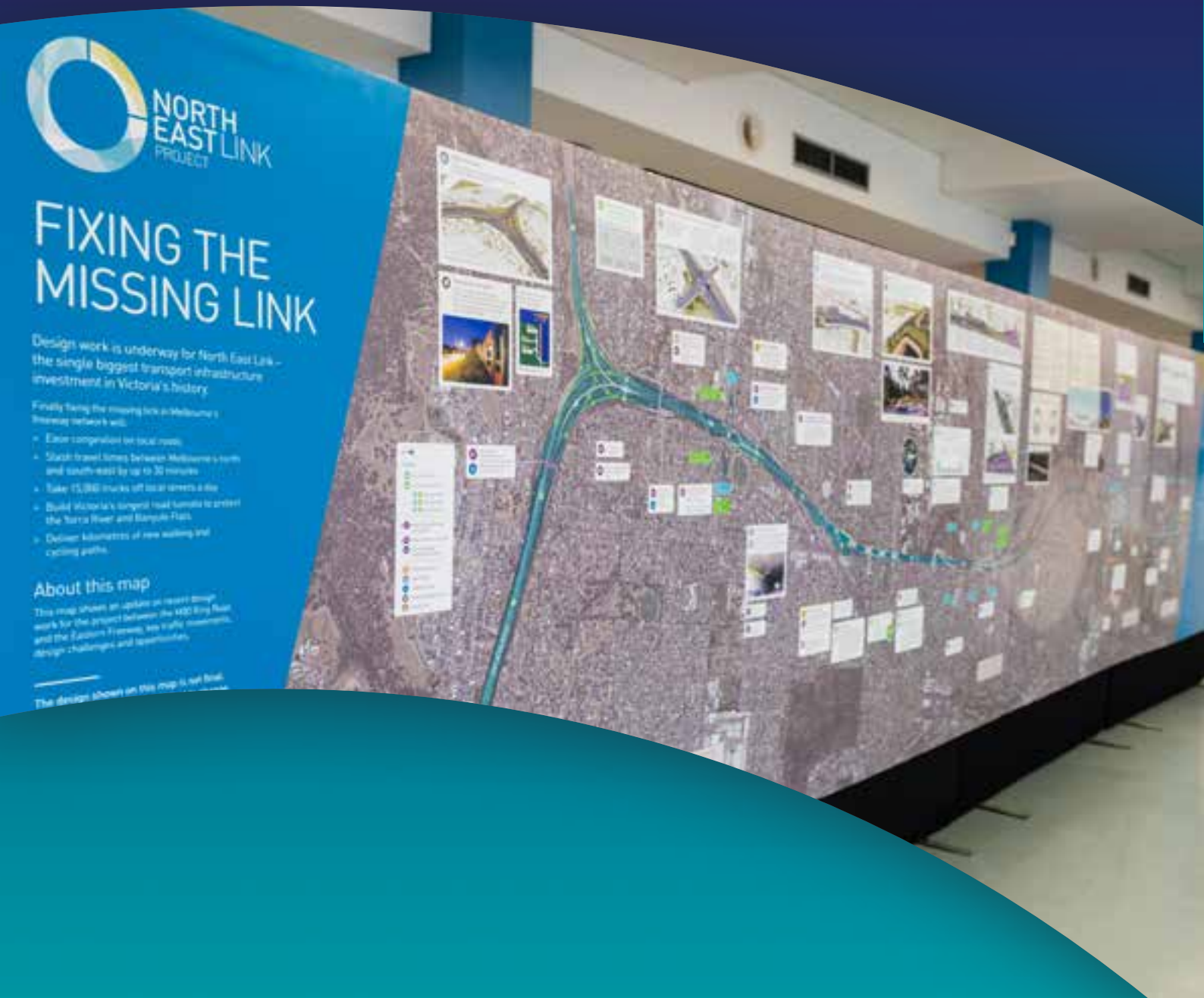
Environment
Effects Statement

Chapter 6
Project development



Chapter 6
Project development

6.1 Introduction

This chapter outlines the project development process for North East Link. It describes how project alternatives have been considered from the Business Case stage through the EES process and provides the rationale for the form of the project assessed in this EES.

6.1.1 Key transport challenges

Cross-city movements between Melbourne's west and north are facilitated via the M80 Ring Road (otherwise known as the Metropolitan Ring Road), extending from the Princes Freeway in Altona to the Greensborough Bypass. Movements between the east and south-east are enabled by EastLink, which traverses the outer eastern and south-eastern suburbs between Donvale and Seaford.

However, there is no freeway-standard connection for cross-city orbital movements between the eastern terminal of the M80 Ring Road and the Eastern Freeway and northern end of EastLink. Instead, these movements are facilitated via arterial roads that are struggling to cope with increasing traffic volumes and competing travel demands that include commuter trips, business trips and intra-city, regional and interstate freight movements.

Three key problems

As outlined in *Chapter 2 – Project rationale*, three key problems have been identified in relation to transport connectivity in the north-east corridor:

1. Melbourne's poor orbital connectivity is constraining the economic potential of the city and Victoria
2. Inefficient freight movement between the north and south-east of Melbourne is limiting supply chain competitiveness and hindering the growth of high value industries
3. Congestion and heavy vehicles on neighbourhood roads in the north-east is harming liveability and community wellbeing.

6.1.2 Overview of the project development process

North East Link is considered to be the most effective strategic response to the key transport challenges summarised in Section 6.1.1 of this chapter. It was identified as the highest priority infrastructure project in Infrastructure Victoria's 30 Year Infrastructure Strategy released in 2016, when the Victorian Government began preparing a business case to test the merits of investing in the project.

Figure 6-1 illustrates how the project was developed from the Business Case stage and as part of the EES process.

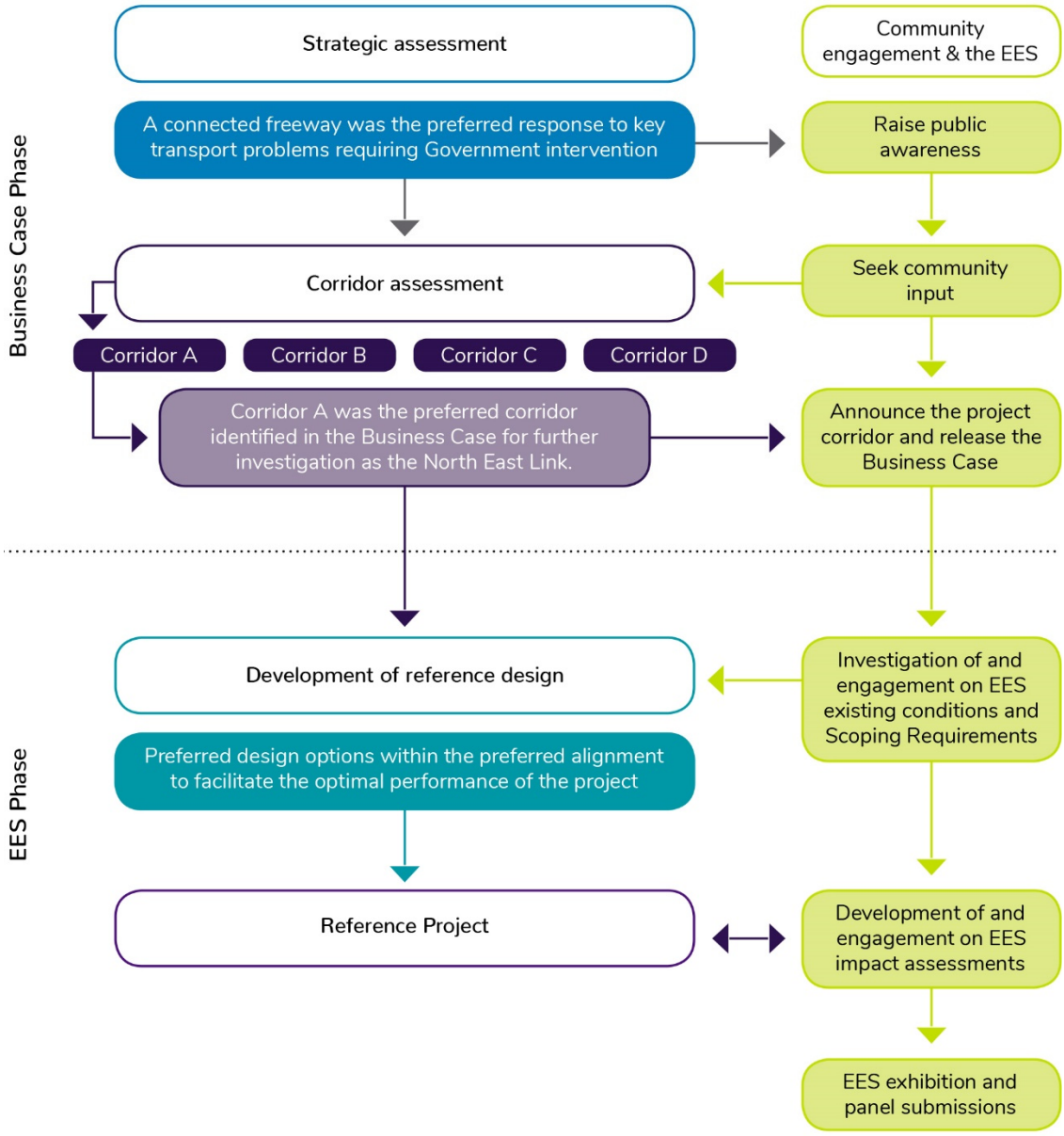


Figure 6-1 North East Link planning and development process

The Business Case examined and tested strategic interventions and options to determine how they addressed the key transport challenges facing Melbourne's north-east. Following identification of a connected freeway as the preferred strategic option, corridor options were developed and assessed. A preferred corridor was selected and the alignment within this corridor was further refined, including identification of key design features. A concept design was developed which defined the proposed project scope and identified minimum infrastructure requirements for the project, based on initial engineering, environmental and other studies.

The project development process was informed by:

- The project objectives and guiding principles (introduced in Chapter 1 – Introduction)
- Relevant policies and legislative requirements (refer to Chapter 3 – Legislative framework)
- Engineering technical requirements
- Relevant technical reports
- Feedback from engagement with the community and stakeholders at each phase shown in Figure 6-1 above. The consultation that was undertaken, feedback received and the way this was integrated into the project is detailed in Chapter 5 – Communications and engagement.

Sections 6.2 and 6.3 of this chapter summarise the strategic options analysis and assessment of road corridor options which led to the selection of the preferred corridor. Along with the concept design, these project phases are discussed in greater detail in the North East Link Business Case (available at <https://northeastlink.vic.gov.au/project/businesscase>).

Section 6.4 focuses on the development of the design, and discusses the options that were assessed for the development of the reference project. Section 6.5 provides an overview of the process of refining the design for the reference project. The reference project (Corridor A) has been assessed in this EES in response to the 'public works' order by the Minister for Planning under the *Environment Effects Act 1978* (Vic). This reference project has been used to develop the recommended Environmental Performance Requirements set out in Chapter 27 – Environmental management framework.

The details of the reference project, design options and proposed construction methodology assessed in this EES are included in Chapter 8 – Project description.

6.2 Strategic assessment

A range of strategic interventions for addressing the problems outlined in the North East Link business case were identified early in the project development process. These strategic alternatives were reviewed during preparation of the Business Case and tested against five criteria:

- Benefits
- Cost
- Time
- Risk
- Impacts.

A 'long list' of alternative strategic interventions was then considered, ranging from those requiring large capital investment, to others giving greater prominence to improving network performance with less capital investment.

From this long list of strategic interventions, high-level actions to address the problems (strategic options) were developed and assessed against their ability to respond to the cause of the problem and to deliver benefits. The benefits, cost, timing, risk and impacts of each strategic option were also considered. A preferred strategic option was identified from this comparative assessment.

This process is shown in Figure 6-2.

Figure 6-2 Methodology for determining preferred strategic option

6.2.1 Strategic interventions

The strategic interventions considered are included in Table 6-1. These fell into three broad intervention types:

- Manage demand on the transport network – address the need for additional transport services now and into the future
- Improve productivity of the existing transport network – develop options to improve efficiency of the transport network by assessing the existing and future levels of demand and supply
- Increase supply of transport assets – address the ability to improve services through increased capacity and availability of transport assets.

Table 6-1 Strategic interventions

Intervention type	Strategic intervention
Manage demand	**Demand management pricing** This is not current government policy, but could include (for example), tolling existing and/or new facilities, cordon pricing (congestion pricing which is a fee or tax paid by users to enter a restricted area, usually within a city centre, to relieve traffic congestion within that area), pricing based on direction of peak travel or demand and vehicle occupancy incentives and restrictions.
	Corridor plan for network and place management For example, a corridor plan could comprise priority measures for public transport on the arterial road network, traffic calming treatments, priority road space allocation depending on time of day, extending truck bans, road use management and turning movement restrictions.
	Land use intervention Using land use zoning to encourage density in employment locations, protect areas from land use changes, enhance the function of places or promote increased accessibility. For example, by encouraging density in employment locations, people would not need to travel long distances to get to work and are more likely to use active transport, which can reduce demand on the network.
	Freight demand management Modifying time of day for deliveries, implementing time of day restrictions for hazardous freight vehicles and travel time restrictions for trucks, and/or coordinating delivery times with industrial precincts.
	Encourage travel behaviour change This can involve awareness campaigns to encourage people to use public and active transport modes or to re-time and/or re-route their journeys. It can also involve promoting flexible working arrangements, offering incentives for workers to use public transport or to travel outside peak periods, and providing bicycle end of trip facilities and/or park-and-ride facilities.

Intervention type	Strategic intervention
Improve productivity	**Intelligent transport systems** This involves providing real-time information to motorists (such as personalised travel information systems) and network-wide active signal management.
	Managed motorways This intervention involves implementing ramp metering, lane use management system, incident detection and response management systems, and variable speed limit systems.
	Modify freight operations Supply chains could be streamlined by introducing vehicle booking systems allowing trucks to book in at any hour, leading to reduced truck queues. Freight can be moved more efficiently through greater use of multimodal freight operations (at intermodal terminals in the west, north and south-east) and 24/7 operations management that integrates rail and road conditions with the ports. The transportation of hazardous goods on the network and in tunnels could be re-examined, based on risks and changing vehicle types to effectively contain hazards, to improve productivity.
Increase supply	**Upgrade to existing roads** Duplicating or widening arterial roads, strengthening bridges and increasing clearances to allow high exiting productivity freight vehicles, over-dimensional vehicles and vehicles carrying dangerous goods to travel on more arterial roads, in order to increase the ability of the road network to carry more vehicles.
	A new freeway link Constructing a high capacity bypass freeway or a connecting freeway to provide extra capacity on the road network.
	Dedicated pedestrian and cycling routes Constructing new or upgraded pedestrian and cycling routes, and/or separating pedestrian and cyclists on key routes.
	Bus improvements May include provision of additional bus services, new orbital and shuttle bus routes, dedicated bus lanes, bus priority at traffic signals, an expansion of the SmartBus network and building new park and ride facilities and interchanges.
	New arterial road connections Constructing new arterial roads to provide additional capacity on the road network.
	Improve freight movements Involves constructing an intermodal freight rail network to connect Interstate Freight Terminals.
	A new heavy or light rail connection Involves constructing a spur line from Hurstbridge railway line to La Trobe NEIC and/or extending Tram Route 86 to employment centres in the north-east.

6.2.2 Strategic options

Five strategic options were developed from the list of interventions. Each strategic option was made up of a combination of some of the strategic interventions outlined in Table 6-1. These included:

- Strategic Option 1 – Network upgrade: focusing primarily on upgrading existing infrastructure to address constraints in the transport network
- Strategic Option 2 – Demand and productivity management: implementing demand management pricing, corridor plans (such as extending truck bans, turning movement bans and parking management, enforcing mode priority during peak periods and undertaking advertising campaigns to encourage mode shift) and land use interventions, such as changing zoning to encourage or discourage density around employment and/or residential areas
- Strategic Option 3 – Public transport and freight: focusing on public transport investments and managing freight movements
- Strategic Option 4 – Bypass freeway: involves constructing a bypass freeway linking the M80 Ring Road to the Eastern Freeway, without intermediate interchanges, supported by a package of complementary measures which could include enhancing the local bus network, land use interventions, network management measures and improving pedestrian and cycling infrastructure
- Strategic Option 5 – Connected freeway: involves constructing a connected freeway linking the M80 Ring Road to the Eastern Freeway known as North East Link, incorporating connections to the wider arterial road network and a package of complementary measures similar to the 'bypass freeway' option.

The benefits, cost, timing, risks and impacts of each strategic option were considered.

Based on the analysis, Strategic Option 5 (Connected freeway: North East Link) was the recommended option to be taken forward for project options development. This option provided the most viable solution to the orbital connectivity and capacity problems identified in Chapter 2 – Project rationale and was expected to deliver considerable benefits to the community and industry in the medium- to long-term. It would provide connectivity to key employment and residential centres to facilitate economic growth and opportunities for residents, and move trucks off local roads, improving liveability and wellbeing for communities in the north-east.

These benefits are supported by modelling and economic analysis undertaken by Infrastructure Victoria, which show North East Link would be a relatively high-performing project that offers substantial benefits in linking people to employment across the city (Infrastructure Victoria, 2016).

Other key findings from the strategic options assessment were:

- Strategic Option 1 (Network upgrade) provides short- to medium-term relief to transport capacity problems in the north-east. There are few alternative north-east arterial roads in the area suitable for widening. As a result, this option does not address the orbital connectivity problem and may attract more heavy vehicles onto neighbourhood roads. It would also likely require significant land acquisition for a short- to medium-term benefit.

- Strategic Option 2 (Demand and productivity management) does not fully address the freight problem, as there are limited alternative freight routes, which may attract heavy vehicles onto neighbourhood roads.
- Strategic Option 3 (Public transport and freight) does not fully address freight movement problems between the north and the south-east, and last mile deliveries (the movement of goods from a transportation hub to the final delivery destination) that are carried out mostly via the road network. A future Doncaster Rail option would not be precluded by North East Link, as and the Doncaster Busway corridor could accommodate heavy rail in the future, should the project be recommended. However, as described above, this option did not align with the project objectives.
- Although Strategic Option 4 (Bypass freeway) provides a medium- to long-term solution to poor orbital connectivity, inefficient freight movements and congestion on neighbourhood roads, it does not provide direct connections to key employment and activity centres to facilitate economic growth and economic opportunities for residents in the north-east.

Further detail is provided in the North East Link Business Case available online at <https://northeastlink.vic.gov.au/project/businesscase>.

6.3 Corridor assessment

6.3.1 Corridor options

Investigations into potential corridors for North East Link began in early 2017. The North East Link Project (NELP) initially identified a broad set of potential alignment options, including those considered in previous studies and others not previously considered. Information from the following sources was reviewed to inform identification of potential alignments and generate broad corridor options:

- Victorian Government (1969), *Melbourne Transportation Plan*
- Victorian Government (1974), *F35 Study: Eastern Freeway – Ringwood to Greensborough*
- Victorian Government (1979), *Outer ring study, Diamond Creek to Ringwood: Technical Report: Transport and Economic Evaluation*
- Victorian Government (2008), *Victorian Transport Plan*
- Infrastructure Victoria (2016), *30 Year Infrastructure Strategy*.

Based on the project objectives and some key constraints, four of the most practical potential corridor options for North East Link were identified, which are described in Section 6.3.5. Potential options further to the west were also identified at this stage, but removed from further consideration early due to their potential to attract trips to central Melbourne that are better served by public transport and existing motorways in the north of Melbourne.

Potential corridors for North East Link were identified by:

- Assessing existing and future traffic conditions and transport movements
- Investigating existing road corridors and utilities easements that could be used for potential corridors
- Identifying potential corridors and constraints to these corridors (such as difficult terrain, sensitive environmental areas and important community assets)
- Considering treatments such as tunnels to avoid sensitive environmental and urban areas or to mitigate surface impacts
- Considering likely geology and geotechnical influences and areas suitable for tunnel construction
- Identifying opportunities for connectivity with the existing road network
- Considering current and future patterns of land use and development in the north-east.

A surface road only option through any part of the north-east was discounted due to potential impacts on areas of environmental sensitivity and residential areas in the north-east.

6.3.2 Assessment criteria

Specific assessment criteria were developed to enable the options assessment. Criteria covered business, household, freight, amenity, environmental, construction and resource use aspects. Each criterion was given the same weighting and treated equally. There was no order of priority. Measures were identified for each criteria and performance was determined using a range of inputs that included:

- Transport modelling
- Land use modelling predictions
- Economic modelling predictions
- Information on the location of key utilities
- Information on geotechnical and topographic conditions
- Information on planning, environmental and heritage constraints
- Constructability assessment
- Risk adjusted cost estimates.

Most measures were quantitative and some were qualitative. The result for each measure was then rated in relation to the project objectives and guiding principles presented in Table 6-2 and Table 6-3.

Table 6-2 Project objectives

Objective 1	Objective 2	Objective 3	Objective 4
Improve business access and growth in Melbourne's north, east and south-east	Improve household access to employment and education in Melbourne's north, east and south-east	Improve freight and supply chain efficiency and industrial growth across the north, east and south-east	Improve access, amenity and safety for communities in the north-east

Table 6-3 Guiding principles

Guiding principle 1	Guiding principle 2	Guiding principle 3	Guiding principle 4
Minimise impacts on communities	Minimise impacts on environmental and cultural assets	Minimise impacts during the construction phase	Optimise the efficient use of resources

6.3.3 Assessment process

The options assessment process was guided by the Australian Transport Assessment and Planning (ATAP) Guidelines Steering Committee and approved by the Transport and Infrastructure Senior Officials' Committee, 2016. A three stage approach was adopted to narrow down a long list of corridor options to a preferred option:

- Stage 1: Strategic merit test – an initial indicative assessment of the corridor option's alignment with the project objectives. This stage of the process enabled an initial filtering of options, with the best performing options moving forward to the rapid appraisal.
- Stage 2: Rapid appraisal – an initial indicative assessment of the scale of a corridor option's alignment with the project objectives. This stage of the process enabled a further filtering of options, with the best performing options moving forward to the detailed appraisal.
- Stage 3: Detailed appraisal – a more detailed evaluation of the benefits, costs and other impacts of the remaining corridor options, assessed against the project objectives and guiding principles. At the end of this stage, the best performing option proceeded to full assessment in the business case.

As shown in Figure 6-3, this framework comprises a series of 'filters', with options being examined in greater detail as they advance through each stage. The process seeks to filter out unsatisfactory and lower performing options before considerable resources are spent on further assessment and development. As the assessment process progresses, more options are rejected. The project option is the one that passes through all the filters.

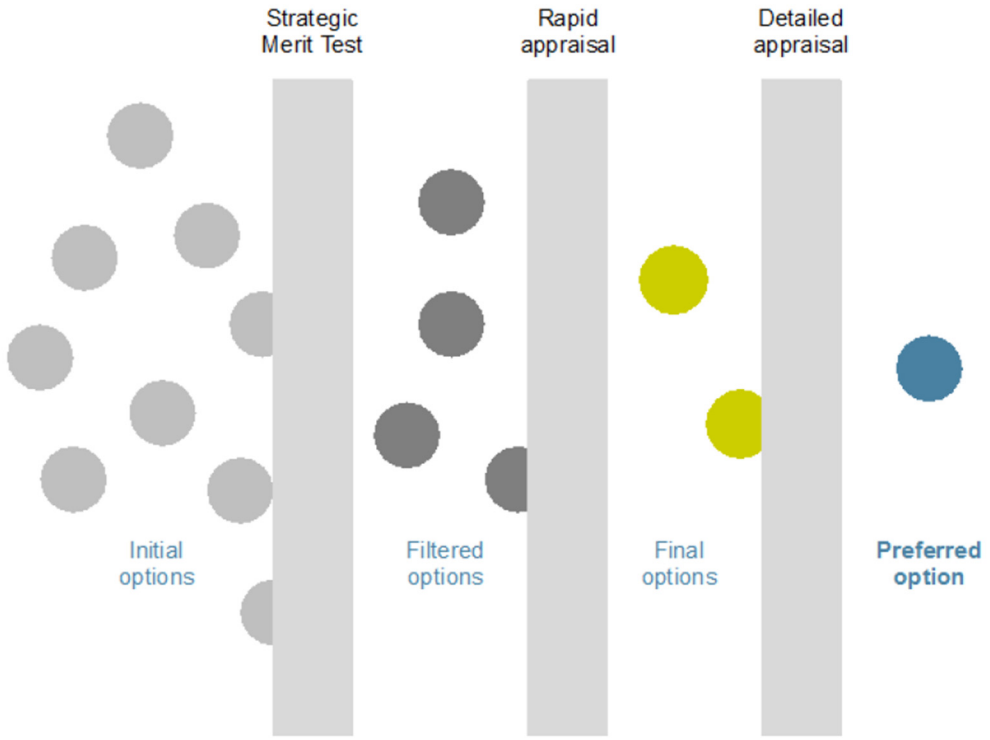


Figure 6-3 Australian Transport Assessment and Planning (ATAP) Guidelines (Source: ATAP)

The strategic merit test and rapid appraisal removed corridor options D and B from further consideration as they performed poorly against the project objectives and guiding principles compared with the other corridors.

6.3.4 Stakeholder and community input

NELP sought early input from the community, local councils, non-government organisations and government agencies for the corridor assessment. This consultation canvassed views on key issues such as community values, current traffic issues and transport-related problems in the north-east. In addition to the transport system objectives of the Transport Integration Act 2010 (Vic), these views contributed to the setting of project objectives and guiding principles for North East Link, which were used to focus the investigation of corridor options and guide the overall development of the project (refer to Section 6.3.2).

Reflecting the views and information provided during NELP's community consultation, North East Link has a strong focus on supporting business and jobs growth in communities across Melbourne's north, east and south-east, while also improving cross-city connectivity and helping to address critical traffic, freight and amenity issues.

As each assessment stage progressed, the assessment of corridor options considered feedback, information provided and questions raised by the community and stakeholders, alongside evidence from technical investigations.

Priority issues identified and considered included:

- Reducing congestion on key arterial roads in Melbourne's north-east
- Removing trucks that don't need to be on arterial roads in Melbourne's north-east
- Providing better connections for people to access existing and new jobs and education opportunities
- Helping businesses better connect to each other and to workers across Melbourne
- Making freight journeys more efficient and reliable
- Improving public transport connections and travel times
- Improving connections for pedestrians and cyclists
- Protecting the environment, culture, heritage and open spaces
- Minimising the impacts from construction-related traffic as the project is being built.

6.3.5 Assessment of corridor options

This section describes the assessment of corridor options in the order that each option was removed from further consideration, based on their assessed performance with the project objectives and guiding principles. Corridor A was announced as the preferred corridor in November 2017. Figure 6-4 below outlines the four corridor options including the existing road upgrades associated with each option (the dotted lines).

Figure 6-4 North East Link potential corridor options

Corridor option D

Corridor option D was not selected as an appropriate corridor for North East Link. The main reasons for this include:

- The corridor route is too long and circuitous. As a result, this option would not address existing or future travel patterns, meaning that it would not attract enough trips away from the existing arterial road network in the north-east.
- The road network in this area is rural in nature and very steep in places, and does not provide for appropriate connections to a new freeway.

- The corridor's location outside the Urban Growth Boundary in areas of very low population density (now and in the future) limits the project's potential to provide better access for businesses or workers. It also has the potential to create development pressure in Green Wedge areas outside the boundary, which does not align with the objectives of *Plan Melbourne 2017–2050*.

Corridor option B

Corridor option B was not selected as an appropriate corridor for North East Link. The main reasons for this assessment include:

- This corridor is not suitable as it is likely to attract more east-west oriented trips and has limited ability to provide relief to the critically congested north-south arterial road network
- Due to the unbalanced spacing location of the interchanges, feeder roads are likely to be affected to a greater extent as traffic would need to travel further distances to access the new link's alignment
- There would be significant impacts on utility services, including high voltage power lines that cannot be moved underground without incurring substantial costs
- Extensive tunnelling requirements would lead to a very high project cost.

Following options D and B being removed from further consideration, a detailed assessment was carried out on corridor options A and C. This assessment removed Corridor option C from further consideration, as summarised in the following sections.

Corridor option C

Corridor option C was not selected as an appropriate corridor for North East Link. The main reasons for this assessment include:

- The available connections to the existing arterial road network from this corridor are not well suited to the levels of traffic likely to be using them, resulting in lower use of a route through this corridor and less trips being attracted from the existing arterial road network (compared with Corridor option A)
- While the corridor supports long-distance trips between the north and south-east of Melbourne, it provides limited support for medium trips, which are cross-city trips that have one end of the trip within the north-east (for example, a trip between Watsonia and Box Hill) – both now and into the future (compared with Corridor option A)
- The corridor provides little support for or integration with the strategic arterial road network through the north-east, resulting in lower levels of traffic on the new link and providing less truck relief on roads in the north-east (compared with Corridor option A)

- The location of the corridor weaves across the Urban Growth Boundary through Green Wedge areas of low population density and has the potential to generate development pressure in these areas, contrary to the objectives of Plan Melbourne
- Extensive tunnelling requirements would lead to a significantly higher project cost.

Corridor option A – preferred option

The detailed assessment found that corridor option A performs significantly more effectively in relation to the Project Objectives and Guiding Principles than corridor option C. Corridor option A provides more benefits to the transport network, removes more vehicles off local roads and has a significant cheaper whole of life cost. The main reasons for this assessment include:

- Corridor option A provides the best opportunity to make connections to the existing arterial road network that respond to travel demand through, in and out of the north-east of Melbourne. This means that corridor option A attracts the most through traffic to the new link out of all the options considered, reducing demand on key arterial roads.
- It provides better connectivity for freight journeys and serves a greater number of freight catchments for trucks travelling across the north, north-east and south-east of Melbourne (compared with Corridor option C). This means the corridor provides the best opportunity to achieve a significant redistribution of trucks from local streets in the north-east.
- By working effectively with the existing arterial road network in the north-east, the corridor has the greatest ability of all the options considered to reduce traffic on existing arterial road networks and provide opportunities to improve conditions for more local journeys and on-road public transport.
- By connecting close to areas of greater activity, it provides better access for businesses and residents in the north, north-east, east and south-east to workers, jobs and services. It provides the greatest improvement in business access to labour markets of all the corridor options considered, particularly the opportunity to stimulate jobs growth in the La Trobe National Employment and Innovation Cluster (NEIC) and between the Broadmeadows, Epping, Ringwood and Box Hill Metropolitan Activity Centres (MACs).
- In enhancing the Eastern Freeway to cater for additional North East Link traffic, the corridor addresses capacity and connectivity issues in the operation of the freeway, 'future proofing' it for growth.
- It provides the best opportunity to improve public transport on the existing arterial road network by facilitating a Doncaster Busway along the Eastern Freeway.
- It provides the best opportunity to connect and expand existing walking and cycling facilities in the north-east.

Overall, corridor A provides a more optimal, efficient and well-used roadway than the other options considered and unlocks greater capacity on the arterial road network. It also extracts the most value from existing infrastructure by making better and more efficient use of the Eastern Freeway. While delivering greater benefits, it also has significantly lower capital and operational costs than Corridor option C.

Based on the assessment undertaken, corridor option A was announced as the preferred corridor in November 2017.

6.4 Reference project development

With the announcement of the preferred corridor, North East Link was envisaged to include the following design elements:

- A tunnelled section, with a minimum length from Blamey Road to Manningham Road (described in Section 6.4.1)
- A section of the road in cutting, extending from Blamey Road to Watsonia railway station, running alongside Simpson Barracks (described in Section 6.4.1)
- Interchanges at M80 Ring Road/Greensborough Bypass, Grimshaw Street, Lower Plenty Road, Manningham Road and the Eastern Freeway (described in Section 6.4.2)
- Upgrades to the Eastern Freeway to increase its capacity in both directions, with dedicated carriageways between Middleborough Road and Burke Road to separate through traffic from traffic entering and exiting the freeway (described in Section 6.4.3)
- A new Doncaster Busway system along the Eastern Freeway from Doncaster Park and Ride to Hoddle Street (described in Section 6.4.4).

NELP undertook further investigation of options within the corridor for these design elements. This section of the chapter provides a summary of the options investigated.

The options associated with the different design elements followed a set of criteria which reflect the transport system objectives and decision-making principles informed by the *Transport Integration Act 2010 (Vic)*. Refer to Chapter 2 – Project rationale for further detail. Key aspects of the criteria are described in Table 6-4 below and referenced throughout Section 6.4.

Table 6-4 Reference project key aspects of assessment criteria

Criteria	Key aspects of criteria	Transport system objectives
Traffic and transport	• Functionality of layout • Accessibility of layout	Integration of transport and land use
Design	• Compliance with standards and best practice including gradient and configuration of road geometry, maintenance access, OH&S and clearances	Efficiency, coordination and reliability
Land planning and environment	• Land acquisition • Visual impact • Environmental impact	Environmental sustainability, Safety health and wellbeing
Stakeholder and community	• Residential and business accessibility and impacts • Minimise displacement impacts	Social and economic inclusion
Financial	• Whole of life considerations	Economic prosperity

Community and stakeholder feedback received via community information sessions, Community Liaison Groups, stakeholder meetings and other engagement activities were also considered as part of the options investigation. Responses to feedback are discussed in Chapter 5 – Communications and engagement.

6.4.1 Tunnel

Tunnels would extend from Blamey Road in the north to south of Veneto Club in the south, built as a combination of driven (TBM), mined and cut and cover tunnel construction methods. Tunnels would contain three lanes in each direction.

During design development, other options assessed for the tunnelled section of North East Link included:

- Extending the tunnel north of Blamey Road
- Extending the tunnel south to the Eastern Freeway
- Narrowing the tunnel to two lanes instead of three
- Potential location options for the primary administration and construction for the tunnelling works.

Why are we tunnelling?

Protecting the Yarra River, its tributaries, floodplains, surrounding environment and culturally significant sites such as Bolin Bolin Billabong is a core requirement for North East Link.

Early feedback from community consultation identified that these environmentally and culturally sensitive areas are highly valued by the Traditional owners of the land – the Wurundjeri people – and the local community.

There are also many residential properties within the project boundary, other sensitive receptors (such as schools) and local businesses.

Tunnelling would minimise potential impacts to homes, community spaces and culturally and environmentally significant areas.

See Figure 6-5 below for a graphic representation of these options.

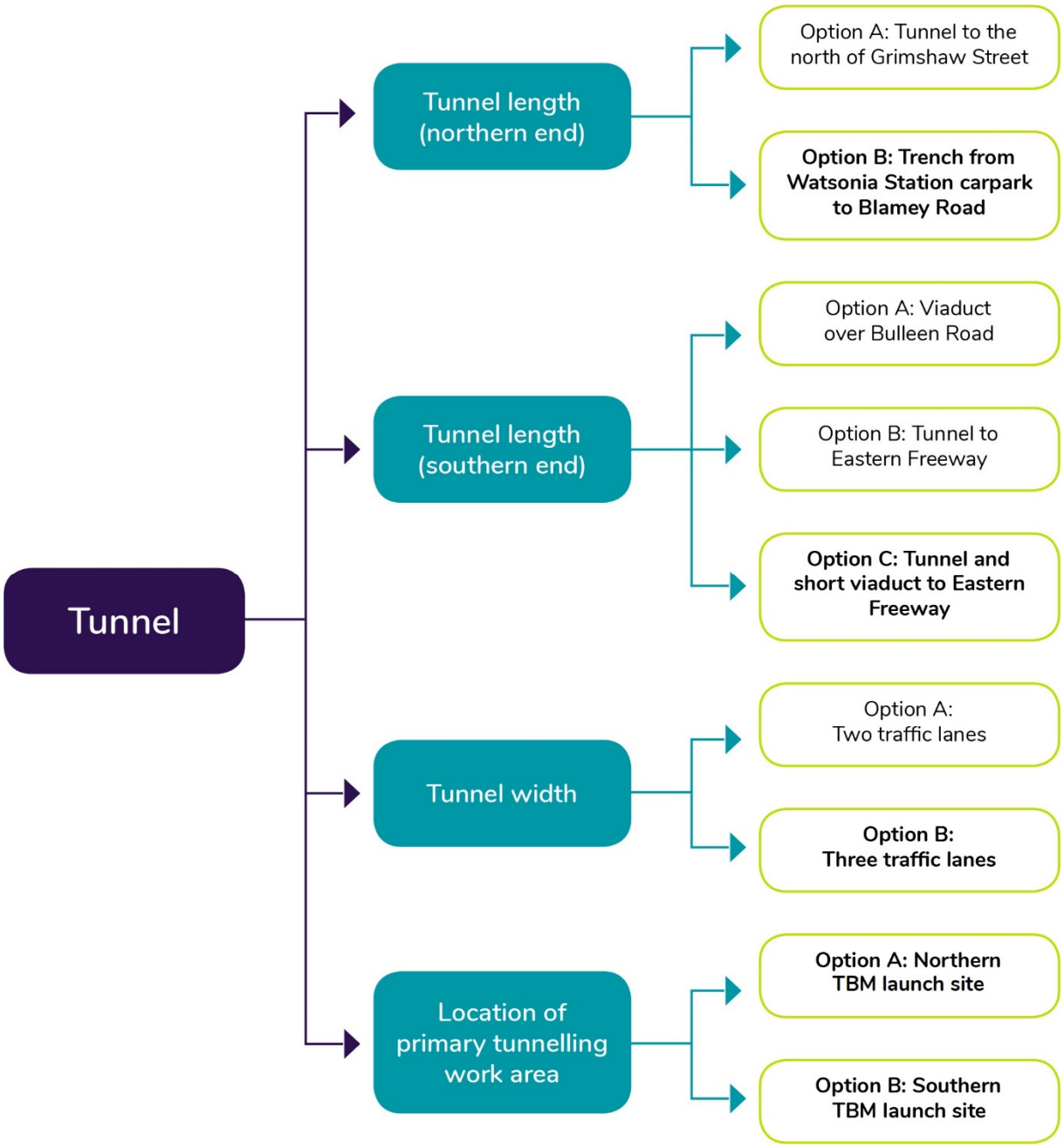


Figure 6-5 Design options for tunnels

Tunnel length (northern end)

The section between the M80 Ring Road and Lower Plenty Road has a number of design challenges due to the need to provide interchanges at the M80 Ring Road, Grimshaw Street and Lower Plenty Road, and because the ground in this area rises steeply to the north. Two key options were assessed for this section of road:

- Option A – Continuation of the tunnel past Lower Plenty Road to Grimshaw Street
- Option B (reference project) – A trench from Elder Street to Blamey Road.

Option A: Tunnel continuing from Lower Plenty Road under Greensborough Bypass to the north of Grimshaw Street.

This option (as shown in Figure 6-6) was originally considered for this section of North East Link as it would minimise, and in some cases entirely avoid, impacts to Grimshaw Street, AK Line Reserve, the Watsonia Primary School, Watsonia railway station and Simpson Barracks.

Despite these advantages, key issues with this tunnelling option were identified, including:

- Traffic and transport:

  Due to the challenging topography of the area, the gradient of the ramps from the tunnel would be too steep for vehicles to exit the tunnel at these interchanges at Grimshaw Street and Lower Plenty Road (ramp gradients of around eight per cent). This is because the ground is considerably higher at the northern end of the project (at the M80 Ring Road), and steadily falls towards the south. Under this tunnelled option, the Lower Plenty Road interchange could not be constructed, and ramps could only be provided to the north at the Grimshaw Street interchange. This would provide connections north to the M80 Ring Road and Greensborough Bypass, but not to the south. This would remove access onto North East Link from Lower Plenty Road and significantly limit access from Grimshaw Street.

- Design:

  To avoid impacting the Hurstbridge rail line, the tunnel would need to be well below the rail corridor near the intersection with Greensborough Road. However, this would mean the tunnel would be too deep to provide entry and exit ramps to Grimshaw Street that have appropriate and safe gradients for vehicles.

- Land planning and environment:

  Despite avoiding impacts at Simpson Barracks, this option would still require acquisition of residential properties on the east side of Sellars Street. This would facilitate the at grade interchange at the M80 Ring Road and Greensborough Bypass.

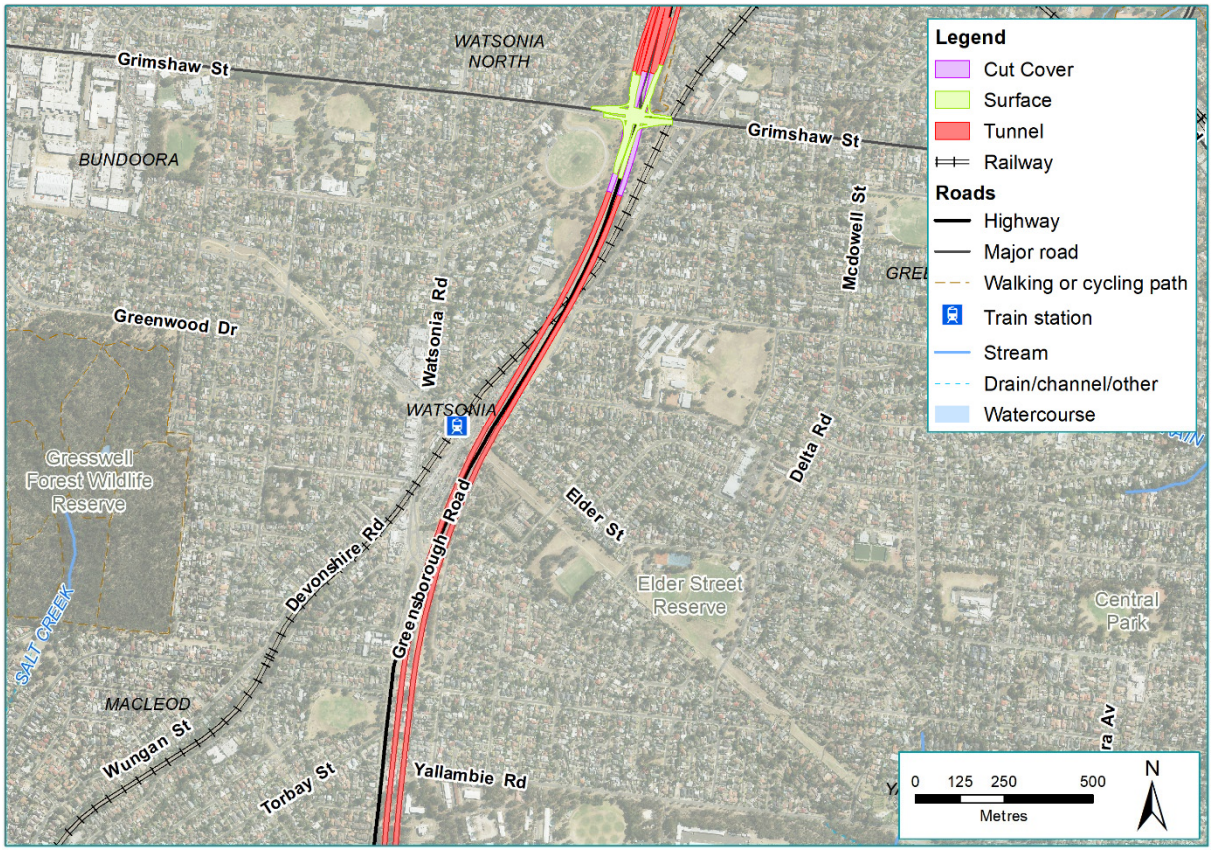


Figure 6-6 Option A: TBM tunnel to north of Grimshaw Street

Due to the range of disadvantages associated with the extension of the tunnel to the north, this option was removed from further consideration. This was largely due to the inability to provide safe and acceptable entry and exit to North East Link.

Option B (reference project): Trench beginning adjacent to Watsonia railway station carpark to Blamey Road.

This option (shown in Figure 6-7 and Figure 6-8) would lower the North East Link carriageways into a trench structure adjacent to the Watsonia railway station car park. Heading south, the trench structure would slowly descend, until Blamey Road, where the road would transition into a cut and cover tunnel. Once the tunnel reaches Lower Plenty Road, driven tunnels, using tunnel boring machines (TBM) would commence.

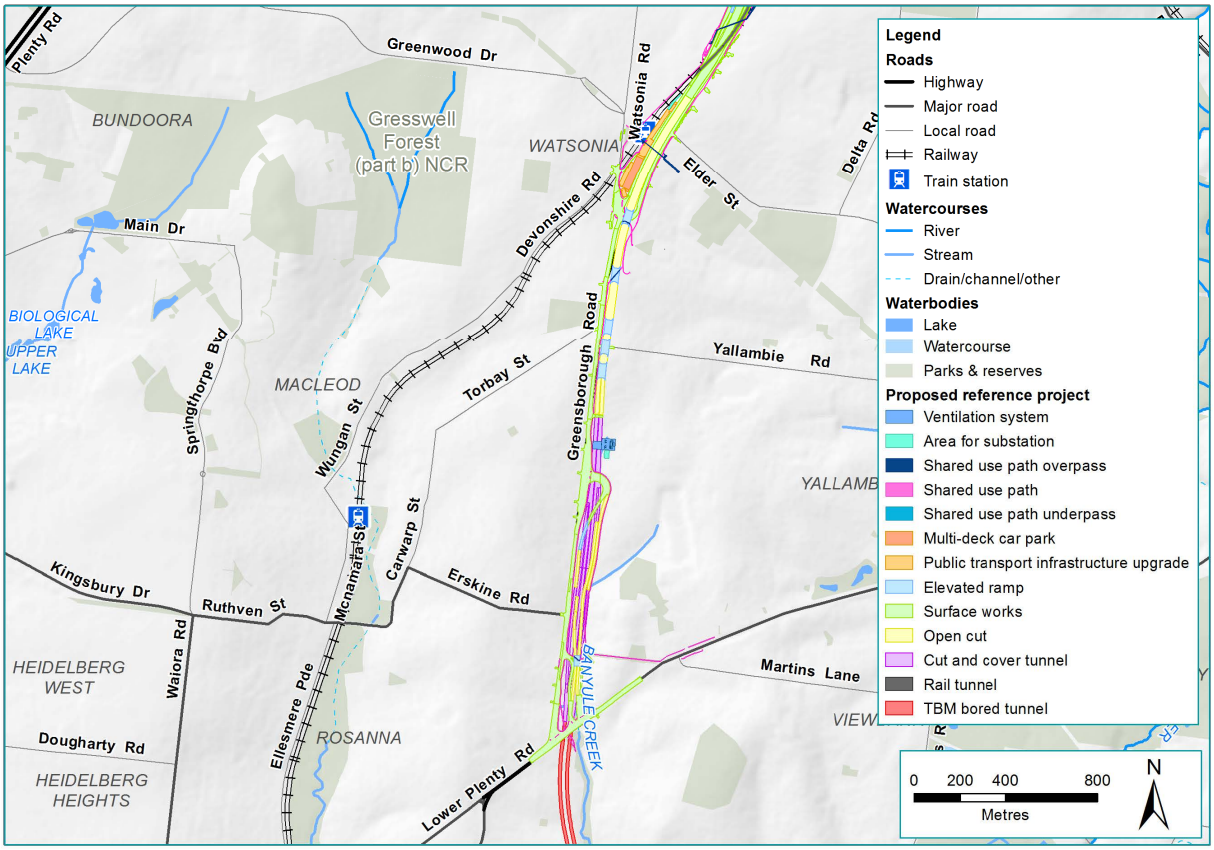


Figure 6-7 Option B (reference project): Trench from Elder Street to Blamey Road

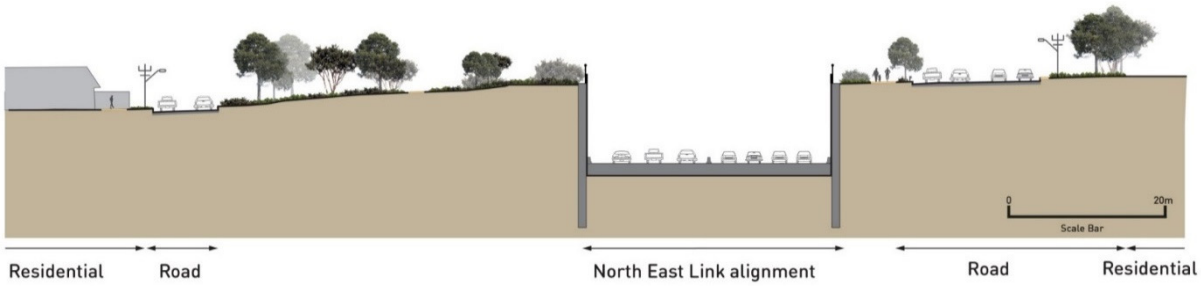


Figure 6-8 Option B (reference project): Indicative schematic cross section of trench

The trench option was progressed through to the reference project as it responds to the following aspects of the criteria:

- Design

  This option provides a horizontal and vertical geometry that responds to the challenging topography within this area. This enables the construction of acceptable and safe entry and exit ramps at Lower Plenty Road and Grimshaw Street.

- Traffic and transport

  This option would reduce the number of large vehicles travelling south on Greensborough Road to Rosanna Road (via Lower Plenty Road). These vehicles would then use existing designated routes on the arterial road network to travel to their destinations, including Rosanna Road and Bulleen Road. These over-dimensional vehicles and some vehicles carrying dangerous goods (those that are placarded loads) would not able to travel in the road tunnels, consistent with CityLink, EastLink and the yet to be constructed West Gate Tunnel Project.

- Land planning and environment

  The impacts to properties on the east side of Sellars Street associated with Option A above would also be largely mitigated or removed entirely under this option.

What are over-dimensional vehicles and vehicles carrying dangerous goods?

Over-dimensional vehicles are vehicles that exceed 5.0 metres high, 5.0 metres wide or 30.0 metres long, or 100.0 tonnes gross mass.

The tunnels cannot contain these vehicles given the limited overhead clearance for large vehicles.

Vehicles carrying dangerous goods of sufficient quantity and type to be a 'placarded load' are also prohibited from being transported via tunnel.

Over-dimensional vehicles and vehicles carrying dangerous goods typically represent less than one per cent of total vehicles travelling within the north-east.

However, because the trench would run along the existing Greensborough Road, this design would impact some residential properties and the Simpson Barracks to the east side of Greensborough Road. These impacts are associated with land acquisition, ecology and arboriculture. These impacts are assessed in Technical report I – Social, and Technical report Q – Ecology.

Tunnel length (southern end)

The options to extend the tunnel on the southern end between Manningham Road and the Eastern Freeway need to consider a number of challenges. These include significant existing traffic volumes on Bulleen Road, acceptable ramp grades to connect to the Eastern Freeway, interfaces with the Koonung Creek and the consideration of a number of sensitive receptors including residential properties, Bolin Bolin Billabong, community facilities, sporting grounds and school facilities. Three key options were assessed for this section of road:

- Option A – Viaduct from Manningham Road to the Eastern Freeway over Bulleen Road
- Option B – Continuation of the tunnel from Manningham Road to the Eastern Freeway under Bulleen Road

- Option C (reference project) – Continuation of the tunnel from Manningham Road to the south of the Veneto Club and viaduct to the Eastern Freeway under Bulleen Road.

Option A: Viaduct over Bulleen Road

This option (shown in Figure 6-9) includes an elevated structure south of Manningham Road interchange over Bulleen Road to connect North East Link to the Eastern Freeway in all directions. While a long viaduct would provide efficient traffic functionality, one key issue with this option included:

- Land planning and environment:

  This option would require significant permanent impacts to residential properties and community facilities south of Manningham Road. Also due to the elevated structures, there would be significant visual and amenity impacts to the community facilities and schools around Bulleen Road. However, this option would minimise impacts within the floodplain.

While this option provides for optimal traffic performance, the visual and amenity impacts to the surrounding facilities were considered too significant to progress this option.

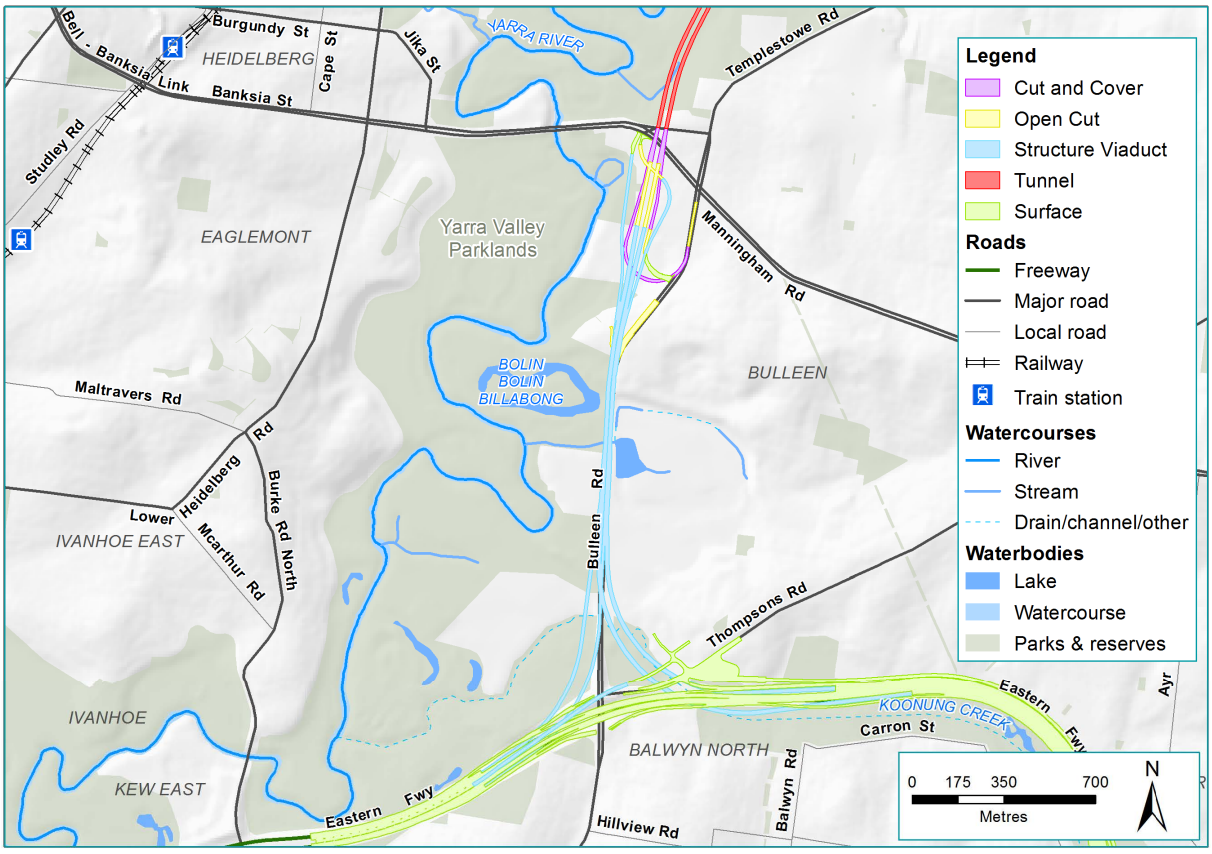


Figure 6-9 Option A: Viaduct over Bulleen Road

Option B: Tunnel to Eastern Freeway

This option continues North East Link in tunnel south of Manningham Road to the Eastern Freeway, connecting to the Eastern Freeway in tunnel to the east and west.

The purpose of this option is to avoid residential property acquisition south of Manningham Road and avoid the visual and amenity impacts associated with a viaduct structure along Bulleen Road associated with Option A above.

A tunnel concept was considered as two options:

- Option B.1: TBM tunnel – this option would use a TBM to construct the tunnels connecting North East Link to the Eastern Freeway. This is presented in Figure 6-10.

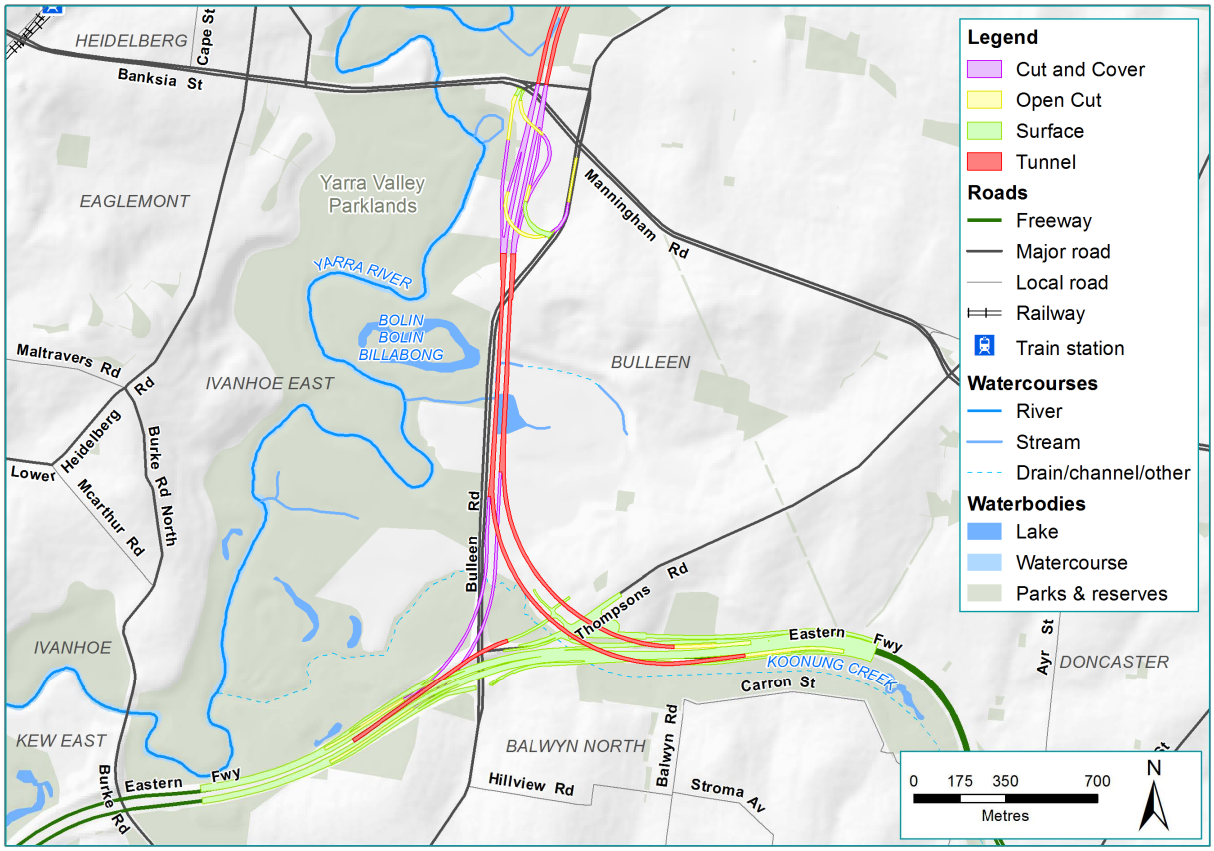


Figure 6-10 Option B.1: TBM tunnels to Eastern Freeway

- Option B.2: Cut and cover tunnel – this option would apply a cut and cover construction methodology, which would require surface level clearing to facilitate the construction of the tunnel. This would result in additional surface level impacts and extensive property acquisition. This is presented in Figure 6-11.

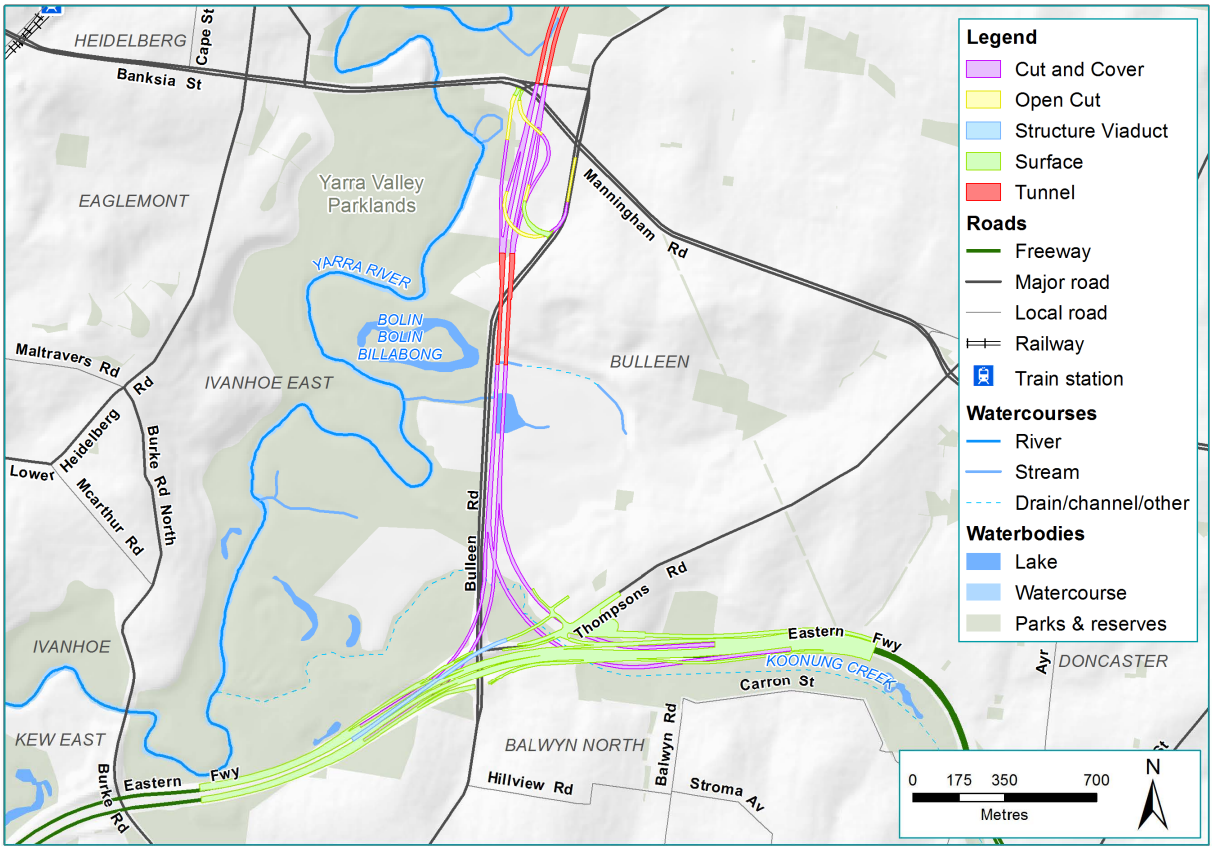


Figure 6-11 Option B.2: Cut and cover tunnels to Eastern Freeway

Despite the advantages of a tunnelled option associated with visual impacts, this was removed from further consideration due to a number of issues:

- Traffic and transport

  The design layout for this option would not provide an acceptable level of traffic functionality. This is due to the tight radius curve of the east-facing tunnel (on the eastern side of Bulleen Road) which would not provide sufficient stopping sight distance.

- Land planning and environment

  This option would also require a larger project footprint at the Eastern Freeway in order to accommodate the tunnel portals and the ventilation structures, which would have permanent impacts on parkland, community facilities and would impact residential properties (as a result of the cut and cover methodology).

Through an assessment of the advantages and disadvantages associated with Options A and B, Option C was developed.

Option C (reference project): Tunnel to the south of the Veneto Club and short viaduct to the Eastern Freeway

This option (Figure 6-12) consists of a combination of the two options assessed above. From the Manningham Road interchange, the North East Link tunnels would pass under residential properties on the east side of Bulleen Road to the escarpment on the north side of the Trinity Grammar School Sporting Complex. The tunnels would then continue from the escarpment to the west side of Bulleen Road with tunnel portals to the south of the Veneto Club property. From the tunnel portals, ramp connections to Eastern Freeway east and west would climb on viaducts that connect to the Eastern Freeway carriageways. This option would retain access for community facilities onto Bulleen Road.

Key benefits of this option include:

- Land planning and environment

  This option would avoid impacts to residential properties on both sides of Bulleen Road due to the tunnelling method underneath residential properties.

- Traffic and transport

  The design of the viaduct structure to the Eastern Freeway would retain an acceptable gradient for Bulleen Road to retain access for community facilities, in contrast to other options, and provide efficient traffic functionality onto the Eastern Freeway.

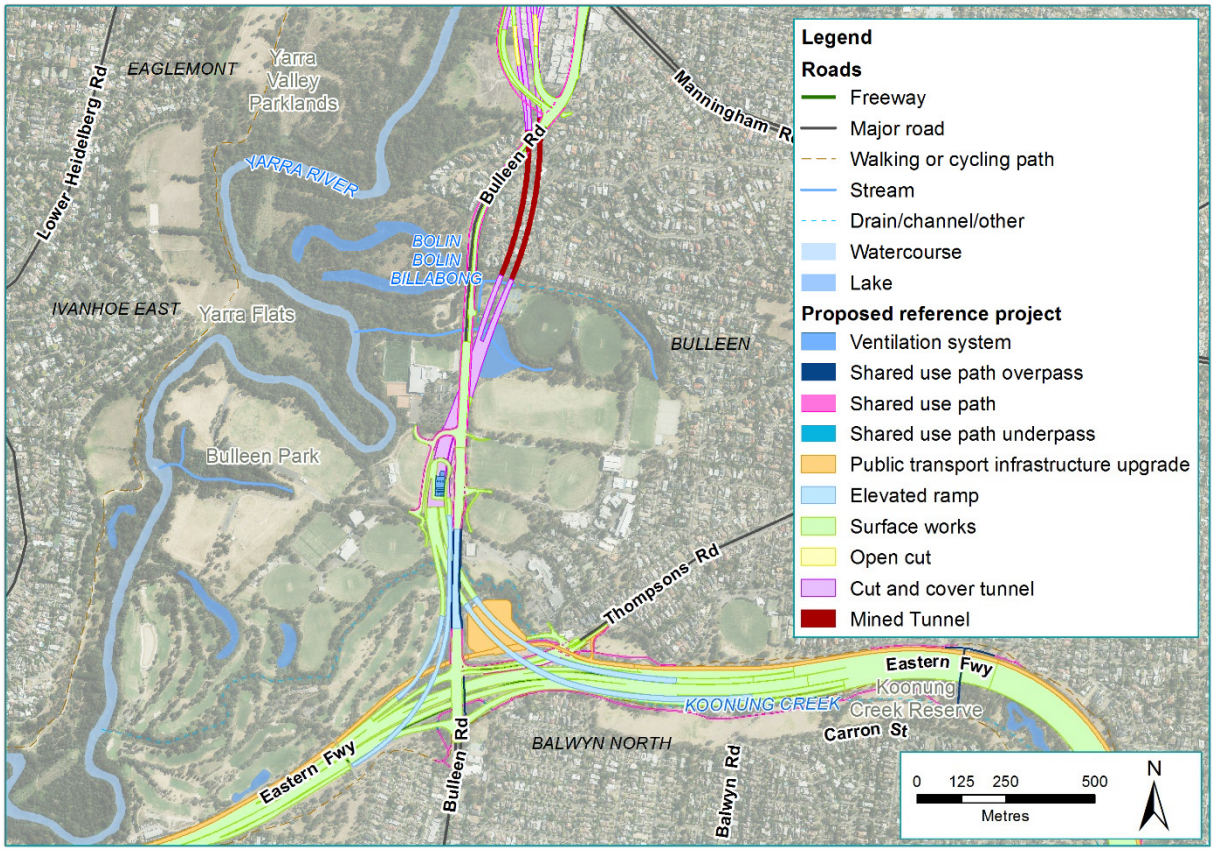


Figure 6-12 Option C (reference project): Mined tunnel and short viaduct

While Option C provides an improved outcome for this section of North East Link compared with options A and B, there are some disadvantages associated with those options. These include significant property impacts to community facilities such as Boroondara Tennis Centre, Bulleen Oval, tennis/netball courts within Carey Grammar Sports Complex, the football oval used by Yarra Junior Football League, the Freeway Public Golf Club, the Bulleen Swim Centre and the visual impact associated with the viaduct structures to the Eastern Freeway.

On balance, this option was progressed through to the reference project due to the advantages associated with the design. While there are a number of community facilities impacted, this option avoids all direct residential property impacts in this location.

Tunnel width – Two vs. three lanes within tunnels

Early project assessment looked at the lane options for the tunnels, specifically whether the tunnels would have two or three lanes in each direction.

Option A: Two traffic lanes

If the tunnels were constructed with two traffic lanes, this would reduce the tunnel width and the total footprint required for construction and operation. Tunnels with two lanes would be less expensive to construct, compared with wider tunnels.

However, two lanes in each direction would not be considered adequate to carry the traffic volumes expected by the project, as discussed below.

Option B (reference project): Three traffic lanes

The estimated daily capacity of the tunnels would be 140,000 vehicles a day. Traffic modelling predicts the tunnels would carry up to 125,000 vehicles a day by the year 2036 (refer to Chapter 9 – Traffic and transport). The tunnels are also expected to be the busiest section of North East Link during operation.

If the North East Link tunnels were constructed with two lanes in each direction, it is expected that upgrading to three lanes in each tunnel would be required not long after the project starts operating, which would be costly and disruptive.

As a result, early traffic studies showed that three lanes in each tunnel would be a better traffic and transport solution and provide the capacity required for projected initial and future traffic volumes. The tunnels would be designed and built to operate with three traffic lanes in each direction.

Location of the primary tunnelling work area

The reference project includes two options for the location of the primary administration and construction for the tunnelling works. These are at the following locations:

- **Option A**: Lower Plenty Road extending north to Blamey Road and described as the Northern TBM launch site
- **Option B**: Bridge Street extending south to Golden Way and described as the Southern TBM launch site.

The descriptions of the launch sites are included in Chapter 8 – Project description. Both launch options exist within the defined project boundary. While the construction layouts for north and south sites change depending on if the launch site is located there, this only means that precise locations of construction sheds/laydown areas change.

6.4.2 Interchanges

Why do we need interchanges?

The decision to locate additional interchanges between North East Link's connections to the M80 Ring Road and Eastern Freeway was made giving consideration to:

- The existing road network – Grimshaw Street, Lower Plenty Road and Manningham Road are the three arterial roads that intersect with the North East Link alignment.
- The VicRoads SmartRoads framework and Transport for Victoria's Movement and Place Framework – SmartRoads is an approach to managing Victoria's arterial road network that aims to better link transport to adjacent land use, by providing a set of guiding principles for road use by transport mode, place of activity and time of day. Transport for Victoria is also currently developing the Movement and Place Framework to replace the SmartRoads road use hierarchy. The framework defines categories for each road link with respect to functionality, transport mix and environmental conditions to guide the planning and development of an integrated transport network. This also extends to the design of people-friendly streets and defining the best outcomes for cycling, walking and place making.
- Traffic studies and modelling of the origins and destinations of vehicles travelling on North East Link – These studies have identified that interchanges at these locations would allow people to use North East Link to more easily access their destinations in the north-east.
- The ability to provide access to residential and employment areas – Interchanges with key arterial roads would allow vehicles travelling on North East Link to travel to and from employment and residential areas in the north-east such as the La Trobe NEIC.

Figure 6-13 highlights the location of proposed interchanges at the M80 Ring Road, Grimshaw Street, Lower Plenty Road, Manningham Road and the Eastern Freeway which would provide access to major population and employment centres.

Figure 6-14 summarises the options considered for each of the interchanges.

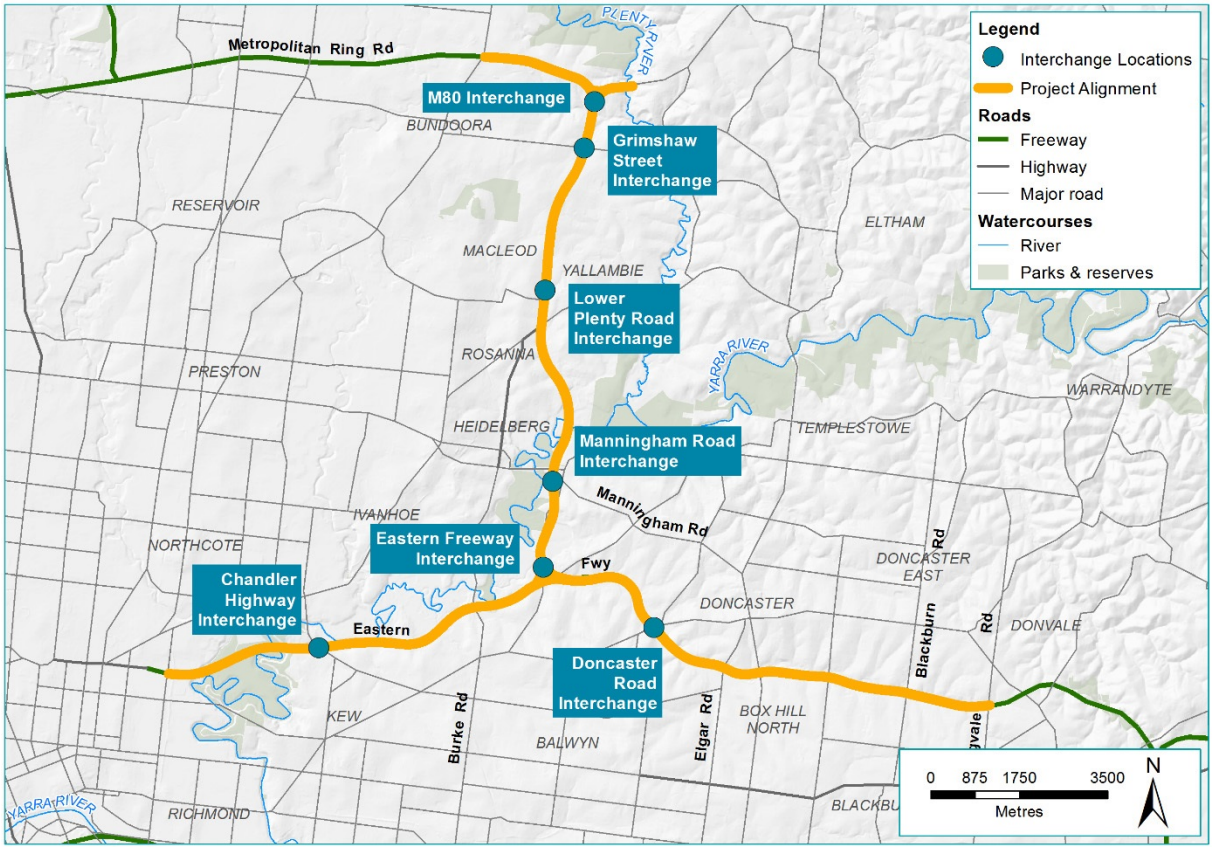


Figure 6-13 North East Link key interchange locations

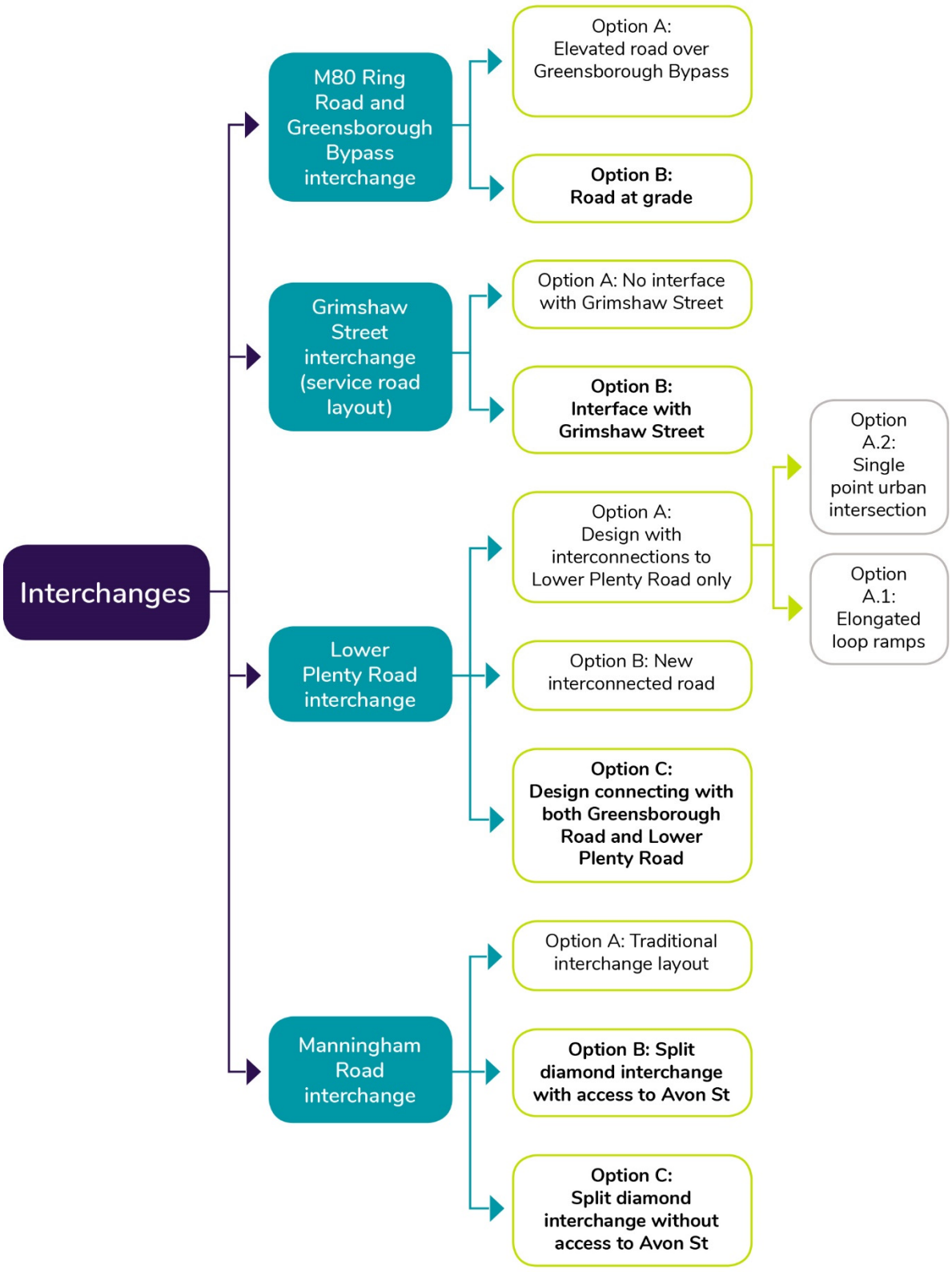


Figure 6-14 Design options for interchanges

M80 Ring Road and Greensborough Bypass interchange

The purpose of the new interchange is to provide connectivity to the Greensborough Bypass to the east, the M80 Ring Road to the west and south onto North East Link and to remove the signal constraints that are currently at this interchange.

The structure of this interchange was dependent on a number of key challenges and decision points in the options development process.

As explained in Section 6.4.1 above, North East Link tunnels would extend from Lower Plenty Road in the north, to south of the Veneto Club, Bulleen in the south. As a result of the tunnel design (described in Section 6.4.1 above), the options for the interchange at the M80 Ring Road and Greensborough Bypass were narrowed to two key options. This includes:

- Option A – An elevated road
- Option B (reference project) – A road at-grade.

Option A: Elevated road over Greensborough Bypass

North of Grimshaw Street, this option (shown in Figure 6-15) would elevate North East Link on a viaduct structure, to separate the Greensborough Bypass from North East Link movements. This option was considered as it would retain all existing local access including to Grimshaw Street, Greensborough Road, Greensborough Bypass, Elder Street, Watsonia railway station and the associated commuter car park.

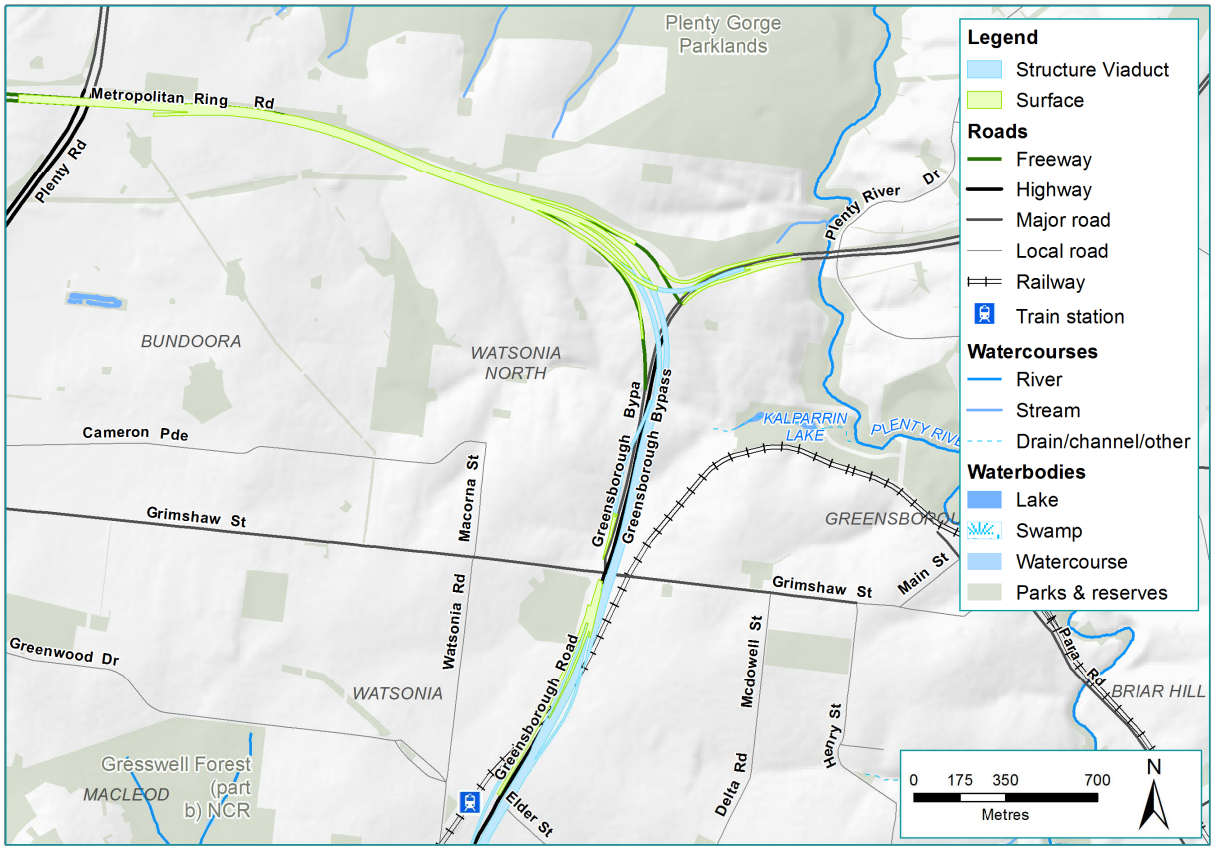


Figure 6-15 Option A: NEL as an elevated road over Greensborough Bypass at the M80 Ring Road interchange

However, this option was removed from further consideration, due to a number of disadvantages. These include:

- Traffic and transport

  This option would not provide a free-flowing exit (without traffic lights) for traffic travelling north of Grimshaw Street. This would require traffic to exit to the Greensborough Bypass, and pass through the Grimshaw Street intersection in the same way it currently operates.

- Land planning and environment

  A large elevated freeway within a built up urban area would have significant visual and amenity impacts to the surrounding community and residential area. This option was removed from further consideration due to these significant impacts.

Option B (reference project): A road at-grade

This option (shown in Figure 6-16) would consist of a free flowing interchange with multiple carriageways, providing connectivity from M80 Ring Road to the west, Greensborough Bypass to the east and North East Link to the south. This at-grade configuration provides a number of advantages including:

- Traffic and transport

  This option improves service road and local road access (including pedestrian overpasses), and allows for intersections at Grimshaw Street and Lower Plenty Road.

- Land planning and environment

  This structure also minimises visual and amenity impacts as it would be located within the existing M80 Ring Road and Greensborough Bypass road corridors.

As this option mitigates the key issues identified in the previous option, this was carried through as the preferred interchange and alignment structure.

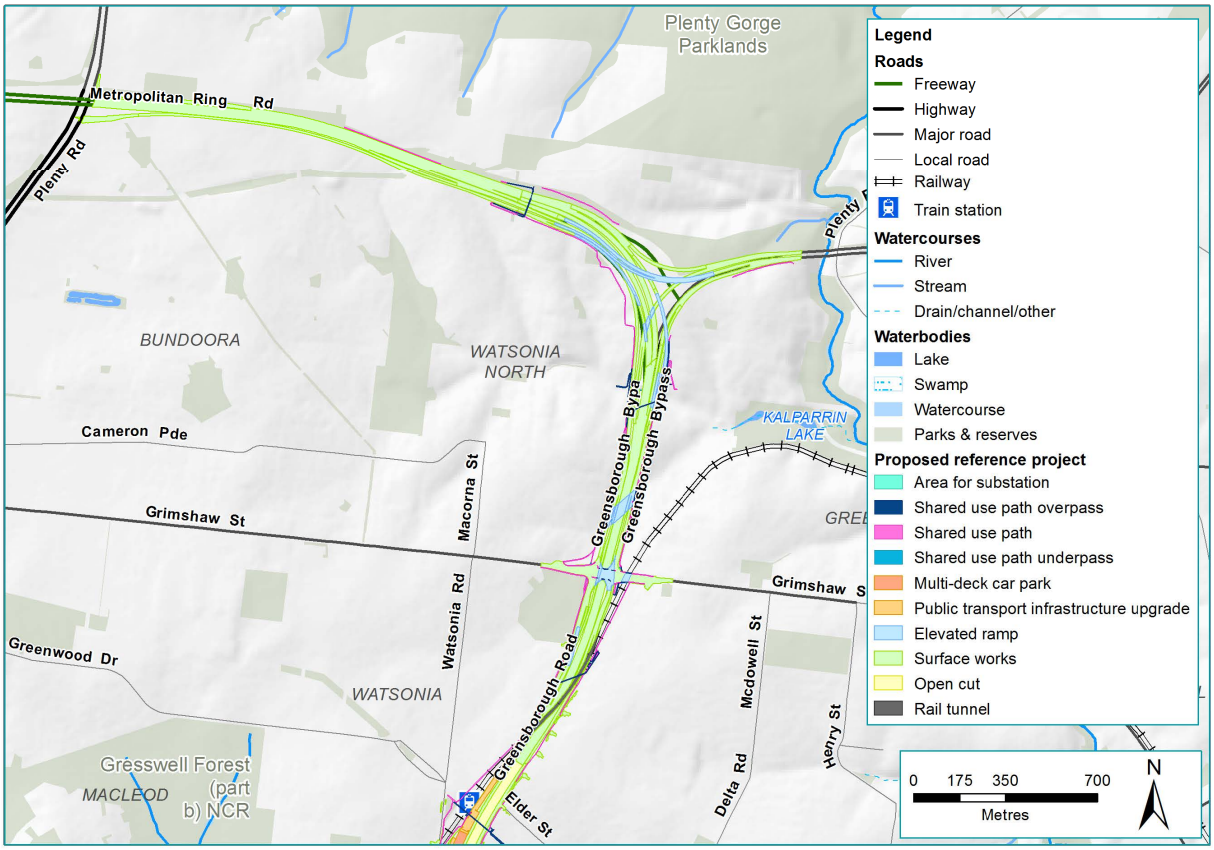


Figure 6-16 Option B (reference project): M80 Ring Road interchange at-grade road

Grimshaw Street interchange

Following the selection of the preferred option for the M80 Ring Road interchange as an at grade road, explained in the above section, the layout of the Grimshaw Street interchange was largely predetermined and takes a single point interchange design configuration. North East Link would be separated vertically from Grimshaw Street to cater for free flowing traffic to and from North East Link. This would be achieved by balancing the lowering of North East Link carriageways and raising of Grimshaw Street.

Key options associated with this interchange were related to the service road provision and local road access around Grimshaw Street. Two options for the service road provision around Grimshaw Street were assessed:

- Option A – No interface with Grimshaw Street
- Option B (reference project) – Interface with Grimshaw Street.

Option A: No interface with Grimshaw Street

This option contained a service road on the eastern side of the intersection that does not interface with Grimshaw Street. To facilitate access, this service road involved a new roundabout located to the south-east of the Grimshaw Street interchange. This was proposed to reduce the number of local movements at the Grimshaw Street interchange, while retaining local connectivity to Watsonia Neighbourhood Village shopping centre.

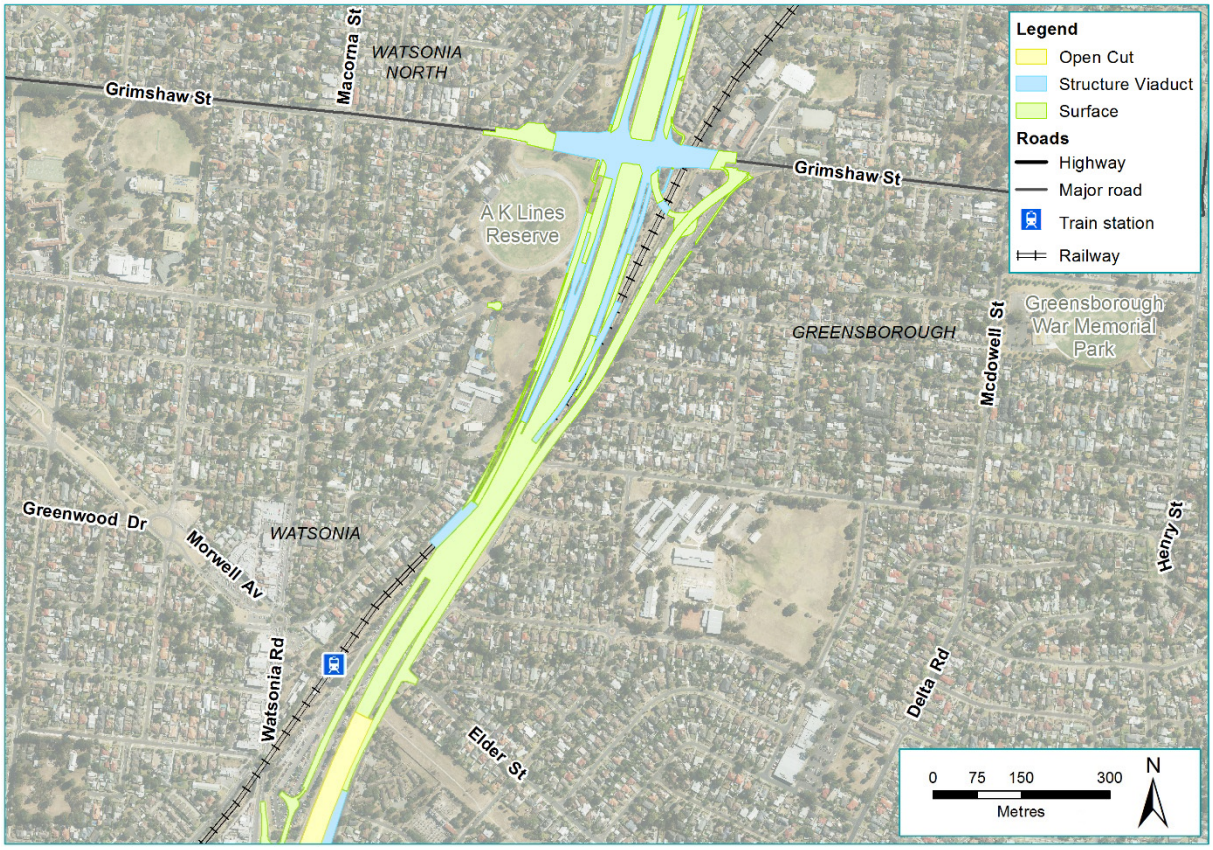


Figure 6-17 Option A: Grimshaw Street service road layout – no interface

This option was removed from further consideration due to the inconsistency with criteria around:

- Land planning and environment

  This option would require additional land acquisition at AK Line Reserve and Watsonia Primary School compared with the reference project.

- Design

  This option creates a number of design challenges associated with the interface between the new service road infrastructure and the Hurstbridge rail line.

However, the option of providing service roads at this interchange was continued, which led to the development of Option B described below.

Option B (reference project): Interface with Grimshaw Street

This option (shown in Figure 6-18) would provide service roads which interface with Grimshaw Street by providing grade separated carriage ways under North East Link, and service roads extending from the M80 Ring Road interchange for local movements on the eastern and western sides of North East Link. Key benefits of this option include:

- Traffic and transport

  This would improve traffic functionality and provide circuitous local access to Watsonia railway station (replacing the current direct access from Elder Street), while still providing connectivity between Watsonia Neighbourhood Village and Grimshaw Street. At the Grimshaw Street interchange, the service roads would interface with the main interchange allowing movements in all directions.

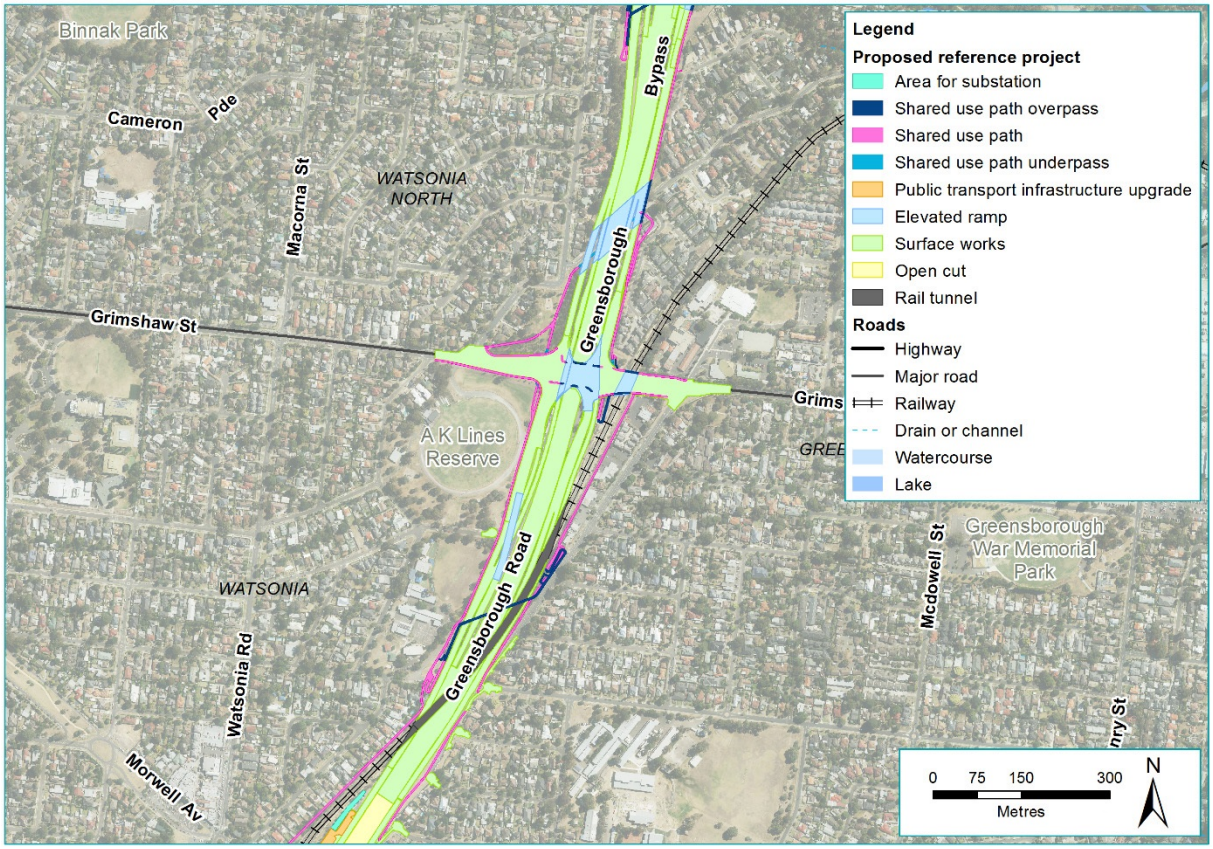


Figure 6-18 Option B (reference project): Grimshaw Street service road layout – interface with Grimshaw Street

Lower Plenty Road interchange

At Lower Plenty Road, North East Link would enter a twin three lane tunnel section and continue south. An intersection at Lower Plenty Road would provide full entry and exit connectivity for traffic. Key challenges associated with this interchange include requirements to:

- Provide acceptable grades for the entry and exit ramps
- Provide cover suitable for a tunnel
- Minimise impacts to the community.

As a result of these competing challenges, a number of configurations were considered for this interchange. Three main options assessed were:

- Option A – Standard interchange design
- Option B – New interconnected road design
- Option C (reference project) – Greensborough Road centric design.

Option A: Design with interconnections to Lower Plenty Road only

This option looked at providing a design at Lower Plenty Road, where the road connects at a single point. This design concept was explored in a number of ways seeking to achieve the required design functionality and traffic performance.

Two options that applied this design concept are outlined below.

Option A.1: Elongated loop ramps (shown in Figure 6-19).

This option would significantly increase the interchange footprint and increase the impact on Simpson Barracks land. Due to these increased impacts, this option was not continued.

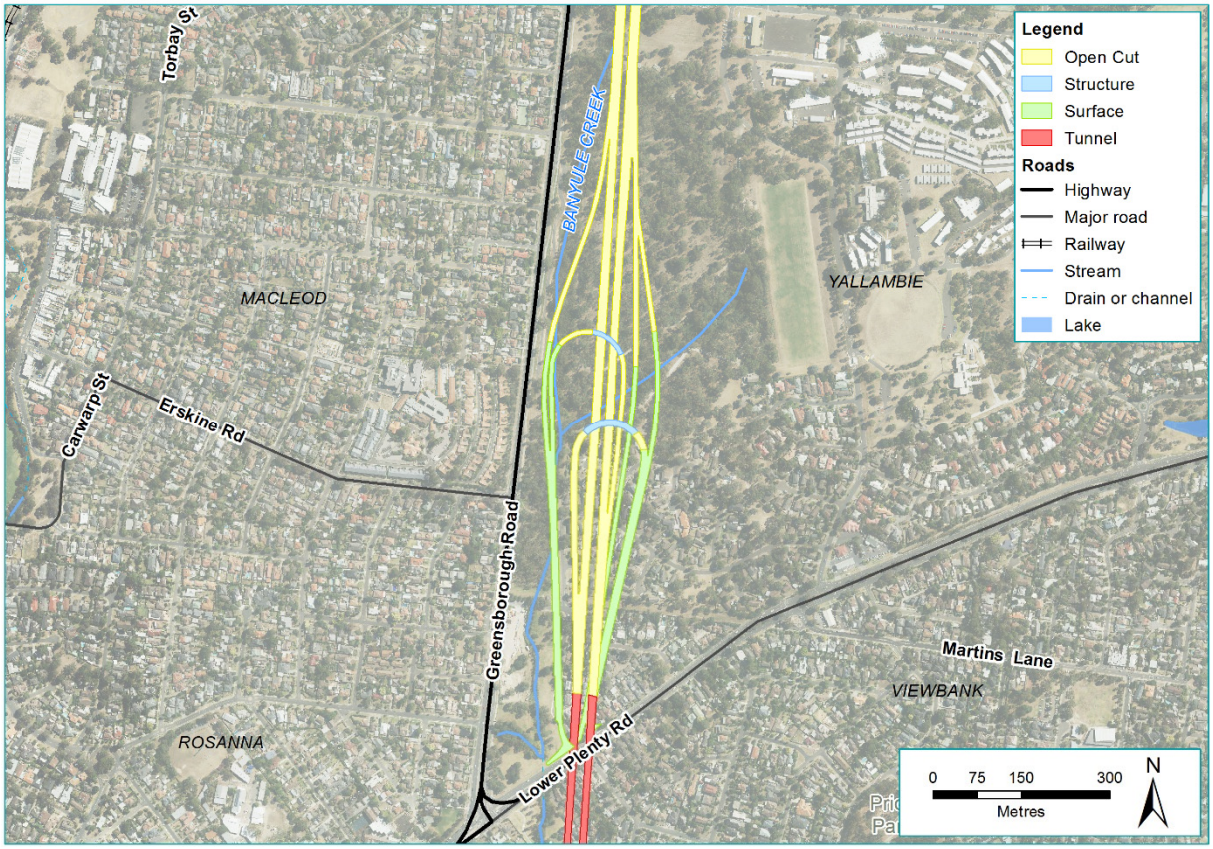


Figure 6-19 Option A.1: Elongated loop ramps

Option A.2: Single point urban intersection (shown in Figure 6-20). This option would provide a single point urban interchange with ramps north and south of Lower Plenty Road. However, these ramps to the south would have significant impact on residential properties south of Lower Plenty Road. Due to the scale of this additional permanent residential impact, this option was removed from further consideration.

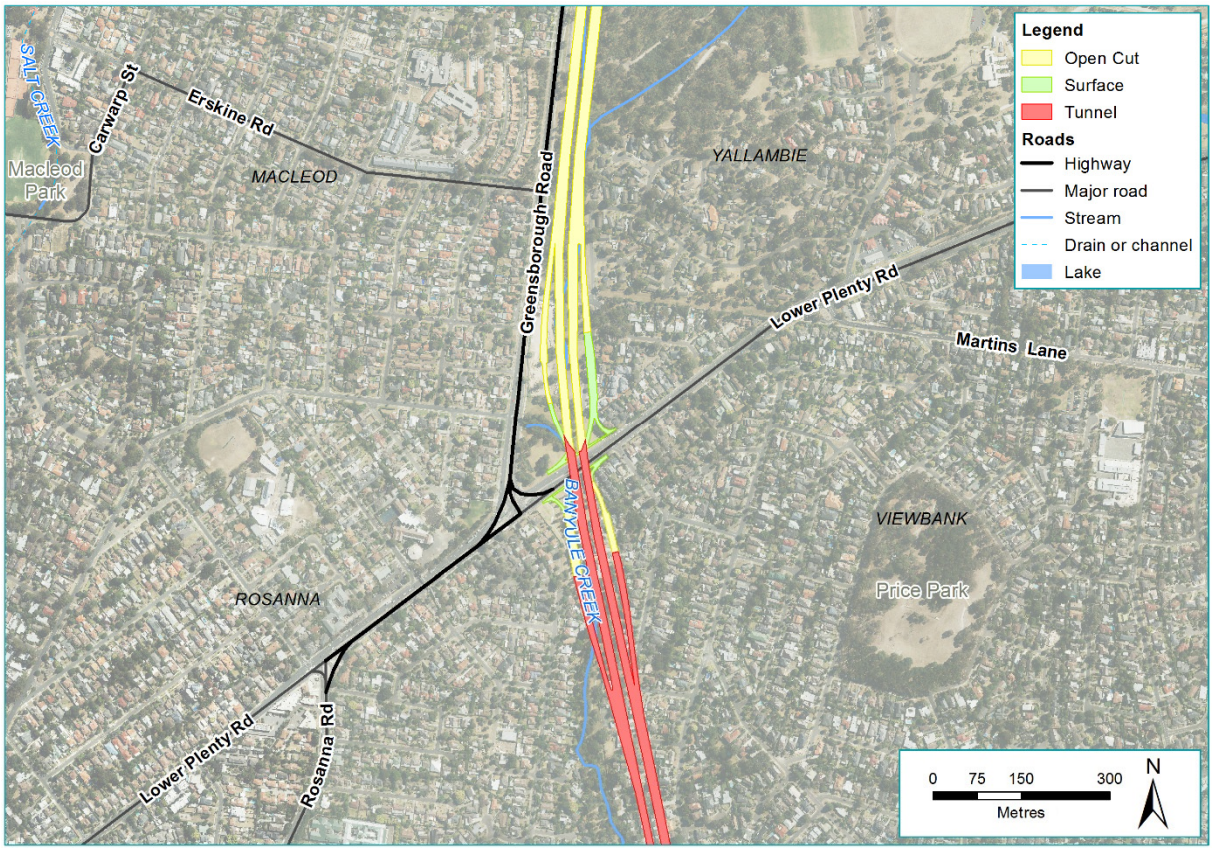


Figure 6-20 Option A.2: Single point urban intersection

Key criteria elements identified the disadvantages with these options. These included:

- Traffic and transport

  Traffic performance issues were identified in the assessment of this option due to the close proximity to the existing intersection of Lower Plenty Road with Greensborough Road

- Land planning and environment

  Assessment of these options identified that a significant number of residential properties and additional land at Simpson Barracks would be required to facilitate the construction and operation of North East Link.

Due to a number of impacts, Option A, a standard interchange design, was removed from further consideration and deemed unsuitable for this location.

Option B: New interconnected road

This option (shown in Figure 6-21) would provide a new interconnected road between Greensborough Road and Lower Plenty Road. Focusing on improved traffic performance, this interchange layout would allow for North East Link movements to run separately from intersection traffic on Lower Plenty Road and Greensborough Road. However, this option would have major impacts on residential properties and Simpson Barracks, and leave a number of properties isolated and surrounded by major roads. Because of the significant property impacts, and inconsistency with criteria around land planning and environment, this option was removed from further consideration.

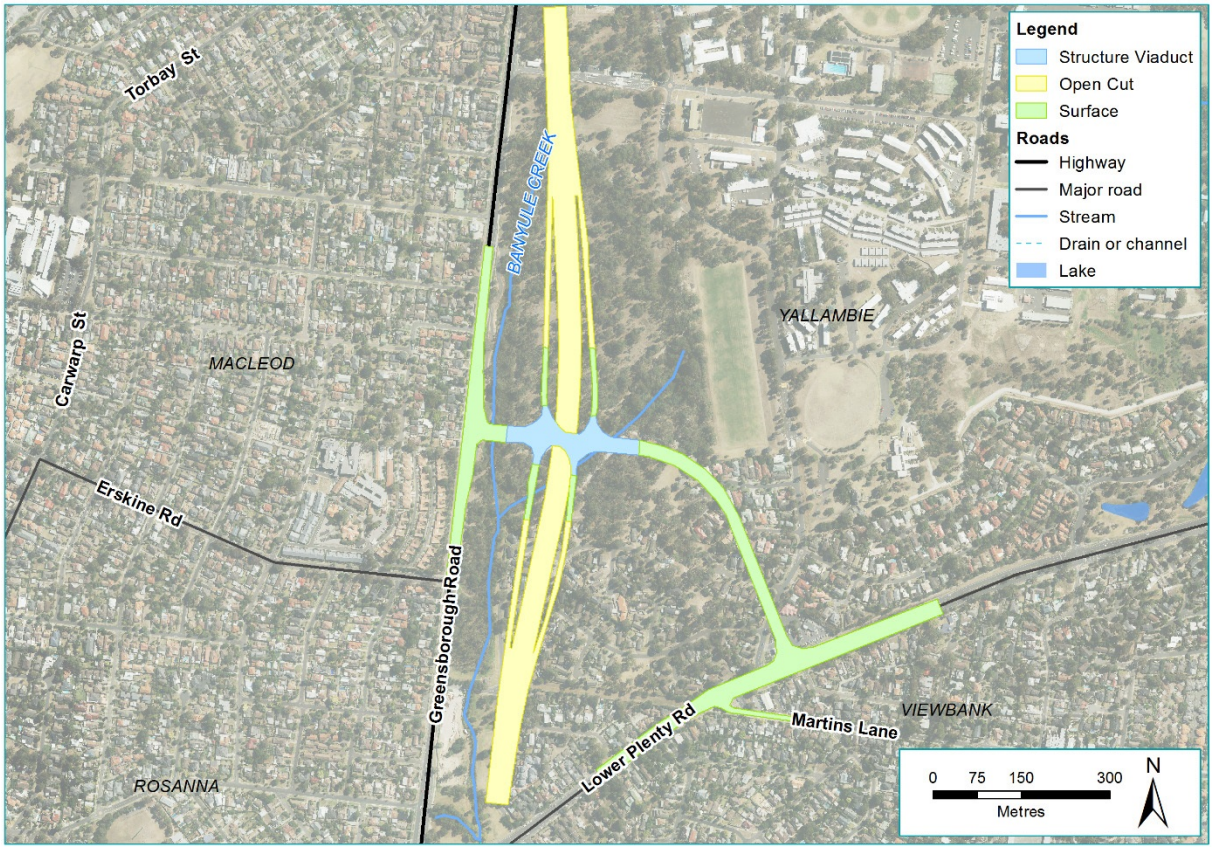
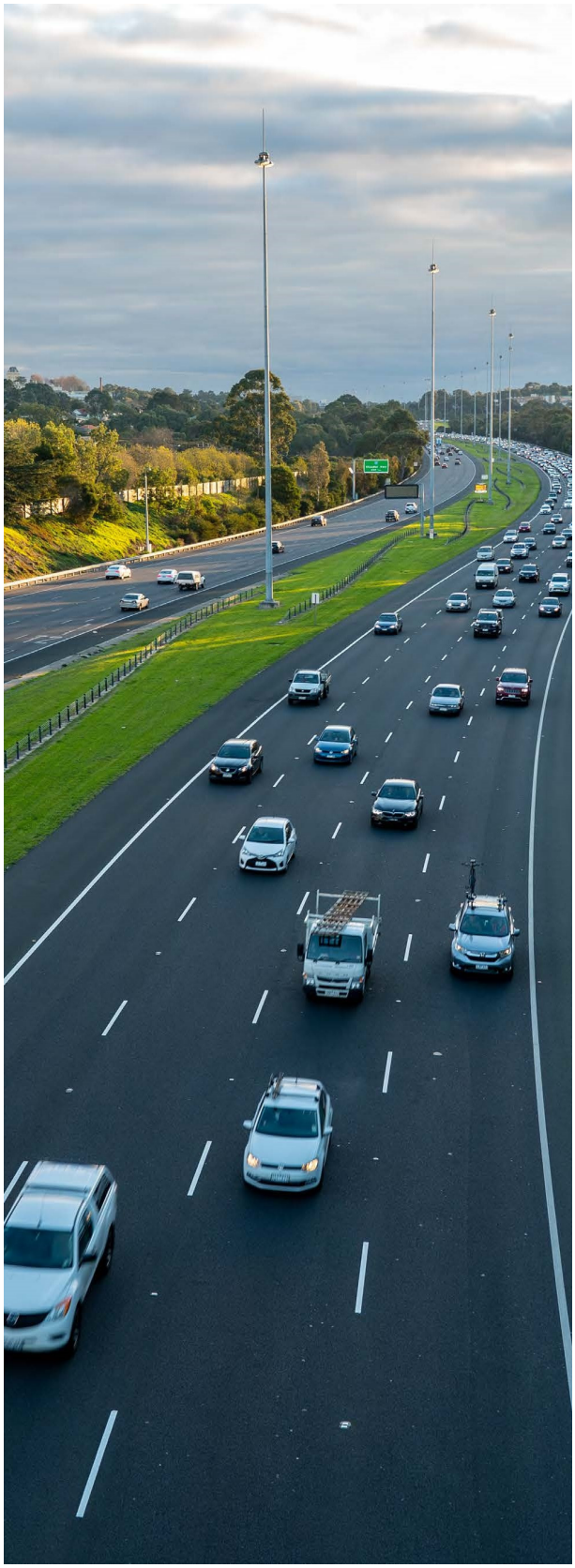


Figure 6-21 Option B: New interconnected road



Option C (reference project): Design connecting with both Greensborough Road and Lower Plenty Road

As a result of impacts to Simpson Barracks and residential properties associated with Options A and B considered above, an alternative interchange design Option C was developed (shown in Figure 6-22).

Option C would provide for all movements northbound and southbound. Transitioning from a trench structure into a tunnel. Southbound vehicles on North East Link north of the interchange would be able to exit to Lower Plenty Road via an exit ramp before the tunnel portal. This would enable oversized vehicles and placarded loads (vehicles carrying dangerous goods) that are travelling southbound to exit North East Link before the tunnel begins, as described in Section 6.4.1 above. Traffic on Lower Plenty Road would be able to enter the northbound carriageway via a ramp from Lower Plenty Road. Vehicles on Greensborough Road and Lower Plenty Road wishing to travel southbound in the tunnel would enter a ramp from Greensborough Road opposite Strathallan Road. Similarly, northbound vehicles in the tunnel wishing to exit to Greensborough Road or Lower Plenty Road would do so via an exit ramp near the tunnel portal, and come up to Greensborough Road opposite Strathallan Road. Despite these benefits, this layout still impacts Simpson Barracks (to a lesser extent than options A and B) and leads to a traffic functionality scenario which is less than optimal. This is due to the complex ramp layouts which are not as intuitive for drivers as in Option B.

Ultimately, the significant benefit of this option is that it aligns with the land planning and environment criteria around minimising land acquisition. This is because it contains the intersection within the road reserve (Greensborough Road) as much as practicable to reduce property impacts. While a small number of residential properties north of Lower Plenty Road would need to be acquired, there is a significant reduction in impacts to Simpson Barracks and removal of impacts to residential properties south of Lower Plenty Road. This option is therefore the preferred option and is included in the reference project.

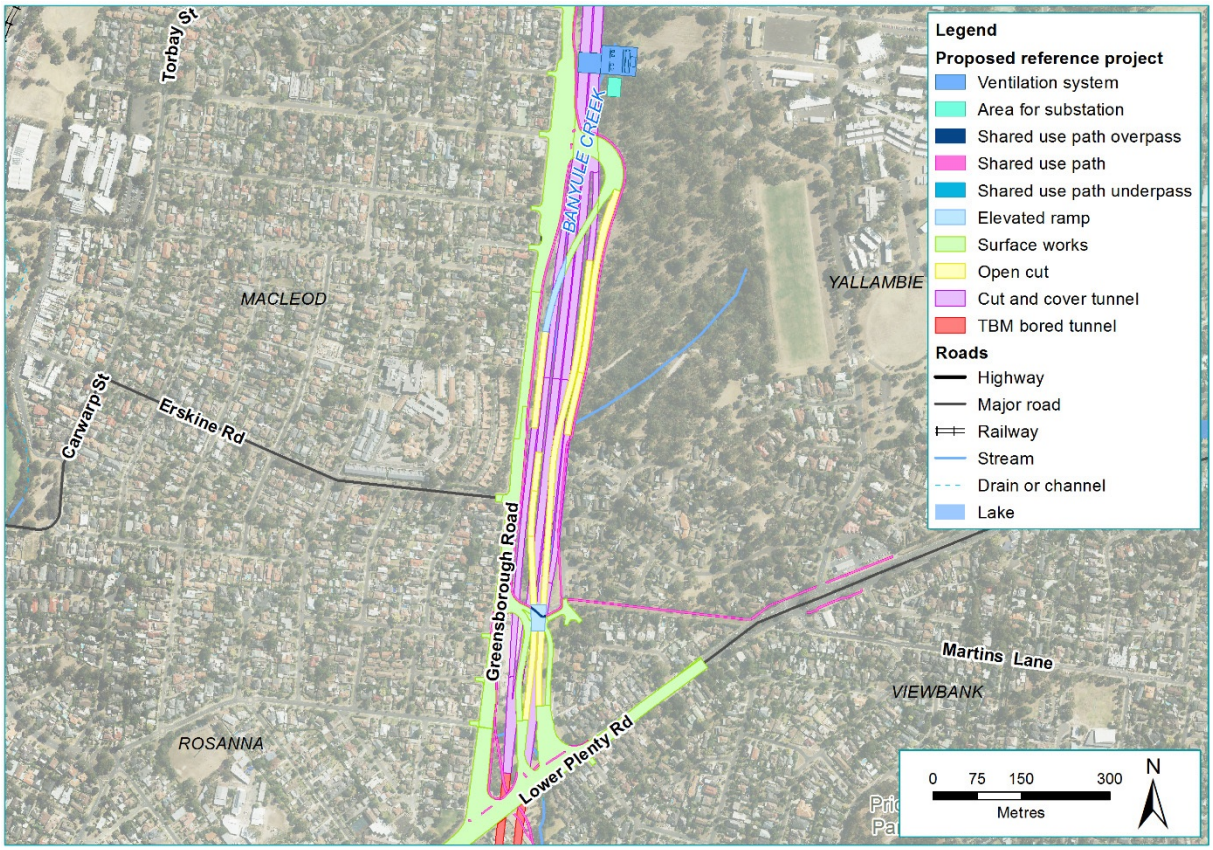


Figure 6-22 Option C (reference project): Lower Plenty Road interchange

Manningham Road interchange

The Manningham Road interchange provides access to both the southbound and northbound tunnels from Manningham Road and includes modifications to Manningham Road to maintain access to Bridge Street.

Key challenges associated with this interchange include:

- The challenging grade conditions associated with a portal interchange layout
- A number of significant community facilities and sensitive receptors
- A number of commercial and industrial properties.

As a result of these competing challenges, three key interchange layout options were considered:

- Option A – Traditional interchange layout
- Option B – Split diamond interchange with access to Avon Street (reference project)
- Option C – Split diamond interchange without access to Avon Street (reference project, alternative design).

Option A: Traditional interchange layout (diamond style interchange)

The feasibility of constructing a simpler diamond interchange for the Manningham Road interchange to avoid the requirement for large looped entry and exit ramps was considered. A number of issues were identified in assessing this option including:

- Design

  This option was found to be inefficient due to unacceptably steep ramp grades from and into the tunnel and insufficient capacity, as connections would only be provided to Manningham Road and not Bulleen Road.

- Land planning and environment

  This option would impact the area north of Bridge Street including the grounds of the Heide Museum of Modern Art, due to the requirement for a shallow, mined tunnel at this location. This would require significant surface construction works that would have an unacceptable impact on properties and stakeholders surrounding the interchange.

The assessment found that a diamond interchange at Manningham Road was not practicable as the impacts were considered to be too great at the concept phase. Accordingly, this option was not developed any further (no design drawings progressed) and a more location-specific and in some sections, complex, solution was developed.

Option B: Split diamond interchange with access to Avon Street (reference project proposed design)

In this option shown in Figure 6-23, the North East Link tunnel levels would be raised through the interchange site (to a minimum cover of 10 metres underneath Heide Museum of Modern Art) to simplify the design, the loop alignment is removed and there is a northbound direct entry ramp connecting to Bulleen Road at the southbound exit ramp terminal intersection located opposite Avon Street. This would reduce the cost of construction and reduce impacts to the Bulleen Industrial Precinct.

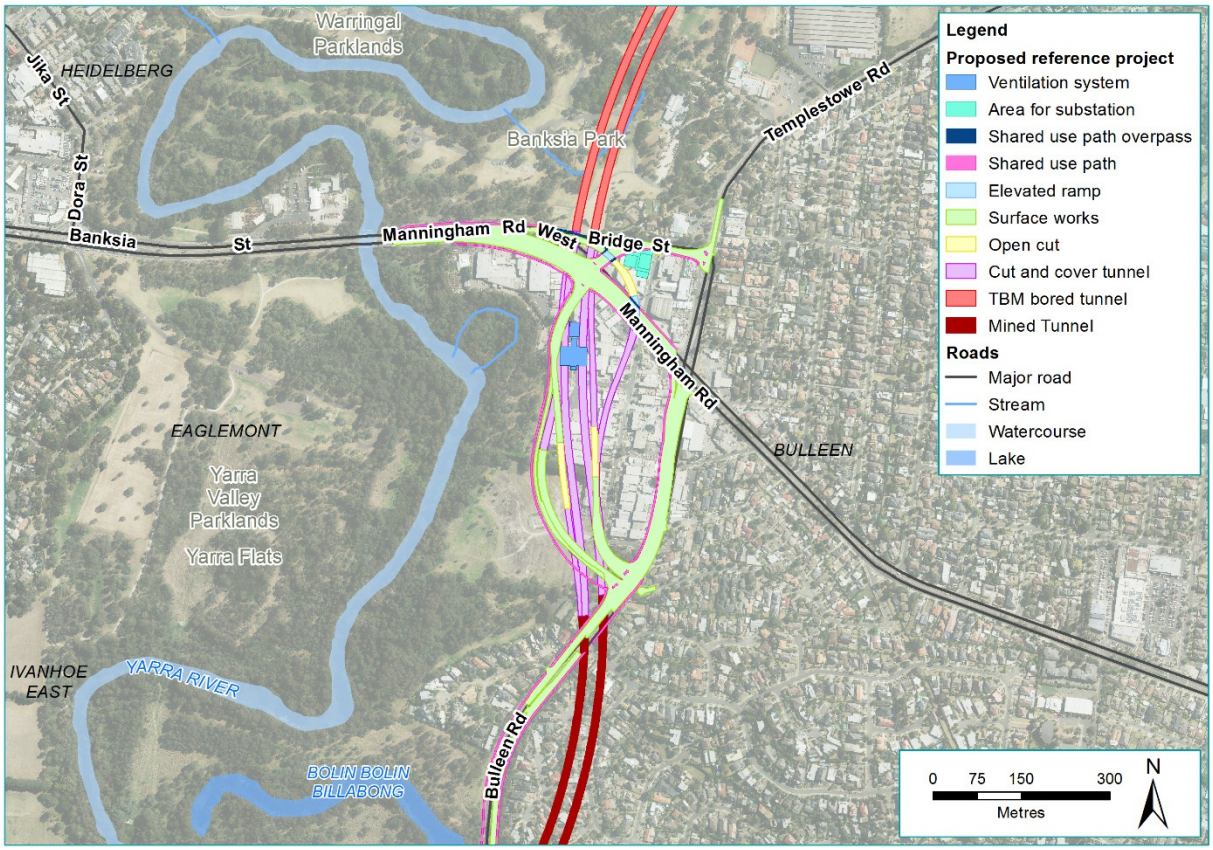


Figure 6-23 Option B: Manningham Road interchange (reference project proposed design)

Option C: Split diamond interchange without access to Avon Street (reference project alternative design)

Consisting of a combination of underground and surface roads extending from south of Bridge Street to just north of Golden Way, this option would provide entry to the northbound tunnel via Manningham Road for westbound traffic through a loop, and to the southbound tunnel via Manningham Road for eastbound traffic (as shown in Figure 6-24). Northbound tunnel traffic could exit via a ramp to Manningham Road and southbound traffic could exit via a ramp to Bulleen Road. This option would remove surface-level impacts on the Heide Museum of Modern Art by providing a minimum cover of 12.5 metres to the crown of the tunnel, which avoids the requirement for surface construction works north of Bridge Street. This interchange layout would also avoid impacts to residential properties south of the interchange. In addition, this option would minimise ramp grades and provides satisfactory traffic performance. However, this option has been identified as an expensive component of the project due in part to the deep and extensive cut and cover construction required, the complexity of the interchange design and the major impact on the Bulleen Industrial Precinct.

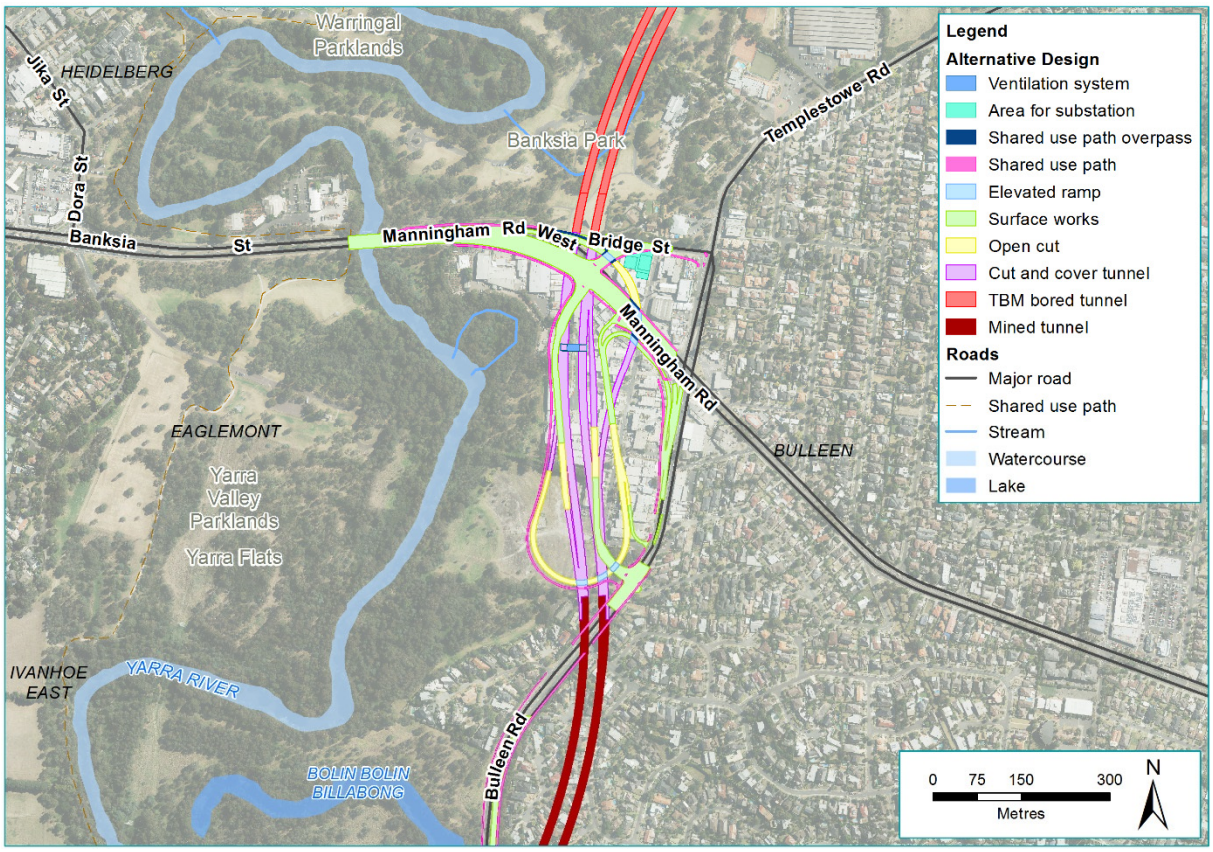


Figure 6-24 Option C: Manningham Road interchange (reference project alternative design)

Eastern Freeway interchange

The options associated with the Eastern Freeway interchange at the southern end of the project were largely determined by the tunnel alignment and elevation of the interchange. This was assessed in Section 6.4.1 above as part of the southern end tunnel length assessment.

6.4.3 Upgrading the Eastern Freeway

Why upgrade the Eastern Freeway?

The Eastern Freeway is one of the last metropolitan freeways in Melbourne to be upgraded to a fully managed motorway. Daily weekday traffic volumes along the Eastern Freeway range from 128,000 to 178,000 vehicles per day. Congestion can be attributed to three key challenges:

- Merging and weaving at interchanges
- Constrained capacity of the freeway ramps
- Constrained sections of road between interchanges.
- North East Link would compound this traffic congestion.

Where North East Link connects into the Eastern Freeway at Bulleen Road, demand for travel along the Eastern Freeway is expected to increase significantly. According to traffic modelling, approximately 75 per cent of traffic would travel easterly along the Eastern Freeway and 25 per cent to the west.

The Eastern Freeway would be upgraded and modernised between Hoddle Street in the west and Springvale Road in the east to integrate effectively with North East Link, and to cater for the increasing traffic volumes and changing travel demands and also provide greater capacity.

Upgrade works would include the widening of the Eastern Freeway to accommodate additional lanes and new dedicated bus lanes between Doncaster Road and Hoddle Street (the 'Doncaster Busway') (outlined in Section 6.4.4 below).

The options considered for the Eastern Freeway are illustrated in Figure 6-25.

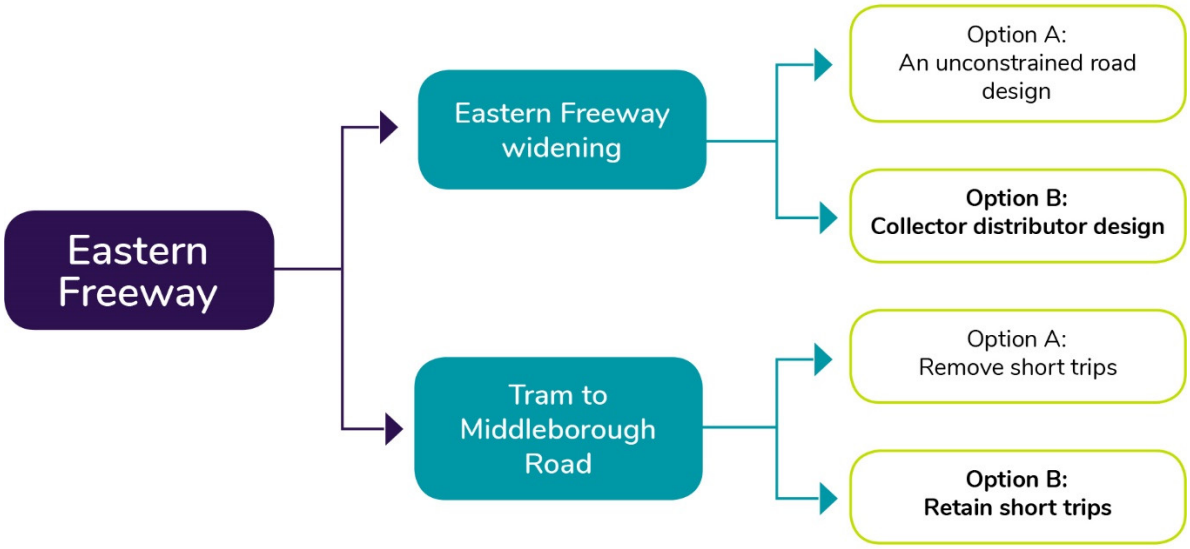


Figure 6-25 Design options for Eastern Freeway

Eastern Freeway widening

Two key road design options were available for the layout of the Eastern Freeway widening:

- Option A – An unconstrained road design
- Option B (reference project) – A collector distributor design.

Option A: An unconstrained road

The current layout of the Eastern Freeway is an unconstrained road where cars in any lane can merge and weave across the corridor in both directions. When high volumes of traffic enter and exit the freeway, the merging and weaving tangles traffic, slows it down and causes congestion. Short distances between entries and exits on the Eastern Freeway intensify the problem, as drivers are trying to move into the left lane to exit, at the same time as traffic is trying to merge on to the freeway.

This road layout, together with insufficient road width, has resulted in parts of the Eastern Freeway, particularly around Bulleen Road, operating close to capacity. During peak periods of the day, some sections are significantly over capacity: Station Street to Elgar Road, Elgar Road to Doncaster Road, and Doncaster Road to Bulleen Road in the PM peak and Springvale Road to Blackburn Road in the AM peak.

As a result of the existing traffic conditions, and the compounding impact of the construction of North East Link, widening using an unconstrained road design was not investigated further.

Option B (reference project): Collector-distributor design

A collector-distributor design for the Eastern Freeway would separate traffic travelling on 'express way' carriageways, from traffic entering and exiting the freeway on local access carriageways. These lanes would be separated by solid safety barriers. Traffic entering the freeway from the city and Chandler Highway would be able to access express lanes straight through to Middleborough Road, Blackburn Road, Springvale Road and the EastLink tunnel. This would accommodate weaving away from the express carriageway, and minimise the number of entry and exit points, while still providing additional capacity. To facilitate this capacity, new lanes would be added between Bulleen Road and Springvale Road, and between Chandler Highway and Bulleen Road to separate traffic staying on the freeway from traffic getting on and off North East Link and Bulleen Road.

By minimising weaving, this design solution would improve the efficiency of the freeway and the safety of drivers. Additional lanes would provide an acceptable level of capacity to support the existing levels of traffic as well as the additional traffic as a result of North East Link. This collector-distributor design layout was identified as the preferred option for the reference project. It is shown in Figure 6-26.

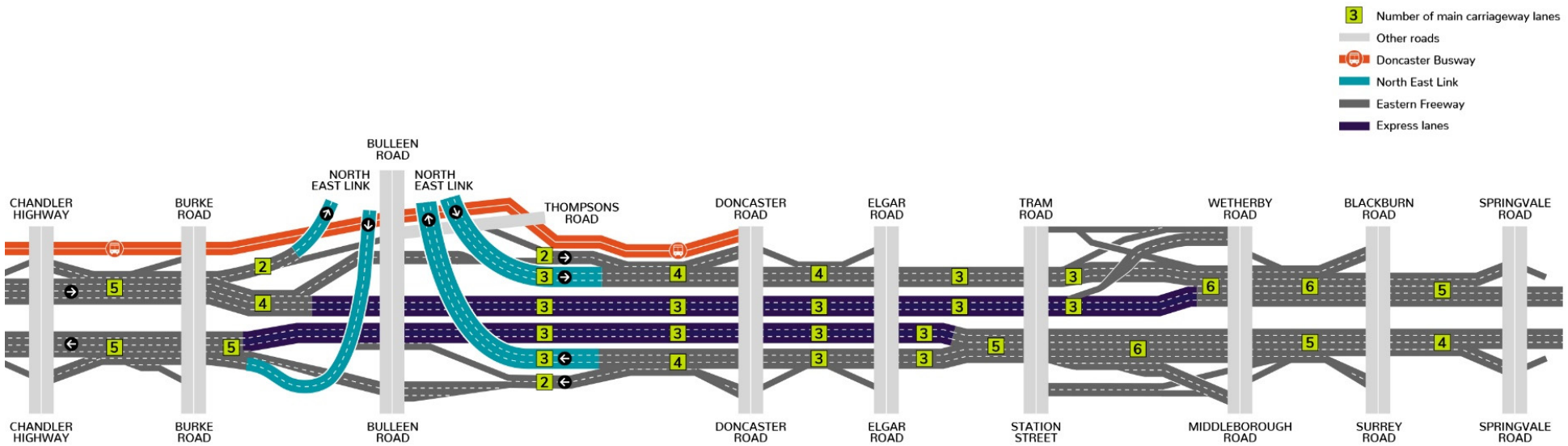


Figure 6-26 Option B (reference project) – Schematic lane diagram of Eastern Freeway upgrades

Tram Road to Middleborough Road short trips

The section of the Eastern Freeway between Tram Road and Middleborough Road is currently used by locals for short trips between Doncaster and Box Hill.

These short trips can be completed via the entry and exit ramps on both carriageways. While trips like this are usually undesirable on the freeway system, at this location this link provides a useful function in the road network, and is used by approximately 400–500 vehicles an hour. This is largely because the nearest alternative arterial road routes, Doncaster Road and Whitehorse Road, are remote from the Eastern Freeway and there are no easily useable local road alternatives between Doncaster Road and Whitehorse Road.

In the context of the collector-distributor design proposed for the Eastern Freeway, two options for these short trips were considered:

- Option A – Remove short trips
- Option B (reference project) – Retain short trips.

Option A: Remove short trips

This option looked at removing the short trip functionality due to the short distance between the entry ramp from Middleborough Road and the exit ramp to Tram Road. Facilitating this movement would require vehicles travelling in express lanes in the centre of the freeway to cross multiple lanes to reach the exit ramp at Middleborough Road. This kind of weaving has the potential to congest the freeway.

However, due to the significant number of locals who rely on these short trips, if removed, locals would need to use already congested local roads including Doncaster Road and Whitehorse Road. As a result, this option to remove short trips was not considered further, and further work was completed to identify whether short trips could be retained without compromising the functionality and safety of the freeway.

Option B (reference project): Retain short trips

This option provides a design solution which would retain short trips without impacting freeway functionality. This would be facilitated by providing dedicated lanes along braided ramps between Tram Road and Middleborough Road, which weave over and under each other to avoid merging and weaving on and off the freeway (as shown in Figure 6-27).

This design option would untangle these traffic movements on the freeway, keep traffic off local roads, maintain traffic flow along the Eastern Freeway and keep drivers safe.

What are braided ramps?

Braided ramps are grade separated ramps which look like a braid from above. They are used to separate merging traffic to improve safety and ease congestion. They can minimise merging and weaving of traffic and maximise freeway capacity.

The upgrades to the Eastern Freeway are described in more detail in Chapter 8 – Project Description and Chapter 9 – Traffic and transport.

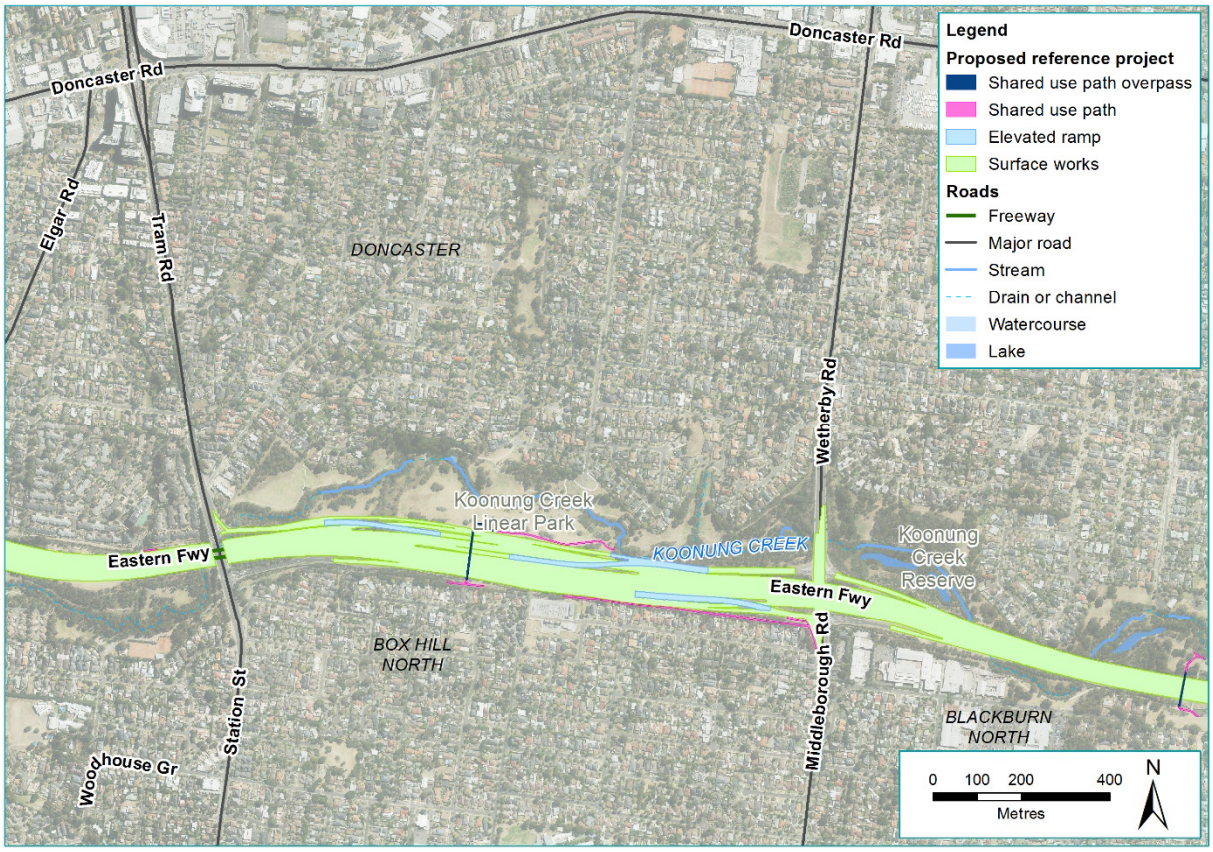


Figure 6-27 Option B (reference project): Short trips between Tram Road and Middleborough Road

6.4.4 Doncaster Busway

Why provide a busway?

The Doncaster Busway, as part of North East Link, is expected to:

- Enable buses to bypass congestion on the Eastern Freeway and its entry and exit ramps
- Improve the reliability of bus travel times along the Eastern Freeway, with the Doncaster Busway travel time along the Eastern Freeway between Doncaster Road and Hoddle Street predicted to be up to 30 per cent faster in 2036 when compared with the non-upgraded Eastern Freeway with no Doncaster Busway improvements
- Allow a higher frequency of services to be implemented, due to faster and more reliable trips between Doncaster Road and Hoddle Street.

Three options for the Doncaster Busway along the Eastern Freeway were assessed as described in Figure 6-28 below.

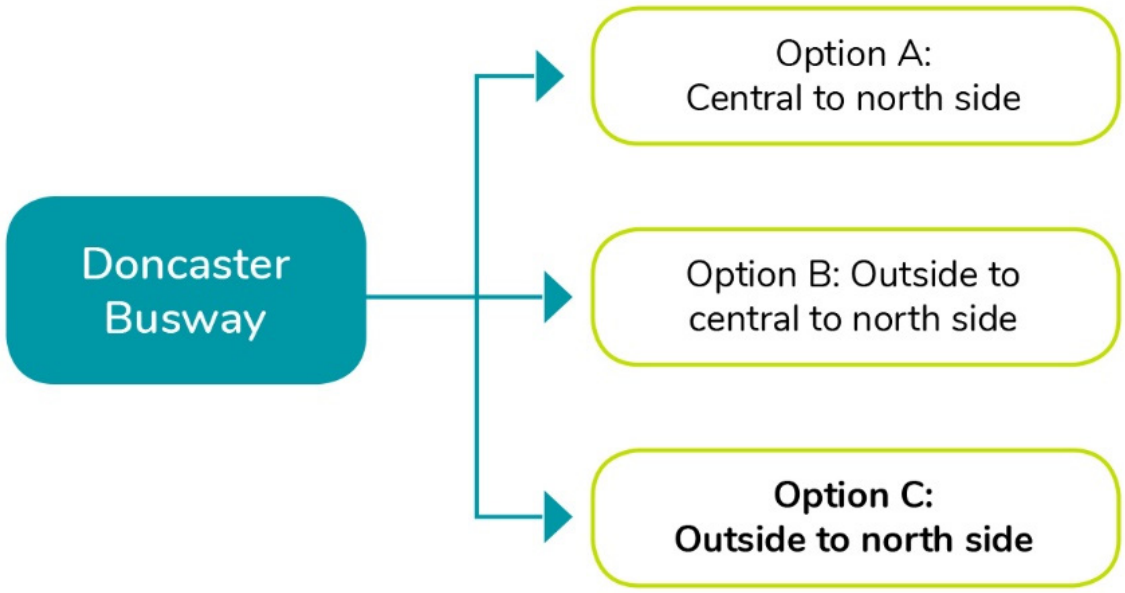


Figure 6-28 Figure 6 28 Design options for Doncaster Busway

Option A: Central median from Victoria Park and north side from Burke Road

This option would provide for a two-lane, two-way carriageway for the exclusive use of scheduled bus services predominantly along the median reservation of the Eastern Freeway from east of Hoddle Street to west of the Bulleen Road interchange with the Eastern Freeway. From just east of Burke Road the busway would move across the outbound carriageway of the freeway (on an elevated structure) then travel along the northern edge of the freeway to Doncaster Road in the east. At its western end, the busway would connect to the Victoria Park railway station precinct (east of the rail line) via an elevated structure over the inbound Eastern Freeway carriageway.

Option A was discounted due to key challenges for safely operating and maintaining dedicated bus lanes in the central median of an operational freeway. This design and functional layout would challenge emergency service access to the busway and also may create safety issues for passengers and other traffic if a bus broke down.

Further, Transport for Victoria advised the busway was to connect directly to Hoddle Street at its western end rather than directly to Victoria Park railway station. Transport for Victoria wishes to preserve an option for a potential future link from the Eastern Freeway busway to Victoria Park railway station.

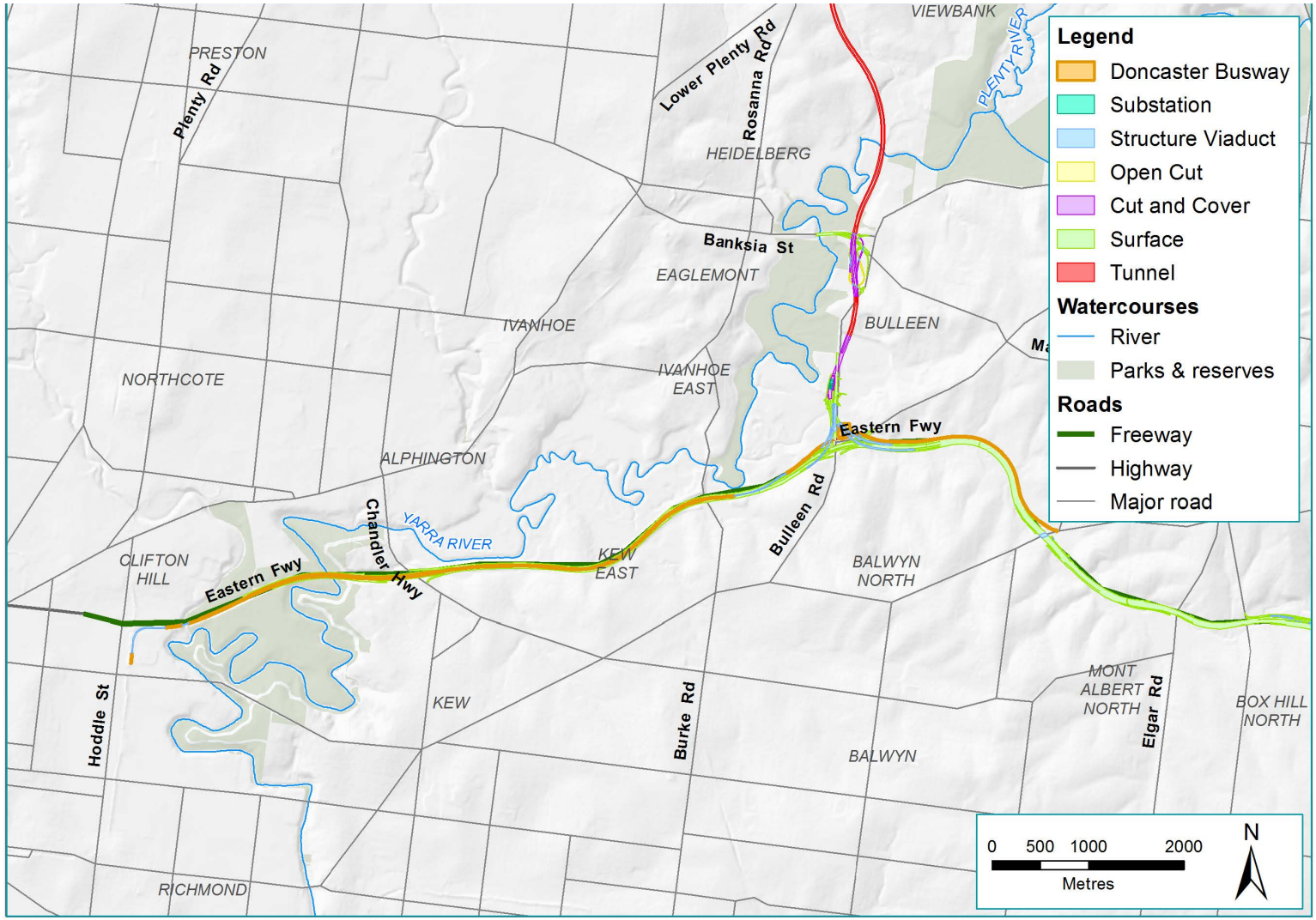


Figure 6-29 Option A: Doncaster busway central median from Victoria Park and north side from Burke Road

Option B: Outside lanes from Hoddle Street, central median from Chandler Highway and north side from Burke Road

This option would provide a dedicated busway on the existing shoulders of the Eastern Freeway between Hoddle Street and Chandler Highway. From Hoddle Street (in both directions), the busway would shift to the central median via underpasses at the Chandler Highway. East of Chandler Highway the busway would remain in the median up to the east of Burke Road before moving to the north side of the freeway, as described in Option A. See Option B in Figure 6-30.

Option B was discounted due to issues related to the ramp structures at Chandler Highway.

As described in Option A above, Option B was also removed from further consideration due to key challenges with being able to safely operate and maintain dedicated bus lanes in the central median of an operational freeway.

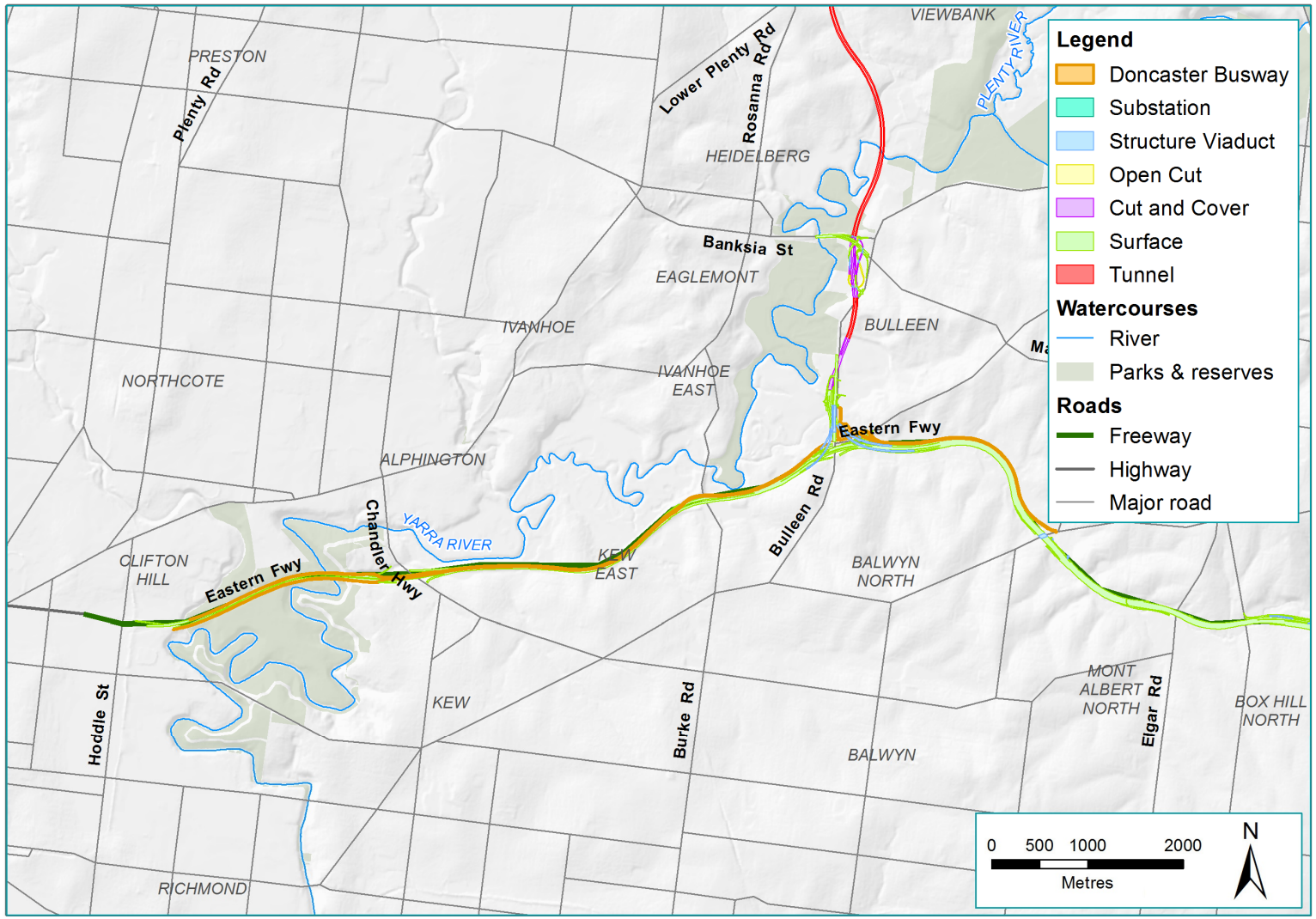


Figure 6-30 Option B: Doncaster Busway outside lanes from Hoddle Street, central median from Chandler Highway and north side from Burke Road

Option C (reference project): Outside lanes from Hoddle and north side from Chandler Highway

This option would include new dedicated bus lanes on the existing shoulders of both the east and west carriageways from Hoddle Street to the Chandler Highway interchange. From the Chandler Highway interchange, the outbound busway lane would pass under the outbound off ramp and remain on the north side of the Eastern Freeway. The inbound busway lane would pass from the northern side of the alignment over both Eastern Freeway carriageways and the inbound on-ramp before connecting to the shoulder. This overpass would be about the same height as Chandler Highway. Connections to and from the Chandler Highway and the busway west of Chandler Highway would also be accommodated. To provide sufficient space for the new dedicated bus lanes, traffic lanes would be shuffled into the median strip to avoid further land acquisition. Option C is shown in Figure 6-31.

Further development and analysis, including consultation with other agencies and bus operators, has found that Option C would provide the most acceptable and efficient outcome. This busway option would provide the following beneficial outcomes:

- A direct connection to the existing bus lanes on Hoddle Street and improved travel times
- It would not preclude bus stations at Chandler Highway and Burke Road
- It would allow bus routes on Chandler Highway to connect to the busway.

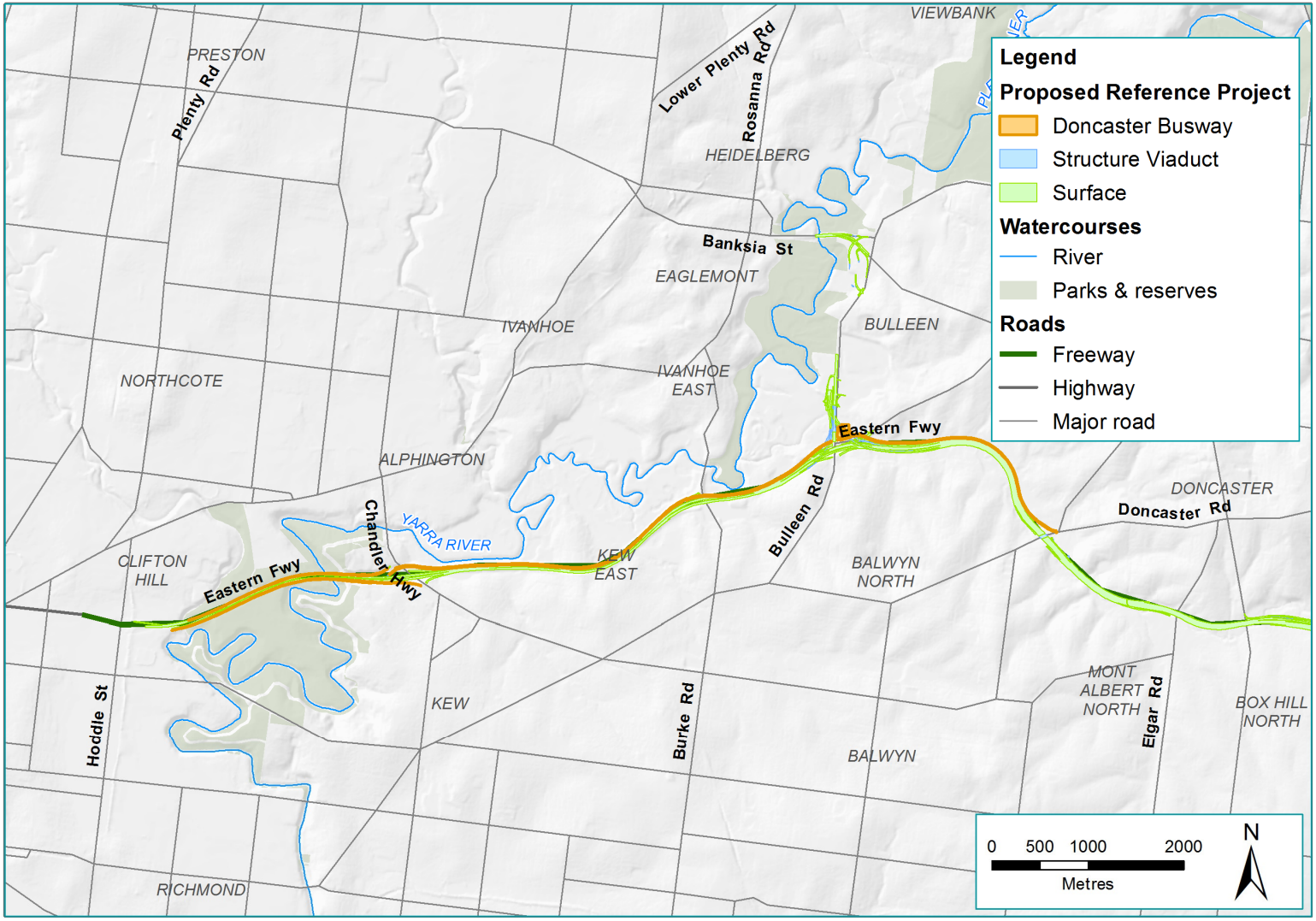


Figure 6-31 Option C (reference project): Doncaster Busway

6.5 The reference project

Following the review and refinement of options for the different key design elements, the reference project was developed for assessment as a part of this EES. In addition to the options described above, key changes made to the design elements were influenced by community and stakeholder engagement and the specialist studies.

Through a number of community design update information sessions and ongoing engagement with stakeholders and the community, key issues relevant to the community and stakeholders were incorporated into the options assessment for the reference project (see Chapter 5 – Communication and engagement for details on when and how feedback was sought).

The specialist assessments of North East Link impacts through the EES process also influenced the refinement of the reference project (see Chapters 9 onwards). This largely occurred through the identification of key impacts and collaboration with the design team to identify where impacts could be avoided or where they needed to be managed through the design. For example, as a result of early Aboriginal Cultural Heritage and Historical Heritage investigations, the EES team worked with the design team to avoid state-significant places including Bolin Bolin Billabong and the Heide Museum of Modern Art.

For a complete overview of the reference project, see Chapter 8 – Project description.