding how they relate to a range of planning and environmental, physical, socio-economic and existing infrastructure constraints in and around the town.

These potential, or preliminary route options, have also been assessed as to their feasibility of providing a viable bypass in terms of route distance, travel time savings, interaction with the existing road network and expected cost.

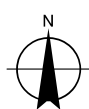
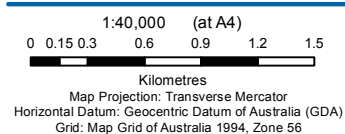
A shortlist of options has been nominated for further investigation and more detailed development to allow a formal assessment through a value management process involving key stakeholders.

The outcome of the investigation will be the nomination of a preferred route for a heavy vehicle bypass of Tenterfield, including the reservation of a corridor for future planning purposes. A preliminary environmental investigation will also accompany the preferred route selection.



LEGEND

Local Road	Existing Rail	Built Up Areas	Recreation Areas
Sub Arterial Road	Watercourse	Forest Or Shrub	
Primary Road	Water Body		



Roads and Maritime Services
Tenterfield Heavy Vehicle Bypass

Job Number 22-16349
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Locality Sketch

Figure 1

1.2 Strategic planning context

This project aligns with a number of strategic NSW and Australian Government priorities and plans.

The New England Highway forms part of the National Land Transport Network (NLTN). This network is recognised for its strategic national importance to national and regional economic growth, development and connectivity. The New England Highway also forms part of the inland route of the Sydney-Brisbane Corridor. The New England Highway passing through Tenterfield is recognised as an inland freight and commuter route allowing for the transport of goods to domestic and international markets via Newcastle, Sydney and Brisbane.

The following plans and strategies are relevant to the strategic planning context of a potential Tenterfield bypass:

- NSW State Plan (NSW 2021)
- NSW Long Term Transport Master Plan (LTTMP) 2012
- NSW Freight and Ports Strategy 2013
- New England North West Regional Transport Plan 2013
- NSW Road Safety Strategy 2012
- Sydney to Brisbane Corridor Strategy 2007

1.2.1 The NSW Government's State Plan (NSW 2021)

NSW 2021 identifies several goals of which the project addresses:

Goal 1: Improve the performance of the NSW economy

The initiative will help improve the performance of the NSW economy by increasing the productivity and efficiency of freight movements associated with agricultural or forestry activities located in the New England area.

Goal 3: Drive economic growth in regional NSW

Investing in regional infrastructure has been identified as a contributing factor to driving economic growth in regional NSW. This section of the highway is a transport artery for freight travelling between Sydney, Newcastle and Queensland and has supported the growth in transportation and employment in NSW.

Goal 7: Reduce Travel Times

The NSW Government is committed to delivering an efficient and effective transport system that reduces the time it takes to travel around Sydney and across NSW. The project will help meet this commitment by increasing average speeds for freight and passenger movements on the New England Highway by removing traffic conflicts between local and through traffic

Goal 10: Improve road safety

This project will provide safety improvements by reducing pedestrian and heavy vehicles conflicts through Tenterfield town centre.

Goal 19: Invest in critical infrastructure

The NSW Government is committed to investing in infrastructure that improves productivity and enhances the State's competitiveness – particularly in the context of road and rail freight. This initiative aligns with this goal, as it would improve the efficiency of the New England Highway – a key component of the National Land Transport Network that:

- Helps meet the inbound and outbound freight task associated with agricultural businesses located in the New England – particularly the movement of agricultural goods for export (via the ports of Brisbane, Sydney and Newcastle)
- Facilitates the movement of interstate freight.

1.2.1 The NSW Government's Long Term Transport Master Plan (NSW LTTMP)

The NSW LTTMP identifies six key themes and challenges for the NSW transport network over the long term. Two of these directly relate to the proposed initiative.

Theme 4: Providing essential access for regional NSW

The NSW LTTMP identifies that decisive action is required to improve accessibility through a better mix of transport options available across NSW. The initiative is directly aligned to this objective as the proposed bypass of the Tenterfield township would enhance the connectivity of the communities and industries based in the New England and rural Queensland, with key metropolitan areas (namely Brisbane, Newcastle and Sydney).

The Master Plan identifies two key actions that support assessment of a Tenterfield bypass:

- Rural highway upgrades, including pinch points on the New England Highway
- A program of town bypasses for regional centres to reduce heavy truck traffic through town.

Theme 5: Supporting an efficient and productive freight industry

The NSW LTTMP emphasises the importance of efficient movement of freight to every person in NSW. It proposes action to grow future freight network capacity through targeted investments that expand capacity and maintain strong international, interstate and intrastate connectivity. This proposal would improve travel efficiency for heavy vehicles (26m B-doubles) along the New England Highway.

The New England Highway has both interstate and intrastate significance, in that it:

- Forms part of the National Land Transport Network (and facilitates the movement of interstate freight between NSW and Queensland).

Serves as the primary access route for the forestry and agricultural industries based in the New England regions of NSW.

The Long Term Transport Master Plan also proposes to develop a new program of town bypasses to improve travel within towns, reduce delays caused to freight traffic and increase safety by considering the following factors relevant to Tenterfield:

- The road's hierarchy classification: Higher-order roads carry higher levels of through-traffic and generate greater benefits than other areas where volumes are much lower
- Proportion of through-traffic for both light and heavy vehicle traffic: Higher proportion of through trips and heavy vehicles supports bypass implementation
- Travel time benefits: Town bypasses can provide travel time saving for the through-traffic.

The need for a heavy vehicle bypass at Tenterfield has been assessed using these principles. The LTTMP identifies the need to undertake a planning study for the Tenterfield bypass to fully assess these issues and identify preferred bypass routes in the short term.

1.2.2 The NSW Freight and Ports Strategy

The NSW Freight and Ports Strategy aims to create a transport network where goods move efficiently to their markets. This proposal contributes to the following freight-specific objectives and reflects the importance of the freight transport network in creating a competitive and productive NSW economy.

Delivery of a freight network that efficiently supports the projected growth of the NSW economy:

- The project supports heavy vehicle movement along the New England Highway facilitating the movement of interstate freight between NSW and Queensland through Tenterfield.

Balancing of freight needs with those of the broader community and the environment:

- The project is aimed at reducing the number of heavy vehicles through the town centre, and improving urban amenity and pedestrian access for the local community.

1.2.3 The NSW Road Safety Strategy 2012-2021

The NSW Road Safety Strategy sets the direction of road safety in NSW for the next 10 years. NSW is committed to reducing fatalities to less than 4.3 per 100,000 population by 2016 together with at least a 30 per cent reduction in fatalities and serious injuries by 2021.

The Road Safety Strategy is underpinned by the Safe System approach to improving road safety. This takes a holistic view of the road transport system and interactions among the key components of that system – the road user, the roads and roadsides, the vehicle and travel speeds. It recognises that all these components have a role to play in helping to keep road users safe.

The existing New England Highway is the main street (Rouse Street) through Tenterfield and caters for a high level of pedestrian movements, heavy vehicle traffic and a high volume of local trips which access the local facilities and businesses. This proposal would improve road safety by reducing the heavy vehicle traffic movements and safety conflicts through the town centre.

1.2.4 The New England North West Regional Transport Plan

The regional transport plan for New England North West is built on the strategic direction, initiatives and state-wide context set by the NSWLTMP.

The New England North West Regional Transport Plan identifies specific challenges the region's transport networks face and prioritises actions to address these challenges. The broad actions are under three themes, better transport services, ensuring effective regulation and improving transport infrastructure. The plans provide a detailed analysis of local transport needs and priorities and respond to issues raised during regional consultation to develop the NSWLTMP.

This Regional Transport Plan targets opportunities to invest in road upgrades identifying upgrades to the New England North West region road network including undertaking a planning study for the Tenterfield bypass to remove heavy vehicles from the local streets of Tenterfield.

1.2.5 The 2007 Sydney-Brisbane Corridor Strategy

This strategy identifies six strategic issues for this corridor:

- Road safety, especially on road sections with high volumes of freight and passenger vehicles, through towns at level crossings or with poor crash performance;

- Managing congestion on urban fringes and at major urban and regional centres;
- The condition of the ageing road and rail infrastructure, which affects safety and efficiency;
- The amenity of towns and major urban areas along the route;
- Improving the rail system's capacity and performance in the corridor supported by future enhancements to other corridors such as Melbourne–Brisbane; and
- Planning for corridor protection, reservation and use to meet future requirements.

A number of projects are proposed, currently underway or recently completed to enhance the future performance of the Sydney-Brisbane Corridor in respect to the above issues. It is expected that a Tenterfield bypass would contribute to the objectives of current and future proposed works by enhancing road safety and increasing capacity through the upgrade of existing road infrastructure along the inland route.

1.3 Problem Definition

The existing New England Highway is the main street (Rouse Street) of Tenterfield. This street experiences heavy vehicle traffic, urban amenity and road safety problems.

The traffic problems are associated with restrictions for over dimension vehicles travelling through Tenterfield. These vehicles require site specific management measures, including the removal of bollards and some street signs, for passage through the main street. There is no feasible alternative route to the existing highway for heavy vehicles passing through Tenterfield.

The New England Highway through Tenterfield also experiences urban amenity issues associated with the mixing of pedestrians and cyclists with local, regional and long distance traffic, including large heavy vehicles. This includes safety problems associated with the conflict between heavy vehicle through movements and local traffic within the town.



Figure 2 View of New England Highway (Rouse St) looking north

1.4 Project objectives

The aim of the project is to determine a preferred route for a heavy vehicle bypass of the urban area of Tenterfield. The preferred route will meet the following project objectives:

- Improve road safety
- Improve road transport productivity, efficiency and reliability of travel
- Minimise the impact on the natural, cultural and built environment
- Provide sustainable economic outcomes for the local community
- Minimise the social impact on the local community
- Provide value for money.

The project objectives were used to establish the assessment criteria for the shortlisting of route options. This is outlined in more detail in subsequent sections of this report.

1.5 Report purpose and structure

The purpose of this Preliminary Route Options Report is to outline the processes and methodology used to identify, develop and assess a range of preliminary route options for the Tenterfield heavy vehicle bypass.

This report includes details of the preliminary route options in the following sections:

- Section 2 – Preliminary engineering investigations
- Section 3 – Environment and heritage investigations
- Section 4 – Socio economic investigations
- Section 5 – Community input summary
- Section 6 – Assessment methodology and criteria
- Section 7 – Development of preliminary route options
- Section 8 – Internal technical workshop
- Section 9 – Shortlisted route options.

2. Preliminary engineering investigations

2.1 Existing road network and traffic volumes

This section provides a description of the existing road network and a summary of the traffic volumes on the key roads in and around Tenterfield. It also includes a preliminary assessment of the potential usage of a bypass around the town.

As well as referencing historical traffic volumes, a range of project specific traffic counts were undertaken for the bypass investigation in October 2012. The key results of these surveys are outlined in detail in this section as follows:

- Seven day Automatic Traffic Counts (ATC), including hourly volume counts and vehicle classifications on all primary roads
- A 13 hour origin – destination (OD) survey was conducted at six sites across the road network.

2.1.1 Existing road network

The town of Tenterfield lies at the intersection of the state significant roads of the New England and Bruxner Highways as well as the regionally significant Mount Lindesay Road.

New England Highway

The New England Highway stretches from Newcastle in the Lower Hunter to Warwick in south east Queensland. This highway services the large regional agricultural areas of the Hunter and New England regions and forms part of the Sydney to Brisbane transport corridor.

The main role of the highway is to provide an important link for the movement of interstate freight, linking a number of cities and towns, and finally to transport agricultural and other goods to the ports of Newcastle, Sydney and Brisbane (Sydney - Brisbane Corridor Strategy 2007).

In the upper New England region encompassing Tenterfield, the role of the highway is to provide a link for agricultural production from the region to market for domestic or export purposes, as well as provide a passage of travel for interstate commuters.

The New England Highway is the main street (Rouse Street) of Tenterfield. It experiences common traffic and safety problems associated with central business district traffic - mixing of local, regional and long distance traffic, including large heavy vehicles.

Rouse Street is relatively narrow, carrying two traffic lanes with parallel parking on each side. It provides linear access to the town's retail and commercial sector. There are three pedestrian crossings in the Rouse Street commercial area. The urban speed limit is 50km/h.

Bruxner Highway / Bruxner Way

The overall Bruxner Highway / Bruxner Way route is approximately 413 kilometres in length and extends from the Pacific Highway near Ballina to the northwest town of Boggabilla. It is the most northern east-west transport corridor in New South Wales, connecting the Far North Coast Region with the New England Tablelands (Ballina to Tenterfield Corridor Strategy 2009).

The role of the Bruxner Highway as a State Road to Tenterfield is to provide an important link for the rural communities of the upper northwest of New South Wales to commute and transport their products to wider markets in Casino, Lismore and Ballina. The highest Average Annual Daily Traffic (AADT) volumes are present at the eastern end of the highway around Lismore (24,500) and Casino (11,500) with volumes dropping to less than 2000 AADT on the eastern side of Tenterfield.

Within the town area of Tenterfield the Bruxner Highway forms Clarence Street which in turn connects with High Street. High Street meets the New England Highway in the Tenterfield CBD area and this intersection represents the end of the Bruxner Highway.

North and west of Tenterfield, the Bruxner Way is a Regional Road, carrying much less traffic further inland from the New England Highway.

Mount Lindesay Road

Mount Lindesay Road extends from Tenterfield to Brisbane and was once the primary highway route from the New England area to Queensland. Today it is a rural road with low volumes of traffic that connects the Tenterfield township with the rural towns of Legume and Woodenbong.

On the southbound approach to the township Mount Lindesay Road forms Logan Street and then joins Naas Street which intersects with the New England Highway north of the CBD and immediately south of the Tenterfield Creek Bridge.

Other local roads and streets

There are a number of other local roads and streets that form part of the Tenterfield road network. Those on the western side of the town area provide crossings of the disused railway corridor that passes through Tenterfield. These local roads and streets are briefly identified as follows:

- Billirimba Road is a rural local road to the south east of Tenterfield from Scrub Road and the Tenterfield Dam area
- East Street is a semi urban road that forms the eastern boundary of the town area
- Bellevue Street / Boundary Road / Old Ballandean Road – is a combination of local roads that provides a route around the eastern and northern periphery of the town
- Douglas Street / Kildare Road / Mount Mackenzie Road – is a series of connecting streets and roads to the south west of Tenterfield passing over the disused railway corridor and providing access to the cemetery before proceeding south west to Mount Mackenzie
- Molesworth Street / Sunnyside Loop Road – is the local road route to the west of Tenterfield, also passing over the disused railway corridor
- Western Street forms the western boundary of the town area, parallel with and on the western side of the disused railway corridor
- Western Boundary Road extends south from the New England Highway at the northern end of the town to a disused bridge over the rail corridor near Petre Street.

2.1.2 Published daily traffic volumes

This section provides detail on published traffic volumes in the vicinity and within the town of Tenterfield. The historical figures provide published traffic volumes on the New England Highway, Bruxner Highway and Mount Lindesay Road. As noted above the Bruxner Highway route west of the New England Highway (north of Tenterfield), has recently been renamed as the Bruxner Way to reflect its lesser status as it is now a Regional Road, not a State Highway.

As expected, the volume of traffic on the New England Highway is well in excess of the traffic volumes on the Bruxner Highway, Bruxner Way and Mount Lindesay Road.

The data presented within this section of the report is referenced from published Roads and Maritime sources as well as some Queensland Transport and Main Roads counts on the New England Highway at Wallangarra, 20 kilometres north of Tenterfield.

Also included in the following tables are volumes recorded in October 2012 specifically for the Tenterfield heavy vehicle bypass investigation. Further details of these surveys are provided in Section 2.1.3.

New England Highway

The published daily traffic volumes for multiple sites on the New England Highway south of Tenterfield, within the town and at Wallangarra are provided in Table 1. These figures are provided, where available, back to 1998.

The historical records provided in Table 1 show that traffic volumes at each of the stations on the New England Highway have generally reduced since 1998. This was the result of some migration of through traffic across to the Pacific Highway as sections of that highway were progressively upgraded. The more recent counts indicate that the downward trend of traffic volumes has stabilised and some new growth is now evident.

Table 1 New England Highway traffic volumes

Location	1998 ¹	2001 ¹	2004 ¹	2007 ²	2011 ³	2012 ⁴
North of Bolivia Hill *	3316*	3157*	2816*	2663*	2786*	
Tenterfield Creek	3482	3578	3131	2372	2120	2476
Rouse Street, north of High Street	8623	7384	7869	7672	6321	
Cowper Street, south of Drummond Street	3886	3961	3313	3635	2470	
North of Bruxner Way						2527
Wallangarra, north of Queensland border *	3417*	3576*	3044*	3018*	2515* ⁵	

Notes:

1. Traffic Volume Data for Hunter and Northern Regions 2004.
2. 2007 Surveys as supplied by Roads and Maritime.
3. 2011 Surveys as supplied by Roads and Maritime.
4. 2012 Surveys for Tenterfield HV Bypass investigation.
5. 2011 Queensland Main Roads survey shows 2332 vpd with 20% HV at Wallangarra.

* Denotes permanent station counting AADT for axle pairs rather than vehicles.

Bold font indicates AADT for axle pairs that are not permanent stations.

Bruxner Highway and Bruxner Way

The published traffic volumes on the Bruxner Highway from Tabulam, 77 kilometres east of Tenterfield, through to the eastern approach to the town and the western leg of the Bruxner Way north of Tenterfield are provided in Table 2.

Table 2 Bruxner Highway and Bruxner Way traffic volumes

Location	1998 ¹	2001 ¹	2004 ¹	2007 ²	2011 ³	2012 ⁴
West of Tabulam *	899*	885*	921*	796*	893*	
West of Bellevue Street		1179	1087	1037	1028	1031
East of Rouse Street	3114	3060	3137		2444	
Bruxner Way west of NEH	383	438	421			334

Notes:

1. Traffic Volume Data for Hunter and Northern Regions 2004.
2. 2007 Surveys as supplied by Roads and Maritime.
3. 2011 Surveys as supplied by Roads and Maritime.
4. 2012 Surveys for Tenterfield HV Bypass investigation.

* Denotes permanent station counting AADT for axle pairs.

These historical counts indicate that the volume of traffic on the Bruxner Highway has remained generally static over a 15 year period. Average counts at Tabulam of approximately 900 vehicles per day (vpd), near Bellevue Street, Tenterfield at 1030 vpd and west of the New England Highway north of town at 330-440 vpd, confirm little or no growth on the Bruxner Highway.

Mount Lindesay Road

The published traffic volumes for the Mount Lindesay Road are limited to one site north of Old Ballandean Road as shown in the Table 3. There has been some historical reduction but this has stabilised at around 400 vpd over recent years. This traffic is most likely associated with daily trips by rural land holders for work, shopping or school activities.

Table 3 Mount Lindesay Road traffic volumes

Location	1998 ¹	2001 ¹	2004 ¹	2007 ²	2011 ³	2012 ⁴
North of Old Ballandean Road	609	522	350		376	425

Notes:

1. Traffic Volume Data for Hunter and Northern Regions 2004.
2. 2007 Surveys as supplied by Roads and Maritime.
3. 2011 Surveys as supplied by Roads and Maritime.
4. 2012 Surveys for Tenterfield HV Bypass investigation.

2.1.3 Surveyed traffic volumes (October 2012)

A series of traffic count surveys were undertaken at various locations on the Tenterfield road network in October 2012. The surveys provide project specific data collected concurrently on all roads and connecting routes that may use a heavy vehicle bypass of the town.

The method of data collection of daily traffic volumes was by way of seven day / 24 hour continuous recording of vehicles passing over automatic traffic counters (fixed tube stations) at selected locations. These Automatic Traffic Counting (ATC) devices also record axle types and the data provides a classification profile of heavy vehicle numbers as well as cars.

The counters were established on both main highways and other roads as set out below. These locations are shown schematically in Figure 3.

- New England Highway north - Site 1
- New England Highway south – Site 5
- Bruxner Way west of NEH – Site 2
- Bruxner Highway east – Sites 4 and 8
- Mount Lindesay Road – Site 3
- Old Ballandean Road – Site 6
- Boundary Road – Site 7.

In each of the following sections the data collected at these locations is summarised in tabular format with some preliminary comment provided for each site.

Summaries of the recorded volumes and the hourly volume splits (including light vehicle / heavy vehicle numbers) are provided in Figure 4 and Figure 5 respectively.

The average daily volumes and traffic composition for each site as shown in Figure 4 have been calculated for a five day week (Monday to Friday). The charts of hourly time increments and volumes in Figure 5 demonstrate the distribution of traffic in daily, peak and night time periods.

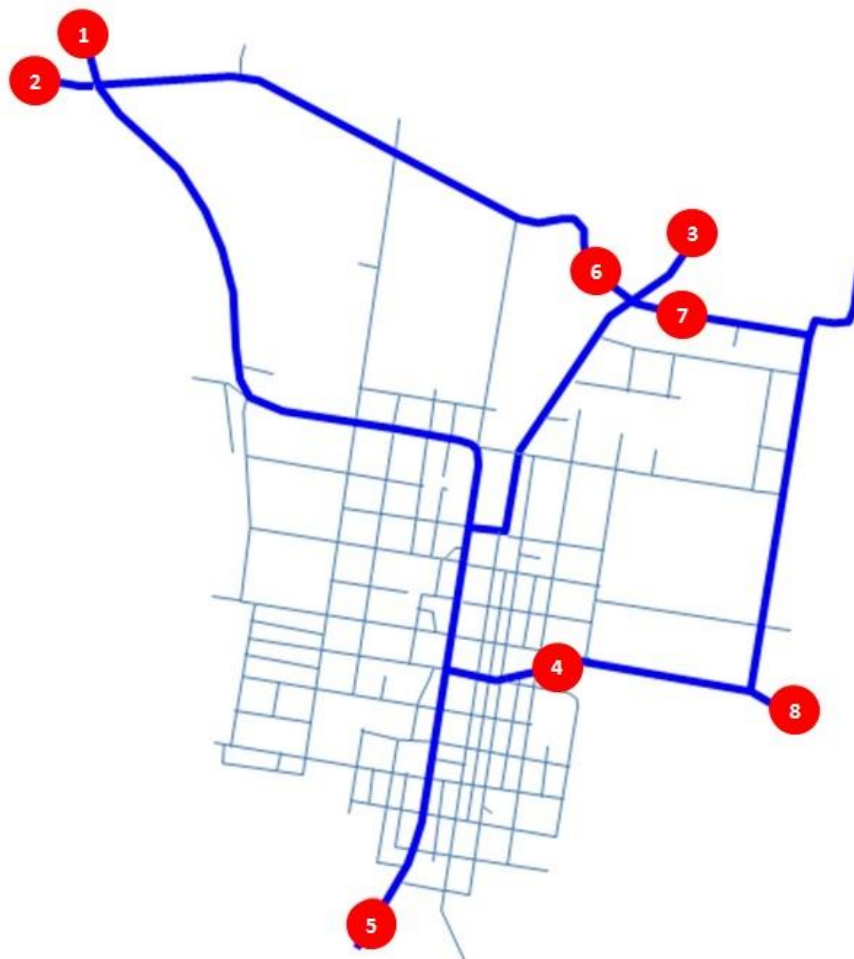


Figure 3 Automatic traffic count locations

New England Highway

The data collected from the two counting stations (Site 1 and Site 5) on the New England Highway north and south of Tenterfield is shown in Table 4 and Table 5 respectively.

Points to note from the data north of Tenterfield (Site 1) are:

- Total two way volumes are just over 2500 vehicles per day
- The proportion of heavy vehicles is high at approximately 20 per cent over the duration of the week
- Figure 5 shows that peak volumes for light vehicles are generally 170 vehicles per hour over a sustained period from 10am to 6pm. Heavy vehicle numbers are also relatively consistent over this time at between 25 and 40 vehicles per hour, for a total of approximately 200 vehicles per hour
- Night time (11pm to 4am) volumes drop to 10 vehicles per hour or less for both light and heavy vehicles, with a typical maximum of 20 vehicles per hour at night.

Table 4 Average traffic volumes for Site 1

Site 1 Survey Results	Average Daily Volumes		Total All Vehicles	Total Heavy Vehicles	% Heavy Vehicles
	Light	Heavy			
5 day week	2083	556	13,196	2779	21.1
7 day week	2044	483	17,688	3379	19.1

Points to note from the data south of Tenterfield (Site 5) are:

- Total two way volumes are slightly less than 2500 vehicles per day
- Light vehicle volumes are approximately 5 per cent less than that north of the town, with a peak volume hovering around 160 light vehicles per hour and 35 heavy vehicles per hour for a total of just under 200 per hour
- Figure 5 shows that this extended typical peak volume of between 170 and 200 vehicles per hour is generally sustained from 10am to 6pm
- Night time volumes and patterns are consistent with the northern site with very low volumes from 11pm to 4am.

Table 5 Average traffic volumes for Site 5

Site 5 Survey Results	Average Daily Volumes		Total All Vehicles	Total Heavy Vehicles	% Heavy Vehicles
	Light	Heavy			
5 day week	1894	458	11,760	2289	19.5
7 day week	1845	472	16,214	3302	20.4

Bruxner Highway and Bruxner Way

The traffic data collected on the Bruxner Highway east of Tenterfield (Site 8 and Site 4) shows that the total daily volumes and heavy vehicle content are generally much lower than the New England Highway.

The data collected on the Bruxner Highway east of Bellevue Street (Site 8) is summarised in Table 6. Points of note include:

- There are a total of approximately 1200 vehicles per day, or about half that of the New England Highway
- Heavy vehicle percentages are also lower at a maximum of around 15 per cent
- Figure 5 shows that daily traffic volumes are generally 70 - 80 light vehicles and 10 - 20 heavy vehicles per hour throughout the day. There is a substantial drop in numbers of both light and heavy vehicles at night, meaning there is effectively negligible traffic between 11pm and 4am.

Table 6 Average traffic volumes for Site 8

Site 8 Survey Results	Average Daily Volumes		Total All Vehicles	Total Heavy Vehicles	% Heavy Vehicles
	Light	Heavy			
5 day week	931	157	5439	783	14.4
7 day week	893	159	7366	1114	15.1

The data collected on the Bruxner Highway near East Street (Site 4) is summarised in Table 7. It shows an increase in light vehicles closer to town (residential traffic) and a reduction in heavy vehicles, indicating some usage (approximately 40 per day) of Bellevue Street by heavy vehicles.

Table 7 Average traffic volumes for Site 4

Site 4 Survey Results	Average Daily Volumes		Total All Vehicles	Total Heavy Vehicles	% Heavy Vehicles
	Light	Heavy			
5 day week (M to F)	1029	123	5758	615	10.7
7 day week (M to S)	1009	117	7880	819	10.4

The data collected from the Bruxner Way west of the New England Highway (Site 2) on the northern outskirts of Tenterfield is summarised in Table 8. It shows that the Bruxner Way west of Tenterfield is very lightly trafficked. Figure 5 shows that it has a consistent usage pattern of approximately 20 light vehicles and up to five heavy vehicles per hour in daylight time, with negligible traffic at night.

Table 8 Average traffic volumes for Site 2

Site 2 Survey Results	Average Daily Volumes		Total All Vehicles	Total Heavy Vehicles	% Heavy Vehicles
	Light	Heavy			
5 day week	284	64	1737	318	18.3
7 day week	276	59	2340	411	17.6

Mount Lindesay Road

Surveyed traffic volumes and average daily traffic data for Mount Lindesay Road (Site 3) is provided in Table 9. These show that Mount Lindesay Road is a very lightly trafficked route.

Table 9 Average traffic volumes for Site 3

Site 3 Survey Results	Average Daily Volumes		Total All Vehicles	Total Heavy Vehicles	% Heavy Vehicles
	Light	Heavy			
5 day week	343	102	2226	511	23.0
7 day week	340	85	2974	595	20.0

Old Ballandean Road

The hourly traffic volumes and daily averages for Old Ballandean Road (Site 6) are provided in Table 10. These show very low daily and hourly volumes on Old Ballandean Road.

Table 10 Average traffic volumes for Site 6

Site 6 Survey Results	Average Daily Volumes		Total All Vehicles	Total Heavy Vehicles	% Heavy Vehicles
	Light	Heavy			
5 day week	145	50	973	248	25.5
7 day week	149	42	1340	295	22.0

Boundary Road

The hourly traffic volumes and daily averages for Boundary Road (Site 7) are shown in Table 11. These show very low daily and hourly volumes on Boundary Road.

Table 11 Average traffic volumes for Site 7

Site 7 Survey Results	Average Daily Volumes		Total All Vehicles	Total Heavy Vehicles	% Heavy Vehicles
	Light	Heavy			
5 day week	144	34	891	171	19.2
7 day week	138	36	1216	251	20.6

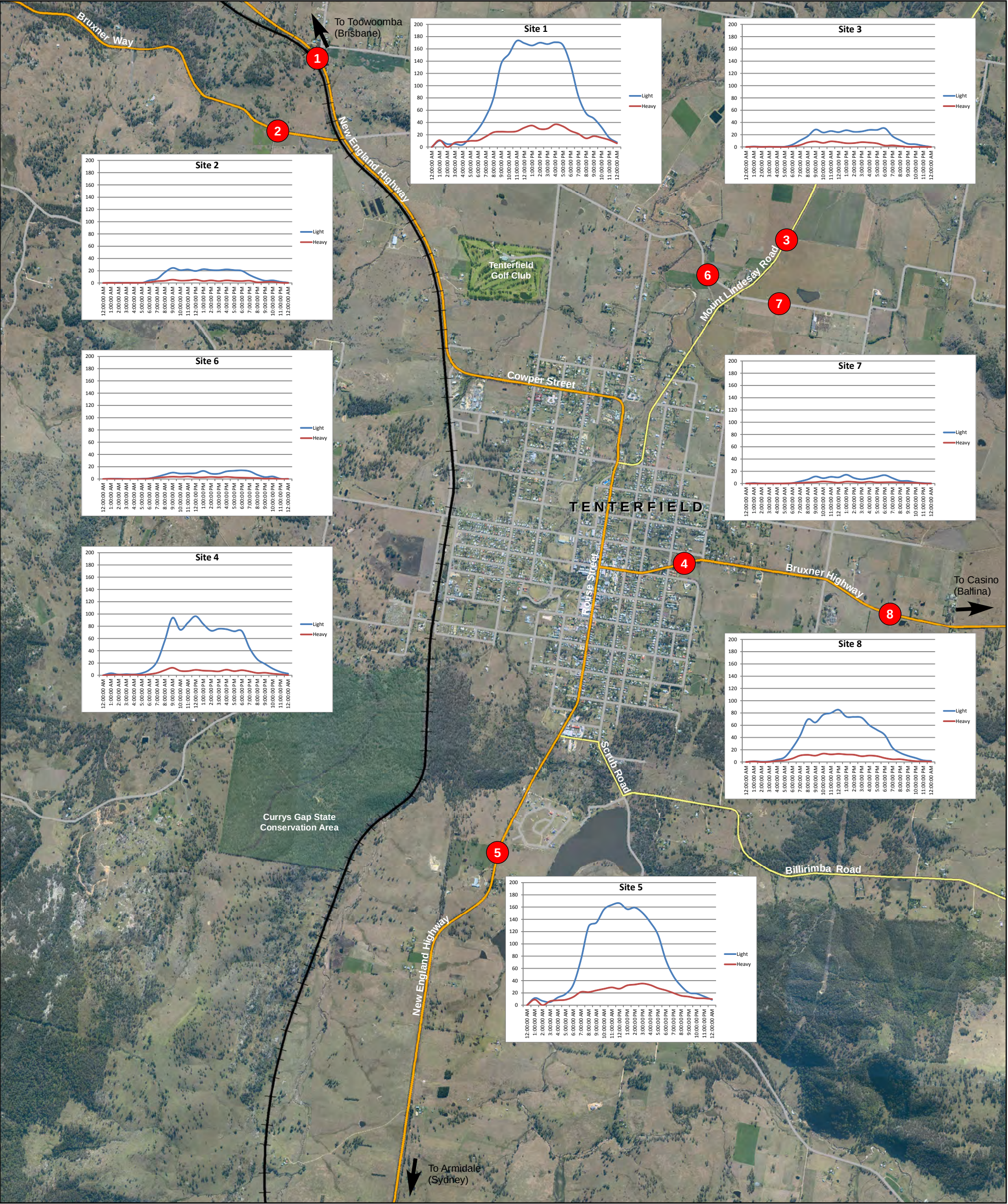


LEGEND

- 1

 Automatic traffic count location
- +

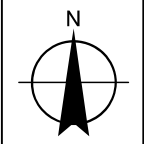
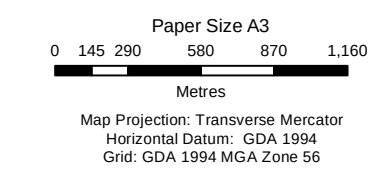
 Disused Railway
- Primary Road
- Main Road
- Local Road



- 1

Automatic traffic count location
- +

Disused Railway
- Primary Road
- Main Road
- Local Road



Roads and Maritime Services
Tenterfield Heavy Vehicle Bypass

Job Number 22-16349
Revision 0
Date 24 Jan 2014

October 2012 Traffic Surveys
Hourly Volumes (M - F)

Figure 5

2.1.6 Origin – Destination survey

Origin-Destination (O-D) surveys are complex traffic surveys that consist of vehicle tracking via registration plate identification between strategically placed survey locations around the perimeter of the study area.

The basic methodology of an O-D survey consists of noting the registration of vehicles passing each station and then analysing the data from each station to determine the patterns and time of travel through the town. A vehicle must pass through two stations during the survey period to be recorded in the survey. The O-D surveys were conducted over a 13 hour period from 6.00 am to 7.00 pm on 16 October 2012. The data obtained provides a record of the through traffic volumes and allows the potential usage of a bypass to be estimated.

O-D network and survey stations

The O-D network survey stations established were very similar to the automatic traffic count locations. A total of six O-D survey locations were selected around Tenterfield in order to capture the traffic from all the main routes leading into and out of the township. The locations of the survey stations are shown in Figure 6.

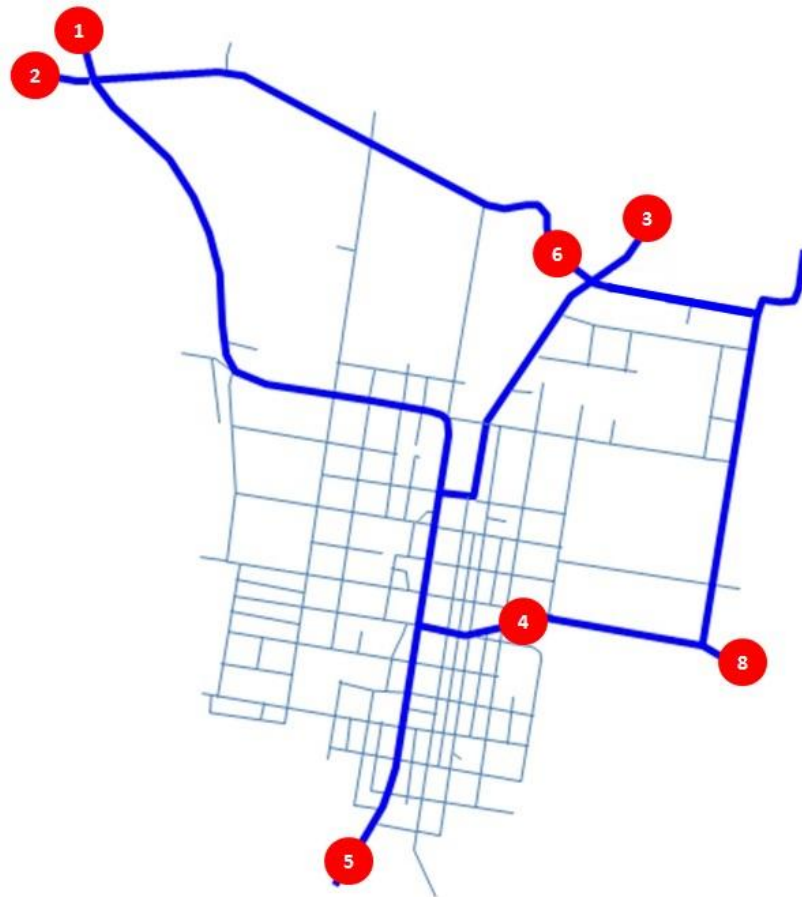


Figure 6 O-D survey station locations

A description of each of the site locations for the O-D survey stations is provided as follows:

- Station 1 is on the New England Highway north of the Bruxner Way intersection
- Station 2 is on the Bruxner Highway west of the New England Highway
- Station 3 is on Mount Lindesay Rd, north of its intersection with Old Ballandean Rd
- Station 4 is on the Bruxner Highway, west of East Street

- Station 5 is on the New England Highway in close proximity to Tenterfield Creek
- Station 6 is an intermediate (check only) station on Old Ballandean Road to identify movements from Bruxner Highway east to / from the New England Highway north
- Station 8 was not part of the O-D survey but information from Station 6 has been used to interpret origins and destinations from that point.

The movements between the various stations indicate a path between an origin and a destination on either side of Tenterfield and as such are indicative of a potential bypass desire path, otherwise known as bypass function.

These bypass desire paths represent the potential demand for a particular type of bypass between adjoining roads in the Tenterfield road network. A legend for the various types of origins and destination paths is outlined and colour coded in Table 12 - for example, demand for a New England Highway bypass is between Station 1 and Station 5 in either direction and is coded blue.

Table 12 Origin / Destination paths

Legend	Bypass desire path or potential bypass demand
	New England Highway bypass – from north to south and vice versa
	New England Highway north to / from Bruxner Highway east
	New England Highway south to / from Bruxner Highway east
	New England Highway north to / from Mount Lindesay Road
	Bruxner Highway east to / from Mount Lindesay Road
	New England Highway south to / from Mount Lindesay Road

The O-D survey also records the vehicles that would not use a bypass, those that enter and leave the survey area through the same survey station. This would be reflected by people travelling to work in the morning period and returning home later in the day, shopping or school drop-offs.

The results of the O-D survey are provided in Table 13. This shows the number of vehicles in each category over the 13 hour survey period and a daily (24 hour) estimate of the potential usage of a bypass between the respective stations.

The O-D survey results show that the New England Highway is by far the dominant traffic flow through Tenterfield. A total of 811 vehicles passed between survey stations south and north of Tenterfield in the 13 hour survey period. Of these, 212 (26%) were heavy vehicles, most of which were semi-trailers and B-doubles. This is extrapolated to an estimated 24 hour volume of 933 vehicles, including 276 heavy vehicles.

The second highest demand is for a bypass from the Bruxner Highway east to the New England Highway south with 280 vehicles over the 13 hour survey and 322 vehicles estimated over the 24 hour period. However, the vast majority of these were light vehicles, with only 18 heavy vehicle movements recorded during the survey.

There were a relatively high number of movements recorded in the no bypass category. In the 13 hour survey period a total of 702 vehicles, including 55 heavy vehicles were recorded entering and leaving via the same survey station.

Table 13 Origin / Destination summary - potential bypass usage

Bypass desire path	13 hour survey		24 hour estimate	
	All	Heavy	All	Heavy
No bypass function – in and out at same location	702	55	807	72
New England Highway north ¹ to south and vice versa	811	212	933	276
New England Highway north ¹ to / from Bruxner Highway east	132	14	152	17
New England Highway south to / from Bruxner Highway east	280	18	322	22
New England Highway north ¹ to / from Mount Lindesay Road	82	43	94	52
Bruxner Highway east to / from Mount Lindesay Road	21	0	24	0
New England Highway south to / from Mount Lindesay Road	29	7	33	8

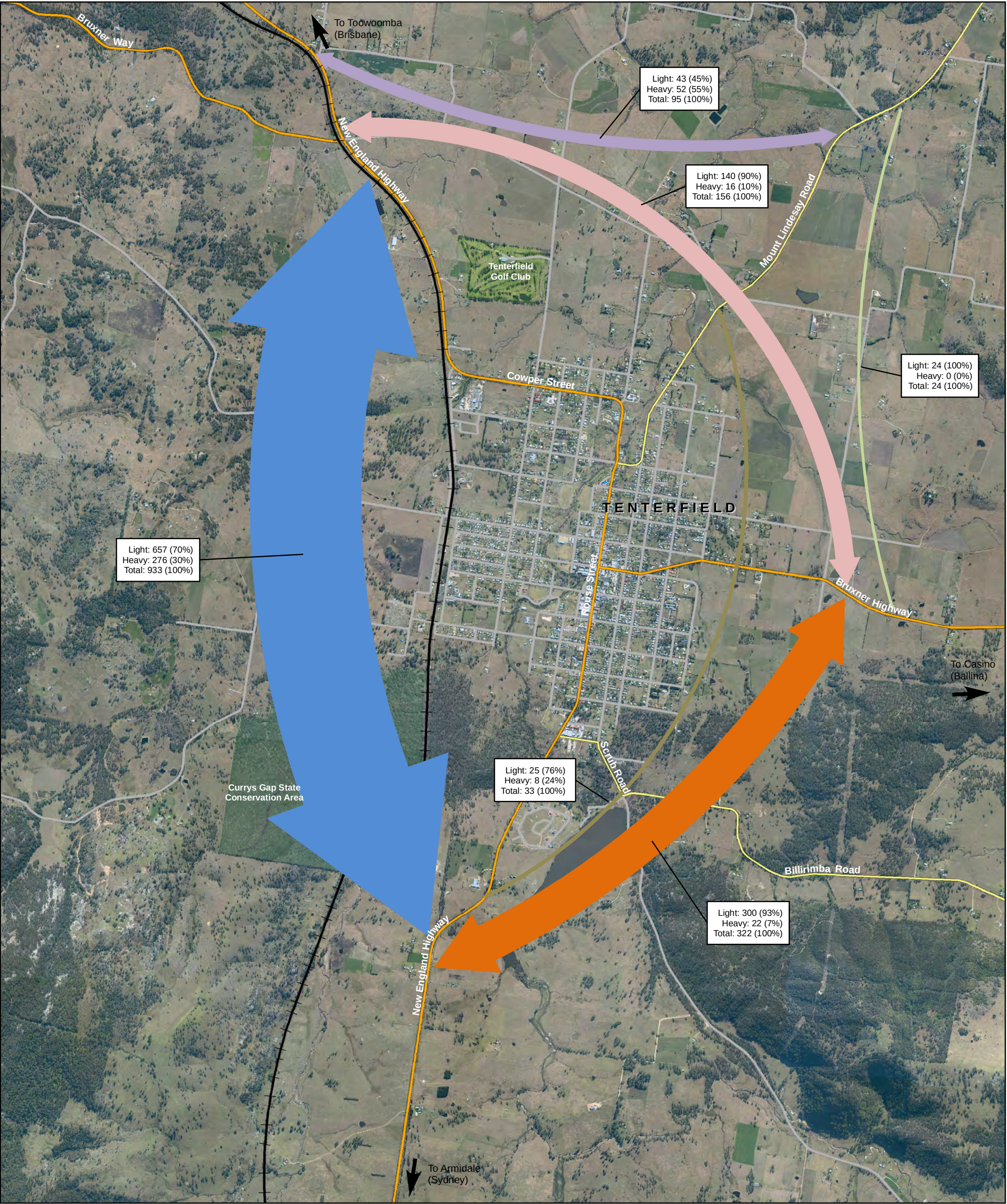
Notes:

1. New England Highway north includes Bruxner Way west of NEH

The survey volumes for each of the potential bypass desire paths are graphically represented in Figure 7. The arrows in this figure represent the origin-destination flows from one road to another, north, south and east of Tenterfield. The thickness of each arrow is proportional to the potential traffic flow volumes and this demonstrates the importance of the New England Highway, particularly in relation to heavy vehicles.

The results for all of the potential bypass functions, including the no bypass results are also charted separately in Figure 8 and Figure 9 for All Vehicles and Heavy Vehicles respectively.

These charts also show the survey results in relation to how long the traffic took to pass through the town, giving a broad indication of stopping patterns. As well as the total 13 hour survey results and the 24 hour estimate of total daily volumes, the vehicles passing through the various survey stations were also able to be identified in terms of how long they took to pass between stations, within certain timeframes set at 30 minutes and 90 minutes.



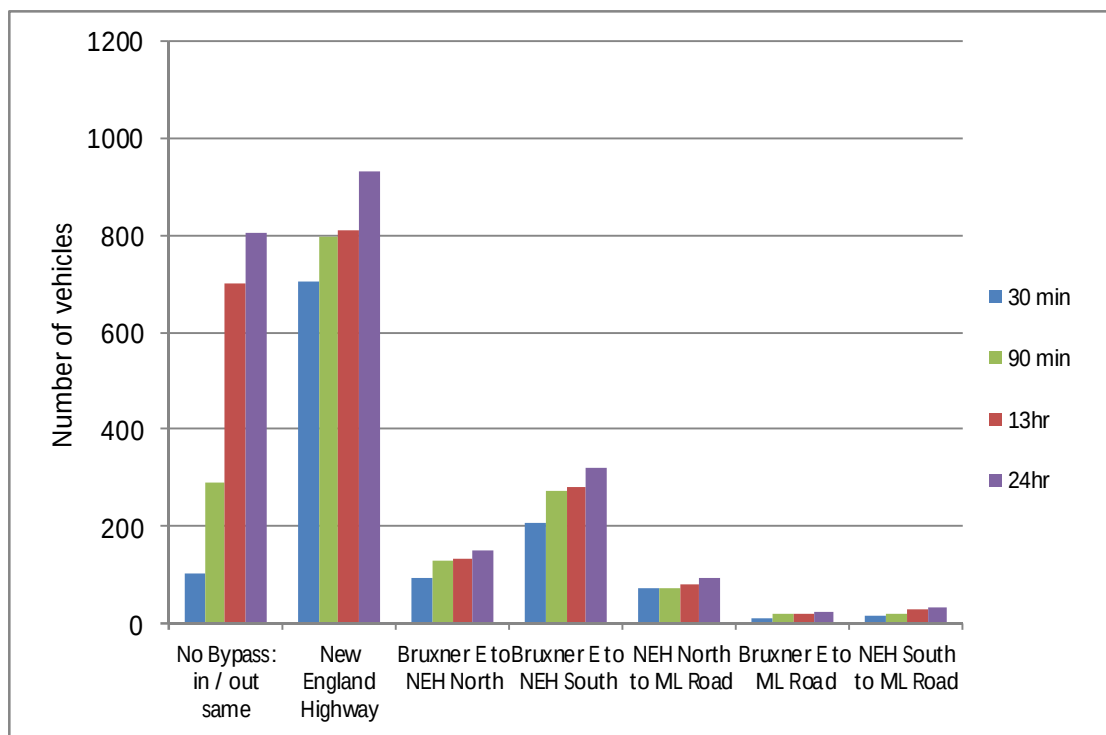


Figure 8 O-D results – bypass demand for All Vehicles

Vehicles passing through Tenterfield within 30 minutes were likely to have not stopped, whereas the small number taking between 30 and 90 minutes most likely did stop. The summary results for each of the 30 minute and 90 minute windows provide an indication of the traffic flow patterns through town. It is apparent that the majority of through traffic does not stop in town.

Conversely, the no bypass results indicate that a large number of vehicles (drivers) stay in town for a much longer period, most likely for employment, shopping and local business activity. This no bypass results are a major portion of travel in and around the township. It has by far the second highest 24 hour volumes identified in Table 13 and this is shown prominently in Figure 8

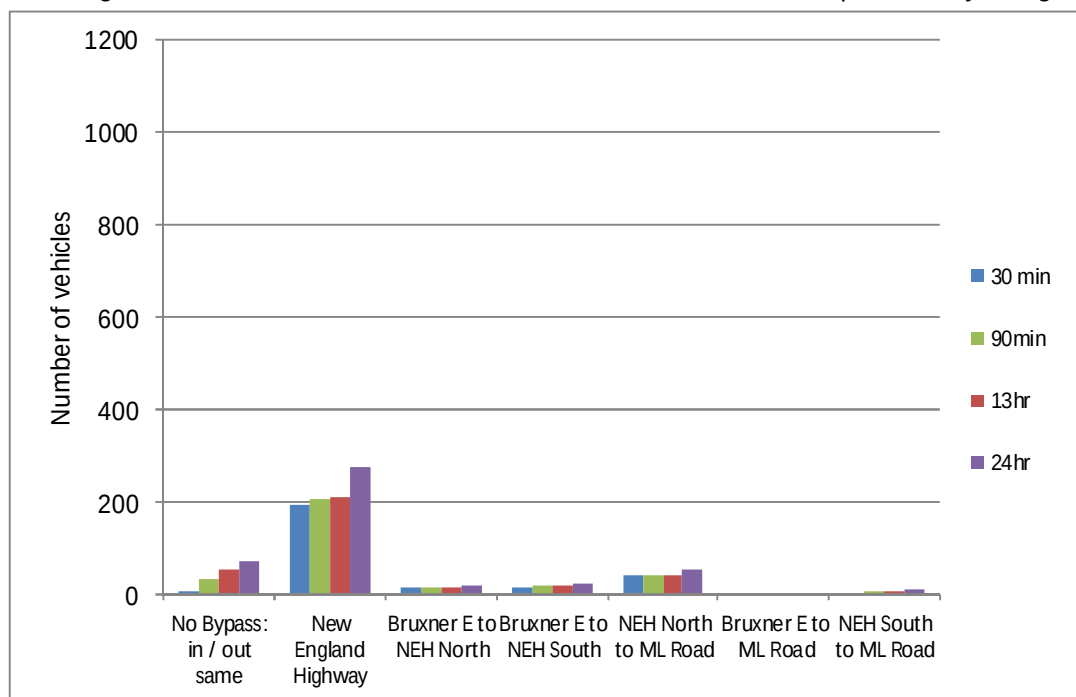


Figure 9 O-D results – bypass demand for Heavy Vehicles

Figure 9 shows that the majority of heavy vehicle movements through Tenterfield are along the New England Highway. The second largest number of heavy vehicle movements wishing to pass through the study area is from the northern intersection of the New England Highway and Bruxner Way to and from Mount Lindesay Road via Old Ballandean Road but these would not pass through the town itself.

Heavy vehicle movements from the Bruxner Highway east to the New England Highway north and south are estimated to be 17 and 22 respectively over a 24 hour period.

Figure 9 also shows that the no bypass function for heavy vehicles is relatively high compared to other (not New England Highway) cross town movements. 55 heavy vehicles entered and left town on the same route in the 13 hour survey period and 31 of those were in less than 90 minutes. These numbers were projected to 72 heavy vehicle movements into and out of town on a daily (24 hour) basis.

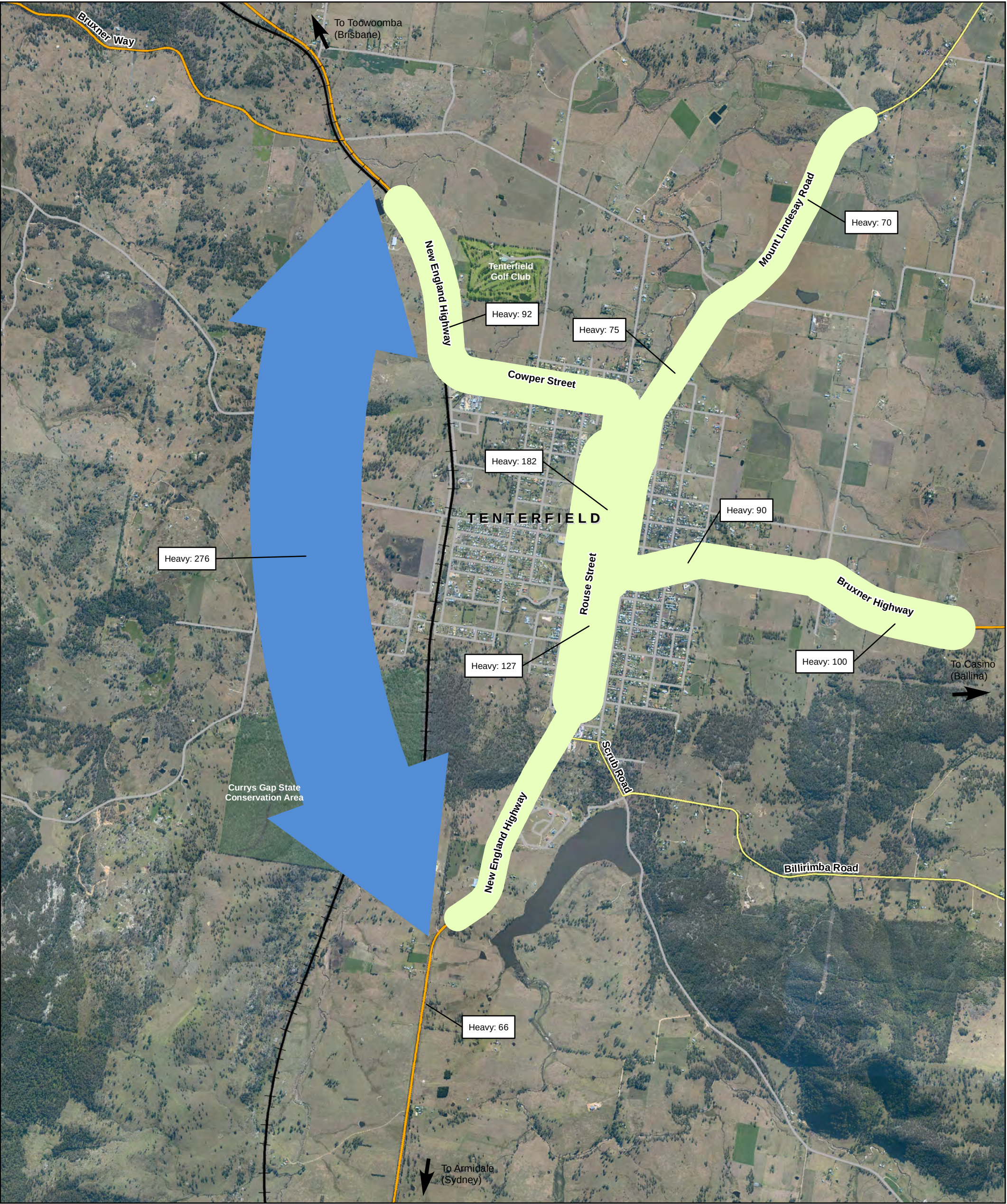
This is indicative of medium sized heavy vehicles coming into Tenterfield on local business and commercial activity - deliveries and pick-ups by vehicles from outside the immediate town area.

Heavy vehicle bypass traffic volumes

The survey results confirm that there would be almost 300 heavy vehicles per day using a New England Highway bypass of Tenterfield.

There would still be a number of heavy vehicles in Rouse Street with a bypass in place. The minor cross town and in town traffic volumes identified in Figure 10 would still be on the main street and other local roads. The need to service shops, supermarkets and service stations, as well as day to day business and industry around town, all require heavy vehicle usage.

The number of residual heavy vehicles expected to be in and around Tenterfield on a daily basis is depicted in Figure 10. This shows the heavy vehicle traffic flows on a heavy vehicle bypass and those residual volumes remaining within the town. It is expected that the majority of these residual movements would be small to medium sized heavy vehicles, servicing Tenterfield as described above. The majority of semi-trailers and B-doubles would be through traffic on the New England Highway and as such within the blue arrow as shown.



LEGEND

New England Hwy

Residual Heavy Vehicle Volume

Disused Railway

Primary Road

Main Road

Local Road

2.2 Preliminary geotechnical investigations - desktop

This section provides a summary of the desktop geotechnical investigations undertaken for the Tenterfield heavy vehicle bypass investigation.

The purpose of the investigations was to describe the geological setting, record previous investigations, groundwater characteristics, constraints and considerations within the study area at Tenterfield, and to determine their potential impact in relation to the development of the route options.

Further, more detailed, geotechnical investigations are proposed for the shortlisted route options.

2.2.1 Geological setting

The geology of the study is predominantly granite and variations of granite. Despite the differing metallurgic descriptions, the majority of the rock mass encountered throughout the study area is expected to display similar engineering properties.

2.2.2 Existing investigations within the study area

A geotechnical investigation was undertaken previously along the section of the New England Highway between Naas Street and Cowper Streets, in the northern part of Tenterfield. A number of test pits, falling weight penetrometers and boreholes undertaken in the course of this investigation indicated that there are alluvial soils in the vicinity of Tenterfield Creek in this location.

Away from the creek, residual soils were encountered above bedrock. High to moderately weathered diorite bedrock, extremely low to low strength with high strength bands, was encountered below either the residual or alluvial soils. This bedrock was encountered at depths ranging between 2.3 metres and 7.4 metres below the ground surface.

2.2.3 Groundwater and water bore database

A bore search using the NSW water bore database returned 52 records from the study area. However less than half of these records contain relevant information from outside of the town area, with records from within the town not considered for the heavy vehicle bypass investigation.

A total of 22 records were interrogated for relevant geotechnical information. The general trends in the geological materials encountered can be observed as follows:

- Significant thicknesses of weathered rock material were encountered, including in the vicinity of streams or creeks, ranging between 1.6 and 15.0 metres
- Variable soil depths, ranging between 0.6 and 12.2 metres
- High or very high strength core stones of fresh weathering grade were encountered in a few bores, over a widely spaced geographical area
- A series of low salinity aquifers were encountered, at shallow depth (3.5, 4.6 and 5.2 metres) and greater depth (16, 26, 32, and 75 metres).

2.2.4 Acid sulphate soil potential

No acid sulphate soil risk maps are available for the study area. As Tenterfield is 850 metres above sea level, it is considered that the potential for acid sulphate soils in the area is very low.

2.2.5 Constraints and considerations

A number of physical constraints, both geotechnical and otherwise, are present that must be taken into consideration when considering options for route selection. These include:

- The geology of the study area suggests that much of the granite in the area will be massive and high to very high strength. Consequently any rock excavation will require the use of large plant or blasting to excavate. Minimising the depth of cuts into high strength rock will be crucial to lowering overall construction costs
- The presence of extensive ridge lines to both the east and west of Tenterfield Dam
- The presence of the disused railway line may require the construction of an overpass to cross the railway
- Whilst only limited bore information is available west of Tenterfield, such data, combined with the relative steepness of the topography compared with the east, suggests a more shallow rock profile to the west. The previous investigation indicates less than two metres depth to weathered bedrock
- The presence of large corestones within the soil profile
- Soft soils adjacent to creek lines identified in the previous report will require specific solutions and investigation should any proposed routes traverse these areas
- Previous investigations in the areas surrounding Tenterfield have encountered various degrees of unstable slopes associated with road cuttings.

2.3 Utilities and services investigation

The purpose of this investigation was to identify and describe the existing utilities and services within the study area at Tenterfield and to determine if there would be any major impact arising from any of the preliminary route options.

The method for investigating the services and utilities consisted of a 'Dial Before You Dig' (DBYD) request to identify the relevant utility providers within the study area and reviewing the plans as received.

Additionally, contact was made with Tenterfield Shire Council (Council) in order to establish the services present within and surrounding the township, to gain an understanding of Council operating systems and to establish the format in which the locations of services could be provided.

The route options will inevitably impact on one or more of the existing services and utilities that service Tenterfield and its periphery. At this stage of the route options assessment all that has been done is to identify, locate and incorporate them into the assessment process. Preliminary cost estimates and adjustment strategies for each of the shortlisted route options will be included in the Route Options Development report.

3. Environment and heritage investigations

3.1 Ecology and biodiversity investigations - desktop

This section provides a summary of the preliminary ecology and biodiversity investigations undertaken as a desktop study of the Tenterfield area. A more comprehensive field based investigation report will be prepared as part of the route options development phase.

The purpose of the preliminary investigation was to present an assessment of the available background information, and to identify biodiversity constraints for the project to assist in the initial assessment of the preliminary route options.

The desktop review of literature, database searches and spatial data was undertaken to help identify habitat, vegetation communities, flora and fauna, and areas of vegetation connectivity. These findings have assisted in the assessment of the preliminary route options and in the formulation of a fieldwork strategy for the shortlisted route options.

3.1.1 Legislative context

The desktop assessment identified threatened flora and fauna species, populations and ecological communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) and Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that may be affected by the project.

3.1.2 Existing environment

Database searches

The following database searches were undertaken (within a 10 kilometre radius) as part of the background review:

- NSW Office of Environment and Heritage (OEH) NSW Wildlife Atlas database (licensed) for records of threatened species and endangered ecological communities listed under the TSC Act that have been recorded within a 10 kilometre radius (locality) of the study area (dated 28 August 2012, OEH, 2012)
- Commonwealth Department of the Environment (formerly SEWPaC) Protected Matters Search Tool for MNES listed under the EPBC Act within a 10 kilometre radius of the study area (dated 28 August 2012, SEWPaC, 2012)
- NSW Vegetation Types database. This database provides descriptions of native vegetation types throughout NSW at a sub-catchment area level
- NSW Department of Primary Industries (DPI) Threatened and Protected Species Records Viewer database for records of threatened fish species, communities and Key Fish Habitats listed under the *Fisheries Management Act 1994* (FM Act) and which have been previously recorded within the study area (DPI, 2011)
- BioMetric: Terrestrial Biodiversity Tool for the NSW Property Vegetation Planning System (OEH, 2012). This tool lists and describes vegetation types within NSW CMA regions.

Search results and tabulated species lists from each database search are detailed in the desktop study report. Following collation of database records and species and community profiles, an assessment of 'likelihood of occurrence' was prepared for each listed threatened species, population and ecological community identified as potentially occurring within the study area.

Document review

A comprehensive review of two major reports was conducted as part of the preliminary assessment.

- *Dumaresq to Lismore 330 kV Transmission Line Constraints Identification and Preferred Corridor Report* (URS, 2009)
- *Vegetation and Floristics of the Tenterfield Nature Reserves* (Hunter, 2000).

These reports provided a valuable reference source for the development of ecological and biodiversity constraints and subsequent mapping of these constraints.

3.1.3 Findings

Threatened ecological communities

A full list of the threatened ecological communities, threatened species, migratory and marine species, and places on the Register of the National Estate is provided in the desktop assessment.

A predictive ecological constraints map identifies several vegetated areas within a 10 kilometre radius of Tenterfield that have the potential to constrain development of the project. These areas are known to provide or have the potential to provide habitat for threatened species. These areas include:

- The town water supply to the south east of the town which also provides habitat for many fauna species
- The creeks and waterways within the area that flow generally from south to north including associated riparian vegetation where present
- Curry's Gap State Conservation Area located to the south west of the town
- Remnant bushland patches across the area especially those larger patches
- Flying fox habitat and key fauna corridors.

There are many terrestrial threatened species and communities identified in the database searches that are likely to be present within a 10 kilometre radius from the centre of Tenterfield. Given their proximity to the town these species and communities have the potential to be impacted by a potential route option, either directly by removal of habitat, or indirectly by creating a barrier to movement.

In summary, the species listed as Matters of National Environmental Significance under the Commonwealth EPBC Act include:

- Two critically endangered ecological communities
- 24 listed threatened fauna species
- 20 listed threatened flora species
- 12 listed migratory bird species
- Four listed migratory wetland species.

In addition to those on the Commonwealth list, there are 28 threatened flora species and 57 threatened fauna species listed under the NSW TSC Act.

From a database search of the NSW Department of Primary Industries Records Viewer, two threatened fish species listed under the Fisheries Management Act were also identified to be within the study area.

Biodiversity fieldwork will be undertaken during the Route Options Development stage. The purpose of the fieldwork is to confirm, where possible, the presence of threatened species and communities within the study area and to better inform the route selection process.

3.2 Aboriginal heritage study - desktop

The purpose of the Aboriginal heritage desktop study was to present the findings of available background information, and to provide an indication of the potential for items of Aboriginal heritage significance within the study area. These findings have been used in the preparation of constraints maps used in the development and assessment of preliminary route options.

Roads and Maritime had previously undertaken a Stage 1 Assessment for Aboriginal heritage as required under the *Procedure for Aboriginal cultural heritage consultation and investigation (PACHCI)*, (Roads and Maritime Services, 2012). The findings suggest that the study area may contain items of Aboriginal heritage significance and that a further (Stage 2) assessment may be required.

3.2.1 Legislative context

Section 2 of the desktop review outlines the legislative framework protecting archaeological heritage sites in NSW. The key planning instruments include:

- *Environmental Planning and Assessment Act 1979*
- *National Parks and Wildlife Act 1974*
- *Environmental Protection and Biodiversity Conservation Act 1999*
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984.*

3.2.2 Existing environment

Environmental context

Environmental characteristics influence the types of archaeological sites and help to predict where Aboriginal people may have undertaken various activities. Much of the area surrounding Tenterfield is relatively flat with abundant water resources. This would have provided suitable camping sites and access to resources. The study area is within the Tenterfield plateau of the New England Tablelands region.

Aboriginal heritage context

European settlement of the area first began around the 1830s. At the time of the arrival of European people to the area it was occupied by the Jukembal (or Jukambal) people. Their lands included the area from near Glen Innes to Stanthorpe.

The study area is within the boundaries of the Moombahlene Local Aboriginal Land Council (LALC).

Database searches

A number of database searches were undertaken as part of the desktop investigation as follows:

- A search of the Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) database was undertaken in August 2012. A total of six Aboriginal sites had been previously recorded. None of these registered sites are within the study area.

- As part of the Stage 1 assessment a search of the Native Title Tribunal (NTT) database was carried out in February 2012. At the time of this search there were no relevant entries in the above database in the study area, although an application on behalf of the Western Bundjalung people has been registered to the north east of the study area
- The online Australian Heritage Database was searched on 23 August 2012. No items were located within the study area boundaries.

3.2.3 Findings

A wide variety of site types have been recorded within the Tenterfield region. The desktop study identifies the likelihood that a range of known site types may occur within the study area.

No sites were located on any other relevant heritage registers for the area. This is most likely due to the lack of archaeological surveys close to the study area and may not reflect the actual presence or absence of sites. None of the previously recorded sites listed on OEH's AHIMS database are in the study area.

A number of pre and post-contact sites were recorded by Hudson (2009) in the State Conservation Area known as Currys Gap. As the mapping information supplied is indicative only, these sites will need to be investigated in detail if potentially impacted by the shortlisted route options.

Some archaeological work undertaken in the vicinity does provide an indication of the likelihood of Aboriginal sites occurring in the study area locality. Sites in the region are most likely to consist of one or more stone artefacts. Other site types such as shelters and semi-open sites (with or without art), petroglyphs, quarries and grinding grooves may be present in areas of suitable geology. Scarred trees may occur if any areas retain vegetation of sufficient age.

Consultation with Aboriginal stakeholders and detailed field investigations will be undertaken during the route options development phase.

3.3 Non-Aboriginal heritage study - desktop

The purpose of the non-Aboriginal heritage desktop study was to identify known (registered) and potential areas of sensitivity for matters of significance in relation to non-Aboriginal heritage within the study area. These findings have been used in the preparation of constraint maps used in the development and assessment of the preliminary route options.

3.3.1 Legislative context

There are three key pieces of legislation that apply to historical heritage within New South Wales and which are relevant to the context of this project. These Acts are:

- *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
- *Environmental Planning and Assessment Act 1979 (Department of Planning, NSW)*
- *Heritage Act 1977 (Office of Environment and Heritage, NSW).*

3.3.2 Existing environment

Historical context

The desktop assessment documents non-Aboriginal heritage items identified within the study area. This was conducted through the desktop review of heritage registers and searches, the Tenterfield Heritage Study (1996), other relevant Tenterfield Shire Council Heritage data and through preliminary consultation with Tenterfield Shire Council.

An initial review of parish maps and historical aerial photographs was also undertaken to assist with this review. A brief history of the Tenterfield Local Government Area and key historical themes are also provided for context.

Database searches

Site searches of a number of historical heritage registers and databases were undertaken for the Tenterfield Local Government Area in August 2012.

- The online Australian Heritage Database administered by the Commonwealth which includes registered historical heritage places of national heritage significance throughout Australia (this database also includes registered historical heritage places on the Commonwealth Heritage List)
- The NSW State Heritage Inventory (including the State Heritage Register) administered by the NSW Office of Environment and Heritage
- The *Tenterfield Local Environmental Plan (1996)*
- Section 170 Heritage and Conservation Register
- The National Trust Register, a non-statutory database maintained by the National Trust.

The review of heritage registers and searches and other relevant studies has identified 137 Non-Aboriginal heritage sites or items. Of these 137 items, the majority (130 items) have been assessed in previous studies or sources as having local significance. The remaining seven items are recorded as having potential State and National significance.

3.3.3 Findings

The results of the desktop research indicates that there are numerous known non-Aboriginal heritage items within the study area. Over 90 per cent of the registered items are of local heritage significance. However there are several notable items of higher heritage significance, including three registered State significant items on the State Heritage Register:

- The Tenterfield Post Office and Quarters
- Tenterfield Railway Station complex
- Tenterfield School of Arts.

The Tenterfield School of Arts and the Tenterfield Post Office are also listed on the Australian Heritage Database for potential national heritage values, along with Ayrrie House. Ayrrie House is an early New England district house that is an excellent example of its type, which remains intact and in virtually original condition.

The former Railway Hotel at 2 Manners Street is also listed on the former Register of the National Estate and may also have potential national heritage values which require further investigation and assessment. These items of potential national and State heritage significance were avoided during the development of preliminary route options as they are of high sensitivity.

The central business area precinct is one area of sensitivity for local heritage values (based on Council's 2004 Heritage Study). The centre of town and the business area was not considered during the development of preliminary route options for the Tenterfield heavy vehicle bypass.

It is possible that additional non-Aboriginal heritage items may be identified during further consultation with Tenterfield Shire Council and Tenterfield District Historical Society and field investigations along the shortlisted route options.

4. Socio-economic investigations

4.1 Preliminary socio-economic assessment

This section provides a summary of the preliminary socio-economic study undertaken as a desktop investigation for the Tenterfield heavy vehicle bypass. The desktop study has assessed the existing socio-economic environment of the Tenterfield Local Government Area (LGA) in relation to the Inverell - Tenterfield statistical region as well as the statistics for all of NSW.

4.1.1 Desktop review

The socio-economic desktop investigation involved a review of available data and information from a number of sources including:

- Population data from the 2011 and 2006 Australian Census
- NSW Department of Planning and Infrastructure (DP&I) population projections (2010)
- Tenterfield Shire Council documents including *Our Community Strategic Plan 2011-2021* and *Tenterfield Shire Council Social Plan 2007*
- Various online databases (eg Tenterfield Community Information website) to access information about social infrastructure.

Consultation with stakeholders, such as Tenterfield Shire Council and local businesses, will be undertaken to supplement this review of available data with local knowledge during the route options development phase.

4.1.2 Existing environment

The town of Tenterfield is the administrative and commercial centre of the Tenterfield LGA and services a number of small villages including Urbenville, Drake, and Torrington.

There are a number of higher order services located in Tenterfield that service surrounding villages and rural properties, including a community hospital, retail and commercial services, a TAFE campus and a high school.

The Tenterfield community is highly reliant on road transport, with the New England Highway running north to south through the town, and the Bruxner Highway running east to Casino, Lismore and Ballina. There is a rail line corridor which runs parallel to the New England Highway to the west of Tenterfield but it has been disused for many years and no passenger trains service the town.

Social characteristics and local economy

Overall, the demographics of Tenterfield are characterised by an older population, with a low rate of population growth. Compared to the state average, there is a higher proportion of Aboriginal residents than other areas, and there is less representation from residents from culturally and linguistically diverse backgrounds. Unemployment rates are higher than the state average, while education rates are lower.

The economy of Tenterfield LGA is rural based, supported by other industries such as retail, as well as government and health services. Since 2006, the agricultural industry has experienced a decrease. Those key industries that have experienced an increase include construction, health care and social services. A large number of Tenterfield's community and recreation facilities are located in the centre of Tenterfield, along the New England Highway.

Preliminary socio-economic issues

Based on a desktop review of the available demographic data, relevant research and Council reports, a number of preliminary socio-economic issues that are relevant to the planning for a heavy vehicle bypass have been identified.

As the project is further developed, consultation with key stakeholders will provide more detailed information about key community issues and needs and how they relate to the shortlisted route options. The socio-economic issues for Tenterfield and surrounding communities include:

- Socio-economic trends – including an ageing population and low rate of population growth
- Property and amenity impacts - a heavy vehicle bypass has the potential to result in property impacts and changes to amenity
- Impacts on businesses - the heavy vehicle bypass could result in a decline in traffic passing through the centre of Tenterfield, which could have both negative and positive impacts on businesses
- Community safety benefits – a heavy vehicle bypass is expected to provide a safer environment for pedestrians and other road users, such as cyclists, within the town
- Construction impacts – various impacts are likely to result from construction activities including impacts on accessibility, connectivity, amenity, noise, air quality, visual and vibration impacts, and traffic impacts
- Impacts on road users – it is anticipated that a heavy vehicle bypass will result in positive benefits for road users, particularly individual truck and fleet vehicle operators, including reduced travel time and increased efficiency for freight operators, which may lead to reduced business costs
- Impacts on social infrastructure - the locations of bypass options should consider the location of existing social infrastructure. Potential property acquisition or relocation of services could impact on the ability of community members to access services, as well as the level of service provision to the community
- Access and connectivity – a heavy vehicle bypass may have positive impacts on accessibility and connectivity within the centre of Tenterfield, particularly for pedestrians, cyclists and other road users.

4.1.3 Next steps

A proposal for a heavy vehicle bypass for Tenterfield would be likely to result in a range of socio-economic impacts, both positive and negative. This preliminary assessment has provided a desktop analysis of the socio-economic environment of Tenterfield, including existing social infrastructure, and provided an outline of potential impacts.

The potential impacts of any future heavy vehicle bypass will be investigated and further assessed in conjunction with the development of the short listed route options. A site visit and consultations with key groups will provide more detailed information on the location of social infrastructure, as well as the character of the town and surrounding areas. This will assess the potential impact of the shortlisted route options, including any impacts on social infrastructure and changes to traffic movements and patterns.

Consultation with community members and key stakeholders will also provide an understanding of community values and issues, and identify other socio-economic impacts that may result from a heavy vehicle bypass.

4.2 Preliminary visual amenity assessment

This section provides a summary of the preliminary visual amenity analysis prepared for the study area and its surrounds.

The purpose of the preliminary visual analysis was to identify a range of landscape zones and key viewing areas within the study area. It also assesses potential (visual and amenity) impacts on the natural, cultural and built environment associated with any future heavy vehicle bypass construction.

4.2.1 Landscape character

From a landscape perspective, Tenterfield's location on the Great Dividing Range at the northern end of the New England Tablelands is significant. The existing New England Highway passes through a saddle between substantial ridge lines south east and south west of the town.

Landscape context

The town of Tenterfield sits in a broad north-south valley with Tenterfield Creek running through the centre of it. The surrounding rural landscape varies in character from the rugged forest-covered Mount Mackenzie to flat cultivated areas and gently undulating grazing areas associated with Tenterfield Creek and tributaries.

The landscape north and east of the town is undulating agricultural landform that includes grazing and cultivation. Homesteads distributed across the landscape are commonly surrounded by planted trees. In contrast, the landscape character west of the town is more strongly undulating with extensive patches of remnant trees, grassland and planted wind breaks.

Mount Mackenzie is located south west of Tenterfield and forms a regional landscape feature that is highly visible from the New England Highway as well as the town. The forest covered slopes have extensive outcrops of granite that form a distinctive natural element in the landscape. A spur running north east from the lower slopes of Mount Mackenzie extends to, and passes through, the Currys Gap Conservation Area to near the southern edge of the town. At this point Tenterfield Creek passes through a gap in the topography downstream of the water supply dam on the eastern side of the New England Highway.

The western edge of the town is defined by a disused railway corridor that passes along a series of cuttings and elevated embankments with remnants of bridges over creek crossings. The heritage listed Tenterfield Railway Station complex forms a distinctive landmark on the western side of the town.

Within the town area the views from the streets are generally defined by adjoining residential and commercial buildings, although views along the streets often extend to beyond the town to forest covered hills and ridges to the north, south, east and west. Views upstream and downstream along Tenterfield Creek are available from a series of road and street crossing points.

Landscape Character Zones

To provide an overall framework for the visual assessment, the study area was analysed to identify and describe a series of Landscape Character Zones (LCZ). These include:

- LCZ 1 - Broad north-south enclosed valley
- LCZ 2 - Prominent tree-covered hill
- LCZ 3 - Rural landscape on low ridgeline
- LCZ 4 - Mount Mackenzie with tree-covered slopes
- LCZ 5 - Undulating rural area
- LCZ 6 - Tenterfield township
- LCZ 7 - Broad agricultural valley
- LCZ 8 - Strongly undulating rural landscape
- LCZ 9 - Gently sloping grazing land
- LCZ 10 - East-west valley and hills.

The location of these zones is shown in Figure 11.

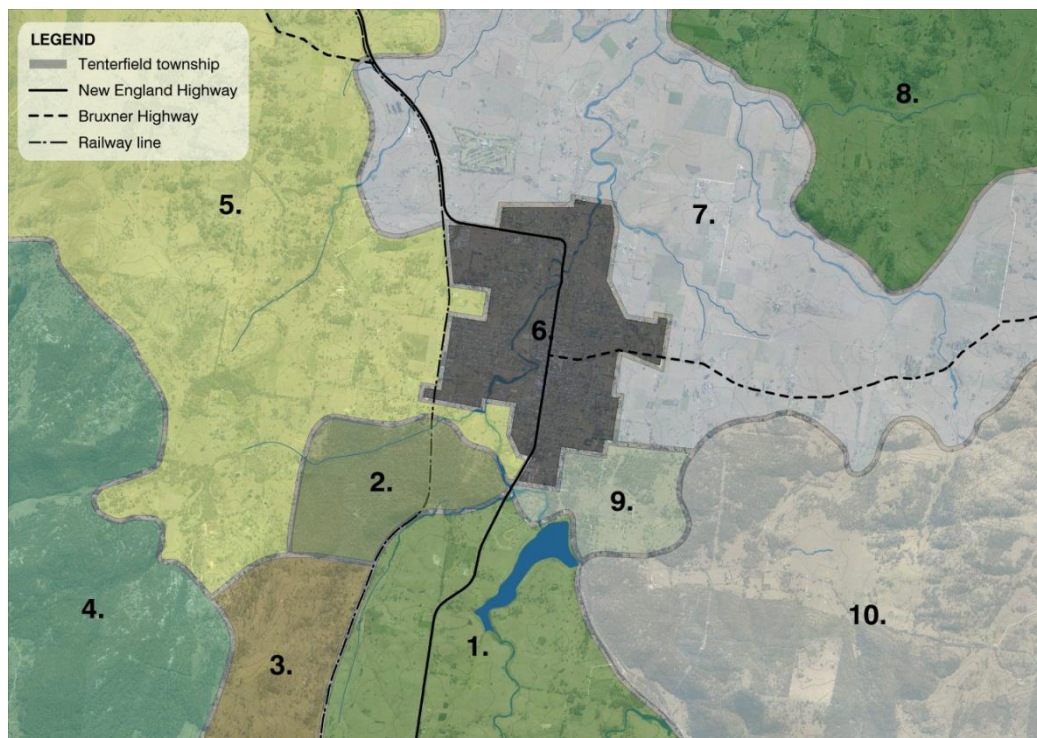


Figure 11 Identified Landscape Character Zones

The next phase of the heavy vehicle bypass investigation will assess how the shortlisted options impact on the landscape scenic quality of the relevant LCZ.

4.3 Planning and zoning investigation

This section provides a summary of the planning and zoning issues that will be integral to any detailed project development for a Tenterfield heavy vehicle bypass. The purpose of this review is to identify potential implications for, and impact on, the project in respect of planning and zoning issues within the study area.

4.3.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the statutory basis for planning and environmental assessment in NSW. Assessment and approvals may be carried out under various parts of the EP&A Act depending on the scale and nature of the impacts of a proposal. A heavy vehicle bypass project will have the potential to be determined under a number of approval pathways, including:

- **Part 4** provides for control of 'local development' that requires development consent from the local Council
- **Part 5** provides for control of 'activities' that do not require approval or development consent from local Council
- **Part 5.1** where the project may result in significant impact, an environmental impact statement would be required to be prepared and the proposal would be classified as State significant infrastructure. This part would also apply if the Minister for Planning and Infrastructure declared the project to be State significant infrastructure or critical State significant infrastructure.

In order to determine the relevant planning approval pathway, consideration must be given to the relevant State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs) for the project.

4.3.2 Relevant environmental planning instruments

The key SEPPs and LEPs relevant to the Tenterfield heavy vehicle bypass project are:

- *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP).
- *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP).
- *Tenterfield Local Environmental Plan 2013* (Tenterfield LEP 2013).

The preliminary route options will have the potential to pass through up to three land use zones under the Tenterfield LEP 2013. The zones that are most likely to be affected are Zone RU5 Urban Village and Zone RU1 Primary Production. There is a possibility that Zone E1 National Parks and Nature Reserves may be traversed by some of the route options. Roads are permitted with consent for both RU5 and RU1, but approval would be necessary for any incursion within E1.

A localised extract of the Tenterfield LEP 2013 is provided as Figure 12.

4.3.3 Other relevant planning issues

NSW State legislation and Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Department of the Environment. It includes management of impacts on matters of national environmental significance.

The study area and 10 kilometre search area has the potential to provide habitat for two threatened ecological communities, 24 fauna species, and 20 flora species. In addition, there is potential habitat for 29 marine or migratory species. There are two Commonwealth Lands within the search area. Therefore, the provisions of the EPBC Act may be relevant to the project and an assessment of matters of national environmental significance would need to be undertaken as part of any environmental assessment.

Planning strategies

A series of Local, Regional and State planning strategies are relevant to the bypass project.

Urban and Rural Land Use Strategy

The strategy has not yet been adopted by Council and therefore a copy is not available for public viewing.

Tenterfield Shire Our Community Strategic Plan 2011-2021

The Tenterfield Shire Community Strategic Plan aims to express the Tenterfield Community's priorities and aspirations and guide Council activities over a 10 year period.

Current conflicts between heavy vehicles and other motorists and pedestrians in the town centre are a significant threat to the safety and wellbeing of the residents and visitors of Tenterfield. The desirability of a bypass was identified by the Tenterfield Community as a priority to ensure a safe and efficient road network for all road users.

Strategic Regional Land Use Plan – New England North West (2012)

The New England North West Strategic Regional Land Use Plan provides a clear strategic framework for the New England North West region, delivering the necessary context for Government investment priorities, servicing strategies and local environmental plan making. A key challenge identified by the plan for the New England North West region is road capacity. Two objectives are identified by the plan for the provision of infrastructure:

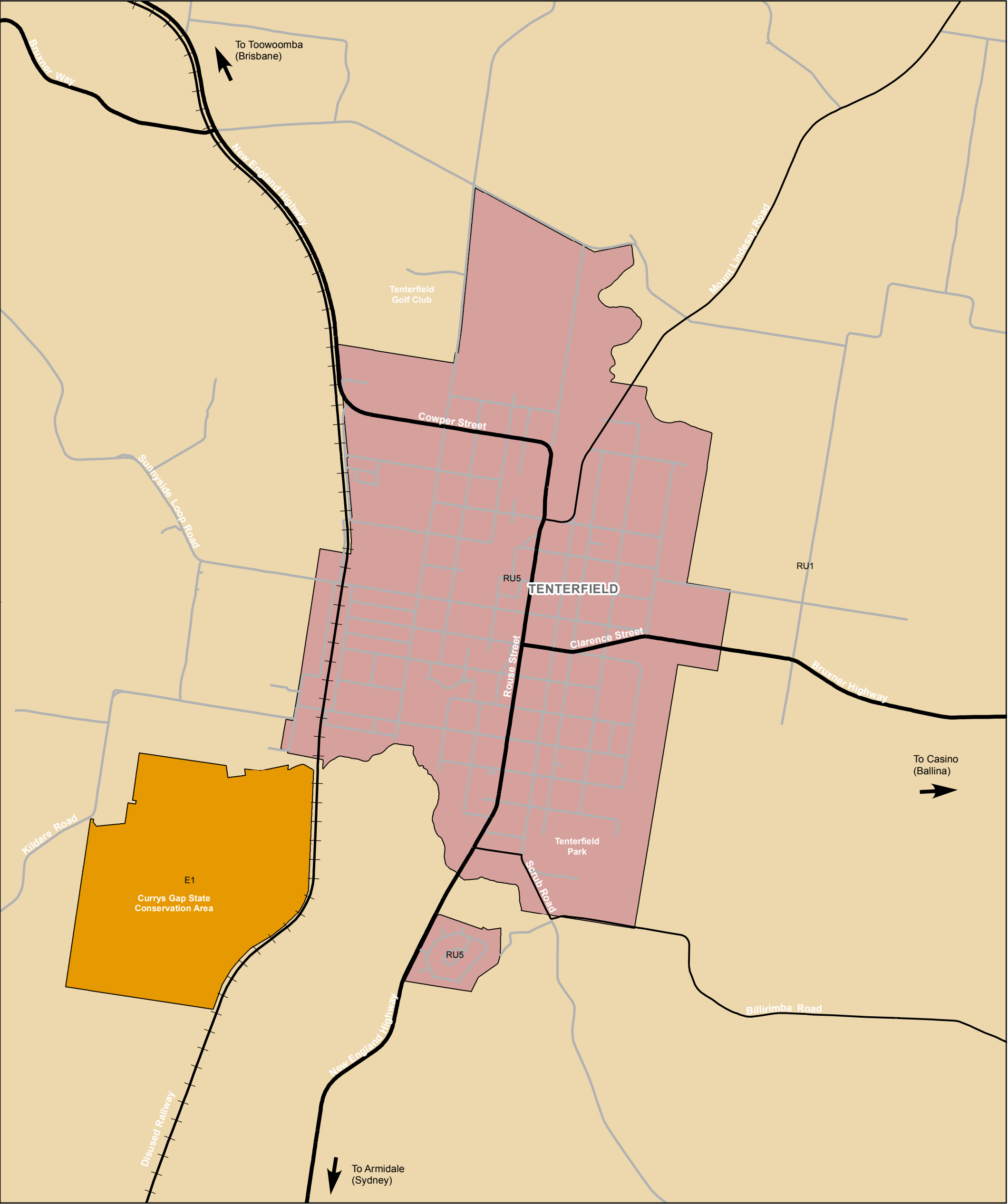
NSW 2021

NSW 2021 is a 10 year plan to rebuild the economy, provide quality services, renovate infrastructure, restore government accountability, and strengthen our local environment and communities. It replaces the State Plan as the NSW Government's strategic business plan, setting priorities for action and guiding resource allocation.

Consultation

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities before the commencement of certain types of development. Clauses 13, 14, 15 and 16 of ISEPP require that public authorities undertake consultation with Councils and other public authorities, when proposing to carry out development without consent.

Formal consultation will be required with Tenterfield Shire Council when assessing the shortlisted route options. Additional consultation will be required with the Office of Environment and Heritage (OEH) in accordance with Clause 16 of the ISEPP, if the proposed heavy vehicle bypass development is adjacent to a National Park or an aquatic reserve.



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- | | | | |
|--|---------------|--|-----|
| | Existing Rail | | E1 |
| | Primary Road | | RU1 |
| | Main Road | | RU5 |
| | Local Road | | |

5. Community input summary

5.1 Consultation approach

A comprehensive stakeholder consultation process has been implemented since the project started. Local stakeholders have important information on issues and constraints in the study area with the potential to affect the location of route options and ultimately the performance of the preferred route.

Stakeholders can also be affected directly and indirectly by the route options.

The objectives of the community and stakeholder consultation are to:

- Work with the public to ensure that community concerns and aspirations are directly reflected in the assessment of route options, and provide feedback on how public input was considered in project decision making processes
- Build relationships with the community and stakeholders
- Proactively engage the local community, key stakeholders and local interest groups about the project, including being clear about negotiable and non-negotiable aspects
- Demonstrate an understanding of community and stakeholder concerns and values
- Provide the community and stakeholders with an opportunity to meet the project team, ask questions, identify issues surrounding the project and provide feedback
- Seek ideas, knowledge and encourage attendance at community meetings, workshops and public displays
- Manage community and stakeholder feedback and complaints in a timely, respectful way
- Monitor and evaluate stakeholder feedback to measure the appropriateness of consultation methods, and review planning and activities as necessary
- Be transparent in communication, making clear, accurate and up to date information publicly available on the assessment of route options at all stages of the process.

5.2 Community updates and displays

The following activities have been carried out to date:

- September 2012 – The first round of community consultation introduced the project to the community, including the objectives of the project, the process to identify preliminary route options and the timeframe for determining the preferred route option. The update displayed the study area, requested community suggestions for route options and the identification of known constraints. This round of consultation included Community Update No.1, Public Display No.1 and two community drop-in sessions
- February/March 2013 – The second round of community consultation provided an update on the study process and displayed the draft preliminary route options to the community, requesting confirmation of the options, as well as any additional route options and known constraints. The draft preliminary route options included those from the community, the options previously identified in the Council's PEECE report and those identified by the project team. This round of consultation included Community Update No.2, Public Display No.2, a community presentation, another drop-in session and a presentation to Councillors

- August 2013 – distribution of Community Update No.3. This provided confirmation of the 22 route options to be assessed in the shortlisting process.

5.3 Community meetings and feedback

Community information sessions were held to coincide with the distribution of the first two community updates and public displays.

The purpose of the information sessions was to provide the community and stakeholders with information on the study process, allow for input into assessment methodology and criteria as well as provide the opportunity to raise issues and concerns and to suggest potential route options.

Project team members from Roads and Maritime and GHD attended, representing a number of disciplines including engineering, community and environment.

The community meetings were well attended with approximately 60 people at the first round of community meetings held on Thursday 18 and Friday 19 October 2012, and over 80 people at the second round of community meetings held on Thursday 14 and Friday 15 March 2013.

The presentations at the sessions were largely informal and allowed for the community to comment and ask the project team any questions about the project and the assessment process. Respondents were encouraged to complete a feedback form during the drop-in session but they were also able to return the completed form via email or post.

5.3.1 Feedback from community meeting 1

Fifty feedback forms were received during the first consultation period. Feedback forms were accepted until Friday 2 November 2012.

Respondents were encouraged to suggest bypass route options on the figure provided on the community feedback forms. All but six respondents mapped a route for consideration.

24 respondents suggested route options to the east of town and 15 suggested options to the west of town. Other respondents suggested a combination of the most popular eastern and western routes.

The key issues raised by the community during this consultation included:

- Need for a bypass to be implemented to reduce heavy vehicle traffic volumes along the main street of Tenterfield
- Concern that bypass options will impact negatively on residential areas and the local economy
- Increase in traffic along the Bruxner Highway should be considered as part of the New England Highway bypass route
- Community and Tenterfield Shire Council need to work together to improve the tourist potential of the town to offset any economic impacts.

Analysis of the community feedback indicates a relatively high level of support for a heavy vehicle bypass due to the positive pedestrian safety, traffic, noise and air pollution impacts that a bypass would provide. The key issues raised by the community for the project team to consider included road safety, economic benefit to the community, impact on the community and the impact on property.

5.3.2 Feedback from community meeting 2

Following the March 2013 community meeting, a total of 107 people returned feedback forms or provided feedback via the project email, with forms accepted until 16 April 2013.

Respondents were asked to rank the importance of each of the project objectives. The two criteria of greatest importance to the community were, 'Provide sustainable economic outcomes for the local community' and 'Improve Road Safety'.

The top five themes or issues raised by the greatest number of respondents included:

- Concern about the impact of the bypass on residents and the need to minimise the number of residents impacted
- The need to ensure the bypass addresses traffic from the New England Highway as well as the Bruxner Highway and Mt Lindesay Road
- Concern about the economic impact of the proposed heavy vehicle bypass on the community and local businesses
- Current safety concerns for the community particularly along Rouse Street but also safety concerns surrounding the future bypass
- The cost effectiveness of the proposed heavy vehicle bypass.

Respondents were asked to provide comment on the preliminary route options and give their preference to a preferred route option, or a type of route option, from within the categories of outer west, central west, inner west, inner east and outer east, as displayed in Community Update No.2.

A number of respondents identified multiple routes as their preference and some identified a combination of routes in similar proximity, consistent with the categories nominated. The outer east route options were supported by the greatest number of respondents, with the second greatest number supporting the inner west route options.

6. Assessment methodology and criteria

The project team developed an assessment methodology and criteria based on the project objectives and experience with similar projects. The assessment criteria were used in the evaluation of the preliminary route options to shortlist four options for further investigation.

6.1 Project objectives

For each project objective there are a number of sub objectives or areas where the project can be broadly measured and selection criteria can be developed. These are set out in Table 14 below.

Table 14 Project objectives and selection criteria

Project objective	Broad measurable / Selection criteria
Improve road safety	- Reduced crash rates and injuries - Improved road safety and geometry standards - Minimise conflict points (intersections) on the highway - Constructability - Work health and safety in construction and maintenance.
Improve road transport productivity efficiency and reliability of travel	- Reduced road freight user costs - Reduced travel time - Target a high level of service for the proposed route - Increase road network capacity.
Minimise the impact on the natural, cultural and built environment	- Impact on fauna habitat including threatened species - Impact on flora including threatened species - Water quality - Air quality - Noise and vibration impact - Aboriginal and European heritage - Stormwater and drainage - Residential and commercial properties impacted - Ecological sustainability - Visual impact and amenity.
Provide sustainable economic outcomes for the local community	- Impact on commercial activities in township (positive and negative) - Impact on retail industry activities in township (positive and negative) - Impact on tourism and accommodation industry activities in township (positive and negative) - Impact on transport industry activities in township (positive or negative).
Minimise social impact on the community	- Maintain community connectivity - Social impact on community groups/locations.
Provide value for money	- Provide a positive Benefit to Cost Ratio (BCR) - Net Present Value over 30 years - Assess road user costs and benefits - Calculate infrastructure operating costs (including maintenance) - Comparative project costs.

6.2 Development of assessment methodology and criteria

The development of the assessment criteria involved identifying a number of measurable items that are a sub-set of each of the project objectives. For each measurable item an evaluation framework was devised to allow scoring of the project objectives and ultimately evaluation of each route option relative to the others.

This was undertaken in a structured manner at a technical workshop convened with a range of discipline leads within the project team and other government stakeholders.

In order to provide equality and to simplify the evaluation calculations, each of the first five project objectives was assigned a total score of 10. This allowed the total evaluation score to be out of 50 for direct comparison between the preliminary route options.

The sixth objective, *Provide Value for Money*, was not evaluated directly out of a score of 10. The evaluation score derived from the first five objectives was divided by the strategic cost estimate for each option to establish a value quotient. This gives a measure of the value for money of each option (benefits per \$M).

The assessment criteria were evaluated prior to and in preparation for the Internal Technical Workshop to finalise the score system for certain criteria. Subjective criteria on the other hand were required to be measured in the workshop based on the general consensus of the attendees. This is discussed in more depth later in this report.

Table 15 lists the preliminary assessment criteria and scoring system for each criterion.

Table 15 Preliminary route option assessment criteria

Project objective and supporting criteria	Route option assessment criteria	Evaluation system
Improve road safety		
- Reduced crash rates and injuries - Improved road safety and geometry standards - Minimise conflict points (intersections) on the highway - Constructability - Work, health and safety in construction and maintenance.	Length of highway bypassed.	5 – Decrease > 20% 4 – Decrease > 10% 3 – Decrease up to 10% 2 – Increase up to 10% 1 – Increase > 10%
	Number of new intersections.	5 – Reduce by 15 4 – Reduce by 10 3 – Reduce by 5 2 – Minor reduction 1 – Any increase
Improve road transport productivity efficiency and reliability of travel		
- Reduced road freight user costs - Reduced travel time - Target a route Level of Service (LoS) of A - Increase road network capacity.	Net travel time saving.	10 – Save > 3 mins (Excellent) 8 – Save up to 3 mins (Good) 6 – Save < 1min (Acceptable) 4 – Increase up to 1 min (Poor) 2 – Increase > 1 min (Unsatisfactory)
Minimise the impact on the natural, cultural and built environment		
- Impact on fauna habitat including threatened species - Impact on flora including threatened species - Water quality	Relative INDEGO score for environment.	10 – Excellent 8 – Good 6 – Acceptable 4 – Poor

Project objective and supporting criteria	Route option assessment criteria	Evaluation system
- Air quality - Noise and vibration impact - Aboriginal and Europe heritage - Stormwater and drainage - Residential and commercial properties impacted - Ecological sustainability - Visual impact and amenity.		2 – Unsatisfactory
Provide sustainable economic outcomes for the local community		
- Impact on commercial activities in township (positive and negative) - Impact on retail industry activities in township (positive and negative) - Impact on tourism and accommodation industry activities in township (positive and negative) - Impact on transport industry activities in township (positive and negative).	Relative INDEGO score for environment.	10 – Excellent 8 – Good 6 – Acceptable 4 – Poor 2 – Unsatisfactory
Minimise social impact on the community		
- Maintain community connectivity - Social impact on community groups/locations.	Proximity to town – business awareness/visit potential.	5 – High 3 – Medium 1 – Low
	Potential severance impact.	5 – Low 3 – Medium 1 – High
Provide value for money		
- Benefit Cost Ratio (BCR) - Net Present Value over 30 years - Road user costs and benefits - Infrastructure operating costs (including maintenance) - Comparative project costs.	Project value over costs (value quotient).	Score for assessment is the value score divided by the project capital cost (i.e. value quotient).

The scoring for two of the project objectives references the INDEGO analysis score for the evaluation of route options. This is a system developed to map various constraints within a Geographic Information System (GIS).

In order to identify, refine and rank a range of preliminary route options a number of studies and investigations were conducted that were: engineering, environment and heritage and socio-economic in nature.

The findings of the studies and investigations were translated into a GIS based layering of constraint categories that allowed for the development of constraints maps. The development of constraints maps enabled a Multi Criteria Analysis (MCA) to be implemented.

7. Development of preliminary route options

This section provides details of the development of the preliminary route options. This includes a description of how each route option was developed, the location and key features of each and an initial assessment of their respective physical characteristics in terms of length, how much of the existing highway would be bypassed and the notional design speed of a heavy vehicle bypass along that route.

A preliminary (strategic level) cost estimate has also been prepared for each preliminary route option to assist in the evaluation and shortlisting process.

7.1 Constraints identification

The first stage of the route options development was to identify key properties or places within the study area that are of community, engineering, social or environmental value and are therefore constraints to route development. Items that were deemed of substantial community, engineering, social or environmental value are:

- Tenterfield water supply dam
- Tenterfield cemetery
- Railway station complex and heritage museum
- Currys Gap State Conservation Area
- Tenterfield Park
- Arydie House
- Tenterfield Golf Club
- Tenterfield Station
- Tenterfield railway stockyard
- Tenterfield rifle range
- Tenterfield cattle saleyards
- Major electricity substation on Bellevue Street south
- F111 memorial site on Old Ballandean Road
- Steep topography to the south east and south west of the township.

7.2 Constraints mapping

Once these major constraints had been identified and located they were then mapped on an aerial photograph base. The mapping was used to distinguish the spatial relationship between these constraints and the preliminary route options as they were developed

The constraints were also classified in three categories to allow assessment of route options in relation to the project objectives:

- Environment and heritage constraints
- Socio-economic constraints
- Engineering constraints.

The development of constraints maps enables a Multi Criteria Analysis (MCA) to be undertaken on the various route options. MCA is a structured approach used to determine overall preferences among alternative options, where the options accomplish several objectives.

7.3 Identification of route options

The preliminary route options presented in this section have been identified from a number of sources, dating back to a study undertaken on behalf of Tenterfield Shire Council (PEECE Report) in 2009.

In addition there have been numerous suggestions from the community and the project team as part of this study since it commenced in mid 2012. These community ideas were then further developed by the project team in conjunction with the constraints mapping previously described.

7.3.1 TSC Route Options - PEECE Report (2009)

Tenterfield Shire Council (TSC) engaged the PEECE group of consultants to undertake a Heavy Vehicle Alternative Route study of the town in 2009. The study conducted a high level investigation into a range of potential route options, including the use of existing streets, new green field alignments and / or a combination of both.

The report investigated a range of options on the eastern and western sides of Tenterfield – with an initial focus on using existing streets wherever possible. This initial generation of route options resulted in three western and three eastern route options and from the preliminary analysis the western options were preferred.

Subsequent to this preliminary finding, further options were developed on the western side of town (to avoid impacts on access to the cemetery) and a wide eastern option was nominated as a potential higher speed alternative. However, this wide eastern option was effectively dismissed as not providing any travel time benefits and was not considered viable.

The total number of PEECE Report options identified was nine – with five western and four eastern routes. These options have all been adopted as preliminary route options for the purposes of this report. They are notarised as PE1 to PE4 east of Tenterfield and PW1 to PW5 to the west of the town. An aerial photo map of the PEECE Report options is provided in Figure 13.

Some of these PEECE Report routes are comparable to those suggested by community members and confirmed as Preliminary Route Options by the project team. These similarities and the opportunity to merge similar options are canvassed in the first pass elimination of route options described in Section 8.



7.3.2 Developed preliminary route options – Project team (2013)

A wider range of preliminary route options was identified through a combination of community suggestions and the outcomes of the constraints mapping processes previously described. A total of 13 potential route options were developed by the project team from these initial suggestions and subsequent constraints analysis.

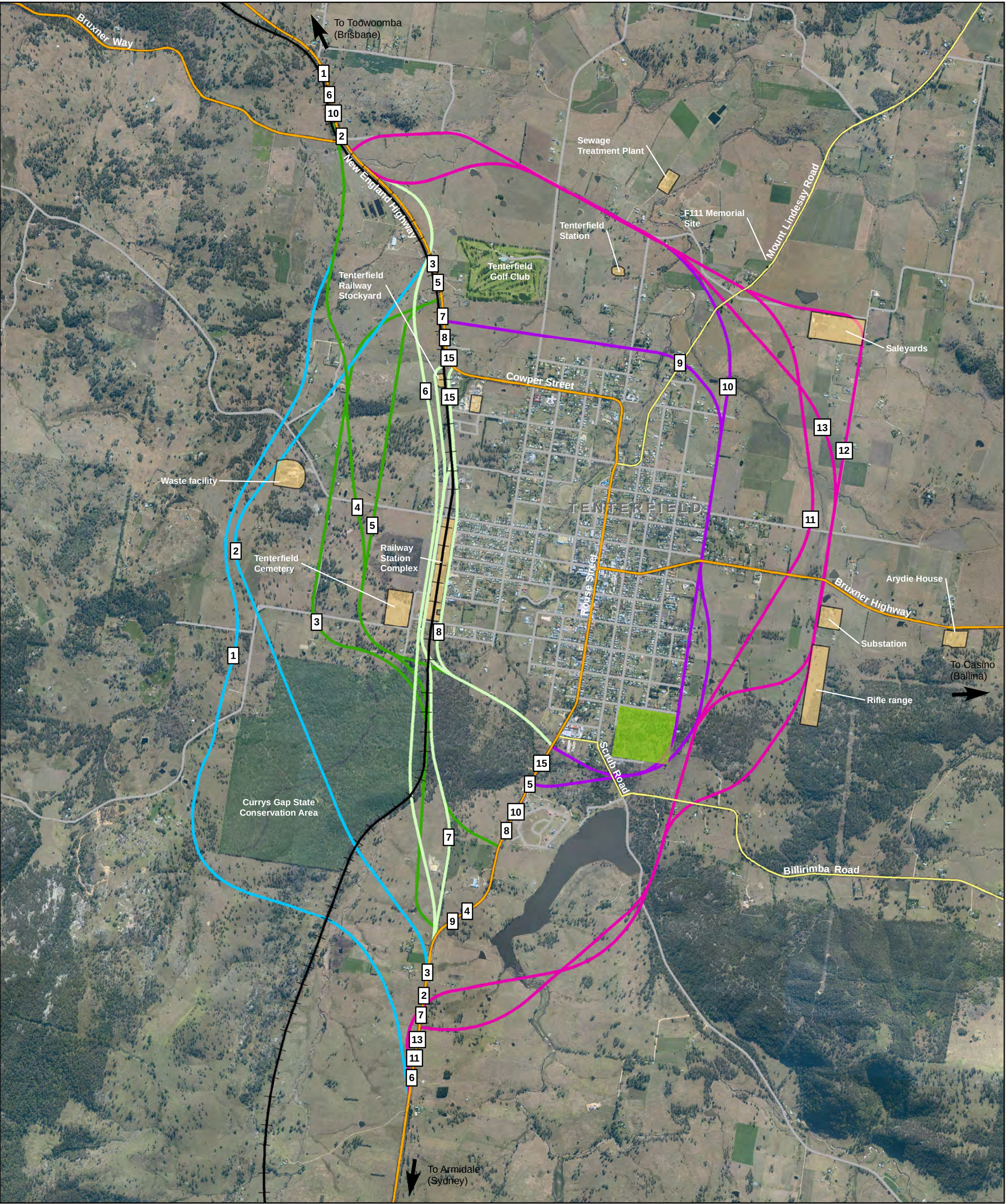
The 13 route options were able to be categorised in regard to the relative distance (west or east) from the town of Tenterfield. These five broad categories were identified from west to east (with route options numbered) as follows:

- Outer west (options 1 and 2)
- Central west (options 3, 4 and 5)
- Inner west (options 6, 7 and 8)
- Inner east (options 9 and 10)
- Outer east (options 11, 12 and 13).

The relative separation from the township dictates that some options would be able to be higher speed than others. Deviated or new routes well away from town would be longer and could be 100 km/h standard, whereas on street routes, or those closer to the built up area would likely be limited to 70 km/h or lower to minimise community (eg noise) impact.

Each of the options was assigned a nominated design speed for the purposes of subsequent travel time calculations. These design speeds in turn would determine the horizontal and vertical alignment standards and the extent of earthworks required to meet the required geometry.

An aerial photo map of the route options developed by the project team is provided in Figure 14.



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Inner West route options

Central West route options

Outer West route options

Outer East route options

Inner East route options

Existing Rail

Primary Road

Main Road

Local Road

Social constraints

7.4 Description of preliminary route options

A short description of each of the PEECE Report route options and the new route options developed by the study team are provided in Table 16 and Table 17 respectively. These descriptions are brief and should be read in conjunction with the two route options aerial photo figures previously referenced.

Table 16 PEECE route options

Route Option	Description
PE1	Option PE1 utilises existing residential streets departing from the NEH at Clive St, turning along East St, into Cowper St and re-joining the NEH at the intersection with Rouse St.
PE2	Option PE2 is a modification of Option PE 1 traversing along and extended Clive St, along Bellevue St and then along an extended Cowper Street to re-join the existing highway.
PE3	Option PE3 is a modification of the Option PE2 with variation being that the route continues along Bellevue St onto Boundary St and then Old Ballandean Rd before re-joining the existing highway.
PE4	Option PE4 departs the NEH south of Tenterfield Dam, cuts through the ridge east of the dam then follows the alignment of Bellevue St, Boundary Rd and Old Ballandean Rd.
PW1	Option PW1 departs the NEH at Clive St and dog legs to Francis St then onto Douglas St. The route utilises Western St and Western Boundary St, re-joining the NEH at Cowper St.
PW2	Option PW2 departs the NEH immediately south of the Rugby League Park joining up with Western St, Western Boundary Rd and re-joins the NEH at the intersection with Cowper St.
PW3	Option PW3 departs the NEH about 2 km south of Douglas St following the alignment of the railway corridor through the ridge adjacent Curry's Gap State Conservation Area, along Western St, Western Boundary Rd.
PW4	Option PW4 departs the NEH about 2 km south of Douglas St follows the railway through a cutting, sweeps west of the cemetery before sweeping back to re-join the NEH at the intersection with Cowper St.
PW5	Option PW5 departs the NEH south of town and bisects Currys Gap State Conservation Area, sweeps to the west of the cemetery and then converge back to Western Boundary Street and re-joins NEH at Cowper St.

Table 17 **Developed route options**

Route Option	Description
Option 1	Option 1 departs the NEH 3.3 km south of town and re-joins the NEH north of the Bruxner Way Intersection. Route traverses steep and undulating terrain to the west of the township and Currys Gap State Conservation Area.
Option 2	Option 2 departs NEH 2.4 km south of town and re-joins adjacent Tenterfield golf course north of town. Route traverses the undulating landscape to the west of the township, bisecting Currys Gap State Conservation Area.
Option 3	Option 3 departs NEH 2 km south of town and re-joins adjacent Tenterfield golf course north of town. Route traverses the undulating landscape to the west of the township and cemetery.
Option 4	Option 4 departs NEH 1.1 km south of town, before transitioning from an alignment closer to town to the outer alignment of Option 1, re-joining NEH north of the Bruxner Way Intersection.
Option 5	Option 5 departs the NEH north of the Tenterfield Creek Bridge, south of town and re-joins the NEH adjacent the golf course north of town. Route passes west of cemetery.
Option 6	Option 6 departs NEH 2 km south of town and re-joins the NEH adjacent the golf course. Route traverses through part of Currys Gap State Conservation Area as well as land west of the railway corridor.
Option 7	Option 7 departs NEH 2 km south of town and re-joins the NEH at intersection with Cowper Street. Route traverses east of existing railway cutting, west of the railway station, using existing Western St and Western Boundary St.
Option 8	Option 8 departs the NEH north of the Tenterfield Creek bridge and re-joins at intersection with Cowper Street. Route remains east of the railway corridor using sections of Railway Avenue and Western Boundary Street.
Option 9	Option 9 departs the NEH north of Tenterfield Creek bridge, sweeps to the east of Tenterfield Park follows East St then runs perpendicular to East St, re-joining the existing NEH south of the Tenterfield golf course.
Option 10	Option 10 departs the NEH south of Tenterfield Creek bridge, sweeps to the east of Tenterfield Park, traversing the eastern edge of the town before converging on Old Ballandean Road and re-joining NEH at existing intersection with Bruxner Way.
Option 11	Option 11 departs the NEH south of Tenterfield Dam and re-joins south of the Bruxner Way Intersection. Route traverses land to the east of Tenterfield Dam, south of Sale yards and utilises a section Old Ballandean Rd.
Option 12	Option 12 departs NEH south of Tenterfield Dam and re-joins south of the Old Ballandean Rd intersection. Route passes east of dam, passes over the ridgeline and connects with the existing Bellevue St, Boundary Rd and Old Ballandean Rd corridors.
Option 13	Option 13 departs the NEH south of Tenterfield and re-joins south of the Old Ballandean Rd. Route traverses east of dam, through ridgeline and utilises parts of existing Bellevue St and Old Ballandean Rd.

7.5 Preliminary length, travel time and cost estimate calculations

A range of calculations have been undertaken on all of the preliminary route options in order to establish basic parameters of the potential bypass function for each route. This involved preliminary calculations of the length of each new route in comparison with the relevant section of the existing New England Highway bypassed.

This provides an initial assessment of the potential benefits that each may bring in terms of route distance and potential travel time savings. These potential benefits were compared to the strategic cost estimate for each as an initial indication of the relative merit of each route option as an aid in a first pass elimination of some options as described in Section 8.

The calculations and results for each preliminary route option provide data for an objective assessment against the selection criteria for the following project objectives:

- Improve road safety
 - Route length
 - Bypassed length
 - Number of new intersections.
- Improve road transport productivity efficiency and reliability of travel
 - Nominated design speed
 - Net travel time savings.
- Provide value for money.
 - Strategic cost estimate.

Results of the calculations undertaken for each of the 22 Preliminary Route Options are provided in Table 18. Summary points to note include:

- Maximum distance savings are achieved by Option 7 at 1.5 kilometres
- Maximum travel time saving is achieved by Option 2 and Option 6 at around 3.1 minutes
- The majority of western route options result in distance and travel time savings
- The majority of eastern route options result in increased distance and travel time
- The longer / higher speed eastern options would provide negligible time savings at a very high cost
- The shorter, inner western options appear to give the best combination of distance and travel time savings at the lower end of the cost spectrum.

Table 18 Initial assessment data for all preliminary route options

Route Option	Bypass length (km)		Nominated design speed (km/h)	Travel time differential (minutes)		Strategic cost estimate (\$m) ¹
	New	Bypassed				
PEECE Route Options (Tenterfield Shire Council, 2009)						
PE1	4.1	2.9	50	Plus	1.44	\$65
PE2	6.1	2.9	60	Plus	2.63	\$85
PE3	10.1	4.5	70	Plus	4.64	\$95
PE4	12.6	8.9	90	Plus	0.37	\$155
PW1	3.7	3.7	50	Plus	0.14	\$50
PW2	3.8	4.3	70	Save	1.77	\$55
PW3	5.0	6.3	80	Save	2.72	\$95
PW4	5.4	6.4	70	Save	1.92	\$80
PW5	5.3	6.3	70	Save	1.89	\$95
Developed Route Options (Community / Project team, 2013)						
Option 1	9.3	8.9	100	Save	2.48	\$185
Option 2	8.0	8.6	100	Save	3.08	\$150
Option 3	6.3	6.8	90	Save	2.62	\$110
Option 4	6.4	7.5	90	Save	2.96	\$110
Option 5	4.9	5.0	80	Save	1.84	\$75
Option 6	6.8	8.2	90	Save	3.11	\$110
Option 7	4.8	6.3	80	Save	2.85	\$90
Option 8	3.7	4.4	70	Save	1.93	\$60
Option 9	6.5	4.1	70	Plus	0.7	\$100
Option 10	8.7	6.1	70	Plus	1.37	\$105
Option 11	11.4	9.1	90	Save	0.55	\$145
Option 12	13.3	9.9	90	Plus	0.17	\$160
Option 13	11.6	9.1	100	Save	1.19	\$160

Notes:

1. Strategic cost estimates are rounded to nearest \$5m

8. Internal technical workshop

An internal workshop comprising representatives from the project team and key specialists was convened to assess the preliminary route options.

8.1 Workshop objectives

The objective for the workshop, as presented to the participants, was to:

“Review and assess the preliminary route options identified for the Tenterfield heavy vehicle bypass and establish a shortlist of options worthy of further development and investigation”.

8.2 Workshop activities

The workshop commenced with a background presentation to the participants covering the project purpose and objectives, and the project givens and constraints highlighted.

The workshop group clarified and agreed to assessment criteria and surrogate measures (aligned to achieving the project objectives) suitable to evaluate the preliminary route options. The project objectives were also weighted in order to acknowledge that although all of them were important, some were more important when evaluating the preliminary route options.

Preliminary route options developed by the community and project team as well as the options developed by the PEECE Report (2009) were presented to the workshop group. In all, 22 options were discussed and evaluated by the workshop group.

An initial assessment was undertaken against the selection criteria. This assessment identified that 12 of the 22 options were not feasible and the group agreed that they would not be further assessed. The reasons why were recorded.

The remaining preliminary route options were evaluated against the assessment criteria and measurable data which reflected the project objectives as discussed earlier. Once the evaluation had been undertaken by the group, the weighted score of each of the preliminary route options was divided by the strategic cost estimate and a value quotient established.

8.3 Evaluation of preliminary route options

8.3.1 First pass elimination

This first pass elimination of the preliminary route options narrowed the number of route options from 22 to 10. The remaining ten options were evaluated using the assessment process. The preliminary route options eliminated by the first pass are presented in Table 19.

Table 19 First pass elimination of route options

Route Option	Reasons for first pass elimination
PE1	• Route is longer than existing highway leading to increased travel times • No attraction to HV to use due to 2 x 90 degree bends and current priority through main street along existing alignment • Additional intersections and use of existing residential streets • Increased travel times as a function of length • Severs future development of township shown on Council LEP • Noise and visual issues • Property access issues • Close proximity to primary school.

Route Option	Reasons for first pass elimination
PE2	- Worse than PE1, same issues but longer - Route is longer than the existing highway leading to increased travel times - No attraction to HV to use due to 2 x 90 degree bends and priority signals through main street along existing alignment - Route would likely be a low speed environment leading to inefficiencies - Number of tight/perpendicular bends that affect travel efficiency and vehicle safety.
PE3	- Route is longer than existing highway leading to increased travel times - No attraction for HV north-south movement to use due to additional length and priority signals through main street along existing alignment - Route would not meet the Roads and Maritime design standards due to use of existing causeway - Less likely to be funded due to cost, comparable to other route options.
PE4	- Route traverses steep topography and hard rock terrain east of Tenterfield Dam which would make construction very costly - Rock cutting would be visible from township and would scar the existing landscape - Route traverses immediately upstream of town water supply – environmental and community sensitivity issues - Route is substantially longer than the existing highway leading to increased travel time - Comparable to other Preliminary Route Options developed by study team.
PW3	Comparable to Preliminary Route Options 6 and 7 with slight variations from these two alignments.
PW5	Route cuts through the Currys Gap Conservation Area which would have significant environmental impacts, requires an Act of Parliament to seek approval. Other routes do not have any impacts of Conservation Area. Costly due to terrain.
1	- Route is very long, skirting around the Currys Gap Conservation Area - Route traverses steep topography and hard rock terrain - Construction would be very costly due to length of new construction required and topography the route traverses - No visibility to town and is a pure bypass - Very deep (up to 60m) cutting required through main ridgeline south west of town.
2	- Route is very long and similar in length to existing highway - Route option dissects Currys Gap Conservation Area - Route traverses steep topography and hard rock terrain - Route construction would be very costly due to length of new construction required and topography the route traverses - No visibility to town and is a pure bypass - Deep cuttings required for road construction through terrain - Inferior to Option 1.
3	- Route would impact northern part of Currys Gap Conservation Area - Swings much wider / farther to the west than needed to avoid impact on cemetery - Route traverses steep topography in some parts - Low proximity to town and visibility of town – reduced trade for businesses.
4	- Route would also impact Currys Gap Conservation Area - Northern section of route effectively runs parallel to existing highway which is a 100km/h asset - Length would make alignment very costly compared to other options that would

Route Option	Reasons for first pass elimination
	achieve the same result • Inferior to Option 5.
6	• Impacts on Currys Gap Conservation Area • Also effectively parallel to existing highway in north and fails to use an existing asset • High cost to construct due to topography through conservation area • Similar but inferior to Option 7 • Southern half of alignment is not ideal and could be improved.
9	• Impacts on Tenterfield Park • Southern portion of option “drives backwards” • Close proximity to reservoir and downstream river system of Tenterfield Creek • Effects on the amenity of Tenterfield Park and other park adjoining NEH • Close proximity to existing intersections south of town and treatments would impact on businesses • Route uses existing residential streets • Close proximity to primary school • Severs future development of township/village as shown in Council's LEP • Would require steep road gradients around town water tank / reservoir • Noise issues • Inferior to 10.

As a check mechanism on this first pass elimination process, the previous table which provided the results of travel distance and travel time calculations for each preliminary route option, as well as the strategic cost estimate for each, is repeated for comparative purposes as Table 20. In this comparison table, the route options eliminated are colour coded to differentiate from those that were retained for further evaluation.

A total of 12 preliminary route options were eliminated prior to the full evaluation. These were primarily because of increases in travel times, very high costs, or similarities with other preliminary route options.

While they could have been eliminated on similar grounds, the outer eastern options (11, 12 and 13) were kept in the evaluation because they were in favour with the community and the full evaluation was necessary to investigate their relative merits.

Table 20 Comparison of eliminated and remaining route options

Route Option	Bypass length (km)		Nominated design speed (km/h)	Travel time differential (minutes)		Strategic cost estimate (\$m)
	New	Bypassed				
PEECE Route Options (Tenterfield Shire Council, 2009)						
PE1	4.1	2.9	50	Plus	1.44	\$65
PE2	6.1	2.9	60	Plus	2.63	\$85
PE3	10.1	4.5	70	Plus	4.64	\$95
PE4	12.6	8.9	90	Plus	0.37	\$155
PW1	3.7	3.7	50	Plus	0.14	\$50
PW2	3.8	4.3	70	Save	1.77	\$55
PW3	5.0	6.3	80	Save	2.72	\$95
PW4	5.4	6.4	70	Save	1.92	\$80
PW5	5.3	6.3	70	Save	1.89	\$95
Preliminary Route Options (Community / Project team, 2013)						
Option 1	9.3	8.9	100	Save	2.48	\$185
Option 2	8.0	8.6	100	Save	3.08	\$150
Option 3	6.3	6.8	90	Save	2.62	\$110
Option 4	6.4	7.5	90	Save	2.96	\$110
Option 5	4.9	5.0	80	Save	1.84	\$75
Option 6	6.8	8.2	90	Save	3.11	\$110
Option 7	4.8	6.3	80	Save	2.85	\$90
Option 8	3.7	4.4	70	Save	1.93	\$60
Option 9	6.5	4.1	70	Plus	0.7	\$100
Option 10	8.7	6.1	70	Plus	1.37	\$105
Option 11	11.4	9.1	90	Save	0.55	\$145
Option 12	13.3	9.9	90	Plus	0.17	\$160
Option 13	11.6	9.1	100	Save	1.19	\$160

Notes:

1. Strategic cost estimates are rounded to nearest \$5m.

Legend:

Eliminated in first pass evaluation.

8.3.2 Weighting of project objectives

Weighting of project objectives was undertaken using a paired comparison approach. The discussions undertaken during the paired comparison allowed the group to understand and appreciate that, although all the project objectives were important, emphasis should be placed on particular objectives when later assessing the preliminary route options.

The final weightings were reached on a consensus basis. Table 21 summarises the weighting of project objectives.

Table 21 Weighting of project objectives summary

Project Objective	Raw Score	Weighting
Improve road safety	3	30%
Improve road transport productivity, efficiency and reliability of travel	4	40%
Minimise the impact on the natural, cultural and built environment	1	10%
Provide sustainable economic outcomes for the local community	0.5	5%
Minimise the social impact of the local community	1.5	15%
Total	10	100%

It should be noted that the *Provide value for money* objective was not included at this stage but was used as a separate evaluation measure. This is discussed in more detail below.

8.3.3 Evaluation of preliminary route options against assessment criteria

The remaining preliminary route options were evaluated against the assessment criteria and assessment methodology discussed in previous sections of this report.

Not all of the workshop group were entirely comfortable using the INDEGO process for two project objectives: *Minimise the impact on the natural, cultural and built environment*, and *Provide sustainable economic outcomes for the local community*.

It was agreed to use the process to score the remaining preliminary route options in the workshop but to later revise some of the INDEGO weightings as a result of the workshop feedback and re-score the options after the workshop.

As a sensitivity check, these two project objectives were also assessed by the workshop group without the INDEGO scoring system and this assessment returned similar results.

As noted above, the *Provide value for money* objective was not included in the weighted evaluation. The evaluation score provided is an assessment score out of 100, or percentage, across the five weighted objectives. This score is then divided by the strategic cost estimate to provide a Value for Money quotient as a second evaluation mechanism.

The results of the two evaluation mechanisms are provided in Table 22. The weighted evaluation score provides an assessment of how each option performs against the weighted criteria. These scores are ranked from 1 to 10 to establish a preferred order on the score alone.

The individual route option assessment scores are then divided by the strategic cost estimate to provide the Value for Money quotient for each. These quotient figures are also ranked to provide a second order of preference for comparison with the first.

Table 22 Summary scores of weighted evaluation of route options

Project Objective	Weight	PW1	PW2	PW4	5	7	8	10	11	12	13
Improve road safety	3.0	12	18	21	18	24	21	6	9	6	9
Improve road transport productivity, efficiency and reliability of travel	4.0	16	32	32	32	32	32	8	24	16	32
Minimise the impact on the natural, cultural and built environment	1.0	6	6	10	4	2	8	10	10	6	10
Provide sustainable economic outcomes for the local community	0.5	1	3	4	5	5	1	4	5	5	5
Minimise the social impact of the local community	1.5	9	12	12	12	12	9	6	9	9	9
Weighted evaluation score		44	71	79	71	75	71	34	57	42	65
Weighted evaluation rank		8	3	1	3	2	3	10	7	9	6
Strategic cost estimate (\$m)		\$50	\$55	\$80	\$75	\$90	\$60	\$105	\$145	\$160	\$160
Provide Value for Money quotient		0.88	1.29	0.99	0.95	0.83	1.18	0.32	0.39	0.26	0.41
Value for Money rank		5	1	3	4	6	2	9	8	10	7

Notes:

1. Strategic cost estimates are rounded to nearest \$5m.

8.3.4 Ranking of preliminary route options

At the conclusion of the evaluation of preliminary route options, the options were ranked in terms of the weighted score of the project objectives (the value of the option in terms of the project objectives) and in terms of the option's value for money (ie the value quotient).

The ranking of preliminary route options enabled a preliminary shortlist of route options to be formulated. Table 23 presents the ranking of the preliminary route options.

Table 23 Ranking of preliminary route options

Rank	Weighted Score of Project Objectives	Value for Money
1	Option PW4	Option PW2
2	Option 7	Option 8
3	Option PW2, Option 5, Option 8	Option PW4
4		Option 5
5		Option PW1
6	Option 13	Option 7
7	Option 11	Option 13
8	Option PW1	Option 11
9	Option 12	Option 10
10	Option 10	Option 12

8.4 Workshop conclusions

As a result of the discussions during the evaluation of route options process, the workshop drew some overall conclusions on the options to be progressed for more detailed development, investigation and refinement. The conclusions drawn by the group included:

- The community needs to be informed of the project objectives and their weightings (through the publication of this report), as well as the focus on the New England Highway heavy vehicle issues being the priority as the project is further developed
- Based on the qualitative assessment undertaken, there appear to be three distinct corridor options (being a combination of preliminary route options that performed best against the assessment criteria) that should move forward for further investigation. The three corridors are all on the western side of Tenterfield
- There appears to be a corridor to the west of the cemetery and the eastern side of the Currys Gap Conservation Area (ie a combination of Option PW4 and Option 5), a corridor on the eastern side of the cemetery, between the cemetery and the railway reserve (ie a combination of Option PW2 and Option 7) and a corridor to the east of the railway reserve (ie a combination of Option PW2 and Option 8)
- These options contributed to the project objectives better than the other options and the corridors could be further refined to reflect the best aspects of each of the route options mentioned. The three corridor options are recommended to move forward for more detailed investigation, development and refinement. This will include more detail on

potential design speeds and road design, intersection treatments, overcoming adverse impacts, future road reserve widths, etc

- None of the eastern preliminary route options were ranked in the top five options in relation to the assessment criteria or in terms of providing value for money. All eastern preliminary route options were ranked as the lowest four options (the four eastern options from the PEECE report were ruled out in the first pass elimination). Also, the strategic cost estimates of the eastern bypass route options were all in excess of \$100 million. At this cost, the eastern route options fail to achieve the *Provide value for money* objective and should not be pursued further, especially when there are cheaper alternatives that achieve the other objectives
- The inner eastern bypass options would have significant impacts on the local primary school and residential areas (visual, safety, noise and amenity impacts). The outer eastern options would require significant earthworks in hard rock terrain south east of the town, and in low lying areas in the north of town
- The priority for the community is to remove heavy vehicles from the main street and there appears to be a community preference for an eastern bypass option. However, the traffic analysis indicates that an eastern bypass option would not provide travel time savings and may not attract many heavy vehicles away from the main street and therefore would not address the problem
- There could be a case to develop a fourth corridor option (a hybrid eastern option) based on the best aspects of the eastern route options that were assessed (ie Options 10-13). However, the hybrid eastern option needs to be developed and evaluated against the assessment criteria to determine if it should move forward with the other three corridor options.

9. Shortlisted route options

9.1 Outcomes of technical workshop

At the conclusion of the evaluation of preliminary route options at the Internal Technical Workshop, the following route options/corridors were recommended for shortlisting:

- A corridor to the west of the cemetery and the eastern side of the Currys Gap Conservation Area (ie a combination of Option PW4 and Option 5)
- A corridor on the eastern side of the cemetery, between the cemetery and the railway reserve (ie a combination of Option PW2 and Option 7)
- A corridor to the east of the railway reserve utilising existing streets (ie a combination of Option PW2 and Option 8)
- Workshop attendees agreed that a fourth corridor option should be investigated based on the best aspects of the eastern bypass route options (Options 10 to 13).

The western route options nominated in the first three points above are shown in Figure 15 as a preliminary shortlist, subject to the nomination of specific corridors.

9.2 Development of hybrid eastern route option

Following the Internal Technical Workshop the project team developed Option 14, a hybrid eastern route option utilising the best elements of Options 10 to 13. The hybrid option would not pass south of the Tenterfield water supply dam as in Options 11 to 13, but would commence at the southern end of Rouse Street where Option 10 starts. From there it would pass over the ridgeline south east of town and connect across to Option 13 near the rifle range.

Option 14 would be substantially shorter than the longer eastern route options but would not use existing streets close to town. It would connect from the ridgeline to parts of Options 12 and 13 before traversing via Old Ballandean Road back to the New England Highway.

A major deficiency in this option is the need for steep grades to pass over this ridgeline close to town. This is likely to generate substantial noise impacts and will discourage heavy vehicle drivers from using the route.

This route option was evaluated against the assessment criteria to determine the merit for further investigation. As anticipated, Option 14 ranked better than Options 10 to 13 in terms of value for money but not enough to be shortlisted for further investigation.

Table 24 provides the results of the post workshop scoring summary for Option 14 in comparison with the results for the other eastern route options previously provided in Table 22.

Similarly, Table 25 displays the ranking of all of the assessed (now 11) preliminary route options, inclusive of Option 14.

These tables show that Option 14, despite being the optimal eastern alignment, does not rank highly across assessment criteria and is ranked lower in terms of value for money than the western route options.

Figure 15 presents the preliminary shortlisted route options and the hybrid eastern route Option 14.



LEGEND

Existing Rail

Primary Road

Main Road

Local Road

Option 5

Option 7

Option 8

Option 14

Option PW2

Option PW4

Social constraints

Table 24 Comparison of Option 14 with other eastern route options

Project Objective	Weight	10	11	12	13	14
Improve road safety	3.0	6	9	6	9	12
Improve road transport productivity, efficiency and reliability of travel	4.0	8	24	16	32	24
Minimise the impact on the natural, cultural and built environment	1.0	10	10	6	10	8
Provide sustainable economic outcomes for the local community	0.5	4	5	5	5	4
Minimise the social impact of the local community	1.5	6	9	9	9	9
Weighted evaluation score		34	57	42	65	57
Weighted evaluation rank		11	7	10	6	7
Strategic cost estimate (\$m)		\$105	\$145	\$160	\$160	\$130
Provide Value for Money quotient		0.32	0.39	0.26	0.41	0.44
Value for Money rank		10	9	11	8	7

Notes:

1. Strategic cost estimates are rounded to nearest \$5m.

Table 25 Ranking of preliminary route options inclusive of Option 14

Rank	Weighted score of project objectives	Value for Money
1	Option PW4	Option PW2
2	Option 7	Option 8
3	Option PW2, Option 5, Option 8	Option PW4
4		Option 5
5		Option PW1
6	Option 13	Option 7
7	Option 11, Option 14	Option 14
8		Option 13
9	Option PW1	Option 11
10	Option 12	Option 10
11	Option 10	Option 12

9.3 Nomination of shortlisted route option corridors

The findings of the technical workshop and the nomination of the preliminary route options that best meet the assessment criteria have been used to develop four route option corridors for further investigation and development.

The nominated corridors are colour coded to differentiate from the preliminary route options and to avoid any perceived preferences at this stage of the investigation.

The shortlisted route options as discussed above have been presented as four broad corridors to allow for flexibility and to accommodate possible combinations of route options. This will allow the project team to assess potential route option combinations and to further refine the route options following more detailed geotechnical, engineering, environmental and property impact investigations.

The general alignment characteristics of the shortlisted route options are discussed in the following sections. The four route corridors are also shown in aerial photo format from Figure 16 to Figure 19.

9.3.1 Blue corridor option

- Bypass starts south of Saddlers Road
- Aligns with the railway line to the east of Currys Gap State Conservation Area
- Crosses the railway to the north of Currys Gap Creek
- Passes to the west of the Tenterfield cemetery
- Connects to the existing highway north of Cowper Street.

9.3.2 Purple corridor option

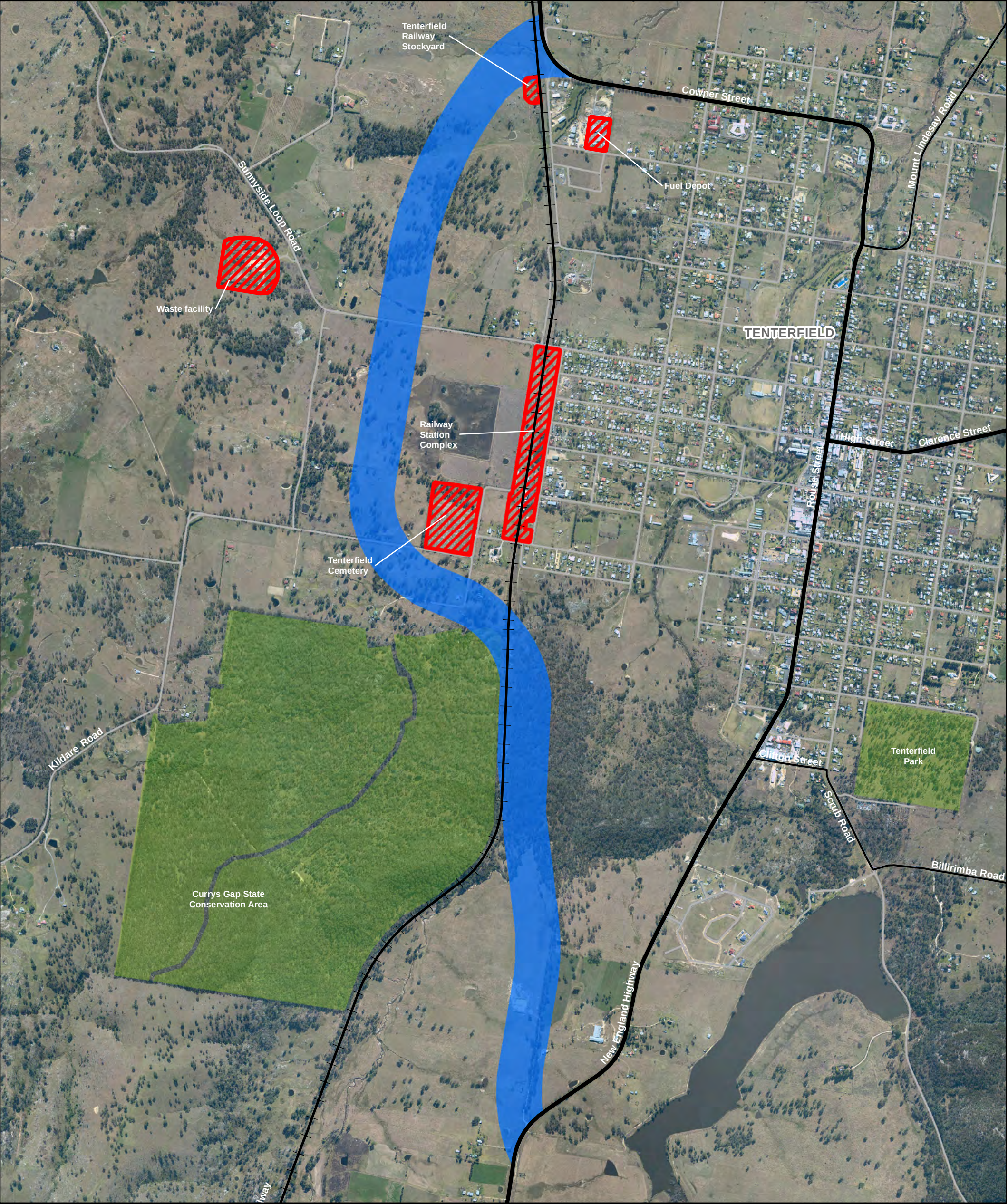
- Bypass starts south of Saddlers Road
- Follows the railway line to the east of Currys Gap State Conservation Area
- Crosses railway, runs along Western Street and recrosses the railway north of Sunnyside Loop Road
- Connects to the existing highway at Cowper Street via the existing Western Boundary Street alongside the industrial sub-division
- Of the shortlisted route options this corridor provides the most direct route.

9.3.3 Orange corridor option

- Bypass starts north of Tenterfield Creek bridge
- Crosses the railway line north of Currys Gap State Conservation Area and travels to the west of the railway along Western Street
- Recrosses the railway line to Western Boundary Street connecting to the highway at Cowper Street.

9.3.4 Yellow corridor option

- Bypass starts north of Tenterfield Creek bridge
- Aligns with Railway Avenue east of the railway line
- Connects to Western Boundary Street and the existing highway at Cowper Street
- This is the shortest corridor.



LEGEND

Existing Rail

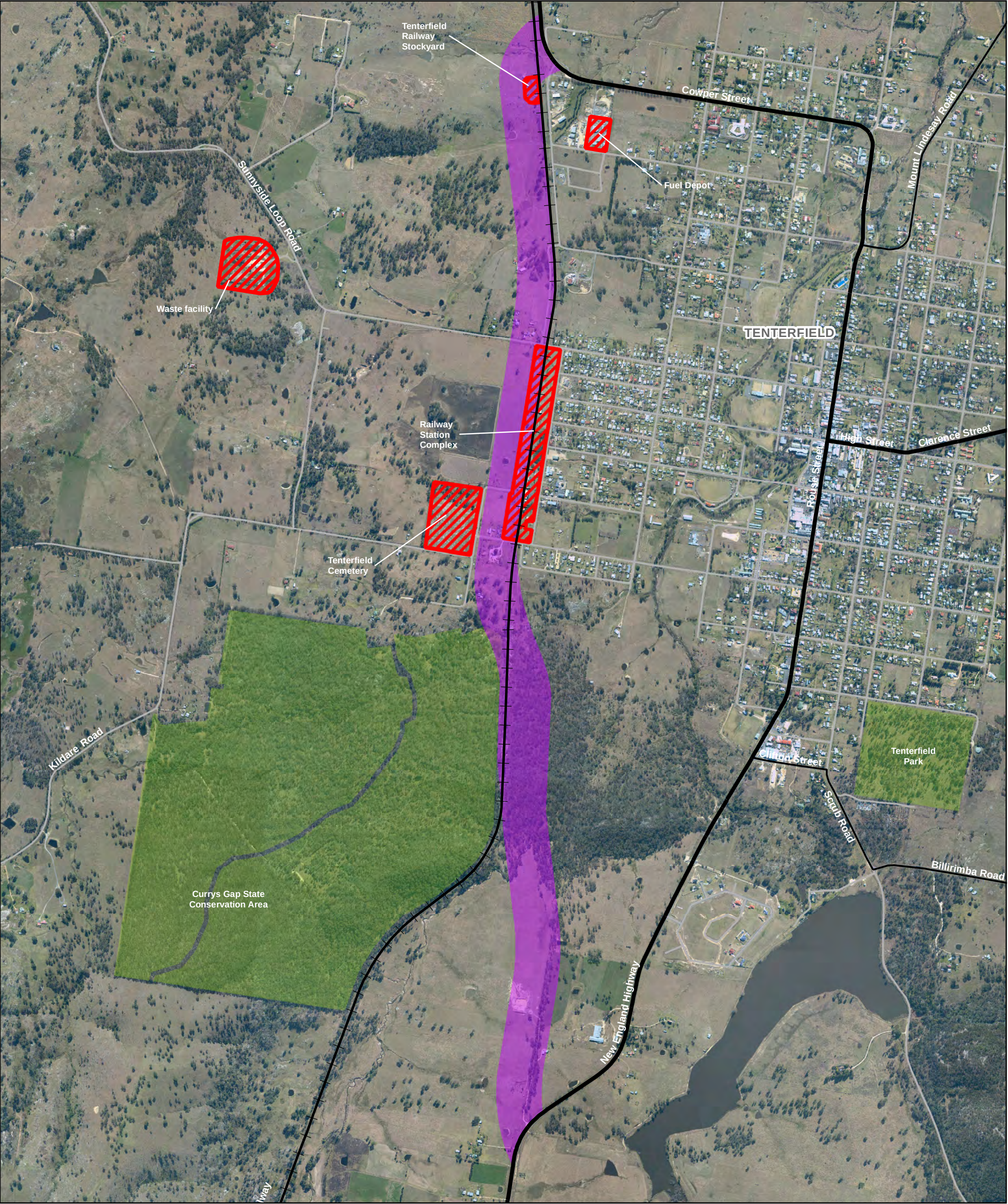
Primary Road

Main Road

Local Road

Constraints

Recreation Area



LEGEND

Existing Rail

Primary Road

Main Road

Local Road

Constraints

Recreation Area

0100200400600800

Metres

Paper Size A3

Map Projection: Transverse Mercator

Horizontal Datum: GDA 1994

Grid: GDA 1994 MGA Zone 56

N

Roads and Maritime Services

Tenterfield Heavy Vehicle Bypass

Job Number

Revision

Date

22-16349

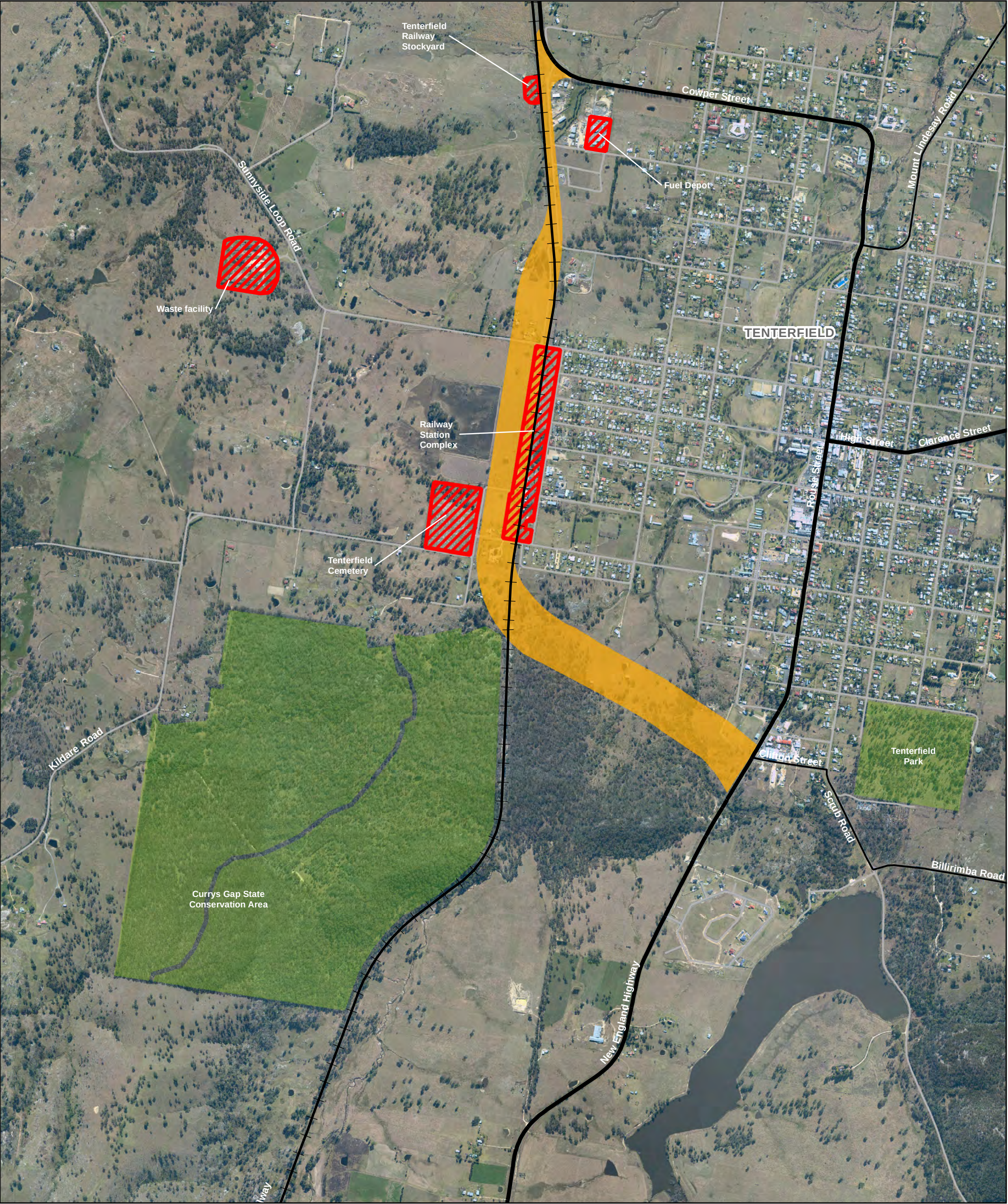
0

24 Jan 2014

Purple corridor option

Figure 17

G:\2216349\GIS\Maps\Deliverables\Preliminary Route Options Report\2216349_PROR008_ShortListedOptions_Purple_0.mxd
Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com W www.ghd.com.au
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Data source: RMS - Aerial Imagery, 2012; LPI - DTDB, 2012. Created by: tmorton, lmackay, gmcdiarmaid



LEGEND

Existing Rail

Primary Road

Main Road

Local Road

Constraints

Recreation Area

0100200400600800

Metres

Paper Size A3

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

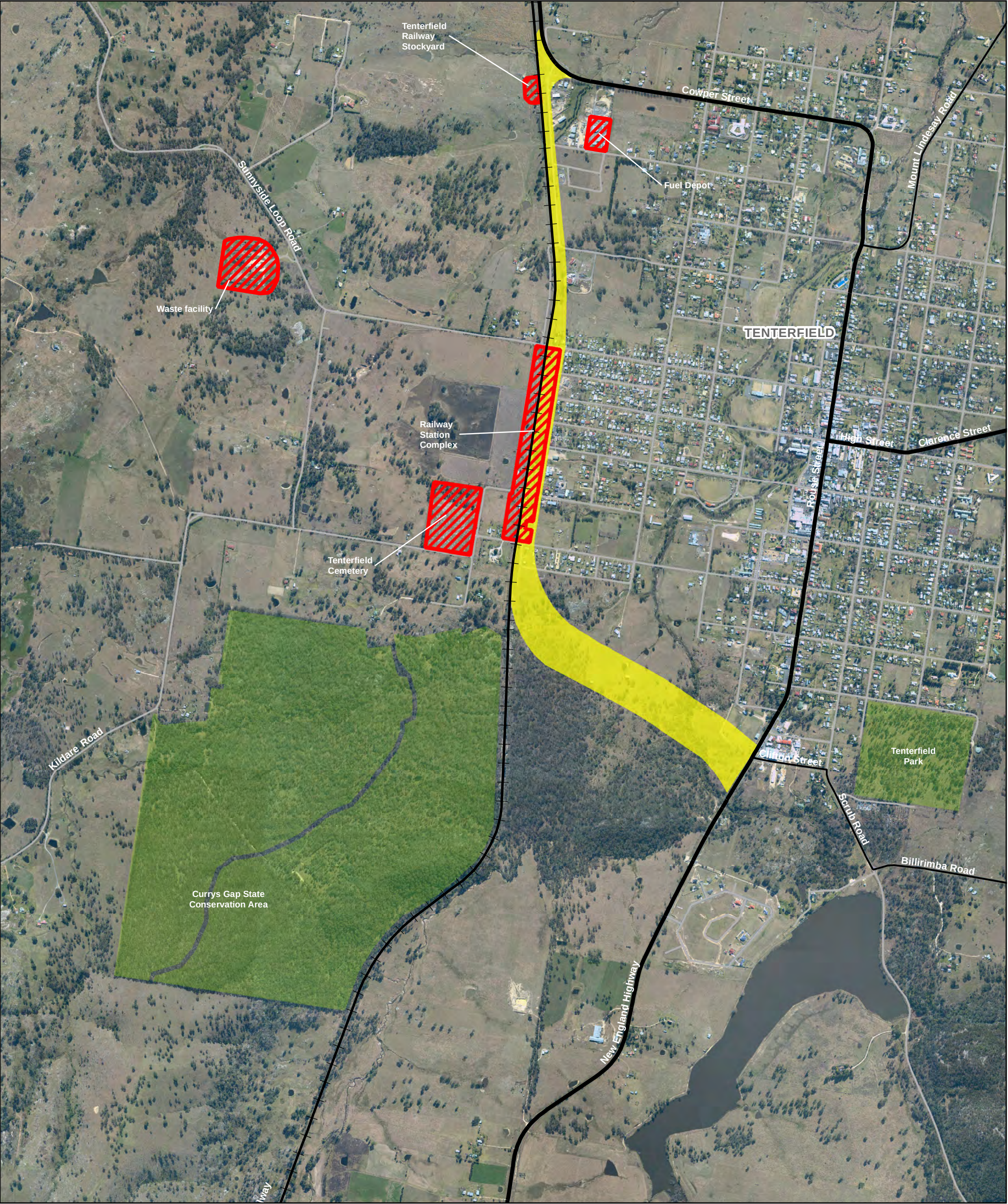
Roads and Maritime Services
Tenterfield Heavy Vehicle Bypass

Job Number22-16349
Revision0
Date24 Jan 2014

Orange corridor option

Figure 18

G:\2216349\GIS\Maps\Deliverables\Preliminary Route Options Report\2216349_PROR009_ShortListedOptions_Orange_0.mxd
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Data source: RMS - Aerial Imagery, 2012; LPI - DTDB, 2012. Created by: tmorton, lmackay, gmcdiarmaid



LEGEND

Existing Rail

Primary Road

Main Road

Local Road

Constraints

Recreation Area

0100200400600800

Paper Size A3

Metres

N

Roads and Maritime Services

Tenterfield Heavy Vehicle Bypass

Job Number

Revision

Date

22-16349

0

24 Jan 2014

Yellow corridor option

Figure 19

9.3.5 Preliminary benefit to cost ratio calculations

Preliminary benefit to cost ratio (BCR) calculations were undertaken for the shortlisted route corridors through application of an economic analysis of the New England Highway bypass function. The economic analysis incorporates a base network (existing) and improved network (bypass) allowing for the network to be broken into sections and analysed on travel time and distance savings.

These BCR calculations are preliminary only and are used for initial comparison of the economic benefits for the various route options. A more comprehensive benefit – cost analysis will be undertaken during the route options development phase using additional and more detailed inputs. The preliminary BCR results for the shortlisted route option corridors are presented with other key technical characteristics in Table 26.

9.3.6 Key technical characteristics of shortlisted corridors

The key technical characteristics of the shortlisted route options – distance saving, travel time saving, strategic cost estimates and benefit to cost ratios, are presented in Table 26.

To address the preferences of some sections of the Tenterfield community for an eastern bypass the hybrid eastern route, Option 14, is also included in this table. This has been included to inform the community that due to its length, cost and lack of travel time savings, an eastern corridor option is not feasible and would most likely not remove heavy vehicles from the main street.

Table 26 shows that the routes to the west of town offer travel time and distance savings. However the hybrid eastern route, Option 14, has a considerable increase in travel distance and provides negligible savings in travel time. The range of estimated costs for the shortlisted corridors is from \$55 to \$95 million, whereas Option 14 would be in the vicinity of \$130 million. These factors result in benefit cost ratios of around 0.4 to 0.5 for the shortlisted options to almost zero for Option 14.

Table 26 Key information for the shortlisted route options and Option 14

Option	Blue	Purple	Orange	Yellow	Option 14
Distance (km)	5.3	4.8	3.8	3.7	9.6
Distance saving (km)	1.1 saving	1.4 saving	0.6 saving	0.7 saving	3.0 increase
Assumed design speed (km/h)	90	80	70	70	90
Travel time saving (minutes)	3.0	2.9	1.8	1.9	0
Estimated cost (\$m)	\$95	\$90	\$55	\$60	\$130
Benefit cost ratio (BCR)	0.47	0.45	0.44	0.43	0.08

Notes:

1. Strategic cost estimates are rounded to nearest \$5m

9.4 Next steps

Further field investigations are proposed on the four shortlisted preliminary route options described in this report. These will include geotechnical investigations, additional heritage studies, noise monitoring and evaluation and a preliminary visual impact assessment. A preliminary concept design and a more detailed cost estimate (including cost benefit analysis) will be prepared for each shortlisted route option.

The next major output will be a route options development report which will be used as briefing information for the Value Management Workshop (VMW).

The route options development report will be displayed to the community later in 2014. This report will include more detailed information obtained from the field investigations and will also include the preliminary concept design for each option.

Community feedback on the route options development report, the outcomes of the VMW and the technical studies will be considered prior to selecting a preferred route option in late 2014.

Planning action will then be undertaken to reserve the corridor in Council's local environment plan to provide planning certainty for Council and the local community.

An overview of the current status of the Tenterfield heavy vehicle bypass investigation and project timeline is provided as Figure 20.



Figure 20 Project timeline

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