

SYDENHAM TO BANKSTOWN

ENVIRONMENTAL IMPACT STATEMENT

> Volume 1A – Main Volume

Transport for NSW
Sydney Metro City & Southwest
Sydenham to Bankstown upgrade
Environmental Impact Statement
Volume 1A – Parts A and B

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Appendices

Volume 1B

Appendix A - Secretary's environmental assessment requirements

Appendix B - Environmental Planning and Assessment Regulation 2000 checklist

Volume 1C

Appendix C – Sydenham to Bankstown Design Guidelines

Appendix D – Construction Environmental Management Framework

Appendix E – Construction Noise and Vibration Strategy

Appendix F – Sustainability Strategy

Appendix G – Temporary Transport Strategy

Appendix H – Urban Design and Place Making Paper

Appendix I – Utilities Management Framework

Volumes 2 to 6 – Technical papers

The following technical papers informed preparation of the Environmental Impact Statement

Volume 2

Technical Paper 1 – Traffic, transport and access assessment

Volume 3

Technical Paper 2 – Noise and vibration assessment

Volume 4

Technical Paper 3 – Non-Aboriginal heritage impact assessment

Technical Paper 4 – Aboriginal heritage assessment

Technical Paper 5 – Social impact assessment

Volume 5

Technical Paper 6 – Business impact assessment

Technical Paper 7 – Landscape and visual impact assessment

Volume 6

Technical Paper 8 – Hydrology, flooding and water quality assessment

Technical Paper 9 – Biodiversity assessment report

Certification

Submission of environmental impact statement

Prepared under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW).

Environmental impact statement prepared by:

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Qualifications:	BSc(Hons), Master of Urban and Regional Planning	BEng(Civil)(Hons)
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Responsible person (proponent):	Rodd Staples Program Director Sydney Metro Transport for NSW Level 43, 680 George St, Sydney NSW 2000	

Address of the land to which the statement relates:

Land within the Inner West and Canterbury-Bankstown local government areas as described within this Environmental Impact Statement.

Description of the infrastructure to which this statement relates:

Construction and operation of the Sydenham to Bankstown upgrade component of the Sydney Metro City & Southwest project.

Environmental impact statement:

An environmental impact statement is attached addressing all matters in accordance with Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) and Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (NSW).

Declaration:

I certify that I have prepared this environmental impact statement in accordance with the Secretary's environmental assessment requirements dated 23 March 2017. The environmental impact statement contains all available information that is relevant to the environmental assessment of the infrastructure to which the statement relates. To the best of my knowledge, the information contained in the environmental impact statement is neither false nor misleading.

Signature:



Name: Amanda Raleigh

Greg Marshall

Date: 7 September 2017

7 September 2017

Executive summary

Overview

The NSW Government has committed to building a significant piece of transport infrastructure by constructing Sydney Metro, a new standalone rail network identified in *Sydney's Rail Future*, providing 66 kilometres of metro rail line and 31 metro stations.

The NSW Government is currently delivering two stages of Sydney Metro – Sydney Metro Northwest (between Rouse Hill and Chatswood), and Sydney Metro City & Southwest (between Chatswood and Bankstown). The Sydney Metro Northwest project is currently under construction and will be operational in 2019.

Sydney Metro City & Southwest will extend Sydney Metro beyond Chatswood to Bankstown. Sydney Metro City & Southwest comprises two core components – the Chatswood to Sydenham project, and the Sydenham to Bankstown upgrade. Planning approval for the Chatswood to Sydenham project was granted in January 2017, with construction activities commencing in 2017.

Figure ES.1 shows the components of the Sydney Metro network.

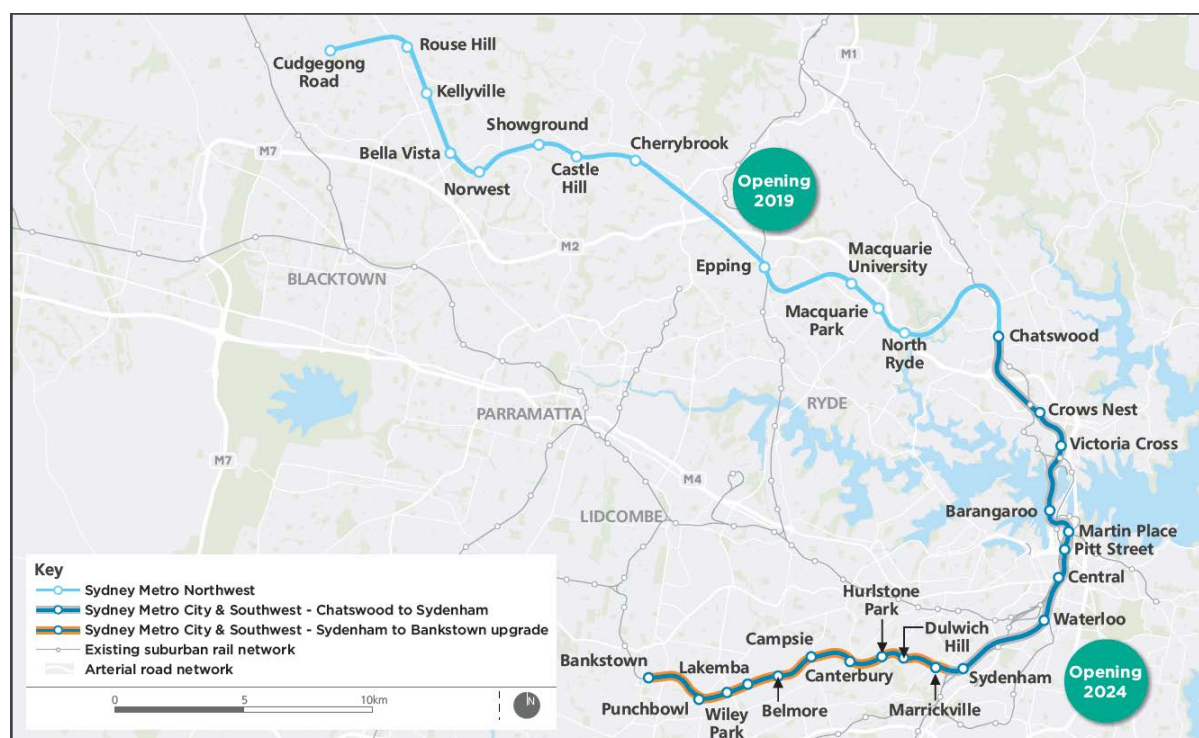


Figure ES.1 Sydney Metro

It is noted that the approved Chatswood to Sydenham project did not involve provision of additional stabling facilities, changes to the Sydney Trains tracks in the vicinity of Sydenham, or works to Sydenham Station prior to the Sydenham to Bankstown component of Sydney Metro City & Southwest being delivered. These works are currently the subject of an application to modify the Chatswood to Sydenham planning approval, to provide the opportunity for Sydney Metro City & Southwest to open in two phases. The first phase would involve services between Chatswood and Sydenham stations, while the second phase could extend Sydney Metro services to Bankstown.

Sydney Metro City & Southwest is planned to be completed by the end of 2024. This Environmental Impact Statement considers the potential impacts of the Sydenham to Bankstown

upgrade ('the project'). It has been prepared to support Transport for NSW's application for approval of the project in accordance with the requirements of Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Sydney Metro City & Southwest was declared to be critical State significant infrastructure in December 2015 due to its importance to the State, and is subject to approval by the NSW Minister for Planning. The Environmental Impact Statement addresses the environmental assessment requirements of the Secretary of the Department of Planning and Environment, dated 23 March 2017.

Sydney Metro

Sydney Metro is part of the NSW Government's infrastructure investment program to respond to the growth in transport demand in Sydney. Sydney Metro, together with other signalling and infrastructure upgrades across the Sydney rail network, will greatly increase the capacity of train services entering the Sydney CBD, from about 120 services an hour today, up to 200 services beyond 2024. This is an increase of up to 60 per cent capacity across the network to meet demand.

Sydney's existing suburban rail system can reliably carry 24,000 people an hour per line. Similar to other metro systems worldwide, Sydney Metro will have a long-term target capacity of about 40,000 customers per hour in each direction.

Sydney Metro will transform Sydney, cutting travel times, reducing congestion, and delivering economic and social benefits for generations to come. Sydney Metro will boost economic activity by more than \$5 billion a year, supporting major jobs and business growth along its route, by:

- improving access to jobs
- changing the way people move about the city and reducing congestion
- allowing people to travel quickly and easily from one key centre to another
- enabling housing and employment growth along Sydney's Global Economic Corridor and west to Bankstown
- encouraging greater commercial development and jobs in key areas
- delivering huge flow-on benefits across productivity, wages, and the state's overall economic performance.

Need for the project

Key challenges

Sydney is experiencing sustained population and economic growth. The need for Sydney Metro is driven by the challenges being experienced in responding to this growth, including the existing and future capacity of Sydney's transport infrastructure.

Over the next 15 years, Sydney will require transport infrastructure to support 40 per cent more train trips, 30 per cent more car trips, and 31 per cent more households.

The rail network is heavily congested, with customers on most rail lines regularly experiencing significant crowding on trains and station platforms during the morning and evening peaks.

As population and employment continue to grow, rail is forecast to experience the highest growth in travel demand, with an additional 100,000 trips expected during the morning peak by 2036.

It is forecast that without further investment, Sydney's rail network will reach capacity in the Sydney CBD and on critical suburban rail lines by the mid to late 2020s (Transport for NSW, 2012a).

The T3 Bankstown Line creates a significant bottleneck for the existing rail network. The line effectively slows down the network because of the way it merges with other railway lines close to the Sydney CBD, including the T2 Airport, Inner West & South Line.

In addition, parts of the T3 Bankstown Line are over 120 years old, with existing infrastructure in varying conditions. A key challenge for this line is customer accessibility, with five of the stations not having lifts. A number of the stations between Marrickville and Bankstown also have very large gaps between the platforms and trains, which makes access difficult for some customers, particularly the disabled, elderly, and those travelling with young children and prams.

Project need

The NSW Government's strategy for accommodating Sydney's future population growth over the next 20 years aims to ensure that a competitive economy is fostered with world-class services and transport. The Sydney Metro system would improve infrastructure and remove existing bottlenecks, providing faster and more reliable connections to jobs, education facilities, health services, and sports and recreation facilities.

As part of Sydney Metro, the project is a key component of *Sydney's Rail Future*, a plan to transform and modernise Sydney's rail network so that it can grow with the city's population and meet the needs of customers in the future.

The project is needed to further progress implementation of *Sydney's Rail Future* and Sydney Metro City & Southwest, enabling the provision of necessary public transport infrastructure to respond to the identified challenges and future demands. With at least 15 trains an hour or a train at least every four minutes in the peak when services start in 2024, the upgrade of the T3 Bankstown Line would deliver benefits across Sydney's rail network. These benefits would further increase when the number of trains increases to 20 per hour as part of the ultimate operations.

By converting the T3 Bankstown Line to metro and delivering greater efficiency and reliability along the line, the project would play a role in encouraging transit oriented urban development around stations between Sydenham and Bankstown. It would facilitate realisation of urban renewal priorities and objectives under the *Sydenham to Bankstown Urban Renewal Corridor Strategy* (Department of Planning and Environment, 2017).

A key element of the project is upgrading all stations along the corridor between Marrickville and Bankstown, to allow better and safer access for more people, by providing new concourses, level platforms, platform screen doors and lifts at all stations. Improvements would also be undertaken within the immediate area surrounding the stations to provide accessible interchange with other forms of transport.

Options considered

Option development has been an integral part of the overall design process for the project. The option selection process has formed part of each design stage, and has taken into account issues raised during consultation with key stakeholders, including government agencies and the community. Options were assessed against a range of criteria, including customer focus, constructability, operation, environmental impacts, accessibility, heritage and place-making considerations, risk and cost effectiveness.

Options were considered for station designs, constructability, track alignment, temporary transport arrangements, and construction programming. The station design process involved consideration of a range of options, in consultation with heritage stakeholders, to minimise the potential impacts

on heritage values. This included refinements to the design to allow the retention of heritage elements where practicable.

The design process also involved recognising the important place-making role of the stations, and consideration of a range of options for the design of key elements at each station, to respond to local place, the surrounding urban context, the functioning of local town centres and input from the community.

Transport for NSW will continue to develop the project to a greater level of detail in conjunction with the appointed design contractor. Transport for NSW will challenge the contractor to develop innovative solutions to detailed design and construction to achieve improved outcomes.

The detailed design and construction methodology proposed to deliver the project would be assessed for consistency with this Environmental Impact Statement and the terms of any approval granted by the Minister for Planning. If the detailed design or construction impacts are not considered to be consistent with any approval granted for the project, an application to modify the project would be lodged.

Place making and urban design

The design of the project has been informed by a detailed analysis of existing and future urban design, community, heritage, engineering, planning, constructability, financial, and environmental considerations. The design has been, and would continue to be, guided by the Sydney Metro City & Southwest Sydenham to Bankstown Design Guidelines (included as Appendix C to this EIS). The design guidelines emphasise the need to respond to place and context, acknowledge the existing conditions, and promote the need to improve the urban interfaces at each station. The overarching project design principle is to 'create welcoming, secure and well maintained public domain spaces and station buildings with an attractive sense of place that responds to the distinct cultures of each station precinct.'

Developing the project design involved a comprehensive urban design analysis. For each station, the design has taken local conditions and place-making opportunities into account, unified by an overall architectural style for Sydney Metro that supports each centre. An example of an artist's impression of a station is provided in Figure ES.2.

Council public domain plans for centres were considered, as well as the emerging character and likely built form of each centre, articulated by the NSW Government's urban renewal strategy for the Sydenham to Bankstown corridor (Department of Planning and Environment, 2015).

The urban design aspects would continue to be developed and refined during future design stages, taking into account considerations such as each station's place making role, future urban development opportunities, heritage, links to the surrounding town centres, and feedback from stakeholders and the community. To reflect local conditions and heritage values, heritage interpretation, public art, and landscaping would be incorporated into the design of each station, in accordance with the design guidelines, and based on consultation with local stakeholders.



Figure ES.2 Artist's impression of Punchbowl station

The project

The project involves upgrading 10 existing stations west of Sydenham (Marrickville to Bankstown inclusive), and a 13 kilometre long section of the Sydney Trains T3 Bankstown Line, between west of Sydenham Station and west of Bankstown Station, to improve accessibility for customers and meet the standards required for metro operations. The project would enable Sydney Metro to operate beyond Sydenham to Bankstown.

The location of the project is shown in Figure ES.3.

Project objectives

The primary objectives of the project are to:

- improve the quality of the transport experience
- provide a system that is able to satisfy long-term demand
- improve the resilience of the transport network

Secondary objectives are to:

- grow public transport patronage and mode share
- support the productivity of the Global Economic Corridor
- serve and stimulate urban development
- improve the efficiency and cost effectiveness of the public transport system
- implement a feasible solution recognising impacts, constraints and delivery risks.

The project also aims to

- deliver accessible, modern, secure and integrated transport infrastructure
- contribute to the accessibility and connectivity of existing and future communities.

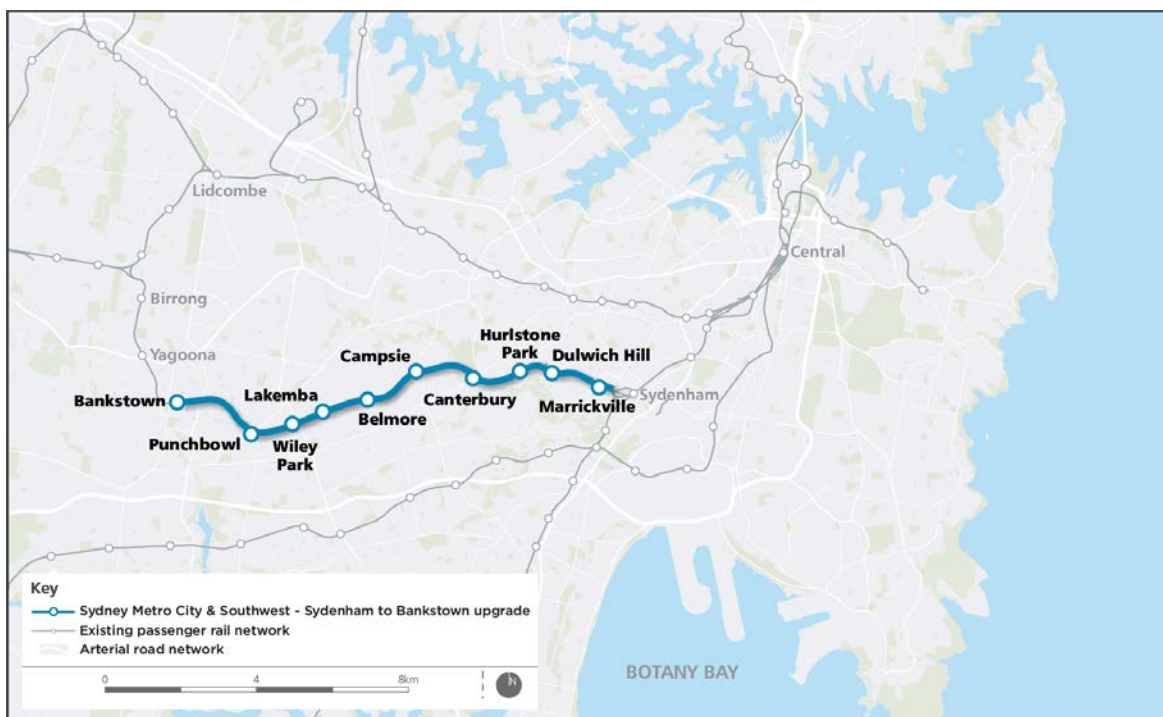


Figure ES.3 Location of the project

Works to upgrade access at stations

The project includes upgrading the 10 stations from Marrickville to Bankstown as required, to meet legislative requirements for accessible public transport, including the requirements of the *Disability Discrimination Act 1992* and the *Disability Standard for Accessible Public Transport 2002*. The proposed works include:

- works to platforms to address accessibility issues, including levelling and straightening platforms
- new station concourse and station entrance locations, including:
 - new stairs and ramps
 - new or relocated lifts
- provision of additional station facilities as required, including signage and canopies.

Works would also be undertaken in the areas around the stations to better integrate with other modes of transport, improve travel paths, and meet statutory accessibility requirements. This would include provision of pedestrian, cyclist, and other transport interchange facilities; as well as works to the public domain, including landscaping.

Works to convert stations and the rail line to Sydney Metro standards

Station works

In addition to the station upgrades to improve accessibility, works to meet the standards required for metro services would be carried out, including:

- installation of platform screen doors
- provision of operational facilities, such as station services buildings.

Track and rail system facility works

Upgrading the track and rail systems to enable operation of metro services would include:

- track works where required along the rail corridor, including upgrading tracks and adjusting alignments, between west of Sydenham Station and west of Bankstown Station
- new turn back facilities and track crossovers
- installing Sydney Metro rail systems and adjusting existing Sydney Trains rail systems
- overhead wiring adjustments.

Other works

Other works proposed to support Sydney Metro operations include:

- upgrading existing bridges and underpasses across the rail corridor
- installation of security measures, including fencing
- installation of noise barriers where required
- modifications to corridor access gates and tracks
- augmenting the existing power supply, including new traction substations and provision of new feeder cables
- utility and rail system protection and relocation works
- drainage works to reduce flooding and manage stormwater.

Active transport corridor and future rail corridor development

The project would also deliver:

- sections of an active transport corridor located around the station areas, to facilitate walking and cycling connections to each station and between Marrickville and Bankstown
- enabling works to support future rail corridor development at Campsie Station.

Construction of the project

Stages and timing

Construction of the project would commence once all necessary approvals are obtained (anticipated to be in early 2018) and would include the following stages of work:

- enabling works, including site establishment and building removal
- main construction works, including the station, track, and other works described above
- finishing works, including demobilisation, rehabilitation, landscaping and testing and commissioning.

Upgraded stations would be progressively delivered from 2019 until 2024. During this period, works to upgrade other infrastructure, such as bridges, embankments and drainage, would also be undertaken. An indicative construction program is provided in Figure ES.4.

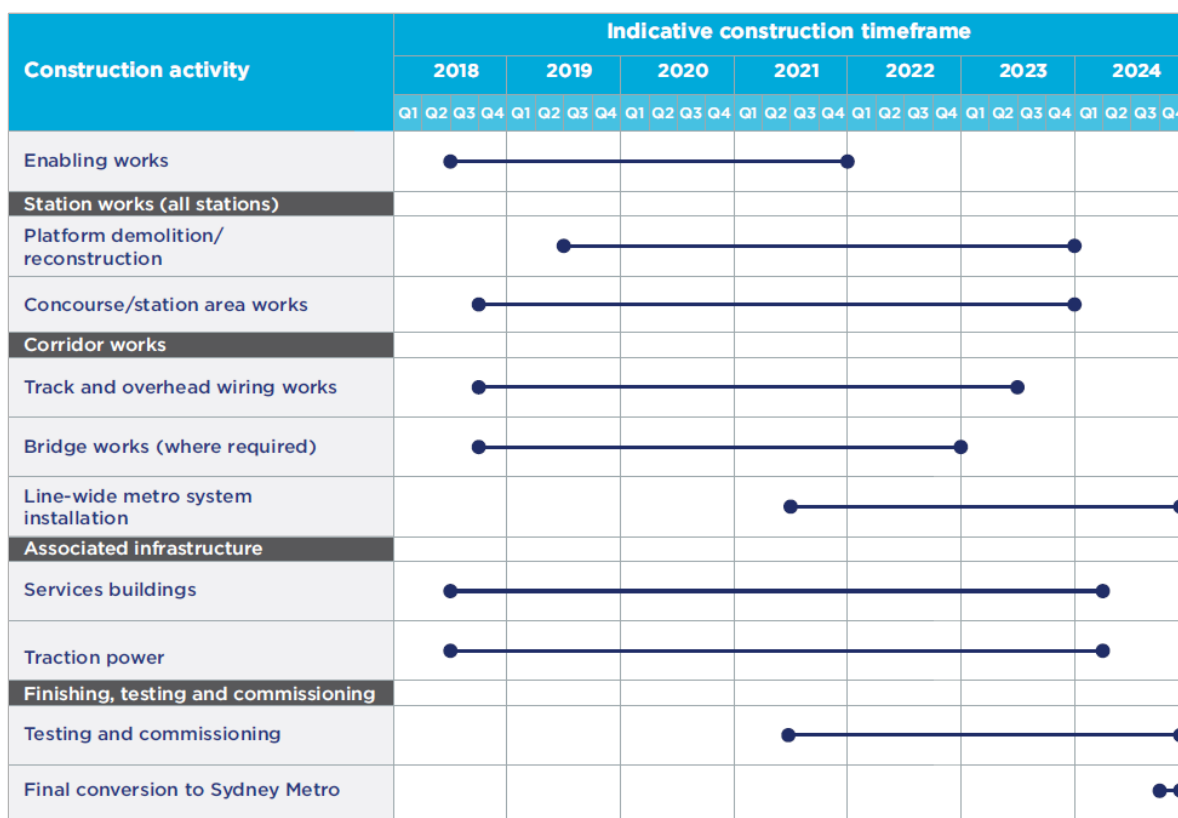


Figure ES.4 Indicative construction program

Possession periods

The T3 Bankstown Line would remain operational during the majority of the construction period. However, to ensure that works are completed as efficiently and safely as possible, and to accommodate works that cannot be undertaken when trains are operating, it is proposed to undertake some work during rail possession periods (i.e. periods where trains are not operating on the line). These works would include major station works, track works, and bridge works. It is anticipated that these rail possession periods would comprise the normal weekend maintenance possession periods (four each year), together with some longer possession periods during school holidays when rail patronage is lower.

A final, longer possession of about three to six months would also be required. This would involve full closure of the line to enable it to be converted to metro operations. This final possession period is to enable works that can only be completed once Sydney Trains services are not operating. It would include works such as the installation of new signalling, communication systems, and platform screen doors.

The indicative possession program would be reviewed during tendering, detailed design, and construction planning to ensure the available possessions are sufficient to complete the works and that the overall impacts to the community are reduced as far as possible.

During each possession period, a temporary transport management plan would be implemented, in accordance with the Temporary Transport Strategy (described below), to provide alternative public transport arrangements, and ensure that rail customers can still reach their destinations.

Prior to the final possession period, Transport for NSW would seek to have the first phase of Sydney Metro City & Southwest in operation, with metro services provided between Cudgegong Road Station in Rouse Hill and Sydenham Station.

Temporary Transport Strategy

A Temporary Transport Strategy (provided in Appendix G) has been developed to guide alternative public transport arrangements during construction, to minimise impacts on rail customers during possession periods and station closures. These arrangements would be detailed within a temporary transport management plan developed for each temporary closure of the rail line. The strategy includes:

- objectives for customers and replacement transport services
- customer markets to be served by the temporary transport management plans
- potential options to maintain public transport connections to and from all affected rail stations
- potential impacts associated with temporary transport options
- temporary transport facilities and measures required
- the process for developing temporary transport management plans, including stakeholder and community consultation
- performance outcomes for the temporary transport management plans.

The strategy would continue to be informed by stakeholder and community input, with the approach refined based on understanding customer needs and ongoing development of alternatives to deliver improved customer outcomes.

The components of the Temporary Transport Strategy are shown in Figure ES.5. The components include:

- buses that stop at all stations along the corridor
- buses that only stop at a limited number of stations before continuing as an express service to the end of the journey
- buses that move passengers to another rail line, such as the T2 Airport, Inner West & South Line, and the T1 North Shore, Northern & Western Line
- an increase in the frequency of existing bus services at specific locations, acknowledging that some customers may prefer to use those instead of the rail replacement bus service.

Operation of the project

Sydney Metro City & Southwest is expected to be fully operational by 2024. Once operational, metro trains would run between Chatswood and Bankstown stations in each direction, at least every four minutes in peak periods, averaging around 15 trains per hour. Customers would be able to interchange with Sydney Trains services at Sydenham and Bankstown stations as required to reach other destinations.

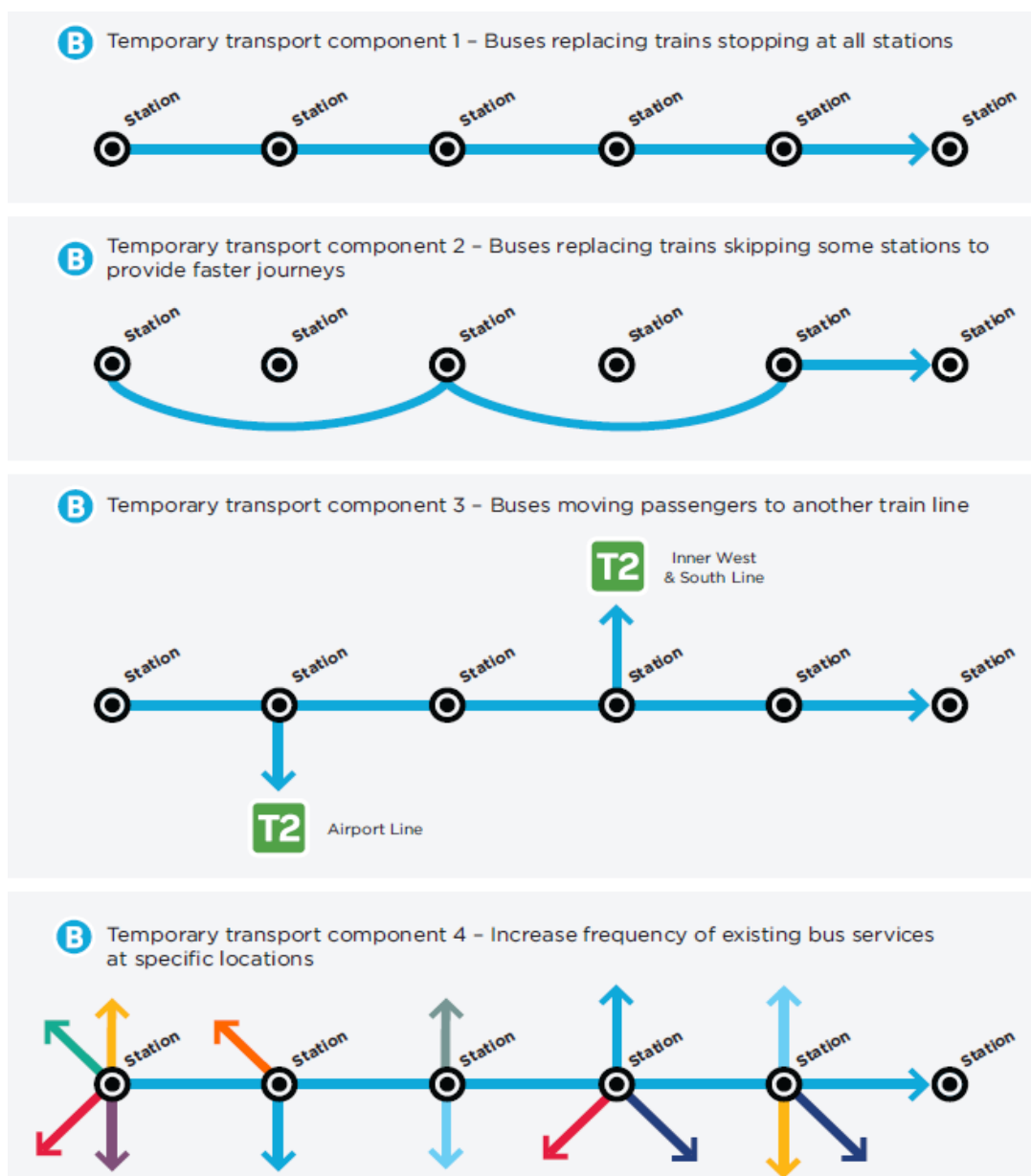


Figure ES.5 Components of the Temporary Transport Strategy

Stakeholder and community consultation

Stakeholder and community consultation for Sydney Metro is an ongoing process that commenced with the release of *Sydney's Rail Future* in 2012. Consultation with stakeholders and the community has occurred during the development of the project and preparation of this Environmental Impact Statement. The consultation strategy has been designed to inform the community and key stakeholders about the project, and encourage participation.

The following consultation activities were undertaken during preparation of the Environmental Impact Statement:

- a project update distributed in February 2017
- community information displays between January 2017 and May 2017
- a planning focus meeting in February 2017
- a community survey seeking feedback on alternative transport arrangements during the construction period

- meetings with relevant government agencies and key stakeholders
- engagement with customer focus groups to inform the designs of stations.

Transport for NSW will continue to work closely with key stakeholders and the community to minimise impacts or issues of concern. Consultation activities will continue as the project progresses to detailed design and construction.

During public exhibition of the Environmental Impact Statement, the community and other stakeholders will be invited to make written submissions about the project. Following exhibition, issues raised in these submissions will be summarised in a submissions report. Transport for NSW will consider the issues raised, and may make changes to the project as a result of submissions or to reduce impacts on the environment. The Minister for Planning will then make a decision about whether to approve the project.

If the project proceeds, Transport for NSW will continue to liaise with key stakeholders and the community during the detailed design and construction. This ongoing engagement process will play an important role in reducing the potential impacts and enhancing the benefits of the project for all stakeholders.

Summary of the key findings

The following sections provide a summary of the key findings of the environmental assessment. The environmental assessment considers the potential for impacts to the project area (defined as the area that would be directly impacted by construction of the project, and including the location of operational infrastructure), as well as the broader study area, where relevant. The environmental assessment was informed by specialist technical assessments of the key environmental issues defined by the Secretary's environmental assessment requirements, and an assessment of other potential issues identified in the State Significant Infrastructure Application Report. The potential impacts of construction and operation were assessed.

Traffic, transport and access

The project area is located within a highly urbanised environment, comprising a number of main roads, and a range of other transport facilities and infrastructure, including the T3 Bankstown Line, train stations, bus stops, light rail, freight rail, pedestrian, and cycle facilities.

Key potential construction impacts

During construction, there would be some impacts to the road network and intersections within and/or connected to the project area. The impact assessment for road traffic during construction considered:

- the use of the road network by construction vehicles, including worker transport
- the combined effects of the construction vehicles with road diversions and lane closures resulting from the proposed works to bridges that cross the corridor
- the potential impacts on the road network of alternative transport arrangements during possessions and/or station closures, guided by the Temporary Transport Strategy.

The assessment concluded that only one intersection, near Lakemba Station, has the potential to experience major delays during construction as a result of construction vehicles. Despite this prediction, it is expected that traffic would redistribute to other intersections, without the need for modification.

The project includes works to bridges located along the rail corridor, which would require partial or full closures at certain times to undertake the works. To minimise congestion and potential delays, these works would generally need to be undertaken outside of peak periods, and potentially at night.

Construction works and the final conversion of the T3 Bankstown Line to support a metro system would require temporary closures of the train line, involving a range of weekend and school holiday possession periods, and a final longer possession period of about three to six months. During these possession periods, about 100,000 customer journeys would be affected each day.

The proposed Temporary Transport Strategy (provided in Appendix G) would guide the provision of alternative public transport arrangements during construction, to minimise impacts on customers during possession periods and station closures. Each temporary transport management plan would be developed to guide the provision of alternative transport arrangements during a specific possession period, in consultation with relevant stakeholders and the community.

Specific initiatives and detailed alternative transport arrangements would be defined by the temporary transport management plans. These initiatives may include:

- increasing train services on other lines
- improving cycle facilities at stations on other lines, for customers who want to continue cycling as part of their journey
- potential road network enhancements and/or bus interchange improvements to support replacement bus operations and reduce their impact on the road network.

Transport for NSW would continue to work to ensure that construction traffic, transport, and access impacts, including disruptions to customers' travel plans and delays to road users, are minimised.

Key potential operation benefits

Once operational, the project would provide more than twice as many trains per hour in peak periods, reducing the waiting time for customers, and significantly improving the capacity and reliability of the rail network. The travel time savings resulting from the project are one of the factors that would encourage people to use Sydney Metro, reducing travel times and providing customers better access to job opportunities and housing choices across Sydney, with fast, more frequent, and direct connections.

The other significant benefit of the project is the accessibility improvements that would be provided along paths to, and within, stations which will provide safe and accessible public transport for all users. The station access hierarchy, shown in Figure ES.6, was used as the basis for the design to ensure that the design of stations, and their integration with other transport modes, gives the highest priority to walking and cycling, followed by public transport. Active transport to stations would continue to be prioritised, with upgrades to pedestrian and cycle facilities to make paths safer and more accessible. The station and train carriage design would also cater for vision and mobility impaired customers.



Figure ES.6 Station access hierarchy

Transport for NSW will work with the Department of Planning and Environment to support the development of an active transport corridor, including walking and cycling infrastructure. As part of the project, Transport for NSW would deliver sections of the active transport corridor around stations. This would facilitate walking and cycling connections to important destinations in the local area and region. When complete, the active transport corridor will link public transport interchanges between Marrickville and Bankstown, and encourage more active, healthier lifestyles.

The project would also benefit bus customers by enhancing connections between bus and rail services, and providing bus stops as close as practicable and with accessible paths to station entries.

Other accessibility benefits of the project include:

- improving the interchange with bus, light rail, pedestrian, and cycling networks, and provision of additional and more convenient taxi, kiss and ride, and bike parking facilities at all stations
- enhancing the accessibility of each station precinct with regard to walking and cycling
- providing infrastructure to ensure that the travel paths between different transport modes meet statutory accessibility requirements.

Noise and vibration

The project area is located in an established urban environment already subject to various sources of noise, including noise generated by the movement of trains along the rail corridor (both passenger and freight trains where relevant), and traffic on the road network. Numerous noise sensitive receivers, including residences and commercial premises, are located close to the project area.

Key potential construction impacts

Potential noise emissions from construction activities were predicted by the noise and vibration assessment in accordance with the *Interim Construction Noise Guideline* (DECC, 2009), by

assuming that the loudest plant for each activity operates at the edge of the work site closest to the receiver, which represents a conservative assessment approach.

The project includes works which cannot be safely undertaken while the rail network is operational. While works would be undertaken during the recommended standard hours defined by the *Interim Construction Noise Guideline*, there would also be a need to undertake works during evenings, at night, and on weekends and public holidays, particularly during rail possession periods.

The noise and vibration assessment concluded that construction activities have the potential to impact surrounding noise sensitive receivers. Exceedances were predicted at most sites for the majority of construction scenarios modelled, with a number of exceedances at residential receivers being greater than 20 decibels above the relevant criteria during the day and night. However, these predictions identify noise levels at the most exposed receiver, which may not be reached, or only infrequently reached, during the construction period. The use of noise intensive construction equipment was found to broadly correlate with construction activities resulting in exceedances of the noise criteria. It is noted that noise intensive construction equipment would not be used for the majority of the construction period. Construction planning would endeavour to minimise the use of this equipment during more sensitive periods.

Road traffic noise was assessed using the preliminary estimate of construction traffic volumes and implementation of alternative transport arrangements during a rail possession period. This assessment found that construction vehicles, rail replacement buses, or a combination of both would result in an increase of greater than two decibels above existing noise conditions along 10 roads. These roads are located in the vicinity of stations east of and around Campsie Station.

A large number of buildings adjacent to the project area are predicted to be located within the recommended offset distance for potential amenity and cosmetic damage resulting from vibration. These impacts are predicted in the event that large hydraulic rock breakers are used at the edge of the work site closest to the receiver. In practice, this may not be necessary and vibration impacts would be intermittent over the duration of construction.

For structures where the vibration levels are predicted to exceed the criteria, a more detailed assessment of the structure and vibration monitoring would be undertaken during detailed design and construction, to ensure that vibration levels remain within appropriate limits.

Given the proximity of construction to a number of heritage items, particularly at stations, there is the potential for vibration impacts if appropriate mitigation measures are not implemented. For heritage items, a more detailed assessment would be undertaken to identify necessary mitigation and monitoring requirements, taking into account the heritage values of the item.

A Construction Noise and Vibration Strategy (provided in Appendix E) has been developed for the Sydney Metro program to provide a framework for implementing appropriate mitigation measures. The strategy provides for the preparation of detailed construction noise impact statements once construction methods are defined at each location, and more detailed assessments of the potential for vibration impacts. Further measures to minimise and manage construction noise and vibration impacts would be identified during detailed design and construction planning in close consultation affected receivers.

Key potential operation impacts

Predictions of future rail noise levels without the project indicate that noise levels would be generally close to, or exceed, the trigger levels identified by the *Rail Infrastructure Noise Guideline* (EPA, 2013) ('the RING'). It is predicted that future noise levels would exceed the RING trigger levels in eight of the twelve noise catchment areas in the study area. Overall, the addition of the project is not predicted to result in significant increases in rail noise – in most instances, the

increase in noise as a result of the project would be less than two decibels which would be barely perceptible.

The majority of exceedances are predicted to occur in the Punchbowl and Bankstown noise catchment areas. These exceedances would be minimised by implementing noise mitigation measures. Feasible and reasonable mitigation measures, such as noise barriers and at-property treatments, would be considered where exceedances have been identified. The final form and location of mitigation measures would be determined during detailed design.

While exceedances of groundborne noise criteria are predicted, airborne noise levels would be more substantial and therefore no mitigation is required. No exceedances of vibration criteria are predicted.

Non-Aboriginal heritage

The project area contains substantial historical resources of significance. All 10 railway stations in the project area are heritage listed. Three stations (Marrickville, Canterbury and Belmore stations) are listed on the State Heritage Register, and the others are subject to listings on local environmental plans and/or a State agency Section 170 heritage register.

Two items listed on the State Heritage Register (Sewage Pumping Station 271 in Marrickville and the Old Sugarmill in Canterbury) are located adjacent to the project area. A number of other locally listed items are located adjacent to, or within 25 metres of the project area. In addition, the project area passes through or adjacent to two heritage conservation areas.

The approach to the design has been to retain as many significant heritage items and/or elements as possible, with particular focus given to items listed on the State Heritage Register. Potential adaptive reuse for the retained items would be determined during detailed design. The design process for the project involved significant work to minimise direct impacts to heritage items as far as possible. However in some instances, to meet accessibility standards and Sydney Metro operational requirements, there has been no alternative to the changes proposed. For example, platforms need to be reconstructed along the alignment to provide safer and easier access to trains.

The main potential for impacts to non-Aboriginal heritage would occur during the construction phase. The project would result in the removal of one or more heritage elements at each station, which would directly impact on heritage listed items as follows:

- a major direct and visual impact to the State Heritage Register listed Marrickville Railway Station Group, mainly as a result of upgrading the Illawarra Road overbridge
- moderate direct and visual impacts to the State Heritage Register listed Canterbury and Belmore railway station groups as a result of the removal some heritage elements associated with these items
- major direct and visual impacts to four locally listed heritage items (Dulwich Hill, Hurlstone Park, Wiley Park, and Punchbowl railway station groups) as a result of the removal of heritage elements associated with these items
- moderate direct and visual impacts to three locally listed heritage items (Campsie, Lakemba, and Bankstown railway station groups) as a result of the removal of some heritage elements associated with these items.

Despite these impacts, the assessment concluded that the T3 Bankstown Line would continue to retain some of its heritage values and demonstrate the historical phases of development of the line. The most significant stations (Marrickville, Canterbury, and Belmore), dating from the first

development period, would retain their significant, near-identical brick buildings of exceptional significance.

Stations representing the second period of development of the line would be conserved largely in their existing states. Lakemba and Bankstown's island platform configurations and platform buildings would be retained. Punchbowl Station would be subject to greater impacts as it would be fully redeveloped.

Stations representing the inter-war development period would be impacted, with Wiley Park Station being fully redeveloped. The inter-war phase of redevelopment of Dulwich Hill Station would also be altered, with the loss of the overhead booking office and major visual impacts on the station building, although the building and the island platform configuration would be conserved.

Examples of each significant platform building type between Marrickville and Bankstown would be conserved.

The project would also have a moderate direct impact on the locally listed Canterbury (Cooks River) Underbridge, as a result of the proposed removal and replacement of the parapets during bridge maintenance and protection works.

The assessment concluded that all State heritage listed items would continue to meet the threshold for State significance following completion of the project. However, two locally listed items (Wiley Park and Punchbowl railway station groups) would no longer meet the threshold for local significance and would likely be de-listed.

In addition to archival recording, additional management and mitigation measures would be implemented to minimise heritage impacts. Measures include considering opportunities for the retention, conservation, and/or reuse of original and significant heritage fabric where impacts are unavoidable. Appropriate landscape treatments, architectural design, and heritage interpretation would be incorporated into the detailed design. A conservation management plan would be prepared for all State Heritage Register listed stations, in accordance with NSW Heritage Council guidelines.

Aboriginal heritage

No listed Aboriginal sites are located within the project area. The closest previously recorded Aboriginal heritage site is a potential archaeological deposit (PAD) (the Fraser Park PAD) located about 650 metres north-east of the project area boundary. Two areas of potential archaeological deposits were identified during field surveys near Belmore and Punchbowl stations (S2B PAD 01 and S2B PAD 02 respectively).

The archaeological significance of the project area within the existing rail corridor is considered to be low as a result of the high levels of ground disturbance. S2B PAD 01, which is located outside the project area is considered to have low to moderate significance, while S2B PAD 02 is considered to have moderate significance, and low to moderate potential for intact archaeological deposits to be identified.

The main potential for impacts to Aboriginal heritage would occur during the construction phase. Construction of the project would not impact any previously recorded Aboriginal heritage sites, however S2B PAD 02 would be impacted by the proposed new access way from Punchbowl Road to Punchbowl Station, and proposed landscaping works. S2B PAD 01 would not be impacted.

Appropriate mitigation measures have been recommended to manage this impact, including preparation of an Aboriginal Cultural Heritage Assessment Report, and archaeological test excavation where impacts cannot be avoided.

Land use and property

The study area consists of a varied and relatively dense mix of land uses, including residential, commercial, industrial, transport infrastructure, community, health, education, and recreation. The majority of the project area is used for transport purposes (rail and road) and is public land managed by State Government agencies.

The design of the project has had regard to relevant strategic planning policies and strategies, and proposed future land uses provided by these strategies, including *A Plan for Growing Sydney* (NSW Government, 2014), the draft *Sydenham to Bankstown Urban Renewal Corridor Strategy*, and relevant district plans prepared by the Greater Sydney Commission.

Key potential construction impacts

Property acquisition would occur during the project planning and pre-construction phases.

A direct impact on property and land use is expected where land would be acquired at Marrickville and Punchbowl stations for the provision of station entrances, plazas, and shared zones. To enable development of the proposed western entrance, concourse, and shared zone at Marrickville Station, three privately owned lots (one residential and two commercial lots) would need to be acquired, and a portion of publicly owned land (in Station Street) would also need to be acquired. All acquisitions would be managed in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

Similarly, a portion of publicly owned land in Station Street, Marrickville and two parcels of public land at Warren Reserve at Punchbowl Station would be required to enable development of the new station entrances and concourse areas.

The majority of construction sites would be located within the existing rail corridor to minimise direct impacts on land use and property. However, direct impacts on land use during construction would include temporary land take and the short term presence of construction equipment, plant, vehicles, and fenced work sites along the proposal site. During construction, the use of the land would change from a transport corridor (the main land use of the majority of the project area) to a construction site. Land subject to acquisition would change from its existing use (commercial, residential, public road, and reserve) to a construction site. Public access would be restricted. The impacts to Warren Reserve would be limited to a small portion of the overall reserve, located adjacent the existing rail corridor.

Other temporary land use impacts during construction would include construction of an underground detention basin in the north-western portion of McNeilly Park in Marrickville, which would restrict the use of this land during construction of the basin. The area above the basin would be restored and returned to public use when construction of the basin is complete.

Key potential operation impacts

Direct operational impacts on land use would be limited to the change in use for those areas of land and properties that would be acquired for the location of permanent operational infrastructure. Land acquired near Marrickville Station would change use, from commercial, road, and residential, to transport. Land acquired near Punchbowl station would change use from reserve/open space to transport.

Although the project would have no major direct operational impacts on land use or properties, it could act as a catalyst for urban renewal and future development. This could stimulate population growth, increase the demand for higher density living along the corridor, and positively affect future property values. In most cases, the project would lead to improvements in accessibility to stations and better integration of the rail network with existing and improved pedestrian, cycle and bus

networks. The project would play a part in facilitating the future development envisaged by the broader urban renewal program.

In terms of future land uses, the project presents opportunities for positive change within the vicinity of the stations, supporting urban renewal, and creating attractive, vibrant and highly accessible places. The relationship between the project and surrounding land uses is mainly being addressed through the planning and land use integration process that commenced with the draft *Sydenham to Bankstown Urban Renewal Corridor Strategy*. Overall, the project is anticipated to integrate positively with the initiatives proposed by the urban renewal corridor strategy, by providing a public transport facility that can meet future needs.

Socio-economic and business impacts

The project area extends through a highly urbanised, densely populated, and ethnically diverse area. It is located within 11 suburbs in the Inner West and the Canterbury-Bankstown local government areas. In 2011, the Sydenham to Bankstown corridor provided about 19,700 jobs. Each station is located within/close to a commercial/retail centre. Businesses of varying types are located close to each station. A small retail business is located at six stations (Dulwich Hill, Belmore, Lakemba, Wiley Park, Canterbury, and Punchbowl). Campsie station is directly adjoined by a number of buildings (located on land owned by RailCorp), which are used for a variety of retail/commercial purposes.

Key potential construction impacts

Both socio-economic benefits and impacts are expected to result from construction of the project. Construction would result in substantial economic benefits by way of job generation and construction multipliers. Some local businesses would expect to receive a direct stimulus from construction workers requiring food and beverage supplies and other goods and services.

There would also be adverse impacts on a number of businesses where acquisition and lease cessation is required. Land requirements to undertake the project would include business interests, as follows:

- full acquisition of two commercial lots near Marrickville Station
- cessation of one existing commercial retail lease at each of six stations (Dulwich Hill, Belmore, Lakemba, Wiley Park, Canterbury, and Punchbowl stations)
- cessation of 31 commercial leases in the building adjacent to Campsie Station.

The project would have the potential to impact community infrastructure located near the project area mainly as a result of impacts to amenity and access arrangements. The former Canterbury Bowling and Community Club would be directly impacted. The majority of the club building and all the surrounding open space is proposed for use as a construction compound and site office. This would mean that the majority of the facility would not be available for community use for the duration of the construction period.

Closure of the rail line and/or stations during possession periods has the potential to impact on the community, which has higher levels of public transport use compared to the Sydney average. It would also have the potential to affect businesses dependent on passing trade generated by rail customers. Implementation of a small business owners support program would assist in mitigating this impact.

Impacts would also include temporary access restrictions; amenity issues, such as increased traffic congestion, noise, vibration and dust; and changes to parking availability.

Management measures would be implemented to minimise the potential impacts of construction on the community and businesses. These measures would include Place Managers tasked with

working with businesses and the wider community during the construction period; implementation of a workforce development plan to promote local employment and skills development; and implementation of business management plans for each locality, detailing location specific mitigation measures.

Key potential operation impacts

Operation of the project as part of Sydney Metro would generate significant local and regional benefits and opportunities, as a result of the enhanced capacity and frequency of transport services, and improved access to the Sydney CBD and the wider transport network. During operation, community access and connectivity are expected to greatly improve through the provision of new, efficient, high capacity public transport and accessible station designs.

In addition to these broader operational benefits, key local benefits would include:

- Marrickville – improved access to Schwebel Street and Illawarra Road resulting in better safety and accessibility outcomes, and a more inviting station entrance in Station Street.
- Dulwich Hill – new accessible, cross corridor access link to facilitate community cohesion, and a new entrance closer to the light rail stop to facilitate interchange between the different transport modes.
- Hurlstone Park – provision of an enlarged station forecourt for safer gathering and interaction, and new pedestrian crossings to facilitate access to surrounding areas.
- Canterbury – improved access to the potential new town centre via a new station entrance on Broughton Street, promoting accessibility, community interaction, and cohesion.
- Campsie – the new station entrance would be more open to Beamish Street, which would further consolidate the station as a focal point for the community.
- Belmore – new station plaza and accessible cross-corridor link to promote community cohesion and gathering, and the proposed improvements to the Tobruk Avenue station frontage would improve connectivity with surrounding streets, the Burwood Road shopping area, and the Belmore Sportsground.
- Lakemba – improved access, new station entrance forecourts, and upgrades to the existing courtyard and memorial space to promote community identity.
- Wiley Park – new station entrance and public domain improvements would provide a more comfortable and safe station access.
- Punchbowl – the new station entrance and forecourt to The Boulevarde would improve pedestrian access to the station, and improve safety by increasing visibility and opportunities for passive surveillance.
- Bankstown – new, at grade cross-corridor link to improve access, cohesion, and integration.

The project would enhance local amenity and character in the areas surrounding the stations as a result of the focus on place making and promotion of active transport in the design development process. The project also has the potential to stimulate growth, new development, and urban renewal around stations, including new housing, employment opportunities, public places, community facilities, and integration with other transport infrastructure. This would provide the opportunity to enhance the health and wellbeing of the broader community.

As one of the two components of Sydney Metro City & Southwest, the project would contribute to economic growth by providing direct benefits to customers through reduced travel time and better reliability. The project would also deliver wider economic benefits by facilitating access to education and employment opportunities, increased connectivity, land development opportunities, and business logistics improvements, particularly for knowledge-based businesses.

Impacts to businesses during operation would largely be positive at the local and regional level, as a result of the enhanced capacity and frequency of transport services. Adverse impacts for local businesses during operation would include the potential for increased commercial rents, increased levels of competition, and changes to customer access and parking. The project may facilitate increased retail investment in local business precincts, due to improved customer access and an enlarged customer base enabled by Sydney Metro. The potential for redevelopment within the local business precincts, would provide subsequent opportunities for businesses to leverage off a growing resident and worker population base.

Landscape character and visual amenity

The existing visual environment is characterised by its highly developed urban nature, which includes existing rail and road infrastructure, and a range of built forms. Landscape character varies along the project area, with a number of different landscape character areas identified by the landscape and visual impact assessment. The landscape character areas are influenced by the nature of the urban form (including residential and commercial areas, and a variety of different built forms), natural features (the Cooks River), and the presence of areas of open space and parks.

Key potential construction impacts

Temporary visual impacts would be experienced during construction in the vicinity of construction work areas, compounds, and work sites. Visible elements would include machinery and equipment, site hoardings, partially complete structures, and other works. However, these impacts would be temporary and limited to the construction period. In addition, the majority of the works would be viewed within the context of a highly developed and dynamic urban environment, where construction and associated works are frequent occurrences.

A number of trees of varying sizes would potentially need to be removed to facilitate the upgrades of stations and station areas. Removal of trees would also be required to occur in sections of the rail corridor. Some of these trees contribute to the amenity and character of the local area and/or screen views from properties surrounding the project area. The removal of these trees would have the potential to reduce some screening between residential dwellings and the rail corridor, and impact on existing amenity. The final number of trees to be removed would be confirmed during detailed design and final construction planning. Impacts to trees would be minimised where practicable in accordance with the tree management strategy. It is noted that minimising tree removal will be key requirement of the construction contract.

Where removal of trees is unavoidable, trees would be replaced in accordance with the proposed tree management strategy, which would be prepared in consultation with relevant stakeholders, including the Inner West and Canterbury-Bankstown councils. This strategy would ensure that any trees that need to be removed would be replaced, and where possible, increased in number. This would include preparation of comprehensive tree reports by a qualified arborist where trees around station areas require protection, or pruning to guide the approach to managing each tree during construction.

In addition, as described below, biodiversity offsets are proposed to mitigate the loss of ecological values as a result of clearing in the rail corridor.

Key potential operation impacts

With the introduction of upgraded stations and new infrastructure in the project area, the project has the potential to result in changes to landscape character and visual amenity. The project would result in changes to the appearance (to differing degrees) of stations, and the addition of new infrastructure along the rail corridor.

The design of the stations and associated facilities has been undertaken to reinforce their role. As new vibrant spaces and destinations, the stations would fit with the NSW Government's transformation and renewal vision for the Sydenham to Bankstown corridor. They could serve as a catalyst for regeneration in the surrounding neighbourhoods and along the road corridors connecting to the stations, reflecting a high level of land use and transport integration. The detailed design of the project would include measures to integrate the changes to the stations into the surrounding urban fabric.

Hydrology, flooding and water quality

The majority of the project area, between Marrickville and Punchbowl stations, is located in the Cooks River catchment. The project area crosses the Cooks River about 400 metres west of Canterbury Station. Between Punchbowl and Bankstown stations, the project area is located within the Georges River catchment.

Around Marrickville Station, the rail corridor and surrounding lands are subject to regular and extensive flooding. Other areas where flooding of the rail corridor may occur are located to the west of Campsie Station, between Campsie and Canterbury stations, and to the east of Canterbury Station, however the frequency and extent is less than at Marrickville. Flooding issues generally result from the limited capacity of existing drainage infrastructure, including infrastructure within and crossing the rail corridor.

As a consequence of the heavily urbanised nature of the drainage catchments, the water quality of major watercourses is generally considered relatively poor, with stormwater runoff fouling the river systems with litter, petroleum derivatives, excess nutrients, and other pollutants.

Key potential construction impacts

A number of construction compounds and worksites would be located in areas that are currently subject to hazardous flooding conditions. However, as a result of the size of these areas relative to the overall floodplain, and the nature of activities proposed, no noticeable changes in floodplain function or storage are predicted. Further investigation and modelling would be undertaken during detailed design to ensure that the function of the floodplain is not materially affected by construction of the project. As far as possible, to minimise potential impacts to existing flooding conditions, all new drainage infrastructure would be constructed and operational prior to disconnection of existing infrastructure. Contingency management plans would also be developed and would include consideration of flooding, ensuring that appropriate arrangements are in place to manage any contingency events should they occur.

During construction, the potential for water quality impacts would be managed by implementing standard erosion and sediment management measures, in accordance with *Managing Urban Stormwater: Soils and Construction*.

Key potential operation impacts

Flood modelling conducted for the study area in the vicinity of Marrickville Station indicated that during the one per cent annual exceedance probability event, flood depths and velocities would generally remain the same or reduce as a result of the upgraded drainage infrastructure to be provided by the project. This would include increasing the capacity of culverts and installing detention basins in key locations.

Preliminary consultation was undertaken with the Inner West and Canterbury-Bankstown councils, and the NSW State Emergency Service, regarding existing flood evacuation routes and the potential impacts of the project. Some roads that currently provide emergency access near Marrickville Station are subject to flooding under existing conditions. Modelling predicted that the project would result in negligible changes to the flood level at the majority of these roads, and a

decrease in the flood level in the vicinity of Marrickville Road (including surrounding roads). Flood emergency management would be incorporated into the design of station infrastructure and the project's operational emergency management plans. Flood modelling of other areas along the rail corridor, including appropriate allowance for climate change, would be undertaken during detailed design.

The project would include installation of water quality treatment measures at stations to capture pollutants, including litter, sediments, phosphorous, hydrocarbons, and nitrogen, to meet water quality targets, which are in keeping with relevant guidelines. However, as a result of the small size of station catchments compared to the much larger overall drainage catchment, there is expected to be no noticeable effect on water quality in receiving waters.

Biodiversity

The majority of the study area has been heavily modified by past and ongoing disturbances associated with urban development and the active rail corridor. The majority of vegetation in the project area and surrounding study area comprises exotic or planted native species on highly modified landforms. There are small isolated patches of remnant or regrowth native vegetation in small portions of the study area associated with rail cuttings with less disturbed soil profiles.

About 0.6 hectares of the native vegetation in the project area matches two threatened ecological communities listed under the *Threatened Species Conservation Act 1995* (TSC Act). No listed threatened flora species were recorded in the project area. Around 650 stems of the endangered Downy Wattle, which is listed as a vulnerable species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the TSC Act, are located near the project area. One threatened fauna species, the Grey-headed Flying-fox, was recorded during site surveys.

The main potential for biodiversity impacts would occur during construction. Potential impacts on biodiversity have been minimised by designing the project to minimise the potential for impacts outside the rail corridor. This included refining the location of project near Punchbowl and Bankstown stations to avoid impacts on Downy Wattle.

A biodiversity impact assessment was undertaken for the Environmental Impact Statement in accordance with the *Framework for Biodiversity Assessment* (OEH, 2014a). It was assumed for the purpose of the assessment that construction would require removal of all vegetation within the rail corridor in the project area. This would involve removal of 29.8 hectares of vegetation. The majority of this vegetation comprises exotic plants (about 21.5 hectares) or planted, often non-indigenous, native species on fill material (about 7.3 hectares). Removing all vegetation in the rail corridor would impact one hectare of native vegetation.

The project would also require the removal of street trees, mainly around station areas. This potential impact is considered above (under landscape character and visual amenity).

The assessment concluded that the project would not significantly impact any listed ecological community or species.

To mitigate potential impacts to biodiversity as a result of clearing of native vegetation in the rail corridor, the proposed Biodiversity Offset Strategy would be implemented in accordance with the *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014b). The offset strategy requires the purchase and retirement of biodiversity credits calculated in accordance with the *Framework for Biodiversity Assessment*.

Sustainability and climate change

For infrastructure projects, 'infrastructure sustainability' is defined by the Infrastructure Sustainability Council of Australia as 'infrastructure that is designed, constructed and operated to optimise environmental, social and economic outcomes of the long term'.

The assessment undertaken for the Environmental Impact Statement considers the application of sustainability principles to the project, and opportunities to achieve sustainability targets and outcomes aligned with best practice infrastructure projects. Sustainability principles have been incorporated throughout the design process. A project-specific environment and sustainability strategy has been developed, and is provided in Appendix F.

Sydney Metro is targeting an 'Excellent' rating under the Infrastructure Sustainability Council of Australia's Infrastructure Sustainability framework. To assist in achieving this rating, a range of sustainability initiatives and targets would be implemented, including:

- provision of solar systems
- incorporating carbon and energy management into the project design
- reduction of greenhouse gas emissions by 20 per cent
- rainwater harvesting and water saving features
- waste reduction targets for different types of waste.

Project contractors would be required to clearly identify how they would achieve specific sustainability objectives, initiatives, and targets. This approach would encourage industry to develop innovative value-for-money sustainability solutions. Key sustainability themes would include governance, carbon and energy management, pollution control, climate change resilience, resources (water efficiency and waste and materials), biodiversity conservation, heritage conservation, liveability, community benefit, supply chain, workforce development, and economic factors.

A climate change risk assessment and a greenhouse gas assessment were also undertaken. The climate change risk assessment identified risk treatments that would be incorporated into the detailed design of the project, including ensuring that adequate flood modelling is carried out and integrated into the design.

The greenhouse gas assessment concluded that operation and maintenance of the project would result in increased emissions of greenhouse gas through increased electricity use. However, the project has the potential to reduce greenhouse gas emissions by providing a reliable and efficient alternative to private car travel. An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions.

Cumulative impacts

A number of major projects are proposed or are being undertaken in the vicinity of the project area, including the Sydney Metro City & Southwest Chatswood to Sydenham project, and two stages of WestConnex.

The Chatswood to Sydenham project would involve works close to the project area, as both projects are located adjacent to each other east of Marrickville Station. The main potential cumulative impacts associated with construction of the two projects include:

- traffic impacts, due to the movement of construction vehicles and the operation of buses to replace rail services during possession periods
- hydrology and flooding impacts, which are assessed as part of the hydrology assessment.

Both projects would provide cumulative transport-related benefits, including a major increase in the capacity of Sydney's rail network.

There is considered to be limited potential for cumulative impacts with the WestConnex projects, due to the distance between the surface works for these projects and the Sydenham to Bankstown upgrade.

Cumulative impacts would be highly dynamic and time/activity specific, so are difficult to define in detail at this stage of the assessment process. Transport for NSW would continue to work closely with relevant stakeholders to manage and co-ordinate the interface with other major projects under construction at the same time, and would consult with a range of state and local government agencies.

Other issues

In addition to the above, other environmental issues, including contamination, air quality; hazards, risk and safety; and waste management, were also considered to develop a comprehensive environmental management framework for the project. These and other impacts would be managed by the implementation of appropriate environmental management measures included in the construction environmental management plan for the project.

Environmental mitigation and management

The detailed design for the project would be undertaken with the objective of minimising potential impacts on the environment and the community. The design and construction methodology would continue to be developed with this objective in mind, taking into account the input of stakeholders.

To minimise and manage the potential impacts identified by the Environmental Impact Statement, the assessment chapters outline a range of mitigation and management measures, including those that have been successfully applied to other major infrastructure projects in Sydney. Chapter 28 summarises the environmental mitigation and management measures that would be implemented prior to and during construction and operation. These include implementation of the:

- Sydenham to Bankstown Design Guidelines (Appendix C)
- Construction Environmental Management Framework (Appendix D)
- Construction Noise and Vibration Strategy (Appendix E)
- Temporary Transport Strategy (Appendix G)
- Utilities Management Framework (Appendix H).

Next steps

During the public exhibition period, stakeholders and the community are encouraged to make written submissions to the Department of Planning and Environment in relation to the project. Following the exhibition period, Transport for NSW will consider the issues raised in submissions and will respond to community feedback in a submissions report. The report will also document the outcomes of any ongoing investigations and design work identified following the exhibition of the Environmental Impact Statement.

Should changes to the project be proposed during the exhibition period, a preferred project report would be prepared to assess the impacts of any changes. The submissions report would be integrated into this report.

If the project is approved, it would be undertaken in accordance with the mitigation measures proposed in the Environmental Impact Statement, the submissions/preferred infrastructure report, and the conditions of approval.

Part A

Introduction and background

1. Introduction

1.1 Background

The New South Wales (NSW) Government is implementing *Sydney's Rail Future*, a plan to transform and modernise Sydney's rail network so that it can grow with the city's population and meet the needs of rail customers into the future.

Sydney Metro is a new, standalone rail network identified in *Sydney's Rail Future*, providing 66 kilometres of metro rail line and 31 metro stations. The NSW Government is currently delivering the first two stages of Sydney Metro, shown in Figure 1.1, which consist of Sydney Metro Northwest (between Rouse Hill and Chatswood) and Sydney Metro City & Southwest (between Chatswood and Bankstown).

Sydney Metro Northwest is currently under construction. Sydney Metro Northwest services will start in the first half of 2019, with a metro train running every four minutes in the peak period. Services will operate between a new station at Cudgegong Road (beyond Rouse Hill) and Chatswood.

Sydney Metro City & Southwest will extend the Sydney Metro system beyond Chatswood to Bankstown, delivering about 30 kilometres of additional metro rail, a new crossing beneath Sydney Harbour, new railway stations in the lower North Shore and Sydney central business district (CBD), and the upgrade of existing stations from Marrickville to Bankstown. Sydney Metro City & Southwest comprises two core components (shown in Figure 1.1):

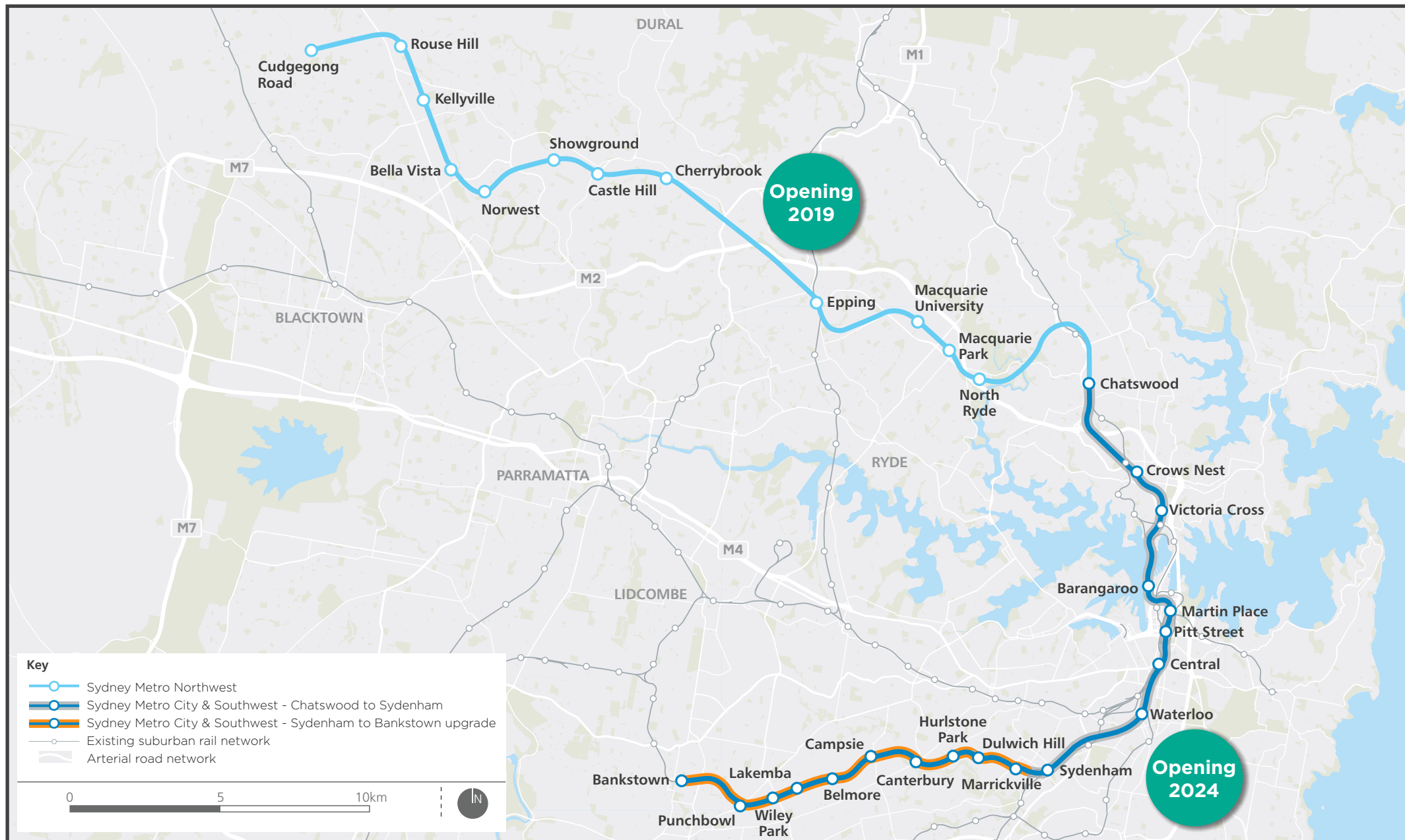
- the Chatswood to Sydenham project
- the Sydenham to Bankstown upgrade (the subject of this Environmental Impact Statement).

Planning approval for the Chatswood to Sydenham project, which includes 15.5 kilometres of new underground rail line and seven new stations between Chatswood and Sydenham, was received in January 2017, with construction activities commencing in 2017. The approved Chatswood to Sydenham project includes the dive structure and tunnel portal located between Sydenham Station and Bedwin Road, Marrickville (the Marrickville dive structure). The approved project does not currently include changes to Sydney Trains tracks in the vicinity of Sydenham (at Sydenham Junction), works to Sydenham Station, or the provision of stabling facilities (the Sydney Metro Trains Facility).

The Sydenham to Bankstown State Significant Infrastructure Application Report noted that works to support the phased opening of the Chatswood to Sydenham project could be accelerated under a separate planning approval. To enable this to occur, Transport for NSW proposes to include the works at Sydenham Junction and Sydenham Station, and construction of the Sydney Metro Trains Facility, as part of the scope of the Chatswood to Sydenham project. A modification to the Chatswood to Sydenham project is currently underway to include these works as part of the scope of that project.

Planning for Sydney Metro West is also currently underway. Sydney Metro West is proposed to be an underground metro railway that will link the Parramatta and Sydney CBDs, and communities in between.

The Sydney Metro Delivery Office, part of Transport for NSW, is managing the planning, procurement and delivery of the Sydney Metro network, as shown in Figure 1.2.



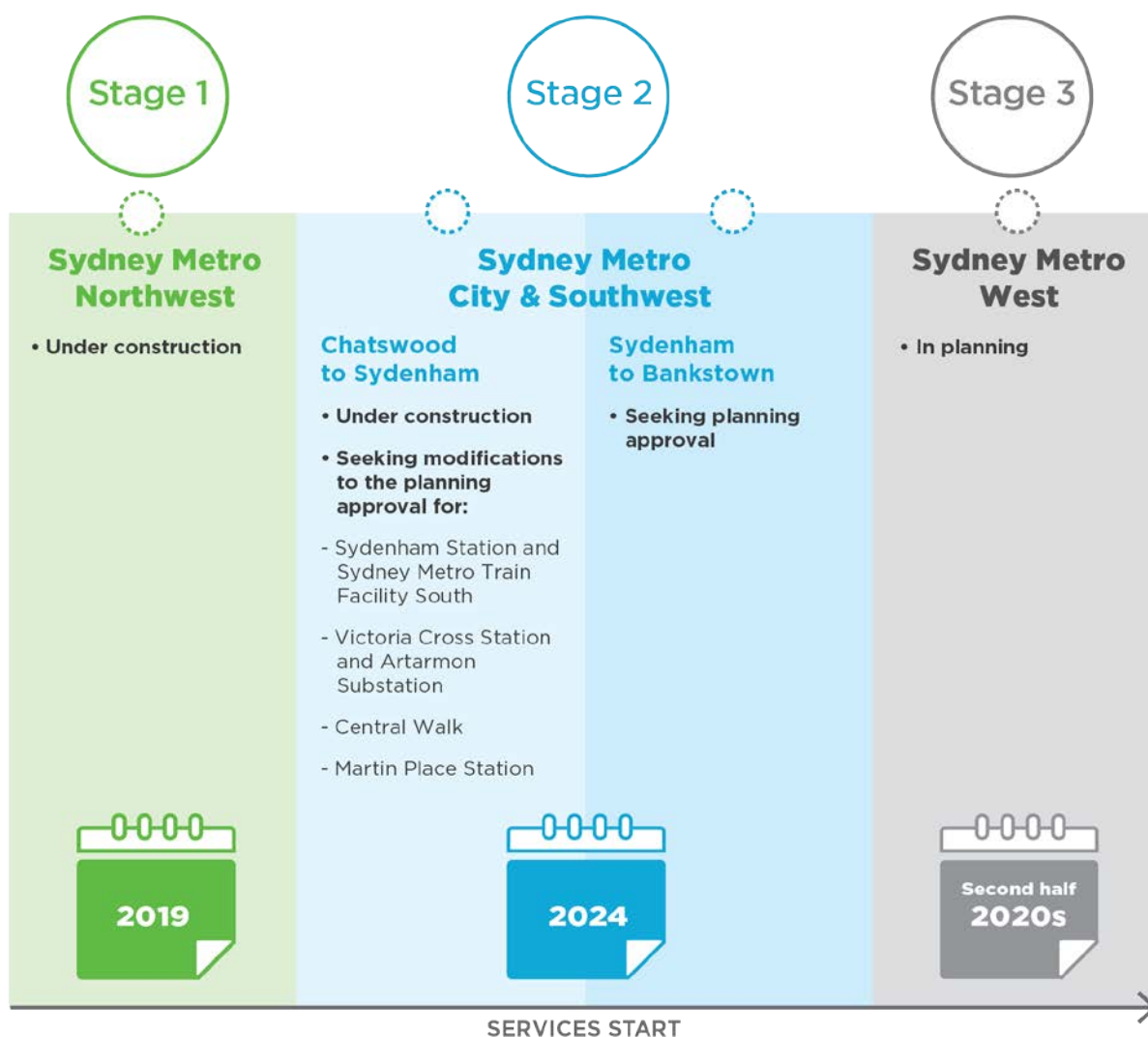


Figure 1.2 The Sydney Metro network – status

1.2 The project for which approval is sought

1.2.1 The project

To further progress implementation of *Sydney's Rail Future* and Sydney Metro City & Southwest, Transport for NSW ('the proponent') is seeking approval to construct and operate the Sydenham to Bankstown upgrade component of Sydney Metro City & Southwest ('the project').

The project involves upgrading 10 existing stations west of Sydenham (Marrickville to Bankstown inclusive), and a 13 kilometre long section of the Sydney Trains T3 Bankstown Line, between west of Sydenham Station and west of Bankstown Station, to improve accessibility for customers and meet the standards required for metro operations. The project would enable Sydney Metro to operate beyond Sydenham, to Bankstown.

A key element of the project is upgrading stations along the corridor from Marrickville to Bankstown, to allow better access for more people, by providing new concourses, level platforms, and lifts at all stations. These upgrades aim to provide a better, more convenient, and safer experience for public transport customers, by delivering:

- stations that are accessible to people with a disability or limited mobility, the elderly, people with prams, and people travelling with luggage
- upgraded station buildings and facilities for all transport modes that meet the needs of a growing population

- interchanges that support an integrated transport network and allow seamless transfers between different modes for all customers.

In December 2015, Sydney Metro City & Southwest (including the project) was declared to be critical State significant infrastructure by the NSW Minister for Planning under *State Environmental Planning Policy (State and Regional Development) 2011*. As critical State significant infrastructure, the project is permissible without development consent, and is subject to assessment and approval by the Minister for Planning under Part 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2.2 Location

The location of the project is shown in Figure 1.3. The key elements of the project are located mainly within the existing rail corridor, from about 800 metres west of Sydenham Station in Marrickville, to about one kilometre west of Bankstown Station in Bankstown. The project is located in the Inner West and Canterbury-Bankstown local government areas.

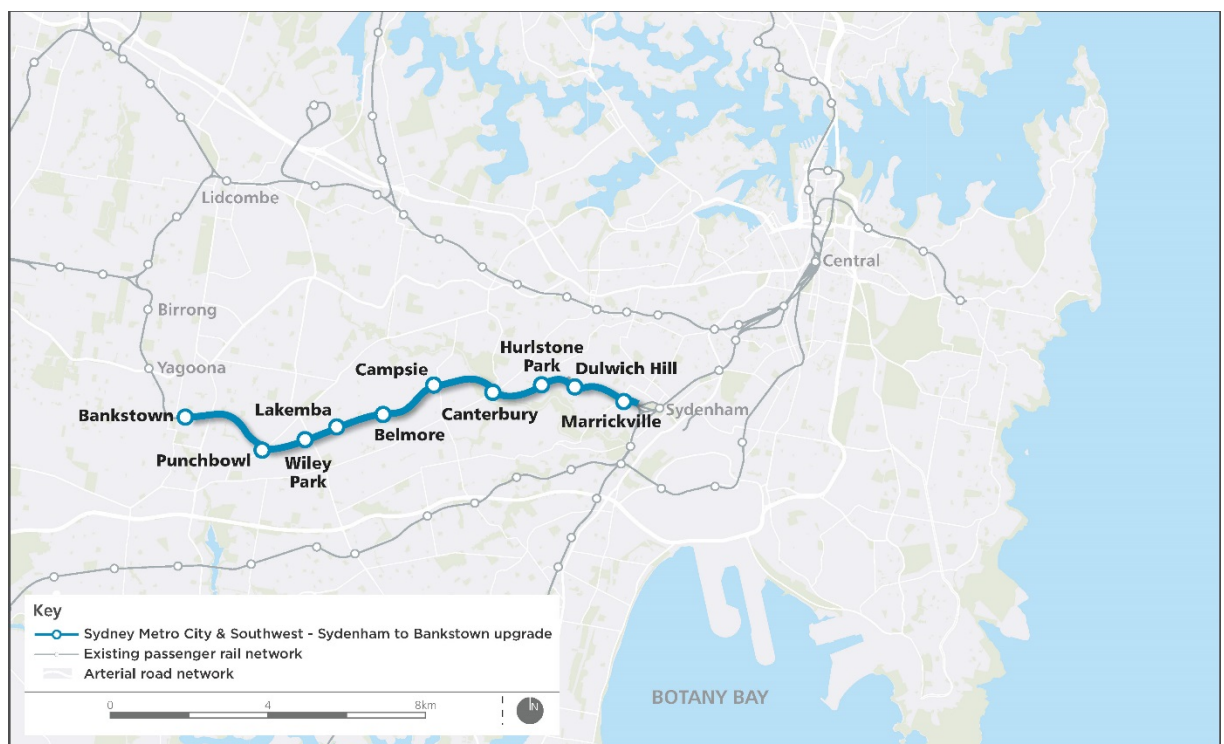


Figure 1.3 Location of the project

1.2.3 Key features of the project

The key features of the project are summarised below and are shown in Figure 1.4.

Works to upgrade access at stations

The project includes upgrading the 10 stations from Marrickville to Bankstown as required, to meet legislative requirements for accessible public transport, including the requirements of the *Disability Discrimination Act 1992* and the *Disability Standard for Accessible Public Transport 2002*. The proposed works include:

- works to platforms to address accessibility issues, including levelling and straightening platforms
- new station concourse and station entrance locations, including:
 - new stairs and ramps

- new or relocated lifts
- provision of additional station facilities as required, including signage and canopies.

Works would also be undertaken in the areas around the stations to better integrate with other modes of transport, improve travel paths, and meet statutory accessibility requirements. This would include provision of pedestrian, cyclist, and other transport interchange facilities; as well as works to the public domain, including landscaping.

Works to convert stations and the rail line to Sydney Metro standards

Station works

In addition to the station upgrades to improve accessibility, works to meet the standards required for metro services would be carried out, including:

- installation of platform screen doors
- provision of operational facilities, such as station services buildings.

Track and rail system facility works

Upgrading the track and rail systems to enable operation of metro services would include:

- track works where required along the rail corridor, including upgrading tracks and adjusting alignments, between west of Sydenham Station and west of Bankstown Station
- new turn back facilities and track crossovers
- installing Sydney Metro rail systems and adjusting existing Sydney Trains rail systems
- overhead wiring adjustments.

Other works

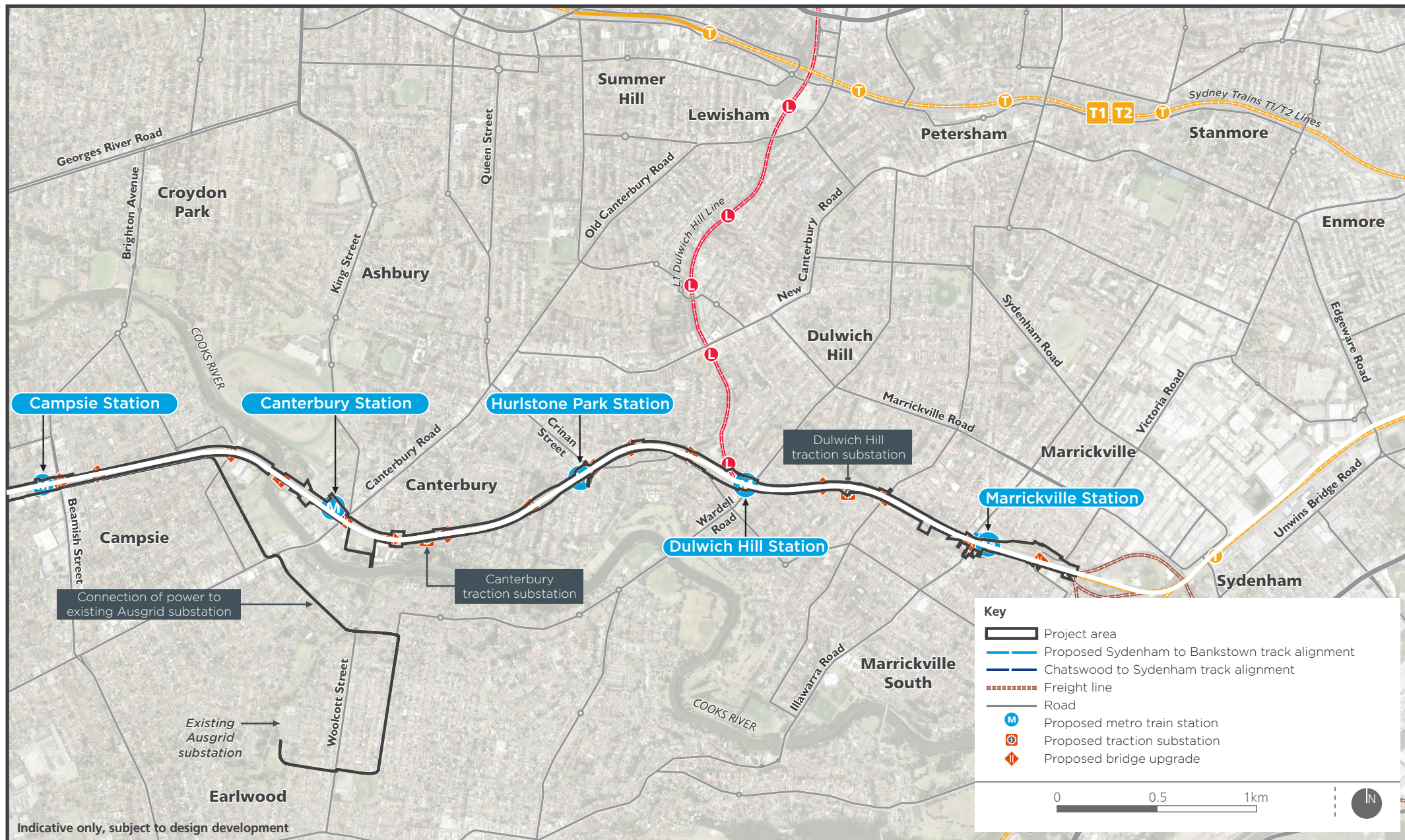
Other works proposed to support Sydney Metro operations include:

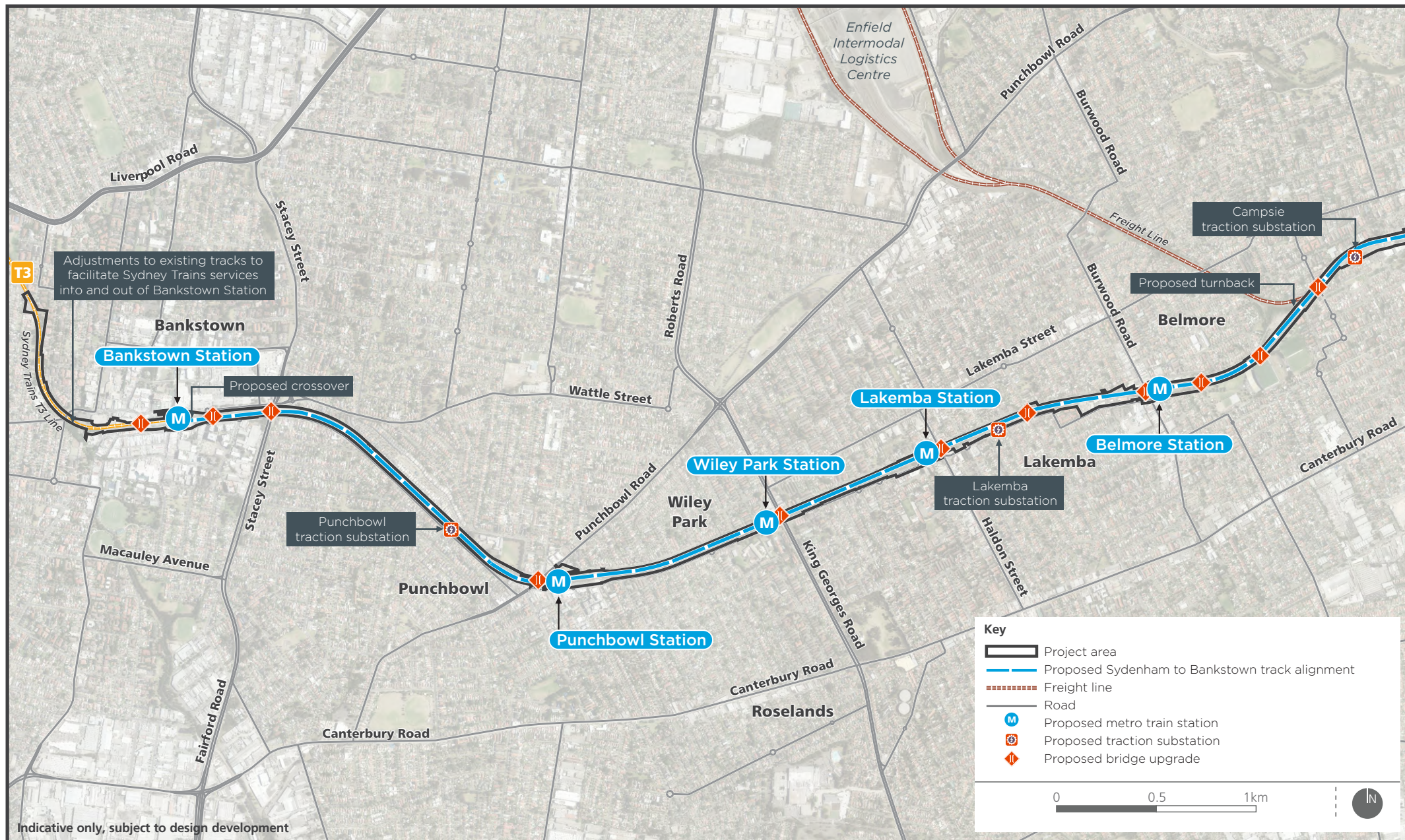
- upgrading existing bridges and underpasses across the rail corridor
- installation of security measures, including fencing
- installation of noise barriers where required
- modifications to corridor access gates and tracks
- augmenting the existing power supply, including new traction substations and provision of new feeder cables
- utility and rail system protection and relocation works
- drainage works to reduce flooding and manage stormwater.

Active transport corridor and future rail corridor development

The project would also deliver:

- sections of an active transport corridor located around the station areas, to facilitate walking and cycling connections to each station and between Marrickville and Bankstown
- enabling works to support future development at Campsie Station (future development would be subject to separate approval).





Temporary works during construction

During construction, the project would involve:

- provision of temporary facilities to support construction, including construction compounds and work sites
- implementation of alternative transport arrangements for rail customers during possession periods and/or station closures, guided by the Temporary Transport Strategy.

1.2.4 Project objectives and aims

The primary objectives of the project are to:

- improve the quality of the transport experience
- provide a system that is able to satisfy long-term demand
- improve the resilience of the transport network.

Secondary objectives are to:

- grow public transport patronage and mode share
- support the productivity of the Global Economic Corridor
- serve and stimulate urban development
- improve the efficiency and cost effectiveness of the public transport system
- implement a feasible solution recognising impacts, constraints and delivery risks.

The project also aims to

- deliver accessible, modern, secure and integrated transport infrastructure
- contribute to the accessibility and connectivity of existing and future communities.

1.2.5 Construction

Construction of the project would commence once all necessary approvals are obtained (anticipated to be in 2018). Upgraded stations would be progressively delivered from 2019 until 2024, with the main station upgrade works estimated to take about two years for each station. During this period, works to upgrade other infrastructure, such as tracks, bridges, embankments and drainage, would also be undertaken.

The T3 Bankstown Line and freight tracks operated by Australian Rail Track Corporation (ARTC) (between Marrickville and west of Campsie) would remain operational for the majority of the construction period. However, to ensure the station and infrastructure upgrade works are completed as efficiently and safely as possible, and to accommodate works that cannot be undertaken when trains are operating, it would be necessary to undertake some work during rail possession periods, when trains are not operating. It is anticipated that these rail possession periods would comprise the routine weekend maintenance possessions scheduled by Sydney Trains (and ARTC), together with some longer possession periods during periods of reduced patronage such as school holidays.

A final, longer possession of about three to six months would also be required. This would involve full closure of the line to enable it to be converted to metro operations. This final possession period is to enable works that can only be completed once Sydney Trains services are not operating. It would include works such as the installation of new signalling, communication systems, and platform screen doors.

During each possession period, a temporary transport management plan would be implemented to provide alternative transport arrangements and ensure that customers can continue to reach their destinations.

1.2.6 Operation

The project would connect with the Chatswood to Sydenham project within the existing rail corridor, about 800 metres to the west of Sydenham Station.

The project would operate in conjunction with Sydney Metro Northwest and the Sydney Metro City & Southwest Chatswood to Sydenham project, which, subject to the modification described in Section 1.1, is proposed to extend from Chatswood Station to Sydenham Station.

Sydney Metro Northwest will be operational between Cudegong Road and Chatswood stations by 2019. Sydney Metro City & Southwest would be fully operational by 2024, with the opportunity for operation to commence in two phases. Initially, Sydney Metro Northwest services would be extended by the City & Southwest project, and would operate from Chatswood Station to Sydenham Station. Some months later, metro operations would extend from Sydenham Station to Bankstown Station, with both phases planned to be completed before the end of 2024. The opportunity for phased opening of the project would enable metro trains to operate from Cudegong Road Station to Sydenham Station prior to the final conversion of the T3 Bankstown Line to metro operations.

Once the project is operational, Sydney Trains services would no longer operate between Sydenham and Bankstown stations. Metro trains would run between Sydenham and Bankstown stations in each direction, at least every four minutes in peak periods, averaging around 15 trains per hour. Customers would be able to interchange with Sydney Trains services at Sydenham and Bankstown stations. Sydney Trains services to and from Bankstown Station to Liverpool and Lidcombe stations would not be affected.

More information on the project is provided in Chapter 8 (Project description – operation) and Chapter 9 (Project description – construction).

1.2.7 Project cost estimate

The indicative cost range for Sydney Metro City & Southwest, comprising both the Chatswood to Sydenham project and the Sydenham to Bankstown upgrade, is estimated to be \$11.5 to \$12.5 billion. The final project budget will be confirmed once all major contracts have been awarded, following the same process used for the \$8.3 billion Sydney Metro Northwest.

1.3 Project need and benefits

1.3.1 Transforming Sydney

Over the next 15 years, NSW will require infrastructure to support 40 per cent more train trips, 30 per cent more car trips and 31 per cent more households.

Sydney's current suburban rail system can reliably carry 24,000 people an hour per line. Sydney Metro, together with signalling and infrastructure upgrades across the existing Sydney rail network, will increase the capacity of train services entering the Sydney CBD – from about 120 services an hour today, up to 200 services beyond 2024. This is an increase of up to 60 per cent across the network to meet demand. Sydney Metro, including the project, will have a long-term target capacity of about 40,000 customers per hour in each direction, similar to other metro systems worldwide.

Sydney Metro, Australia's largest public transport project, will transform Sydney, cutting travel times, reducing congestion, and delivering economic and social benefits for generations to come. It will boost economic activity by more than \$5 billion a year, supporting major jobs and business

growth along its route with better connectivity and urban renewal opportunities, and greatly improving business logistics, especially for knowledge-based businesses.

With at least 15 trains an hour in the peak when services start in 2024, the conversion of the T3 Bankstown Line to metro operations would address one of Sydney's biggest rail bottlenecks, delivering benefits across Sydney's rail network. These benefits would further increase when the number of trains increases to 20 per hour as part of the ultimate operations.

The T3 Bankstown Line effectively slows down the Sydney Trains network because of the way it merges with other railway lines close to the city, including the T2 Airport, Inner West & South Line.

Parts of the T3 Bankstown Line are over 120 years old with existing infrastructure in varying conditions. A key challenge for this line is customer accessibility, with five of the stations not having lifts. In addition, a number of these stations have larger than desirable gaps between the platforms and trains, which makes access difficult for some customers, particularly the disabled, elderly, and those travelling with young children, prams or luggage.

Further information on the need for and benefits of the project is provided in Chapter 5 (Project need).

1.3.2 Customer experience

The design and delivery of Sydney Metro is centred on the customer and focussed on their needs, at each stage of their journey. Sydney Metro's commitment is to provide a reliable transport solution that will make it easy for all customers to get to where they need to go.

Sydney Metro is being designed to deliver a service that is on time, clean, safe, comfortable, efficient, convenient, accessible and easy for customers to use. It will also be seamlessly integrated with other transport modes, including interchanges with the existing Sydney Trains network, as well as buses, light rail and ferries.

Customer benefits of Sydney Metro include:

- no timetable – customers can just turn up and go, with services every four minutes in the peak
- opal ticketing – fares set and controlled by the NSW Government, the same as the rest of Sydney
- customer service assistants at every station and moving through the network during the day and night
- Australian-first platform screen doors (running the full length of all metro platforms and only opening at the same time as the train doors), which keep people and objects away from the edge, improving customer safety and allowing trains to get in and out of stations faster
- continuous mobile phone coverage throughout the metro network
- 98 per cent on time running
- clean platforms and trains
- two multi-purpose areas per train for prams, luggage, and bicycles
- wheelchair spaces, separate priority seating, and emergency intercoms inside trains
- safety benefits, including security cameras on trains, and the ability for customers to see inside the train from one end to the other
- video help points at platforms, connecting directly with train controllers – an Australian first
- level access between the platform and train, and three double doors per side per carriage, for faster loading and unloading

- heating and air-conditioning in all metro trains
- on-board real time travel information and live electronic route maps.

As Australia's first fully automated railway, customer safety is a priority of Sydney Metro. At all times, a team of expert train controllers will monitor the network, making sure everything runs smoothly.

1.4 Purpose and structure of the Environmental Impact Statement

This Environmental Impact Statement supports an application for approval of the project as critical State significant infrastructure under Part 5.1 of the EP&A Act. It addresses the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the 'Secretary's environmental assessment requirements'), dated 23 March 2017 (refer to Appendix A).

The Environmental Impact Statement (volume 1) is structured in four parts as follows:

- **Part A Introduction and background:**
 - an introduction to the environmental impact assessment (**Chapter 1**)
 - a description of the project area and a concise description of its general biophysical and cultural environment (**Chapter 2**)
 - an overview of the project's statutory context, in terms of relevant assessment and approval requirements (**Chapter 3**)
 - a summary of previous and proposed community and stakeholder consultation (**Chapter 4**).
- **Part B The project:**
 - an overview of the strategic context and need for the project (**Chapter 5**)
 - a summary of the strategic alternatives to Sydney Metro as a whole and the options considered during design development (**Chapter 6**)
 - a description of how the project design was developed, including how urban design, place making, heritage, and other environmental considerations formed part of the design process (**Chapter 7**)
 - a description of the project features and operation (**Chapter 8**), including design features and infrastructure proposed, operations, acquisition requirements, and maintenance
 - an indicative description of the likely construction process and activities (**Chapter 9**).
- **Part C Environmental assessment:**
 - the results of the assessment of the key environmental issues identified by the Secretary's environmental assessment requirements, including information on the existing environment, potential construction and operation impacts, and proposed mitigation measures (**Chapters 10 to 27**).
- **Part D Conclusion:**
 - provides a synthesis of the findings of the Environmental Impact Statement, a description of the proposed approach to environmental management during construction and operation, and a consolidated list of mitigation measures (**Chapter 28**).

Other appendices in volume 1 provide supporting information.

The specialist technical reports prepared as an input to the Environmental Impact Statement are provided in volumes 2 to 6.

2. Location and setting

This chapter describes the project's location. It defines the project area for the purpose of the Environmental Impact Statement, and provides a summary of the key features of the environment of the project area, and the broader study area in which it is located. The Environmental Impact Statement assesses the potential impacts of the project on the project area and, where relevant, the broader study area. These terms are defined in the chapter.

The Secretary's environmental assessment requirements addressed in this chapter are listed in Table 2.1. A full copy of the assessment requirements and where they are addressed in the Environmental Impact Statement is provided in Appendix A.

Table 2.1 Secretary's environmental assessment requirements – location and setting

Ref	Secretary's environmental assessment requirements – location and setting	Where addressed
2.1(i)	A concise description of the general biophysical and socio-economic environment that is likely to be impacted by the project (including offsite impacts).	This chapter

2.1 Definitions used in this Environmental Impact Statement

The following are the key locational descriptor definitions used in this Environmental Impact Statement.

2.1.1 Project area

The term 'project area' is used in this Environmental Impact Statement to refer to the area where the project would be undertaken. The project area is the area that would be directly disturbed by construction of the project (for example, as a result of ground disturbance and the construction of foundations for structures). It includes the location of construction activities, compounds and work sites, areas that may be affected by alternative transport arrangements during construction, and the location of operational infrastructure. A description of the project area is provided in Section 2.2.2.

2.1.2 Study area

The study area is defined as the wider area including and surrounding the project area, with the potential to be directly or indirectly affected by the project (for example, by noise and vibration, visual, or traffic impacts). The actual size and extent of the study area varies according to the nature and requirements of each assessment and the relative potential for impacts. For example, the study area for the heritage assessment is generally restricted to the area with the potential for heritage impacts, extending for a distance of about 25 metres on either side of the project area. In comparison, the study area for the noise and vibration assessment is based on noise catchment areas, and extends for a distance of about 100 metres on either side of the majority of the project area, and 200 metres around construction compounds.

A concise description of the general biophysical, social, and cultural environment of the study area is provided in Sections 2.3 and 2.4.

2.1.3 Station area

The station area is the area surrounding the stations, within which works are required to provide facilities associated with the upgraded stations. Works are proposed in the station area to meet

statutory accessibility requirements, better integrate the station with other modes of transport, and improve travel paths. As noted in Section 1.2, this would include providing pedestrian, cyclist, and other transport interchange facilities, as well as works to the public domain, such as landscaping. The extent of the station area around each station is shown in Figure 2.1.

2.2 Location of the project and the project area

2.2.1 Location

The project is located in Sydney's inner to middle ring western/south-western suburbs, between about seven and 17 kilometres south-west of the Sydney CBD (extending from west of Sydenham Station to west of Bankstown Station respectively). At its closest point (at Bankstown Station), the project area is located about 11 kilometres south of the Parramatta CBD.

The location of the project is shown on Figure 1.3 and Figure 1.4.

2.2.2 The project area

The project area is shown in Figure 2.1. It extends for about 13 kilometres along the rail corridor, from west of Sydenham Station in Marrickville, to west of Bankstown Station in Bankstown.

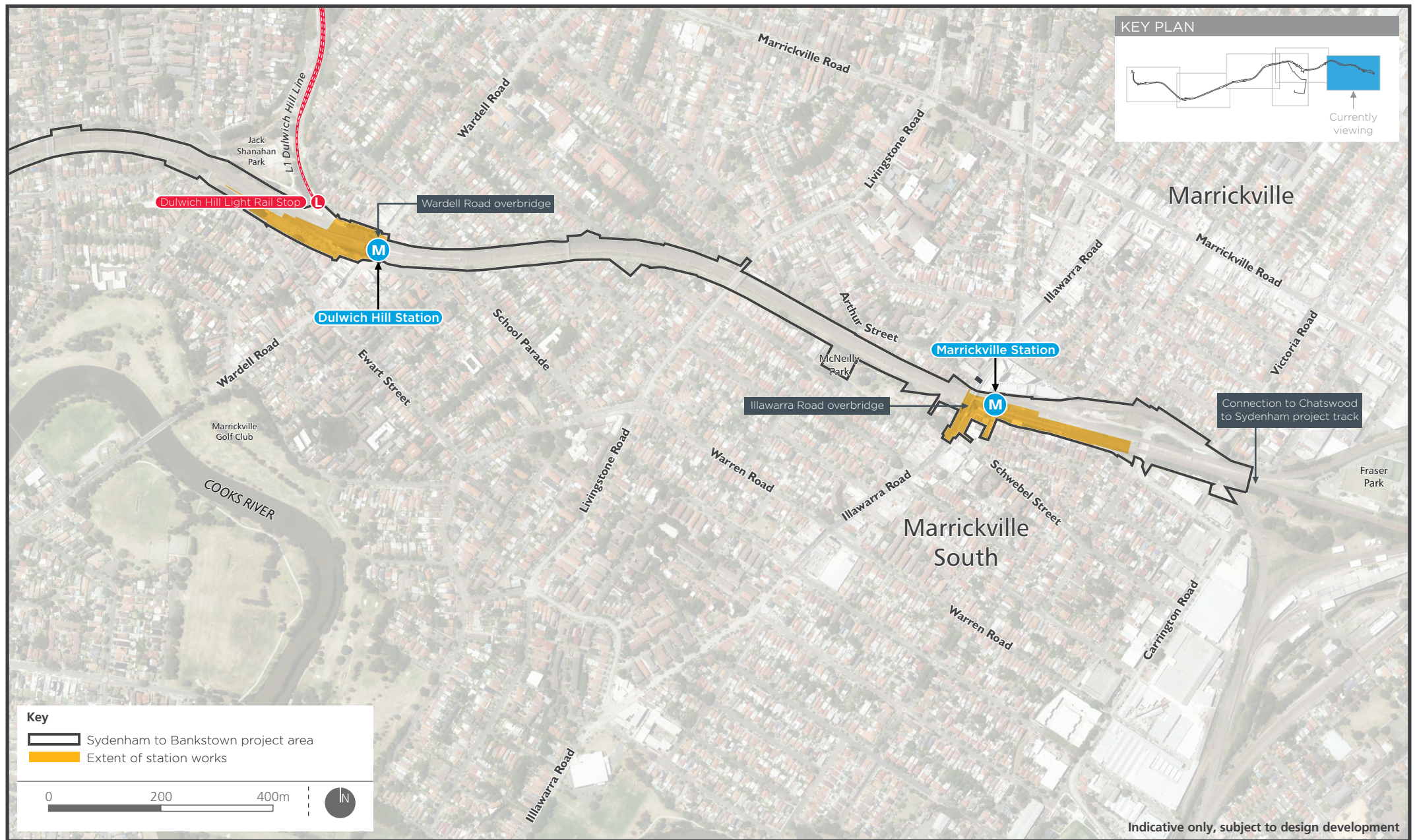
The eastern end of the project area is located within the rail corridor, about 800 metres west of Sydenham Station and about 500 metres east of Marrickville Station, to the west of Fraser Park (near Meeks Road). From this location, the project area extends west along the T3 Bankstown Line. In some locations, the project area extends beyond the rail corridor to provide for the location of construction compounds, construction worksites, station work areas, and ancillary infrastructure.

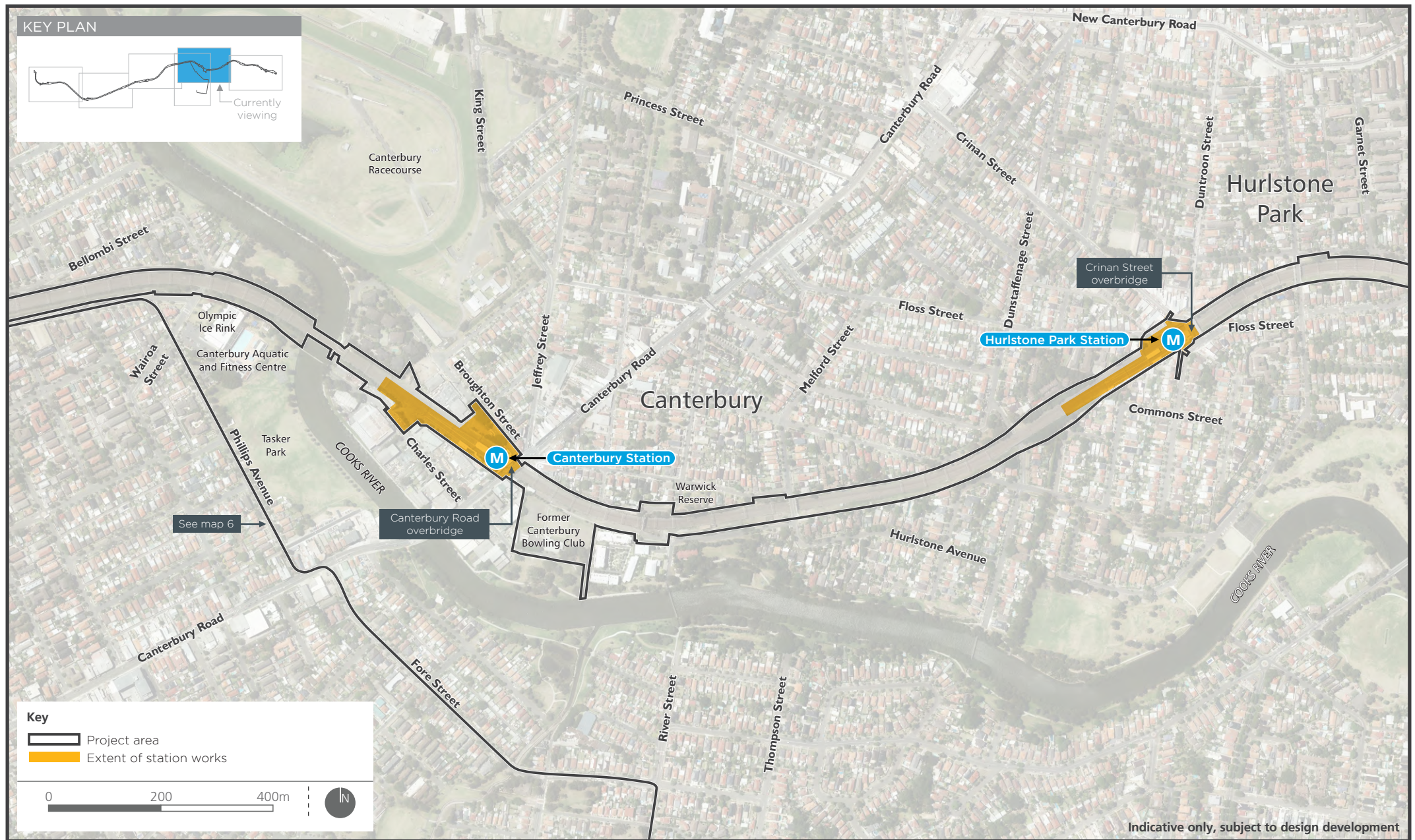
The western end of the project area is located within the rail corridor about one kilometre to the west of Bankstown Station, near Carmen Street, Bankstown.

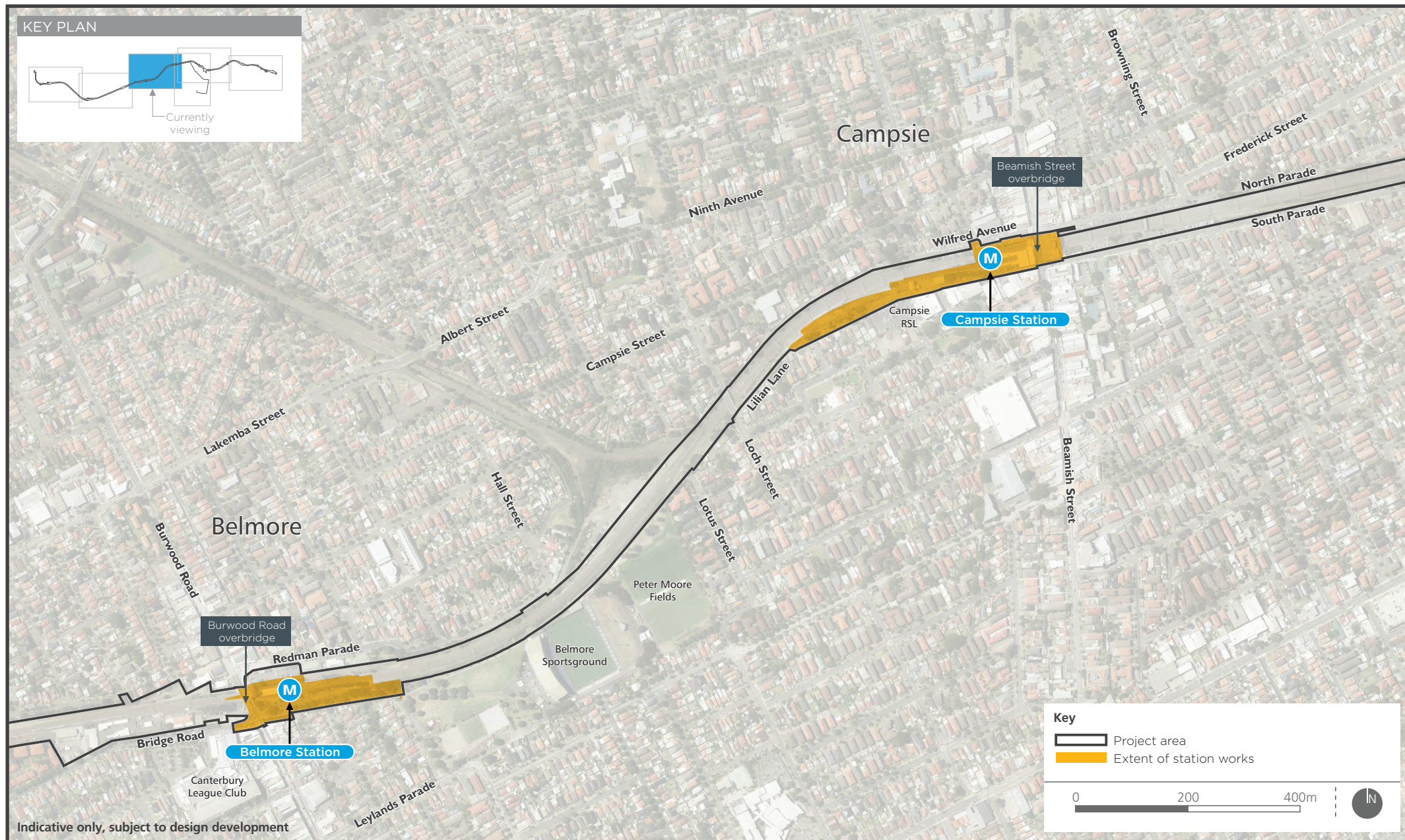
The project is as described in this Environmental Impact Statement, and is generally located within the suburbs of Marrickville, Sydenham, Tempe, Dulwich Hill, Hurlstone Park, Canterbury, Campsie, Belmore, Lakemba, Wiley Park, Punchbowl, and Bankstown, in accordance with the critical State significant infrastructure declaration. Further information on the permissibility of the project is provided in Section 3.1.1.

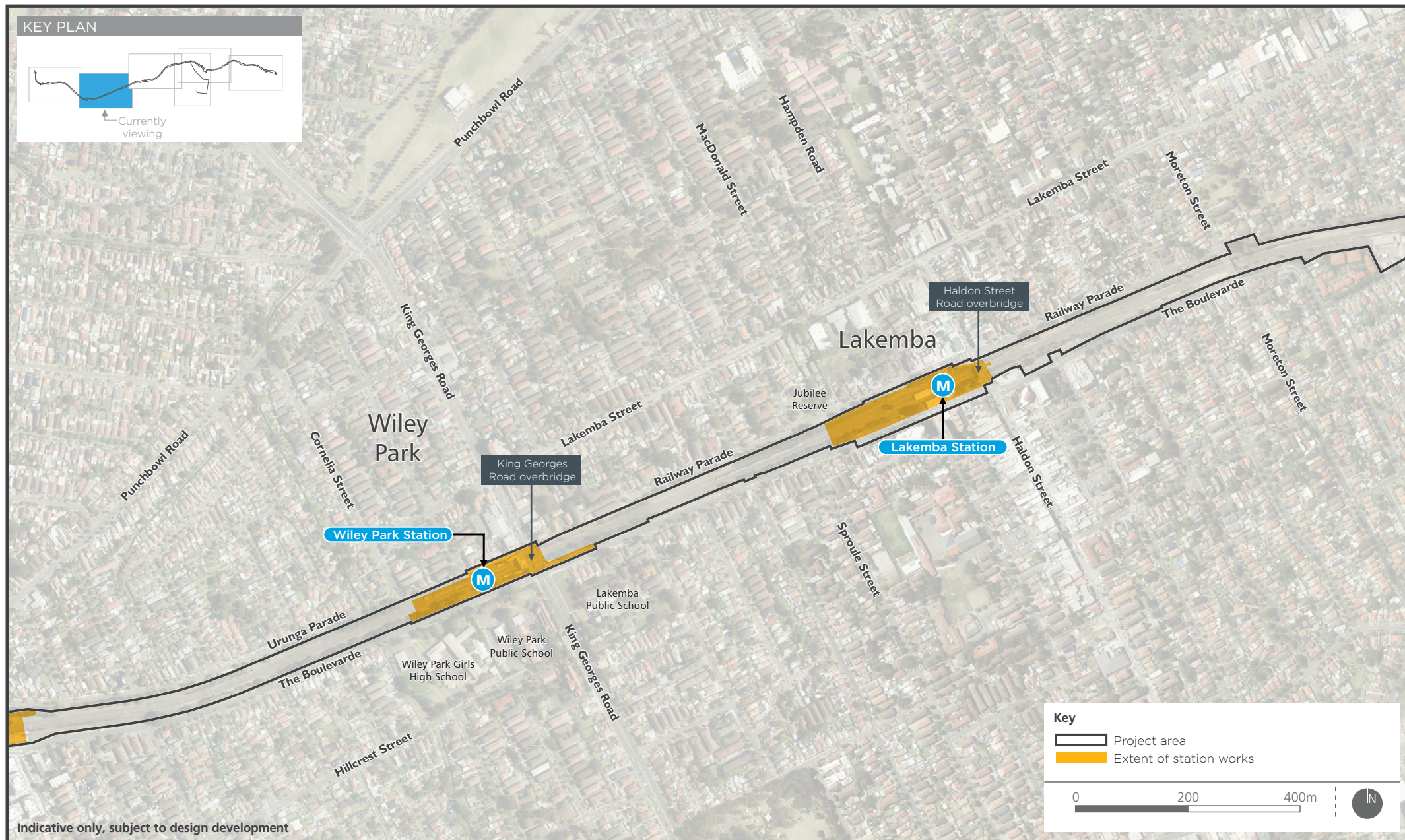
The project area generally includes:

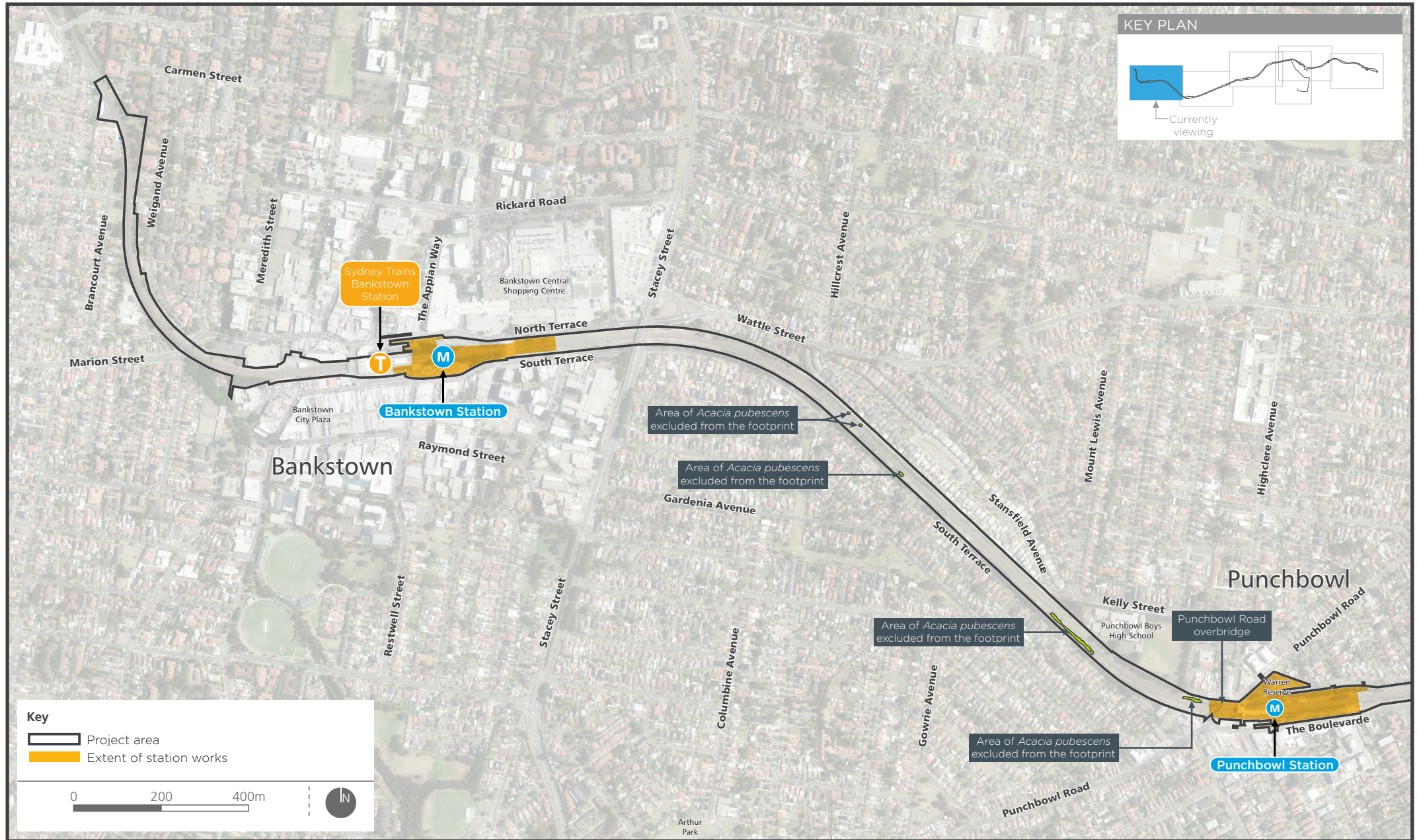
- the existing rail corridor from west of Sydenham Station to west of Bankstown Station
- Marrickville, Dulwich Hill, Hurlstone Park, Canterbury, Campsie, Belmore, Lakemba, Wiley Park, Punchbowl, and Bankstown stations
- bridges crossing the rail corridor where works are proposed as part of the project (described in Section 8.1.3)
- the proposed locations of construction compounds and work sites (described in Section 9.8 and shown in Figure 9.1)
- the location of the proposed new 33 kilovolt electricity feeder cable between Campsie Station and Ausgrid's Canterbury Substation (described in Section 8.1.3 and shown in Figure 2.1)
- works required to prepare the road network and station surrounds for the implementation of temporary transport management plans (described in Sections 9.2.3 and 10.3.1).
- works required to prepare the road network for the movement of heavy vehicles during construction, including works at certain intersections (described in Section 10.3.3) to allow vehicles to make safe turns.

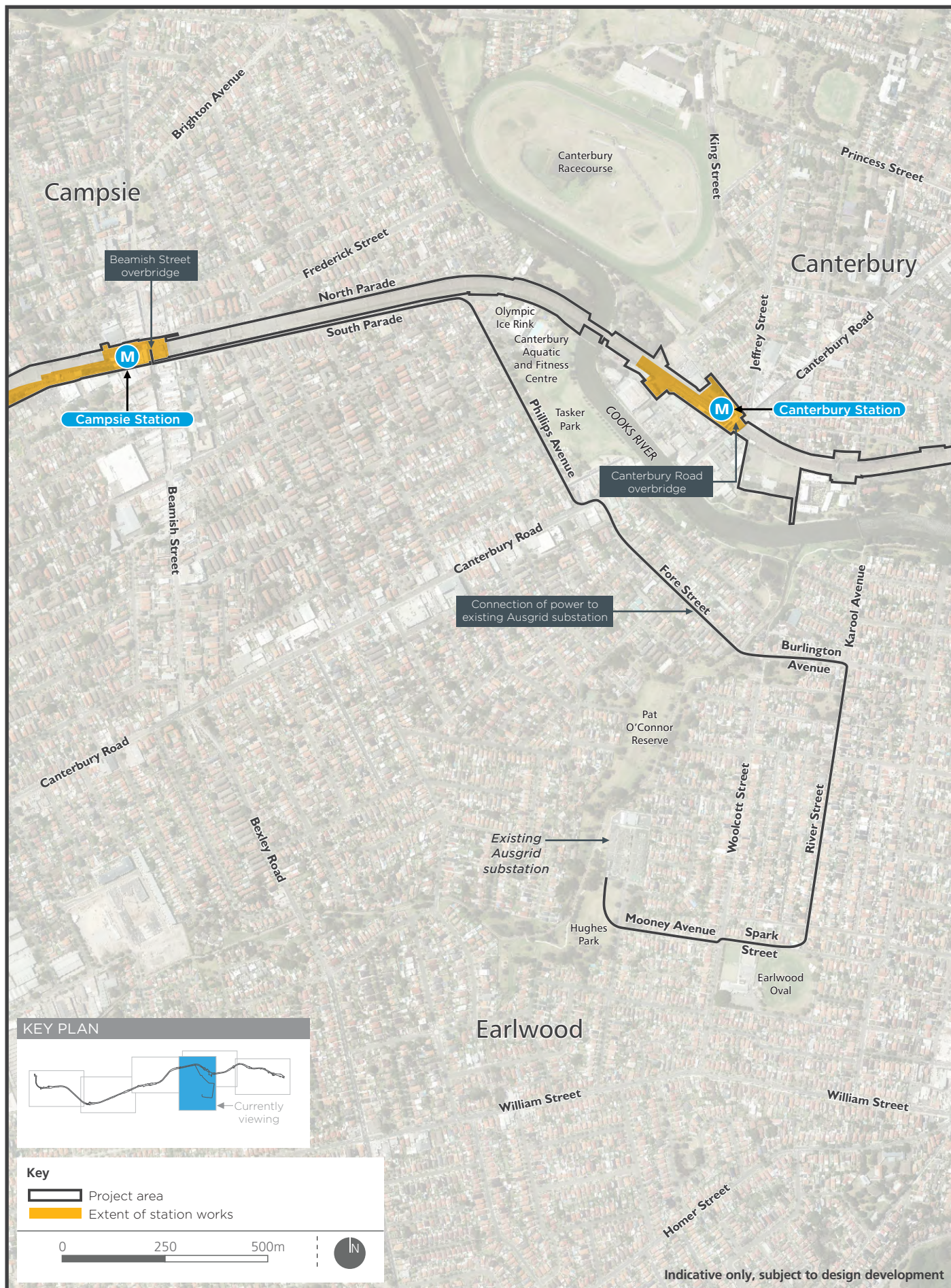












2.3 General biophysical environment

A summary of the general biophysical characteristics of the study area is provided below.

2.3.1 Soils

Sandstone and shale geological units underlie the majority of the project area. There are some alluvium deposits and volcanic intrusions along the project area. The majority of the project area is located on the Blacktown soil landscape, which generally has low soil fertility and poor drainage. Between Canterbury and Marrickville stations, the project area is located on the Gynea soil landscape, which is highly erodible, highly permeable, and has low soil fertility. Isolated areas of the Birrong soil landscape are located along drainage lines that cross the project area, with this landscape subject to localised flooding.

Within the rail corridor, the majority of the project area consists of fill associated with railway embankments, or exposed bedrock associated with cuttings and overlain with rail ballast or fill. Saline soils are located west of Punchbowl Station, with some isolated areas of high salinity potential. Acid sulphate soils are located along the Cooks River.

A preliminary contamination assessment undertaken as part of the design process identified that there is a low to medium risk of contamination along the majority of the project area, with a medium to high risk in three areas (between Sydenham and Marrickville stations, between Campsie and Belmore stations, and between Punchbowl and Bankstown stations).

Further information on soils is provided in Chapter 20.

2.3.2 Water

Between Marrickville and Punchbowl stations, the project area is located within the Cooks River catchment. The project area crosses the Cooks River about 400 metres west of Canterbury Station. The proposed location of the electricity feeder cable from the Canterbury Substation crosses Cup and Saucer Creek, which is a tributary of the Cooks River. Between Punchbowl and Bankstown stations, the project area is located within the Salt Pan Creek catchment.

Within both catchments, water generally drains to nearby watercourses via stormwater drainage infrastructure.

Water quality within the two catchments is generally poor because of the influence of run-off from urban areas. However, water quality improves in downstream areas within both catchments.

Around Marrickville Station, the rail corridor and surrounding lands are subject to regular and extensive flooding. Other areas where flooding of the rail corridor may occur are located to the west of Campsie Station, between Campsie and Canterbury stations, and to the east of Canterbury Station, however the frequency and extent is less than at Marrickville. Flooding issues generally result from the limited capacity of existing drainage infrastructure, including infrastructure within and crossing the rail corridor.

Further information on hydrology, flooding, and water quality is provided in Chapter 21.

2.3.3 Biodiversity

The majority of the study area has been heavily modified by past and ongoing disturbances associated with urban development and the active rail corridor. Vegetation within the project area is dominated by grasses, small shrubs, and a variety of weeds, with some scattered trees. The majority of vegetation comprises exotic or planted native species on highly modified landforms. This includes vegetation in the form of street trees in the vicinity of stations and also along the corridor. There are small isolated patches of remnant or regrowth native vegetation in small portions of the study area associated with rail cuttings with less disturbed soil profiles.

Two threatened ecological communities, listed under the *Threatened Species Conservation Act 1995* (TSC Act), occur in the project area:

- Sydney Turpentine Ironbark Forest in the Sydney Basin Bioregion
- Shale Gravel Transition Forest.

There is limited riparian vegetation at the location where the Cooks River is crossed by the rail corridor.

One threatened fauna species, the Grey-headed Flying-fox, was recorded in the study area during site surveys. Four other species listed as vulnerable under the TSC Act are likely to occur at least on occasion: the Eastern Bentwing Bat, Large-footed Myotis, Eastern Freetail Bat and Yellow-bellied Sheath-tail Bat.

Potential habitat for the endangered Long-nosed Bandicoot population is present in parts of the study area. Despite a number of targeted searches and different methods being employed, no individuals were recorded.

The rail corridor also contains around 650 stems of the endangered Downy Wattle, which is listed as a vulnerable species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the TSC Act. These stems are located between Punchbowl and Bankstown stations.

Further information on biodiversity is provided in Chapter 22.

2.4 General social and cultural environment

A summary of the general social and cultural characteristics (including land use, heritage, and socio-economic) of the study area is provided below.

2.4.1 Land use and property

The study area consists of a varied and relatively dense mix of land uses, including residential, commercial, industrial, transport infrastructure, community, health, education, and recreation. The majority of the project area is located within an active rail corridor used for transport (rail) purposes. This includes suburban rail uses (the T3 Bankstown Line), and regional rail freight uses. Other land uses include commuter car parks at various stations along the corridor, and businesses operating within some stations.

Land uses surrounding the project area mainly include a mix of residential and commercial land uses, with other land uses scattered throughout the study area. Low to medium density residential areas are located in the vicinity of most stations and between stations. Higher density residential areas are concentrated around a number of stations, including Canterbury, Campsie, Lakemba, and Bankstown stations.

Commercial development is generally focused within local and neighbourhood centres, located in the vicinity of stations. Campsie and Bankstown stations are located within larger regional centres.

The vast majority of the project area is located on publicly owned land.

Further information on land use and property is provided in Chapter 16.

2.4.2 Heritage

Non-Aboriginal heritage

Urban development in the vicinity of the project area increased between 1892 and 1939 with the construction of the rail line between Sydenham and Bankstown. The line was opened in three stages, with the Sydenham to Belmore section opening in 1895, and extensions to Bankstown and

Regents Park in 1909 and 1939 respectively. Development of the line coincided with development of land adjacent to the line.

The project area contains substantial historical resources of significance. All 10 railway stations in the project area are heritage listed. Three stations (Marrickville, Canterbury and Belmore stations) are listed on the State Heritage Register, and the others are subject to listings on local environmental plans and/or a State agency Section 170 heritage register.

Two items listed on the State Heritage Register (Sewage Pumping Station 271 in Marrickville and the Old Sugarmill in Canterbury) are located adjacent to the project area. A number of other locally listed items are located adjacent to, or within 25 metres of the project area. In addition, the project area passes through or adjacent to two heritage conservation areas.

Further information on non-Aboriginal heritage is provided in Chapter 14.

Aboriginal heritage

The project area is located within an area thought to have been occupied by the Wangal clan, whose territory extended between the Parramatta River and the Cooks River, from Darling Harbour to Rosehill.

There are no listed Aboriginal heritage sites located within the project area.

The closest previously recorded Aboriginal heritage site is a potential archaeological deposit (PAD) (the Fraser Park PAD) located about 650 metres north-east of the project area boundary. Two areas of potential archaeological deposits were identified during field surveys near Belmore and Punchbowl stations (S2B PAD 01 and S2B PAD 02 respectively).

The archaeological significance of the project area located within the existing rail corridor is considered to be low as a result of the high levels of ground disturbance. S2B PAD 01, which is located outside the project area is considered to have low to moderate significance, while S2B PAD 02 is considered to have moderate significance, and low to moderate potential for intact archaeological deposits to be identified.

Further information on Aboriginal heritage is provided in Chapter 15.

2.4.3 Socio-economic

The project area extends through a highly urbanised, densely populated, and ethnically diverse area. It is located within 11 suburbs in the Inner West and the Canterbury-Bankstown local government areas. According to the 2011 census¹, the combined population of both local government areas was 542,514 people (ABS, 2011) with about 35 per cent of the population living in the Inner West LGA (comprising the former Ashfield, Leichhardt and Marrickville LGAs), and around 65 per cent in the Canterbury-Bankstown LGA (comprising the former Canterbury and Bankstown LGAs).

The Inner West local government area is characterised by densely populated, older, inner-city suburbs, with numerous significant heritage and cultural items. The local government area also contains substantial industrial and commercial areas, many of these being historic areas that are gradually converting to other uses. Since the 1970s, the area has experienced significant urban renewal and gentrification.

The former Canterbury local government area is densely populated and culturally diverse. Parks, historical sites, open space, and sport and recreational facilities contribute to the amenity of the area. These include Belmore Oval, Canterbury Racecourse, Canterbury Ice Rink, Canterbury

¹ At the time of the assessment, the 2016 Census data had not yet been released

Aquatic and Fitness Centre, and open space corridors surrounding the Cooks River, Wolli Creek, and Salt Pan Creek. A designated cycle path and walking track is located along the Cooks River.

The character of the former Bankstown local government area is largely residential. It has a commercial core (the Bankstown town centre) adjacent to Bankstown Station.

Further information on the existing socio-economic environment is provided in Chapter 17.

2.4.4 Businesses

Ten business precincts were identified within the study area. These precincts vary in size and the proportion of land used for business purposes, with distinct differences in business and industry profiles. According to the 2011 census, the Sydenham to Bankstown corridor provided about 19,700 jobs. About 45 per cent of the employment was attributed to three major industry sectors, being health care and social assistance (18 per cent), retail trade (16 per cent), and accommodation and food services (11 per cent).

Bankstown's status as a regional centre is reflected in its role as the largest retail employer in the study area, employing nearly 1,700 people. Bankstown is also the location of a major regional shopping centre, the Bankstown Central Shopping Centre, which is located about 150 metres north-east of Bankstown Station. Campsie is the second largest centre along the rail corridor. Other stations adjoin local centres.

Businesses of varying types are located close to each station. A small retail business is located at six stations (Dulwich Hill, Belmore, Lakemba, Wiley Park, Canterbury, and Punchbowl). Campsie Lakemba stations are also directly adjoined by a number of buildings (located on land owned by the NSW Government) that are used for a variety of retail/commercial purposes.

Further information on the existing business environment is provided in Chapter 18.

2.4.5 Transport infrastructure

Transport infrastructure in the study area includes rail infrastructure, other public transport infrastructure, numerous regional and local roads, and active transport facilities. A brief overview of the existing infrastructure is provided below. Further information on transport infrastructure within and near the project area, including local and regional infrastructure, and existing active and public transport networks, is provided in Chapter 10.

Rail

Rail infrastructure in the study area consists of Sydney Trains suburban rail lines and a freight rail line. The Sydney Trains T3 Bankstown Line is located within the project area. Other rail lines operated by Sydney Trains in the vicinity of the project area pass through Sydenham Station to the east of the project area. These include the T2 Airport, Inner West & South and the T4 Eastern Suburbs & Illawarra lines.

It is noted that the NSW Government is currently implementing the More Trains, More Services program, which involves delivering extra services and upgraded rail infrastructure to the Sydney Trains rail network. As part of the program, a refreshed rail network map has been developed. Changes to the network, including new line names and additional services, will be implemented in late 2017 and 2018. Line names used in this Environmental Impact Statement reflect the existing naming conventions.

A rail line forming part of the Sydney Metropolitan Freight Network (managed by ARTC) runs within the rail corridor in the project area, adjacent to the T3 Bankstown Line, between about 500 metres east of Marrickville Station, and about 700 metres west of Campsie Station.

Other public transport

A number of bus routes cross the project area and serve stations within the project area. Major concentrations of bus routes are focussed around Canterbury, Campsie, and Bankstown stations. This includes a major bus interchange at Bankstown Station.

The light rail line travelling to/from the inner west (the L1 Dulwich Hill Line) terminates near the project area at the Dulwich Hill light rail stop, located about 130 metres to the north-west of Dulwich Hill Station.

Roads

Classified main roads close to and/or crossing the project area via road overbridges include Illawarra Road, Canterbury Road, Beamish Street, King Georges Road, Punchbowl Road, and Stacey Street. A number of local roads also cross the project area via road overbridges, generally in a north–south direction.

Stacey Street (part of the A6) and King Georges Road (part of the A3) connect with Canterbury Road and the South Western Motorway (the M5) located to the south of the project area.

The M5 and the M5 East, which are located between around 1.5 and three kilometres to the south, run roughly parallel to the project area. Marrickville Station is located about 1.5 kilometres to the north-west of the Princes Highway (the A36). The Hume Highway (the A22) is located about one kilometre north of Bankstown Station.

Active transport

The pedestrian network consists of footpaths and dedicated road crossings. Both signalised and un-signalised pedestrian crossing facilities are located throughout the footpath/road network.

The majority of local cycling connections are on-road mixed environments or pathways through recreation areas/parks. Bike parking facilities are provided at a number of stations in the project area.

3. Planning and assessment process

This chapter provides a review of the statutory context and approval pathway for the project. It addresses the Secretary's environmental assessment requirements listed in Table 3.1.

Table 3.1 Secretary's environmental assessment requirements - planning and assessment

Ref	Secretary's environmental assessment requirements – planning and assessment	Where addressed
1. Environmental Assessment Process		
1.1	The Environmental Impact Statement must be prepared in accordance with Part 3 of Schedule 2 of the <i>Environmental Planning and Assessment Regulation 2000</i> (the Regulation).	Section 3.1.3
1.2	It is the Proponent's responsibility to determine whether the project needs to be referred to the Commonwealth Department of the Environment for an approval under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).	No approval is required Requirements under the EPBC Act are considered in Section 3.2.2
2. Environmental Impact Statement		
2.1	(p) Statutory context of the project as a whole, including: <ul style="list-style-type: none"> how the project meets the provisions of the EP&A Act and EP&A Regulation a list of any approvals that must be obtained under any other Act or law before the project may lawfully be carried out 	Section 3.1 Section 3.2

3.1 NSW environmental planning approvals

The EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) are the primary pieces of legislation regulating land use planning and development assessment in NSW. A range of environmental planning instruments, including State environmental planning policies (SEPPs) and local environmental plans, support the legislation.

As described below, the project is critical State significant infrastructure that is permissible without development consent. It is subject to the assessment and approval provisions of Part 5.1 of the EP&A Act.

3.1.1 Permissibility of the project

Clause 79 of *State Environmental Planning Policy (Infrastructure) 2007* provides that development for the purpose of a railway or rail infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land. The project is characterised as development for the purpose of a railway or rail infrastructure facilities, and would be carried out by or on behalf of Transport for NSW, a public authority, accordingly, development consent under Part 4 of the EP&A Act is not required for the project.

Section 115U(4) of the EP&A Act provides that specified development on specified land is State significant infrastructure if it is specifically declared to be State significant infrastructure by a SEPP or by an order of the Minister that amends a SEPP for that purpose.

Section 115V of the EP&A Act provides that any State significant infrastructure may also be declared to be critical State significant infrastructure if it is of a category that, in the opinion of the Minister, is essential for the State for economic, environmental or social reasons.

The *Environmental Planning and Assessment Amendment (Sydney Metro City and Southwest Project) Order 2015*, which was made on 10 December 2015, amended Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011*, by adding clause 5, which describes Sydney Metro City and Southwest. The effect of this was that:

- development for the purposes of Sydney Metro City & Southwest was specifically declared to be State significant infrastructure by an order of a Minister that amends a SEPP under section 115U(4) of the EP&A Act
- this State significant infrastructure was also declared to be critical State significant infrastructure, under section 115V of the EP&A Act.

The project is development for the purpose of Sydney Metro City & Southwest. Hence, the project is State significant infrastructure and critical State significant infrastructure. It does not require development consent under Part 4 of the EP&A Act, but it does require the approval of the Minister under Part 5.1 of the EP&A Act.

Transport for NSW will review the scope of the declaration to ensure consistency with the project area and all elements of the project.

3.1.2 Planning approval process under Part 5.1 of the EP&A Act

Part 5.1 of the EP&A Act regulates the assessment and approval process for critical State significant infrastructure. An overview of the process is shown in Figure 3.1.

As required by Section 115X of the EP&A Act, Transport for NSW submitted a State Significant Infrastructure application and supporting State Significant Infrastructure Application Report to the Secretary of the Department of Planning and Environment on 16 February 2017. The Secretary's environmental assessment requirements for the project were issued (as per Section 115Y of the EP&A Act) on 23 March 2017. The Secretary's environmental assessment requirements are provided in full in Appendix A.

The Department of Planning and Environment will place this Environmental Impact Statement on public exhibition for a minimum of 30 days (as per Section 115Z of the EP&A Act). During the exhibition period, interested parties can review the Environmental Impact Statement and make a written submission to the Department of Planning and Environment for consideration during the assessment process.

At the completion of the public exhibition period, the Department of Planning and Environment will collate and provide Transport for NSW a copy of all submissions received. After reviewing the submissions, Transport for NSW will prepare a submissions report that responds to the relevant issues raised. If changes are required to the project to respond to the issues raised or to minimise environmental impacts, a preferred infrastructure report may also be required. This report would be made available to the public.

Approval from the Minister for Planning is required before Transport for NSW can proceed with the project (as per section 115ZB of the EP&A Act).

STAGE 1 EARLY CONSULTATION

Early project consultation undertaken prior to the commencement of the formal assessment process.

Project refined on the basis of the early project consultation.

Initial scoping of EIS investigations undertaken on the basis of early project consultation.

STAGE 2 ENVIRONMENTAL IMPACT STATEMENT

Transport for NSW prepares and submits a State significant infrastructure application to the Secretary of the NSW Department of Planning and Environment (DP&E), which includes a supporting document outlining the project and its likely impacts.

Planning focus meeting with key government stakeholders and community engagement.

DP&E issues Secretary's environmental assessment requirements (SEARs) for EIS with focus on key issues.

EIS prepared addressing the matters outlined in the SEARs.

STAGE 3 EXHIBITION CONSULTATION AND REVIEW

DP&E exhibits the EIS for a minimum of 30 days and invites public submissions.

Secretary may require proponent to respond to submissions and submit a preferred infrastructure report outlining proposed changes to minimise environmental impacts or address any other issues raised during assessment of the application.

STAGE 4 ASSESSMENT AND DETERMINATION

Assessment by DP&E, draft Secretary's environmental assessment report prepared with recommended conditions or refusal. Agencies and councils consulted by DP&E.

Secretary's environmental assessment report finalised with recommendations and submitted to Minister for Planning.

Determination by the Minister, including if approved, any conditions of approval.

Post approval implementation and compliance (if project approved).

3.1.3 Environmental Planning and Assessment Regulation 2000

This Environmental Impact Statement has been prepared in accordance with the requirements of clauses 6 and 7 of Schedule 2 of the EP&A Regulation. These requirements, and where they are addressed in the Environmental Impact Statement, are provided in Appendix B.

Clause 193 of the EP&A Regulation includes the provisions for owner's consent and notification requirements for State significant infrastructure projects. As the application for the project is being made by a public authority and is for linear transport infrastructure, the consent of individual landowners will not be required to make the application. However, the proponent needs to give notice of the application in accordance with the requirements of clause 193(4).

3.1.4 NSW environmental planning instruments

Section 115ZF of the EP&A Act provides that environmental planning instruments do not apply to critical State significant infrastructure projects (with some exceptions, including how they apply to the declaration of critical State significant infrastructure). As described in Section 3.1.1, the project is declared critical State significant infrastructure, and is listed on Schedule 5 of the State and Regional Development SEPP. As critical State significant infrastructure, the project is permissible without consent under clause 16(a) of the State and Regional Development SEPP.

3.1.5 Approvals process for future rail corridor development

The project has identified future rail corridor development opportunities at Campsie where an existing commercial property is to be removed to allow the upgrading of Campsie Station.

Provision for future rail corridor development may include foundation work, retaining walls, concrete slabs, providing building services (such as water, sewer, power, etc.), and providing adequate space and access routes for pedestrian, cyclists, and vehicles.

All future rail corridor development would be subject to a separate planning and approvals process. Subject to the size, scale, and type of rail corridor development, this could include local or regional development (with the local council or a regional planning panel as the consent authority) or State significant development (with the Minister for Planning as consent authority).

3.2 Requirements under other legislation

3.2.1 NSW approval requirements

Approvals that would otherwise apply

In accordance with sections 115ZG and 115ZH of the EP&A Act, some environment and planning legislation does not apply to critical State significant infrastructure or must be applied consistently.

Section 115ZG of the EP&A Act specifies authorisations that are not required for approved State significant infrastructure. Approvals of potential relevance to the project include:

- permits under sections 201, 205 and 219 of the *Fisheries Management Act 1994* (FM Act)
- approvals under Part 4, excavation permits under section 139 and Division 8 of Part 6 of the *Heritage Act 1977*
- Aboriginal heritage impact permits under section 90 of the *National Parks and Wildlife Act 1974*
- various approvals under the *Water Management Act 2000*, including water use approvals under section 89, and activity approvals (other than aquifer interference approvals) under section 91.

Similarly, section 115ZG of the EP&A Act specifies directions, orders or notices that cannot be made or given so as to prevent or interfere with the carrying out of approved critical State significant infrastructure. These include:

- an interim protection order (within the meaning of *National Parks and Wildlife Act 1974* or the *Threatened Species Conservation Act 1995*)
- an order under Division 1 (Stop work orders) of Part 6A of the *National Parks and Wildlife Act 1974*, Division 1 (Stop work orders) of Part 7 of the *Threatened Species Conservation Act 1995* or Division 7 (Stop work orders) of Part 7A of the *Fisheries Management Act 1994*
- an environment protection notice under Chapter 4 of the *Protection of the Environment Operations Act 1997*
- an order under section 124 of the *Local Government Act 1993*.

Section 115ZH of the EP&A Act identifies approvals or authorisations that cannot be refused if they are necessary to carry out approved State significant infrastructure and are substantially consistent with the Part 5.1 approval. Those of potential relevance to the project include:

- an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997*
- consent under section 138 of the *Roads Act 1993*.

Consideration of requirements under relevant NSW legislation

NSW environmental planning related legislation relevant to the project is identified in Table 3.2.

Table 3.2 Consideration of requirements under relevant NSW legislation

Legislation	Requirement	Relevance to the project
<i>Contaminated Land Management Act 1997</i>	Section 60 of the Act outlines the circumstances in which notification of the Environment Protection Authority (EPA) is required in relation to the contamination of land.	The EPA would be notified in writing of contamination identified within the project area, in accordance with the requirements of section 60 of the Act.
<i>Fisheries Management Act 1994</i>	Section 199 of the Act requires a public authority to notify the Minister prior to carrying out dredging or reclamation (defined by section 198A).	The project would require works adjacent to the Cooks River at Canterbury, which may trigger the notification requirements of the Act. Further information on the works required is provided in Chapters 8 and 9 (Project description – operation and construction). The potential impacts on the river are considered in Chapter 21 (Hydrology, flooding and water quality). The Minister for Primary Industries would be notified in writing if dredging or reclamation work is required, in accordance with the requirements of section 199.
<i>Heritage Act 1977</i>	Section 146 requires that the Heritage Council be notified if a relic is uncovered, where it is reasonable to believe that the Heritage Council is unaware of the location of the relic.	The Heritage Council would be notified in writing of relics uncovered during construction, in accordance with the requirements of section 146.
<i>Land Acquisition (Just Terms Compensation) Act 1991</i>	Specifies the procedures and requirements for the acquisition of land for a public purpose.	Chapter 16 (Land use and property) provides information on the acquisition of private property required for the project. Acquisition would be undertaken in accordance with this Act.

Legislation	Requirement	Relevance to the project
<i>Noxious Weeds Act 1993</i>	Under Part 3 Division 1 of the Act, public authorities are required to control noxious weeds on their land.	The approach to managing weeds during construction is provided in Chapter 22 (Biodiversity).
<i>Protection of the Environment Operations Act 1997</i> (POEO Act)	An environment protection licence (EPL) is required for scheduled activities or development work listed by the POEO Act. Scheduled activities requiring a licence relevantly include: (1) railway systems activities (clause 33) meaning: (a) the installation, on site repair, on site maintenance or on site upgrading of track, including the construction or significant alteration of ancillary works, or (b) the operation of rolling stock on track.	A separate EPL would be required for construction and operation of the project.
<i>Roads Act 1993</i>	Section 138 requires approval from the relevant roads authority to impact, or carry out work on or over, a public road. Clause 5(1) of Schedule 2 to the Roads Act exempts public authorities from this requirement, except in relation to works on or over classified and Crown roads.	The project would impact on classified roads, including Illawarra Road, Canterbury Road, Beamish Street, King Georges Road, Punchbowl Road, and Stacey Street. Further information is provided in Chapter 10 (Construction traffic and transport). Approval would be required under section 138 for works to these roads.
<i>Waste Avoidance and Resource Recovery Act 2001</i>	Encourages the most efficient use of resources to reduce environmental harm.	As described in Chapter 26 (Waste management), waste resulting from the project would be managed in accordance with the requirements of this Act.
<i>Water Management Act 2000</i> and the <i>Water Act 1912</i> (the Water Act)	Temporary dewatering and construction activities that interfere with aquifers are generally identified as aquifer interference activities in accordance with the Water Management Act and the <i>NSW Aquifer Interference Policy</i> (DPI, 2012). However, the aquifer interference approval provisions of the Water Management Act have not commenced, and licensing of these activities is carried out under Part 5 of the Water Act. A licence under Part 5 is required for dewatering activity that would require the extraction of more than three megalitres of groundwater per year.	Excavation would be undertaken to construct the project. Although groundwater may be intercepted, it is unlikely that dewatering would exceed three megalitres of groundwater per year. A licence would be obtained if required.

3.2.2 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

Under Part 3 of the EPBC Act, approval from the Australian Government Minister for the Environment and Energy would be required for an action that:

- has, will have, or is likely to have a significant impact on a matter of national environmental significance
- is undertaken on Commonwealth land and has, will have, or is likely to have a significant impact on the environment
- is undertaken outside Commonwealth land and has, will have or is likely to have a significant impact on the environment of Commonwealth land
- is undertaken by the Commonwealth and has, will have or is likely to have a significant impact on the environment.

Matters of national environmental significance comprise:

- world heritage properties
- national heritage places
- wetlands of international importance
- Commonwealth-listed threatened species and ecological communities
- Commonwealth-listed migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

No world, national or Commonwealth heritage items have been identified within or adjacent to the project area.

The potential for impacts on ecological matters of national environmental significance are considered in Chapter 22 (Biodiversity). No potential significant impacts were identified.

The project would not impact on Commonwealth marine areas or the Great Barrier Reef Marine Park, and it does not involve a nuclear action or coal seam gas/coal mining.

As no significant impacts on matters of national environmental significance or Commonwealth land are predicted, and the project is not being undertaken by a Commonwealth agency, approval under the EPBC Act is not required.

Native Title Act 1993

The main objective of the *Native Title Act 1993* is to recognise and protect native title. Section 8 states that the Native Title Act is not intended to affect the operation of any law of a State or a Territory that is capable of operating concurrently with the Act. Searches of the register maintained by the National Native Title Tribunal indicated that there are no native title claims registered with respect to land within the project area. The project also would not directly affect Crown land that is currently the subject of a native title claim.

Disability Discrimination Act 1992

The *Disability Discrimination Act 1992* aims to eliminate as far as possible discrimination against persons on the ground of disability in areas including access to premises and the provision of facilities, services and land. The project has been, and would continue to be, designed to be independently accessible and comply with the objectives and requirements of the Act. The design guidelines for the project (*Sydney Metro City & Southwest Sydenham to Bankstown Design Guidelines* – provided in Appendix C) are consistent with the objectives of this Act.

Disability Standards for Accessible Public Transport 2002

Section 33.1 of the *Disability Standards for Accessible Public Transport 2002* requires all new public transport premises, infrastructure, and conveyances to comply with the requirements of the standards, unless unjustifiable hardship is incurred by implementation. The project would continue to be designed to comply with these standards.

3.3 Summary of approval and notification requirements

In summary:

- The project is critical State significant infrastructure, requiring approval from the Minister for Planning under Part 5.1 of the EP&A Act.
- The project is permissible without consent.
- Environment protection licences under the POEO Act are required to construct and operate the project.
- Approval under section 138 of the Roads Act is required for works to classified roads.
- A licence would be sought under Part 5 of the Water Act if extraction of more than three megalitres of groundwater per year is required to construct the project.

4. Stakeholder and community consultation

This chapter describes the consultation undertaken to date, and that proposed during the detailed design and delivery of the project. The Secretary's environmental assessment requirements relevant to consultation, together with a reference to where they are addressed in this chapter and the Environmental Impact Statement, are provided in Table 4.1.

Table 4.1 Secretary's environmental assessment requirements – consultation

Ref	Secretary's environmental assessment requirements - consultation	Where addressed
4. Consultation		
4.1	The project and its assessment must be informed by consultation, including with relevant government agencies, (including the Department of Planning and Environment (Growth, Designs and Programs) and within the Transport for NSW cluster (such as Roads and Maritime Services and Sydney Trains), local councils, infrastructure and service providers, special interest groups, affected landowners, businesses and the community. The consultation process must be undertaken in a manner commensurate with expected levels of impact and stakeholder significance.	This chapter
4.2	The Proponent must document the consultation process, and demonstrate how the project has responded to the inputs received (inclusive of a strategy of engagement with key stakeholders on key design elements of the project).	Consultation undertaken to date is described in Sections 4.1 and 4.2 The key issues raised, and a summary of how the design has responded to the issues raised by key stakeholders, is provided in Section 4.3 and Chapter 7 (Design development and place making)
4.3	The Proponent must describe the timing and type of community consultation proposed during the design and delivery of the project, the mechanisms for community feedback, the mechanisms for keeping the community informed, and procedures for complaints handling and resolution.	Section 4.4

4.1 Consultation approach and objectives

4.1.1 Approach

Stakeholder and community consultation for Sydney Metro is an ongoing process that commenced with the release of *Sydney's Rail Future* in 2012. Consultation undertaken since June 2014 for the Sydney Metro City & Southwest project has played an important role in informing and scoping the design of the project and this Environmental Impact Statement.

Transport for NSW is implementing a comprehensive community and stakeholder consultation program for Sydney Metro, to engage proactively with local communities and key stakeholders.

Key stakeholders for the project include:

- NSW Government agencies and elected representatives
- Inner West and Canterbury-Bankstown councils
- directly affected communities, including residents and businesses
- business and industry groups
- community groups
- utility and service providers
- Sydney Trains customers
- the broader community.

4.1.2 Communication objectives

The communication objectives for Sydney Metro are to:

- communicate the rationale for Sydney Metro and the broader network benefits it will deliver, including how it fits with the NSW Government's plans to increase Sydney's rail capacity
- communicate the Sydney Metro concept and timing
- build community and stakeholder relationships and maintain goodwill
- provide information about the planning approvals process and encourage community participation
- clearly communicate the property acquisition process.

4.2 Consultation and engagement activities to date

Consultation for Sydney Metro City & Southwest, including the Sydenham to Bankstown upgrade, has included:

- early stakeholder consultation between June 2014 and June 2015
- project scope consultation following the announcement of Sydney Metro City & Southwest in June and July 2015 and design development for Sydney Metro City & Southwest (described below)
- consultation during preparation and exhibition of the Environmental Impact Statement for the Chatswood to Sydenham project, between June 2015 and June 2016 (which also captured feedback on the Sydenham to Bankstown upgrade - refer to Table 4.3 for relevant issues raised)
- consultation as part of lodgement of the State Significant Infrastructure Application Report for the Sydenham to Bankstown upgrade, between February and June 2017
- consultation during preparation of the design and Environmental Impact Statement for the Sydenham to Bankstown upgrade, between February 2016 and July 2017.

A summary of consultation undertaken for Sydney Metro City & Southwest (including the Sydenham to Bankstown upgrade) is provided in Section 4.2.1. Further information on consultation undertaken prior to exhibition of the Environmental Impact Statement for the Chatswood to Sydenham project is provided in the State Significant Infrastructure Application Report for that project.

4.2.1 Consultation during development of Sydney Metro City & Southwest

Community consultation

On 4 June 2015, the Premier of NSW announced that funding had been secured to progress the Sydney Metro City & Southwest project. The announcement also initiated a round of community consultation undertaken to:

- collect stakeholder and community feedback on the project
- inform the Environmental Impact Statement for the Chatswood to Sydenham project
- inform the planning and design process for the Sydenham to Bankstown upgrade.

During this period, consultation was undertaken along the project corridor between Chatswood and Bankstown, to proactively engage with the community prior to the commencement of the formal environmental impact assessment process for both components of Sydney Metro City & Southwest. Engagement activities have continued since then.

Consultation activities included:

- provision of contact details including an information line (toll free), email address, website and postal address
- establishment of a mobile community information centre
- appointing Place Managers
- community information sessions (June and July 2015)
- interactive online forums (June to August 2015)
- industry consultation and briefings (June 2015, September 2016, and April 2017)
- media releases
- advertisements in local newspapers including foreign language newspapers
- issue of various project collateral (eg newsletter and project updates)
- preparation of an animation/fly-through.

Stakeholder consultation

Consultation was undertaken with a wide range of stakeholders as an input to the design and environmental impact assessment process. Consultation included the interface between Sydney Metro City & Southwest and assets owned by relevant stakeholders, and general briefings.

Stakeholders consulted included:

- Inner West and Canterbury-Bankstown councils
- Sydney Trains and NSW Trains
- Roads and Maritime Services and Sydney Co-Ordination Office
- Department of Planning and Environment
- Office of the Environment and Heritage
- Office of the Government Architect
- Australian Rail Track Corporation
- utility providers including Transgrid, Ausgrid, Qenos, and Sydney Water
- Sydney Motorway Corporation (in relation to WestConnex).

A summary of the key issues discussed with the various stakeholders and the design and assessment responses is provided in Section 7.4.

4.2.2 Consultation during preparation of this Environmental Impact Statement

The objective of consultation before public exhibition of the Environmental Impact Statement was to ensure stakeholders were aware of the project and the design and assessment process. The key engagement activities undertaken are described below.

Stakeholder identification and analysis mapping

A desktop search and site visit was undertaken to identify stakeholders within/close to the project area and those likely to have an interest in the construction and operation of the project.

Community contact and information tools

The community contact and information tools available during the preparation of the Environmental Impact Statement are listed in Table 4.2. These will remain in place for the duration of the project.

Table 4.2 Community contact and information points available during the planning and approval process

Activity	Detail
Community information line (toll free)	1800 171 386
Community email address	sydneymetro@transport.nsw.gov.au
Website	http://www.sydneymetro.info/
Postal address	Sydney Metro City & Southwest PO Box K659, Haymarket, NSW 1240
Place Managers	Contact details are provided at http://www.sydneymetro.info/

State Significant Infrastructure Application Report

On 16 February 2017, the State Significant Infrastructure Application Report was made available to the public on the Department of Planning and Environment's Major Projects website. The statutory advertisement was placed in three daily newspapers and three local papers. It was also translated and placed in six non-English news publications to ensure that the culturally and linguistically diverse communities in the vicinity of the project area were made aware of the project and its status.

Project update

After lodgement of the State Significant Infrastructure Application Report, the Sydney Metro City & Southwest project update was delivered to 70,000 properties located in the vicinity of the project area on 16 February 2017. The update provided information about the project, the next steps, consultation mechanisms and the State Significant Infrastructure Application Report. The project update was also made available on the Sydney Metro website.

Copies of the update were distributed to relevant ethnic community organisations. The update was also translated into Arabic, Vietnamese, Greek, Mandarin, Bengali, Hindi, and Korean.

Door knocks

Members of the project team visited properties potentially affected by acquisition and those located adjacent to the stations. Occupants were provided information on the release of the State Significant Infrastructure Application Report, what it means for them and the upcoming stages of the environmental assessment and acquisition process.

Community information display

Community information displays were held to provide up to date information on the project (and the Sydney Metro in general) and to provide the opportunity for community members to ask questions and provide feedback. The information displays were held at the following events and locations (total number of visitors is included in brackets):

- Sydney Festival at Barangaroo in January 2017 (31,000 visitors)
- Bankstown Central in March 2017 (1,452 visitors)
- Lakemba Markets in April 2017 (175 visitors)
- Sydney Royal Easter Show in April 2017 (88,882 visitors)
- Campsie Shopping Centre in May 2017 (806 visitors)
- Marrickville Metro in May 2017 (820 visitors).

A summary of the questions asked and issues raised is provided in Table 4.3.

Station information flyers

In May and June 2017, over 5,600 information flyers were handed out at the following stations during the morning and afternoon peak periods:

- Hurlstone Park Station
- Canterbury Station
- Dulwich Hill Station
- Wiley Park Station
- Belmore Station
- Punchbowl Station.

The aim of the flyers was to provide information about Sydney Metro, including future benefits, service frequency, and estimated travel times. Members of the community were also encouraged to engage with the Place Managers and share their comments and feedback.

Key issues raised during this activity are included in Table 4.3.

Community survey on the Sydney Metro website

A survey was developed and uploaded onto the Sydney Metro website seeking feedback from the community regarding existing travel habits, the use of rail replacement buses during Sydney Trains scheduled possessions, and potential alternative transport arrangements during the project construction period. The survey included the following questions:

- How often do you catch train services on the Bankstown Line on weekdays?
- How often do you catch train services on the Bankstown Line on weekends?
- Have you ever wanted to catch the train on the weekend, but found that rail replacement buses were operating?
- In the future, if rail replacement bus services are provided during temporary closures of the Bankstown Line on either weekdays or weekends, what will be most important to you?
- What else would make catching rail replacement buses more appealing?
- How would you like to be informed about the temporary closure of the rail line?

Between 14 May and 12 June 2017, a total of 35 responses to the survey were received.

Alternative transport arrangements would be implemented to convey rail customers to their destinations during periods where temporary station or track closures are required, including provision of temporary rail replacement buses and other services during rail possession periods. Information on alternative transport arrangements is provided in Section 9.11.

Planning focus meeting

A planning focus meeting was held with government agency stakeholders on 27 February 2017 to provide information on the project and the scope of the Environmental Impact Statement, and to assist agencies in their response to the Department of Planning and Environment in relation to issues relevant to the Secretary's Environmental Assessment Requirements. Representatives of the Inner West and Canterbury-Bankstown councils and a number of NSW State government agencies, attended the meeting.

A summary of issues formally raised by agencies as an input to the Secretary's Environmental Assessment Requirements is provided in Table A.3 of Appendix A.

Customer focus groups

Transport for NSW conducted research with customers in early 2017 to understand their perspectives and receive feedback on the preliminary station designs. Areas of focus for customer feedback included usability, safety, efficiency, interchange, the station role in the community, and the challenges faced by people with accessible transport needs. This early customer engagement provided key insights that have informed the ongoing design of the stations. There would be further customer research and testing during key stages of design development. Further information on how the design developed is provided in Chapter 7.

Government agency consultation

Ongoing consultation has been undertaken with specific groups, including regular meetings with:

- Heritage Working Group – this group was consulted on the station designs, including options and design drivers influencing heritage, potential project impacts on heritage items, and management strategies. The group includes heritage specialists and representatives from the Department of Planning and Environment, Transport for NSW, Sydney Trains and the Office of Environment and Heritage. Further information on heritage was considered during design development is provided in Chapter 7.
- Sydney Metro Roads Integration Working Group - this group was consulted on the traffic and transport assessment, the potential project impacts and management strategies. The group includes the Sydney Co-ordination Office and Roads and Maritime Services.

Transport for NSW's government agency consultation focussed on cross-agency integration and communication. Regular meetings were held with a variety of government stakeholders to ensure key issues were appropriately addressed in the Environmental Impact Statement, including (but not limited to):

- Department of Planning and Environment
- Environment Protection Authority
- Office of Environment and Heritage
- Department of Primary Industries
- Department of Premier and Cabinet

- UrbanGrowth NSW
- Sydney Motorway Corporation (WestConnex)
- Inner West Council
- Canterbury-Bankstown Council
- Sydney Water
- Ausgrid.

Major stakeholder consultation

Transport for NSW's stakeholder consultation team was responsible for ensuring local members of parliament, councils, peak bodies, and industry groups were proactively engaged and informed about the project. Regular briefings were held to keep stakeholders informed and to ensure key issues raised were addressed.

Community design workshops

The Hurlstone Park Association and the Save Dully Action Group raised a number of issues and concerns about the potential impact the proposed station upgrades on the character of Hurlstone Park and Dulwich Hill. In response, Transport for NSW held interactive design workshops to seek feedback from the groups on the following dates:

- Hurlstone Park Association – 24 May 2017
- Save Dully Action Group – 29 June 2017.

The workshops covered:

- current station designs
- explaining negotiable and non-negotiable elements of the design, and those aspects that could be influenced, such as accessibility and maintenance requirements
- opportunities, constraints, and challenges.

The participants were also encouraged to provide feedback on what they liked and disliked about the existing station, their concerns, priorities for the upgrade, ideas for the station precincts, materials to be used, and areas to be enhanced and preserved. Where possible, feedback provided has been incorporated into the design.

4.3 Results of consultation relevant to this Environmental Impact Statement

Key issues raised during consultation relevant to the Environmental Impact Statement, including the potential impacts to be considered and the information to be provided, are summarised in Table 4.3. A summary of the issues raised by agencies in response to the request by the Department of Planning and Environment for input to the Secretary's environmental assessment requirements is provided in Appendix A. It is noted that these lists present a summary of the key issues raised.

Table 4.3 Summary of key community issues raised relating to the Environmental Impact Statement

Issue category	Issues raised	Where addressed in the EIS
Project scope	• What does the project involve and where is it located?	Chapters 1, 2 and 8
	• Public domain improvements proposed	Section 8.1
	• What other transport facilities are included? Is the bus interchange at Bankstown included in the scope?	Section 8.1.1
	• What other facilities are required (eg external storage sites outside the corridor)?	Section 9.8
	• Will there be any acquisition or divestment of lands?	Section 8.2
	• Why is this section not underground like in the city?	Section 6.3.4
	• Infrastructure ownership and nature of private operating contract	Section 8.3
	• Project cost and who is paying for it	Section 1.2.1
	• Suitability of existing stations for Sydney Metro operations	Section 8.1
	• Will the project result in the permanent closure of any stations?	Section 8.1
Project design and features	• Station design (location, access, platform length etc)	Section 8.1
	• Train/carriage design (numbers of seats, heating/air conditioning etc)	Sections 8.3.4 and 8.3.5
	• Security on trains (if no driver) and at stations	Section 8.3.4
	• Emergency and mechanical failure response arrangements	Section 8.3
Project need/justification	• Reason for/purpose of the project	Section 5.1
	• Journey to work benefits	Sections 5.3.4 and 5.3.5
	• The project is not needed - the cost should be allocated to other transport projects, as there is already rail services along the T3 Bankstown Line	Chapter 5
Operation of the project	• How the project would operate, including timing of operation and frequency of services	Section 8.3.2
	• Future travel times to the city	Section 5.3.5
	• Interface with the Sydney Trains network	Section 11.4.2
	• Cost of fares and use of Opal cards	Section 8.3.6
	• Routes and service patterns – including future travel routes and services; for example, impacts on direct access to stations, including City Circle stations (Museum/St James/Circular Quay/Wynyard/Town Hall), and St Peters and Erskineville stations, services beyond Bankstown	Section 11.4.2
Construction	• Construction timing and duration	Section 9.7.1
	• Service disruptions (timing and duration) during construction	Sections 9.7.2 and 9.7.3
	• Transport strategies and bus services that would be provided during construction to replace trains	Section 9.11 and Chapter 10
Traffic, transport and access	• Impacts on accessibility, including ‘whole of journey’	Section 11.4.2
	• Impacts on/benefits for traffic during operation	Section 11.4

Issue category	Issues raised	Where addressed in the EIS
	• Access to pedestrian and cycling links	Chapters 10 and 11
	• Integration with other modes of transport, such as buses and light rail	Sections 8.1.1 and 11.4
Noise	• Construction noise and vibration	Chapter 12
	• Noise during operation	Chapter 13
Heritage	• Impacts of upgrading stations on heritage listed stations, and impacts on heritage overall	Section 7.3.7 Chapter 14
Socio-economic and business impacts	• Impacts on employment, including employment of rail staff/train drivers	Chapter 17
	• Impacts on businesses around stations	Chapter 18
	• Access for customers and staff	Chapter 18
Landscape and visual amenity	• How many trees would need to be removed, and would these be replaced	Sections 9.3.2 and 9.4.4
Hydrology and flooding	• Impacts on existing flooding situation – would the project make it worse?	Section 21.3
Land use and future planning	• Interface with the Sydenham to Bankstown urban renewal corridor strategy	Section 16.3
Air quality	• Air quality impacts of additional traffic during construction	Section 23.3.2

4.4 Future consultation and engagement

4.4.1 Public exhibition of the Environmental Impact Statement

The Department of Planning and Environment will place this Environmental Impact Statement on public exhibition for a minimum of 30 days. During the exhibition period, government agencies, project stakeholders and the community will be able to review the Environmental Impact Statement and make a written submission to the Department of Planning and Environment for consideration in its assessment of the project.

Advertisements will be placed in newspapers to advise of the public exhibition, where the Environmental Impact Statement can be viewed and details of community consultation activities and information sessions.

Consultation activities during public exhibition will include:

- environmental impact statement overview document
- media releases
- information sessions
- community event stalls
- door knocks
- newsletter letterbox drop
- project website updates
- newspaper advertising
- displays at local councils
- stakeholder meetings

- local business engagement
- translated materials
- government stakeholder engagement.

The activities to be implemented are listed in Table 4.4.

At the completion of the public exhibition period and after reviewing the submissions, Transport for NSW will prepare a submissions report and/or a preferred infrastructure report. This report would be made available to the public. Further information on the approvals process is provided in Section 3.1.

4.4.2 Ongoing consultation and engagement activities

Consultation activities

Transport for NSW will continue to work with stakeholders and the community to ensure they are informed about the project and have opportunities to provide feedback to the project team.

The existing community contact and information tools (listed in Table 4.2) would remain in place throughout the duration of the project. Translated materials and content will continue to be provided on the Sydney Metro website. All publications provide information on translation services available through TIS National and where appropriate, Sydney Metro will take translators to face-to-face meetings with stakeholders.

A list of the proposed activities and timing is provided in Table 4.4.

Consultation and complaints handling during construction

The Construction Environmental Management Framework (Appendix D) sets out the environmental, stakeholder and community management requirements for construction. It provides a linking document between the planning approval documentation and the construction environmental management plan to be developed by the construction contractor/s.

The Construction Environmental Management Framework requires the construction contractor/s to develop a Community Communications Strategy for construction and the framework sets out the main elements required to be included and implemented as part of the plan. These include a complaints handling procedure. The Sydney Metro Construction Complaints Management System will be used to record, manage and where required escalate and mediate complaints. Further information is provided in Appendix D.

Table 4.4 Ongoing consultation and engagement activities

Activity	Timing	EIS exhibition	Design	Construction	Operation
Awareness and marketing campaign to engage future customers	Ongoing	●	●	●	●
Community event stalls/community information displays	Ongoing	●	●	●	
Community information sessions	During exhibition of the EIS	●			
Community and business forums	As required			●	
Overarching Community Communication Strategy for Sydney Metro City & Southwest	Existing			●	

Activity	Timing	EIS exhibition	Design	Construction	Operation
Community Communication Strategy for project	Prior to construction			●	
Translated materials	Ongoing	●	●	●	●
Construction complaints management system	Existing			●	
Construction notifications	Seven days prior to construction starting			●	
Displays at council offices	During exhibition of the EIS	●			
Door knocks	As required	●	●	●	●
Email updates	At relevant milestones	●	●	●	●
Enquiries and complaints information line	Ongoing	●	●	●	●
Environmental Impact Statement overview document	During exhibition of the EIS	●			
Fact sheets	As required	●	●	●	●
Government stakeholder engagement	As required	●	●	●	●
Local business engagement	As required	●	●	●	●
Media releases	At relevant milestones	●	●	●	●
Newsletter	During exhibition of the EIS and other relevant milestones	●	●	●	●
Newspaper advertising	During exhibition of the EIS and other relevant milestones	●	●	●	●
Operation communications plan	Prior to operation				●
Place Managers	Ongoing	●	●	●	
Project briefings and presentations	Relevant milestones	●	●	●	
Project overview document	Relevant milestones	●	●	●	
Site signage	Prior to construction			●	
Social media updates	Ongoing	●	●	●	●
Stakeholder meetings	As required	●	●	●	●
Website, animations and online forums	Ongoing	●	●	●	

Part B

The project

5. Project need

This chapter describes the need for the project, strategic context, and project benefits. The Secretary's environmental assessment requirements addressed by this chapter are listed in Table 5.1. A full copy of the assessment requirements and where they are addressed in the Environmental Impact Statement is provided in Appendix A.

Table 5.1 Secretary's environmental assessment requirements – project need

Ref	Secretary's environmental assessment requirements – project need	Where addressed
2.1(d)	A summary of the strategic need for the project with regard to its critical State significance and relevant State Government policy.	This chapter

5.1 Need for the project

The project consisting of the upgrade of the T3 Bankstown Line between Marrickville and Bankstown is needed for three key reasons:

1. To meet the growing demand for services on the T3 Bankstown Line.
2. To resolve current accessibility and safety improvement issues on the T3 Bankstown Line.
3. To relieve existing bottleneck and capacity issues affecting the T3 Bankstown Line and the overall rail network.

In addition to these localised needs, the project would contribute to the regional needs of a growing population and aid in the response to housing and job demands. It would also promote improved liveability through better public transport opportunities by:

- contributing to population and economic growth in Sydney
- helping to meet increasing community demand for public transport
- responding to housing demands in Sydney.

The local and regional needs, issues and drivers for the project are described in Sections 5.1.1 and 5.1.2.

The project also addresses a number of strategic needs, as outlined in the following plans and policies:

- *Australian Infrastructure Plan* (Infrastructure Australia, 2017)
- *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b)
- *Rebuilding NSW – State Infrastructure Strategy* (NSW Government, 2016a)
- *Premier's and State priorities: NSW State Plan* (NSW Government, 2015)
- *Sydney's Rail Future* (Transport for NSW, 2012a)
- *Sydney City Centre Access Strategy* (Transport for NSW, 2013a)
- *A Plan for Growing Sydney* (Department of Planning and Environment, 2014)
- *Draft Sydenham to Bankstown Urban Renewal Corridor Strategy* (Department of Planning and Environment, 2017)

- *Draft South District Plan* (Greater Sydney Commission, 2016)
- *Draft Central District Plan* (Greater Sydney Commission, 2016).

The strategic needs and context for the project are described in Section 5.2.

5.1.1 Key local needs

Inability to meet growing demand with current T3 Bankstown Line services

For customers travelling on the network into and out of the Sydney CBD, the limited network capacity restricts the number of services that can be provided, resulting in increased crowding on trains and platforms and within train carriages, as well as decreased reliability of services.

By 2026, without an increase in network capacity, it is predicted that demand will exceed capacity on the T3 Bankstown Line, as well as the T1 North Shore, T1 Northern and T2 Inner West & South lines. Demand will also be approaching capacity on the T2 Airport Line.

Analysis undertaken by Transport for NSW identifies that by 2036, demand for rail services will be at 108 per cent of capacity, leading to widespread crowding and a decrease in reliability. For the T3 Bankstown Line, based on the annual growth rate of six per cent between 2014 and 2016, there will be around twice as many customers attempting to use this service.

The *NSW Long Term Transport Master Plan* notes that 'The Bankstown Line had the highest average load in the morning peak hour at 150 percent. The two faster services from Liverpool via Bankstown had an average load of 140 percent at Campsie. Such congestion results in reduced public transport reliability'.

Outside peak periods, services on the T3 Bankstown Line are even more limited. Typically, waiting times for trains into the Sydney CBD are around 15 minutes. This can deter some customers from using public transport and the interchange with their destination may be incompatible with their daily travel needs.

Accessibility issues on the T3 Bankstown Line

Of the 10 stations from Marrickville to Bankstown, five have not had major upgrades and remain largely as they were built early last century. These stations do not comply with NSW and Australian Government accessibility standards for public transport. Access is generally provided by stairs or ramps, while only five of the 10 stations have lift access. Nine of the 10 stations have curved platforms, which creates larger gaps between the train and platform compared to straight platforms, and forms a barrier to movement. This large gap makes access difficult for some customers, particularly the disabled and the elderly, those travelling with young children and prams, and customers travelling with luggage. Accessibility issues also extend into the areas surrounding the stations, presenting challenges for movement between different modes of transport.

The platform buildings along the T3 Bankstown Line are generally in good condition. However, many of them are not accessible and due to security and operational considerations are vacant, locked and unavailable to the public.

Existing bottleneck and capacity issues with the rail network and the T3 Bankstown Line

The reliability and capacity of the Sydney Trains rail network is constrained by a number of factors. Most of the rail network was built more than 100 years ago and is very complex compared to other rail networks. Part of the complexity is a result of numerous lines having to converge into fewer inbound tracks through the CBD. The convergence of these lines constrains the number of services that can operate along each of the lines in the Sydney Trains rail network. In most instances, the existing lines are unable to operate at maximum capacity.

As a result of the identified limitations, the overall capacity and reliability of the rail network and the number of services that can be provided is restricted, resulting in increased crowding on trains and platforms, and decreased reliability of services. Merging and crossing movements required as part of the convergence of lines into the CBD also introduce risks to service reliability during times of service disruption.

The existing T3 Bankstown Line effectively slows down the Sydney Trains rail network because of the way it merges with other lines close to the CBD. The T3 Bankstown Line services have to merge with services operating on other lines approaching the CBD, including the T2 Inner West & South Line at Sydenham Station and the T2 Airport Line at Central Station. The existing timetable provides for windows to accommodate merging/crossing movements without affecting reliability. However, problems arise during times of disruption, when those windows for merging and crossing are affected. This can increase the likelihood that delays on one line will impact another line.

The T3 Bankstown Line and the T2 Airport, Inner West & South Line use the City Circle to traverse the Sydney CBD. In the morning peak, the eight T3 Bankstown Line services that operate each hour are split, with four services operating on the City Inner track (counter-clockwise), and four services operating on the City Outer track (clockwise). This method of operating means that some customers using the T3 Bankstown Line have a longer journey time to reach Town Hall and Wynyard Stations, or have to change lines at Sydenham or Central Stations.

In the afternoon, given the different service types and patterns that operate via the City Circle before travelling onwards to other destinations, passengers often have to wait at the station platform for the service they wish to board, contributing to station congestion and overcrowding.

Figure 5.1 provides an indication of how services currently operate on the City Circle.

Other capacity constraints resulting from the existing infrastructure, which further limit the capacity of the network, include:

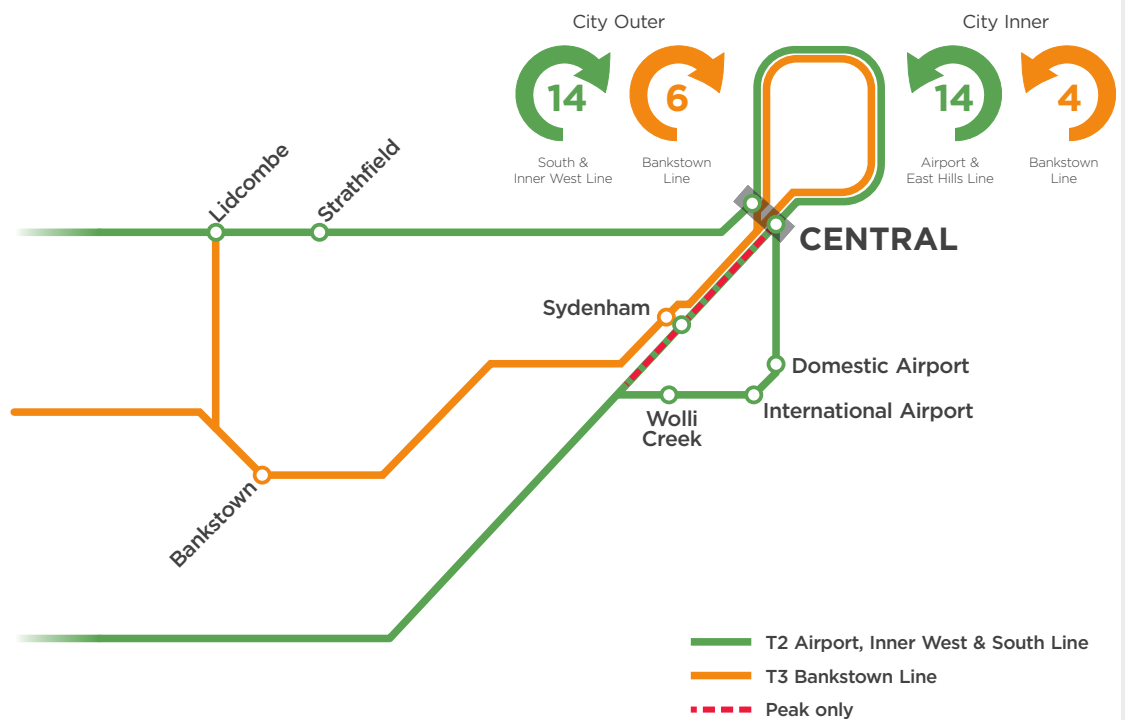
- narrow station platforms at some stations
- vertical egress required at key stations, such as Town Hall Station
- limitations associated with passenger flow rates boarding/alighting from double deck trains
- different stopping patterns for trains operating from the same platforms at many CBD stations.

5.1.2 Regional demands and drivers

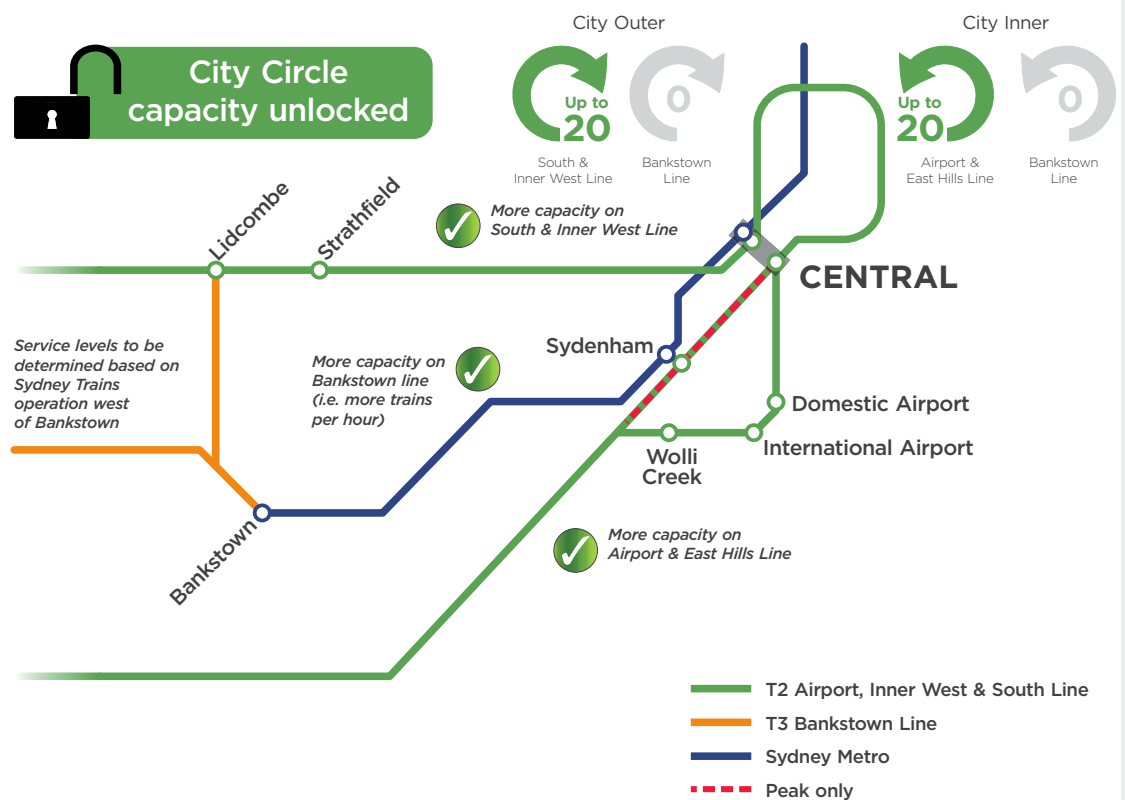
Contributing to population and economic growth in Sydney

As noted in *Sydney's Rail Future*, Sydney is a modern international city experiencing growth in population and employment. Sydney currently has a population of about 4.6 million which is projected to grow significantly over the coming years to 5.1 million by 2021 and around 6 million by 2031. Driven by population growth, employment in Sydney is expected to increase from its current level of 2.1 million workers to 2.6 million by 2031 (Transport for NSW, 2012a). *A Plan for Growing Sydney* predicts that by 2031, Sydney's economic output will almost double to \$565 billion a year and there will be 689,000 new jobs.

For Sydney to continue to be one of the most economically productive and liveable areas in Australia, its growth needs to be managed. To maintain the liveability of the city, transport capacity is required to enable the development of affordable housing and to enable people to move around the city to enjoy their daily lives.



WITHOUT SYDNEY METRO SERVICE



SYDNEY METRO OPERATIONAL

The NSW Government's strategy for accommodating Sydney's future population growth over the next 20 years aims to ensure that a competitive economy is fostered with world-class services and transport. The transport system needs to be high quality and have provision for increased capacity if Sydney is to maintain its current levels of global competitiveness and growth.

The Sydney Metro system would not only improve infrastructure and remove existing bottlenecks, it would provide faster and more reliable connections to jobs, education facilities, health services, and sports and recreation facilities. Sydney Metro will have a target capacity of about 40,000 customers per hour, similar to other metro systems worldwide.

The Australian and NSW Governments have developed national and city building policies to support the continued growth and development of Sydney's economy and sustainability. Further investment in transport infrastructure, including Sydney Metro, is a key requirement to achieve these policy objectives. Further information is provided in Section 5.2.

Helping to meet increasing community demand for public transport

Growth in employment and population will require increased transport capacity to ensure continued productivity growth and to sustain Sydney's liveability.

The growing demand for access to Sydney's City Centre is recognised by a number of studies, including the *Sydney City Centre Access Strategy*, which notes the following:

- About 180,000 of the more than 630,000 trips made into the City Centre each weekday are in the morning one hour peak. Over 80 per cent of these peak hour trips are made using public transport, with rail carrying the biggest share.
- Over 115,000 of these 180,000 trips to the City Centre in the morning peak hour occur in two main corridors: the multi-modal Harbour Bridge corridor to the north (with rail being the dominant mode) and the rail corridor through Central Station. Increasing access through key corridors will be a critical part of meeting future demand.
- The number of people travelling to the City Centre each day will grow to some 775,000 by 2031 – an extra 145,000 trips.
- Major developments at Barangaroo and Darling Harbour will generate significant travel demand, with the development at Barangaroo alone bringing an additional 23,000 jobs to the City Centre.

The current transport system cannot provide the capacity required. The road and bus networks are already heavily constrained and cannot effectively be augmented into the CBD. While there is significant investment planned for the road network, cars and buses alone are not able to provide for future travel demands.

Public transport use in Sydney is rapidly increasing, putting more pressure on already crowded trains and buses. An annual snapshot by the NSW Audit Office shows that patronage across the public transport network increased by 12 per cent in the 2015-16 financial year. Trips on the rail network increased from 328 million to 363 million (up 10.7 per cent) last financial year. Trips on Sydney's buses increased 12.8 per cent, from 257 million to 290 million. Trips on the L1 Dulwich Hill light rail line increased by 66 per cent, from six million to 10 million, while ferry trips remained stable.

The continuing rise in patronage is putting pressure on public transport, creating crowding, and issues with punctuality, reliability and capacity. The rail network in particular is experiencing significant constraints and challenges.

The *Sydney City Centre Access Strategy* describes Sydney's rail network as the backbone of the city's public transport system. On a typical workday, customers take approximately 1.2 million journeys on the rail network, one-third of which occur between 6am and 9.30am. With the expected

rate of population growth, Sydney is fast outgrowing its rail network. Growth in population and employment is forecast to increase rail network demand by 41 per cent by 2026 and by 61 per cent by 2036.

The implementation of planned rail service enhancements to coincide with the opening of Sydney Metro Northwest will increase passenger demand into the CBD by 31 per cent by 2026. The following lines are forecast to experience significantly higher growth in passenger demand into the CBD by 2026:

- T1 North Shore Line – increase of 7,200 customers per hour (40 per cent)
- T2 Inner West & South Line – increase of 5,200 customers per hour (36 per cent)
- T2 Airport Line via Airport – increase of 4,500 customers per hour (47 per cent)
- T3 Bankstown Line – increase of 4,900 customers per hour (58 per cent)
- Intercity (Northern Line) – increase of 3,500 customers per hour (88 per cent).

This increased rail demand to the CBD is estimated to represent over 6,700 additional trips in the AM peak. Efficient, high capacity public transport services will be needed to meet this growing demand to get people into the City Centre. As noted in *Sydney's Rail Future, NSW Long Term Transport Master Plan* and *Sydney City Centre Access Strategy*, the NSW Government has determined that Sydney Metro will play a key role in this regard.

Responding to housing demands

The benefits of land use and transport planning integration are generally accepted. Development may be in response to new or improved public transport or may occur where public transport provision is anticipated in light of strategic land use planning.

There is a need to provide 664,000 new dwellings in Greater Sydney over the next 20 years, which is an average of over 33,000 dwellings per annum across the city. These dwellings will need to be high quality, well connected to jobs and services, affordable, within the walking catchments of larger centres and serviced by transport infrastructure.

The draft *Sydenham to Bankstown Urban Renewal Corridor Strategy* identifies opportunities for additional housing and jobs within walking distance of the train stations along the existing T3 Bankstown Line between Sydenham and Bankstown. The strategy forecasts that around 35,400 additional dwellings could be built within the corridor by 2036.

The Greater Sydney Commission is responsible for regional planning in Greater Sydney, in a partnership between State and local government. District planning undertaken by the Commission will guide the delivery of *A Plan for Growing Sydney* across the six districts that form Greater Sydney. The project area is located within the South and Central Districts.

The draft South and Central District Plans set out the vision, priorities and actions for the development of the South and Central Districts. The draft plans outline the vision for the South and Central Districts, with Sydney Metro City & Southwest reinforcing the district's strong connections to employment hubs at Sydney Airport and the Sydney CBD, and enhancing housing opportunities along the corridor from Sydenham to Bankstown.

Regional planning undertaken by the Greater Sydney Commission indicates that accessing a greater number of jobs and services within a 30 minute commute is a key strategic goal. This requires better transport connections and stronger economic and employment centres.

5.2 Strategic context

5.2.1 Strategic planning context

The strategic context for Sydney Metro (including the project) is influenced by the outcomes of a number of strategic plans for transport and urban development that have been prepared at the national, state, regional, and local levels.

Key state and regional strategies, policies and plans have also informed and influenced the vision, objectives and development of Sydney Metro and the project. These plans and strategies are listed in Table 5.2 with a summary of the key policies/directions that are relevant to Sydney Metro and/or the project.

Table 5.2 Relevant strategies and plans

Strategy/plan/policy	Key policies and strategies relevant to the project need ¹
National	
<i>Australian Infrastructure Plan</i> (Infrastructure Australia, 2017)	Sydney Metro City & Southwest is identified as a high priority initiative under the plan, to address rail capacity issues, improve transport access to the Global Economic Corridor, and assist in realising employment growth and increased productivity.
NSW	
<i>NSW Long Term Transport Master Plan</i> (Transport for NSW, 2012b)	<p>The master plan:</p> <ul style="list-style-type: none"> recognises Sydney's Rail Future and the proposed 'three tier' network (described below), as well as the role of high capacity rapid transit services notes that without the creation of additional rail capacity, crowding levels on the network will continue to increase, with many parts of the rail network predicted to be near or exceeding capacity in 2031 recognises the major transport challenges for Sydney, including the need to build a fully integrated city-wide transport system. <p>Relevant actions identified include:</p> <ul style="list-style-type: none"> increase train capacity on the T3 Bankstown Line support Department of Planning and Infrastructure (now Department of Planning & Environment) in delivering urban renewal encourage transit-oriented development moving towards an accessible transport system.
<i>Rebuilding NSW – State Infrastructure Strategy</i> (NSW Government, 2016a)	<p>The strategy notes that:</p> <ul style="list-style-type: none"> Sydney Rapid Transit (the previous name for Sydney Metro) is the next phase in the evolution of Sydney's transit system. By extending the North West Rail Link (now known as Sydney Metro Northwest) services under Sydney Harbour and through the Sydney CBD, onto the T3 Bankstown Line, significant new capacity will be delivered for the whole rail network.
Premier's and State priorities: <i>NSW State Plan</i> (NSW Government, 2015)	<p>The following priorities are relevant to Sydney Metro:</p> <ul style="list-style-type: none"> creating jobs building infrastructure increasing housing supply ensuring on-time running of public transport.
Regional	
<i>Sydney's Rail Future</i> (Transport for NSW, 2012a)	<p>The future of Sydney's rail network is identified in Sydney's Rail Future as involving three tiers of services:</p> <ul style="list-style-type: none"> Tier 1 Rapid Transit (i.e. Sydney Metro) Tier 2 Suburban (the Sydney Trains network) Tier 3 Intercity (Central Coast, Newcastle, Wollongong and Blue Mountains services).

Strategy/plan/policy	Key policies and strategies relevant to the project need ¹
	<p>The strategy notes that conversion of the T3 Bankstown line would form part of the delivery of a rapid transit network for Sydney and that this would allow the introduction of faster services with 'turn up and go' convenience for commuters with services more than doubling after connection to the new rapid transit system.</p>
<i>Sydney City Centre Access Strategy</i> (Transport for NSW, 2013a)	<p>The strategy:</p> <ul style="list-style-type: none"> notes that rail will remain the dominant transport mode for getting to the City Centre recognises the growing demand for access to Sydney's City Centre recognises the role that rapid transit and improvements to the rail network will play in improving access to the City Centre.
<i>A Plan for Growing Sydney</i> (Department of Planning and Environment, 2014)	<p>The following goals and principles are relevant to Sydney Metro:</p> <ul style="list-style-type: none"> Goal 1: A competitive economy with world-class services and transport Goal 2: A city of housing choice, with homes that meet our needs and lifestyles Goal 3: A great place to live with communities that are strong, healthy and well connected Principle 1: Increasing housing choice around all centres through urban renewal in established areas Principle 3: Connecting centres with a networked transport system. <p>Relevant directions and actions under the plan include:</p> <ul style="list-style-type: none"> expand the Global Economic Corridor invest in strategic centres across Sydney to grow jobs and housing and create vibrant hubs of activity preserve future transport and road corridors to support future growth undertake urban renewal in transport corridors that are being transformed by investment, as well as around strategic centres.
<i>Draft Sydenham to Bankstown Urban Renewal Corridor Strategy</i> (Department of Planning and Environment, 2017)	<p>The corridor strategy was prepared to identify opportunities for urban renewal and additional housing and jobs around the stations on the T3 Bankstown Line. It notes that the improvements to public transport that would be provided by Sydney Metro are likely to increase the attractiveness of the area as a place to live. The strategy forecasts that about 35,400 new homes and 8,700 new jobs could be built within the corridor by 2036.</p> <p>The corridor strategy is supported by an integrated transport strategy. Relevant actions under the strategy include:</p> <ul style="list-style-type: none"> provide a connected and integrated network that offers a range of travel options for residents, workers and visitors provide high quality walking connections between the rail stations and the surrounding environment develop a continuous and connected cycle network that provides local and regional connections and leads to an increase in cycling trips prepare strategies to reduce the reliance on private vehicle use and encourage walking, cycling and public transport. <p>As the strategy is currently in draft form, Transport for NSW would continue to work with the Department of Planning and Environment to ensure consistency between the project and the final strategy.</p>
<i>Draft South District Plan</i> (Greater Sydney Commission, 2016)	<p>The plan:</p> <ul style="list-style-type: none"> recognises Bankstown and Campsie as district centres served by future Sydney Metro City & Southwest stations and notes the benefits of Sydney Metro to these centres in terms of increased accessibility notes that Sydney Metro City & Southwest will improve the South District's connections to the other parts of Sydney.

Strategy/plan/policy	Key policies and strategies relevant to the project need ¹
	<p>Relevant priorities and actions under the plan include:</p> <ul style="list-style-type: none"> • planning for job target ranges for strategic and district centres • growing economic activity in centres • providing access to a greater number of jobs and services within a 30 minute commute • facilitating enhanced walking and cycling connections.
<i>Draft Central District Plan</i> (Greater Sydney Commission, 2016).	<p>The plan:</p> <ul style="list-style-type: none"> • recognises Marrickville as a major employment and urban services precinct in the Central District served by future Sydney Metro City & Southwest stations. It notes the benefits of Sydney Metro to these centres in terms of increased accessibility • recognises that major transport infrastructure projects such as the construction of the Sydney Metro will improve access and productivity. <p>Relevant priorities and actions under the plan include:</p> <ul style="list-style-type: none"> • alignment of land use planning and infrastructure planning • investigation of opportunities to enhance east-west public transport connections • planning and delivery of regionally significant transport infrastructure • planning for job target ranges for strategic and district centres • improve 30 minute access to jobs and services • facilitate enhanced walking and cycling connections.

Notes: 1. Includes both the project in its own right and as part of Sydney Metro as a whole.

5.2.2 Strategic transport context

A key benefit of Sydney Metro City & Southwest is its role in expanding Sydney Metro. The project forms one of two components of Sydney Metro City & Southwest. Without it, the full benefits of Sydney Metro City & Southwest cannot be realised. As identified in the strategies, plans and policies listed in Table 5.2 and the *Final Business Case Summary* (NSW Government, 2016b), the strategic transport context of Sydney Metro involves the following key factors:

- the need to provide adequate transport capacity to respond to growth in population and economic growth in Sydney
- increasing demand for public transport in Sydney, in particular, rail transport
- the need to encourage transit-oriented housing and job opportunities, to respond to the growth in Sydney's population.

5.3 Project benefits

The project forms one of two components of Sydney Metro City & Southwest, which has been declared to be of critical State significance. The project is needed to complete Sydney Metro City & Southwest and to realise its full strategic benefits as part of Sydney Metro.

5.3.1 Sydney Metro City & Southwest has critical State significance

Sydney Metro City & Southwest (including the project), together with Sydney Metro Northwest, has been declared critical State significant infrastructure. Both these Sydney Metro projects have been declared as critical State significant infrastructure because they are, in the opinion of the Minister for Planning, essential for the State for economic, environmental and social reasons. These declarations recognise that Sydney Metro is part of the NSW Government's infrastructure investment program to respond to the growth in transport demand in Sydney.

With regard to Sydney Metro City & Southwest, the declaration recognised its role as part of Sydney Metro and the need for Sydney Metro. It also recognised the benefits of Sydney Metro City & Southwest in responding to existing issues with the rail network and the T3 Bankstown Line.

5.3.2 Supporting the growth of Sydney Metro

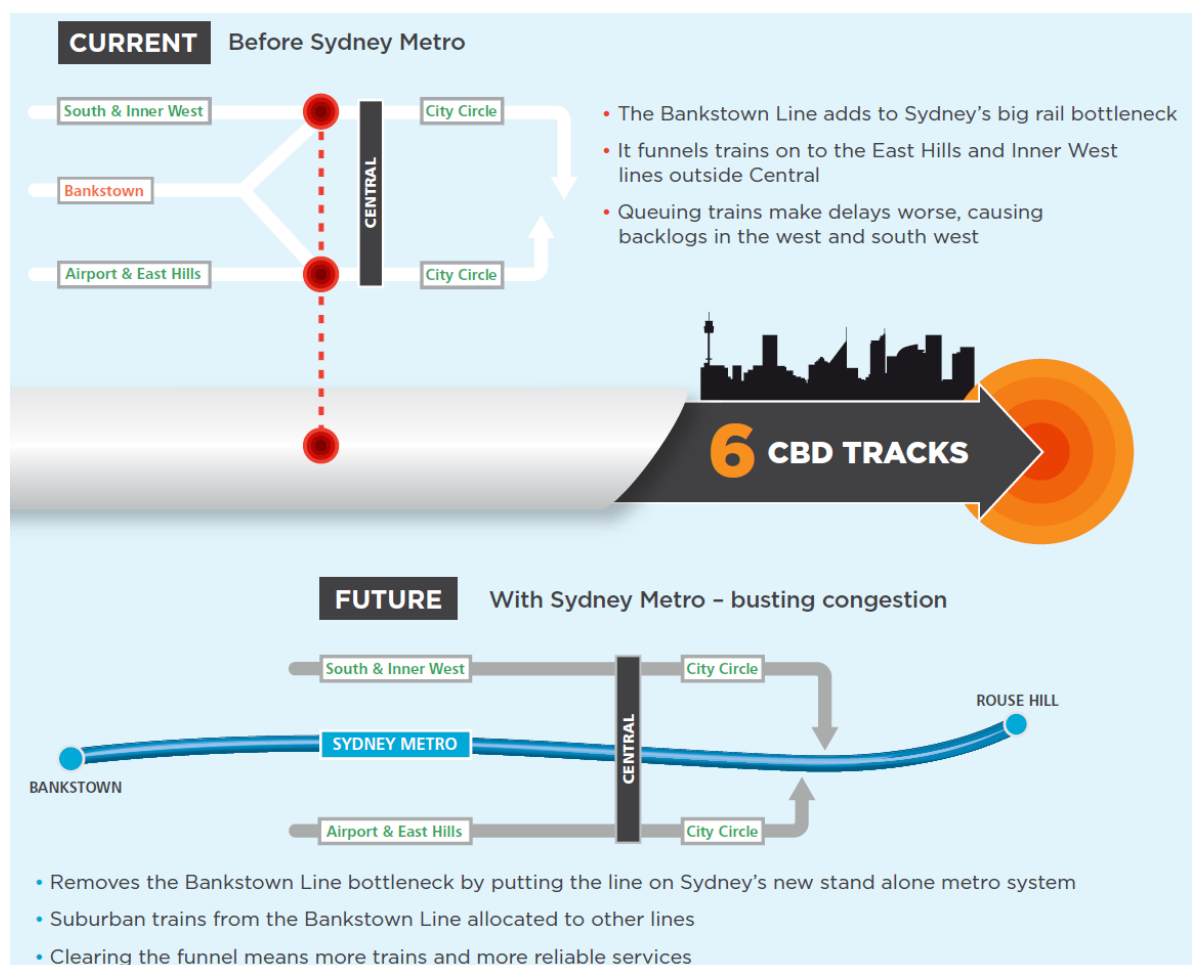
The project would further progress implementation of *Sydney's Rail Future* and Sydney Metro City & Southwest, enabling the provision of necessary public transport infrastructure to respond to the identified challenges and future demands.

Undertaking the project would enable Transport for NSW to extend the Sydney Metro system beyond Chatswood through to Bankstown. Benefits of the massive capacity growth anticipated through delivery of Sydney Metro – enough room for an extra 100,000 customers an hour – can only be achieved by delivering the full City & Southwest metro rail system (including the project) to work together with the existing suburban rail network.

5.3.3 Addressing capacity constraints

The upgrade of the T3 Bankstown Line to metro standards would address one of Sydney's biggest rail bottlenecks, delivering benefits across Sydney's rail network, as illustrated in Figure 5.2.

The suburban trains currently operating on the T3 Bankstown Line could be allocated to other railway lines. This in turn will enable the City Circle to be dedicated to the T2 Airport, Inner West & South Line in a simpler pattern of operation.



Source: Transport for NSW

Figure 5.2 Benefits of removing the T3 Bankstown Line from the existing heavy rail network

5.3.4 Better access for more people

By upgrading stations along the corridor between Marrickville and Bankstown, the project would enable better and safer access for more people and facilitate accessible interchange with other forms of transport.

This would promote mobility and safe autonomous access for all mobility levels, in accordance with relevant guidelines and standards, including the *Disability Discrimination Act 1992* and the *Disability Standards for Accessible Public Transport*.

In addition to the accessibility improvements, other station and precinct benefits to customers would include:

- new concourses, greater circulation space and new station entries better located to connect with areas surrounding the station
- improved public domain
- improved station interchange facilities.

The upgrades would deliver seamless travel to and between transport modes, encourage greater public transport use and better integrate with the role and function of the town centres along the corridor.

Accessibility improvements and bicycle facilities at upgraded stations, and safeguarding for an active transport corridor between Sydenham and Bankstown along the rail corridor, would encourage active transport use and deliver health benefits, by encouraging customers to walk and cycle to and from train stations.

5.3.5 Travel time savings

The project would result in travel time savings by providing more direct access for:

- T3 Bankstown Line customers to key destinations in the Global Economic Corridor
- T4 Eastern Suburbs & Illawarra Line customers to the key regional centre of Bankstown.

Benefits of travel time savings from the project are illustrated by comparison of typical travel times to and from certain destinations associated with introducing Sydney Metro City & Southwest (including the project) to the network, as shown in Table 5.3.

Table 5.3 Estimates of indicative travel time savings

Journey	Current travel time (using Sydney Trains) ¹	Travel time using Sydney Metro	Travel time savings
Bankstown to Central	Up to 36 minutes	26 minutes	Up to 10 minutes
Sydenham to Macquarie Park	45 to 51 minutes	29 minutes	At least 16 minutes
Bankstown to Martin Place	36 to 41 minutes	30 minutes	Up to 11 minutes

Notes: 1. Times take into account interchange between train services and wait times.

Figure 5.3 provides an illustration of how travel times would improve with the operation of Sydney Metro. The figure shows example journey options between Campsie and Macquarie Park using existing services - one using the existing Sydney Trains network only and one using both trains and buses. As shown in Figure 5.3, travelling between Campsie and Macquarie Park stations using public transport would currently take about 58 minutes. Using Sydney Metro, the travel time would reduce to about 42 minutes and no transfers would be required.

The examples show that, even in the absence of other transport changes, the project would make a major difference to travel times across the transport network. The improved connectivity and

travel time benefits represent new and more direct access to major CBD stations, to more job and employee opportunities (e.g. at Macquarie Park), and faster, more frequent access, to key education and medical services.

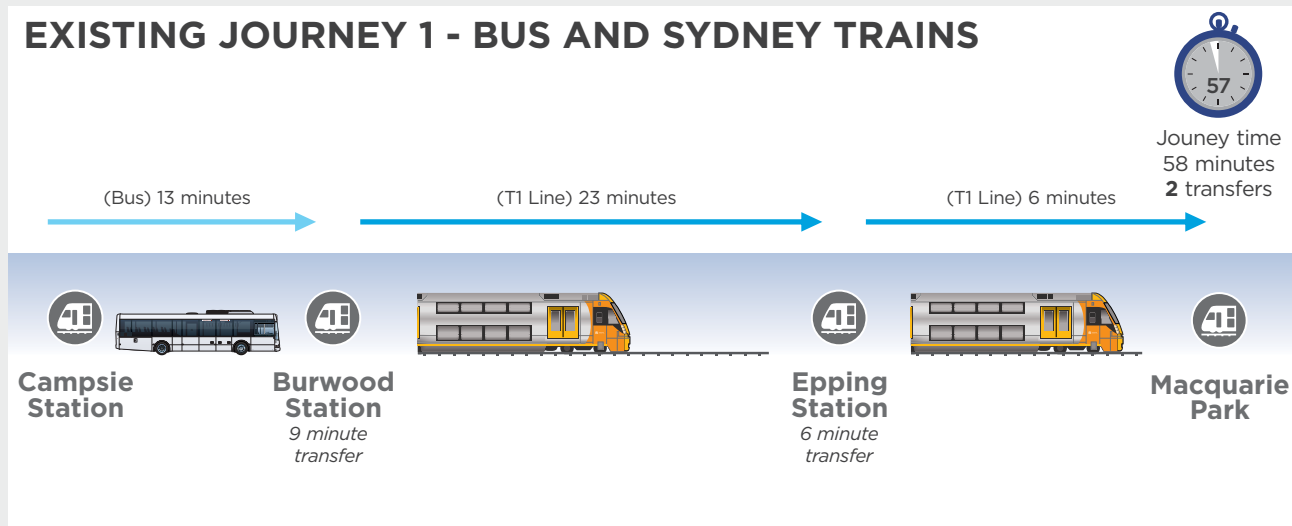
5.3.6 Facilitating urban renewal opportunities

The project would upgrade stations and support planned urban renewal opportunities, consistent with the aims of the draft *Sydenham to Bankstown Urban Renewal Corridor Strategy*, which has been prepared to identify opportunities for urban renewal, additional housing and jobs around the stations between Sydenham and Bankstown. It forecasts that over 35,000 additional dwellings could be built within the urban renewal corridor by 2036.

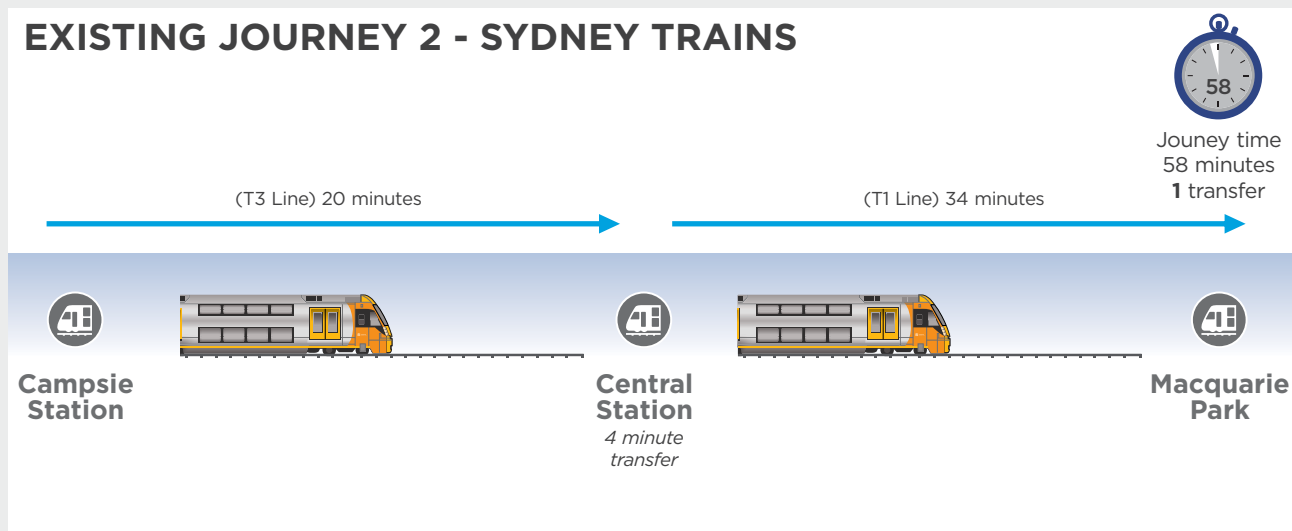
By upgrading stations, converting the T3 Bankstown Line to metro and delivering greater efficiency and reliability along the line, the project would play a role in encouraging transit oriented urban development around stations between Marrickville and Bankstown. It would facilitate realisation of urban renewal priorities and objectives under the draft *Sydenham to Bankstown Urban Renewal Corridor Strategy*, as well as the draft South District Plan and the draft Central District Plan prepared by the Greater Sydney Commission.

Further discussion on the linkages between the project and future planning in the Sydenham to Bankstown corridor is provided in Chapter 16 (Land use and property).

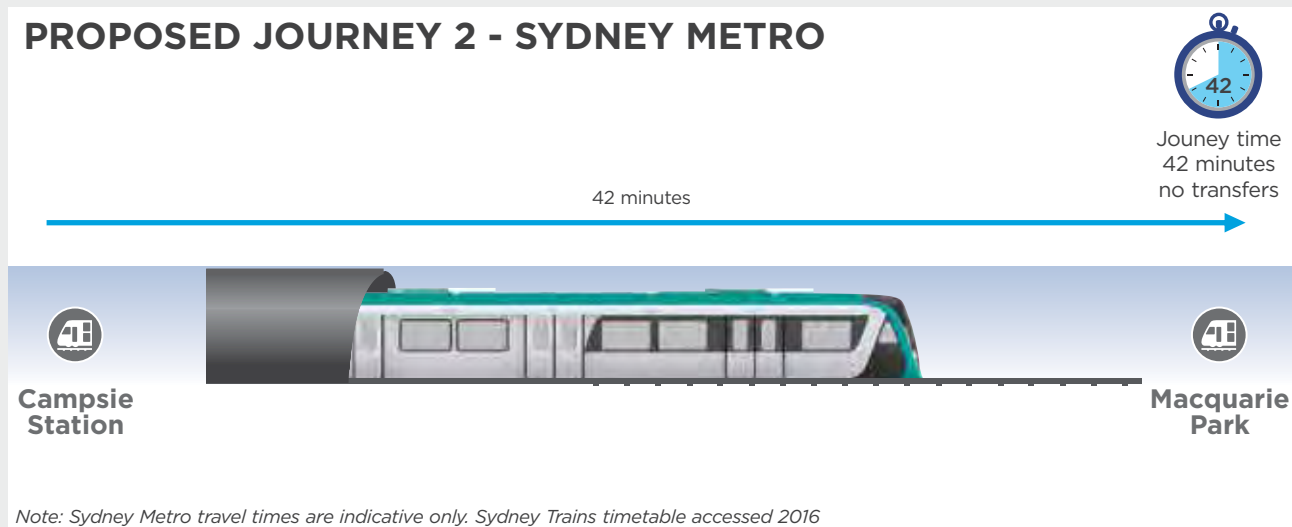
EXISTING JOURNEY 1 - BUS AND SYDNEY TRAINS



EXISTING JOURNEY 2 - SYDNEY TRAINS



PROPOSED JOURNEY 2 - SYDNEY METRO



Note: Sydney Metro travel times are indicative only. Sydney Trains timetable accessed 2016

6. Project alternatives and options

This chapter describes the alternatives to Sydney Metro as a whole (including the project) and the options considered for key design elements. The Secretary's environmental assessment requirements addressed in this chapter are listed in Table 6.1.

Table 6.1 Secretary's environmental assessment requirements – alternatives and options

Ref	Secretary's environmental assessment requirements – alternatives and options	Where addressed
2 Environmental Impact Statement		
2.1	The EIS must include, but not necessarily be limited to, the following: (e) an analysis of feasible alternatives ¹ to the project	Section 6.1 The 'do nothing' alternative is considered in Section 6.4
	(f) a description of feasible options ¹ within the project	Sections 6.3, 6.5 and 6.6
	(g) a description of how alternatives to and options within the project were analysed to inform the selection of the preferred alternative/option. The description must contain sufficient detail to enable an understanding of why the preferred alternative to and options(s) within the project were selected	Sections 6.1, 6.3, 6.5 and 6.6
	(h) describe opportunities for further network expansion and consideration of relationship to other Government public transport initiatives	Section 6.8

Note: 1. The Secretary's environmental assessment requirements define alternatives to a project as 'different projects which would achieve the same project objective(s) including the consequences of not carrying out the project' and options within the project as 'variations of the same project'.

6.1 Strategic transport alternatives

Various alternative transport solutions were considered as part of strategic rail planning undertaken to develop the *NSW Long Term Transport Master Plan* (the *Transport Master Plan*) and *Sydney's Rail Future*. Strategic alternatives to further investment in rail were considered as part of this process. Alternatives considered included:

- regulatory, governance, and better-use reforms (considered in Section 6.1.1)
- investment in road, bus, and light-rail (considered in Section 6.1.2)
- *Sydney's Rail Future* alternative rail transport solutions (considered in Sections 6.1.3 and 6.2).

6.1.1 Regulatory, governance, and better-use reforms

The NSW Government considered a range of regulatory, governance, and better-use reforms to improve transport outcomes, and meet Sydney's growing population needs (refer Chapter 5 (Project need)). The following reforms were considered:

- regulatory reform, including review of customer transport legislation to allow for more flexible transport services
- governance reform, including centralising transport planning and policy functions within Transport for NSW, and integrating land use and transport planning, including for major growth corridors

- better-use reforms, including continued implementation of the integrated electronic ticketing system, a bus priority system, interchange upgrades, and improvements, expansion and modernisation of train and bus fleets.

While these reforms are vital to meeting the government's policy objectives and are already being implemented, they were considered insufficient on their own to resolve current issues and meet growing demand. Additional investment in transport infrastructure (considered in the following section) would also be required to meet existing accessibility issues and ensure Sydney's transport network meets future levels of demand.

6.1.2 Investment in road, bus, and light rail

The NSW Government is currently delivering or has delivered a number of rail, road, bus, and light rail projects across Sydney as part of the *Transport Master Plan*, the *Sydney City Centre Access Strategy*, *Sydney's Bus Future* (Transport for NSW, 2013e), and the More Trains, More Services program. These projects include WestConnex, NorthConnex, the CBD and South East Light Rail, the Inner West Light Rail extension, and a number of bus priority projects, including the Northern Beaches B-Line Program.

However, while investment in road, bus, and light rail projects forms part of the solution to Sydney's transport needs, these alternatives are, by themselves, insufficient to address the forecast growth in travel demand. Alternative transport modes have limited capacity to absorb Sydney's forecast long-term travel demand growth. For example, the number of people travelling to the Sydney CBD each day is forecast to grow to 775,000 by 2031, which equates to about 116,000 more cars or 2,685 more buses each day.

Sydney's suburban rail network is the backbone of the city's public transport system. On a typical workday, commuters make about one million journeys on the rail network, with one third occurring in the morning peak (between 6 am and 9.30 am) and rail will continue to be the dominant mode for getting to the city centre. Where possible, new roads (such as the proposed Western Harbour Tunnel, Beaches Link, and the M4 – M5 Link) will provide additional cross-regional links. However, investment in roads forms only part of the solution to providing the mass transit capacity required to support Sydney's growth. In addition, there is limited ability to augment the existing road network within Sydney's CBD. Accessing the Sydney CBD by car is further constrained by a lack of available on-street car parking.

Buses and light rail are complementary modes, bringing customers to, and dispersing them from, the major transport hubs served by suburban and metro rail services. However, buses and light rail cannot wholly support the large hourly commuter movements required into and out of the Sydney CBD, and to other key destinations in the Global Economic Corridor. Buses can provide a flexible response to local demand pressures, and light rail offers medium capacity solutions for major transport corridors, replacing lower capacity bus services. However, both modes alone would not provide sufficient mass transit capacity to address Sydney's transport bottlenecks or future demand. As a result, it is also necessary to invest in the expansion of the rail network.

6.1.3 Sydney's Rail Future

Sydney's Rail Future, which forms part of the *Transport Master Plan*, is a long-term plan to increase the capacity of Sydney's rail network through investment in new services and upgrading of existing infrastructure. It aims to modernise and transform Sydney's rail network and comprises a five-stage program to meet the challenges of a growing population and the needs of customers in the future. The five key stages comprise:

1. Operational efficiencies
2. Network efficiencies
3. New rapid transit system (now called Sydney Metro Northwest)

4. Second harbour crossing
5. Southern sector conversion.

Developing *Sydney's Rail Future* involved consideration of a number of alternatives for expansion of the rail network. Further information on these rail future alternatives is provided in Section 6.2.

6.1.4 Preferred strategic transport alternative

Based on the need described in Chapter 5 (Project need), including the projected population growth and transport demand in Sydney, additional investment in rail is considered to be a more efficient and effective solution than the other strategic transport alternatives.

While the other alternatives considered (regulatory, governance, and better-use reforms; investment in road, bus, and light rail; and stages one to three of Sydney's Rail Future) are in the process of being implemented, they will fall short of achieving the overall strategic goals and objectives over the long term. As a result, additional investment in rail, comprising stages four and five of Sydney's Rail Future, is required.

6.2 Rail network alternatives

6.2.1 Alternatives considered

The process undertaken in developing *Sydney's Rail Future* involved consideration of a number of rail network alternatives. A total of 15 opportunities were considered and grouped into four broad network alternatives, as summarised in Table 6.2. The first alternative (Rail Future A) is equivalent to a 'do minimal' alternative.

Table 6.2 Summary of rail network alternatives considered

Alternative	Key features
Rail Future A – the suburban alternative (existing rail network)	<ul style="list-style-type: none"> • use of the existing suburban rail network • continuation of using double-deck rolling stock on the existing network, including for all future expansions (including a second harbour crossing) • capacity of 20 trains per hour per direction (or 24,000 people per hour per direction)
Rail Future B – the rebuild alternative	<ul style="list-style-type: none"> • rebuilding parts of the existing network to run single-deck metro trains • conversion of the North Shore Line services across the Harbour Bridge to metro, using the existing harbour crossing • major upgrading of the existing CBD infrastructure and stations required
Rail Future C – a metro network integrated with the existing rail network	<ul style="list-style-type: none"> • a metro rail network that would maximise use of, and be integrated with, the existing rail network • new CBD rail line and harbour crossing
Rail Future D – an independent metro network	<ul style="list-style-type: none"> • a completely new metro network • would operate independently and not integrate with the existing rail network • new CBD rail line and harbour crossing

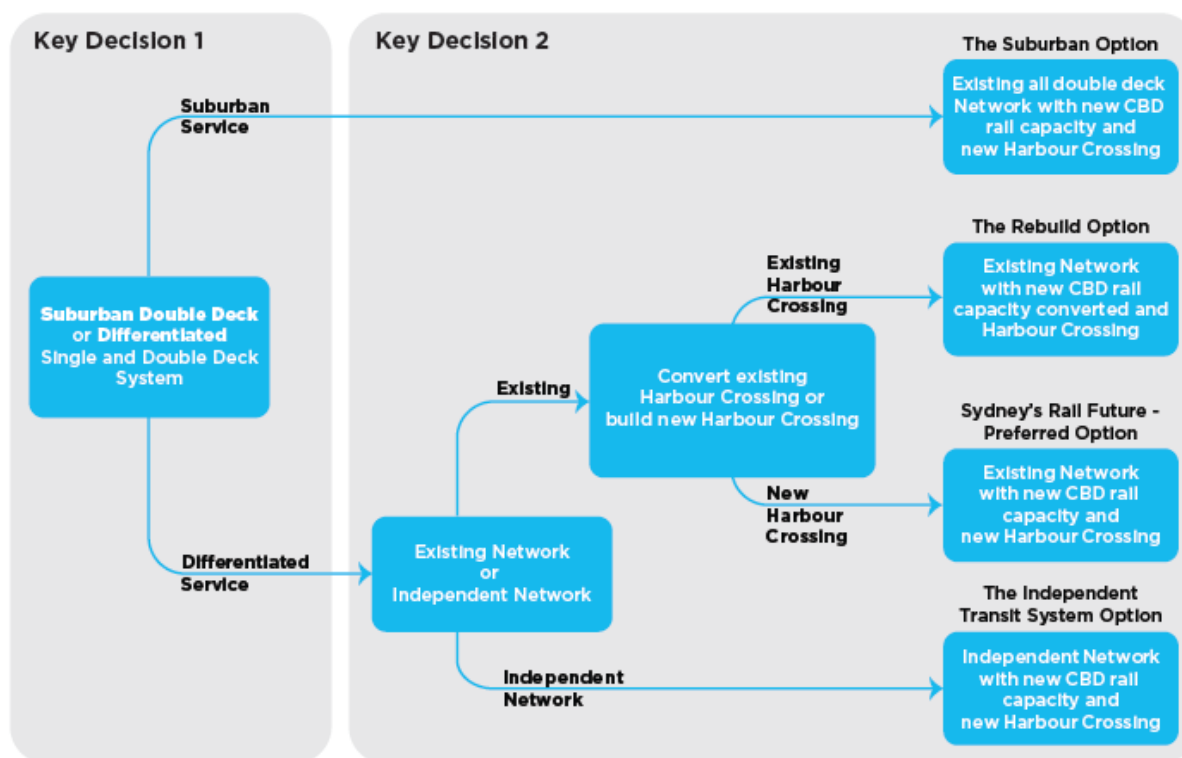
6.2.2 Assessment of alternatives

Each alternative was assessed against the criteria listed in Table 6.3.

Table 6.3 Criteria for assessment of rail network alternatives

Criteria	Measure
Customer focus	Delivery of high-quality, customer-centric services, which prioritise timeliness, safety and security, and comfort.
Network capacity	Provision and management of capacity to match future population growth and meet increased demand for passenger rail travel.
Network resilience	Improvement of on-time running performance and sectorisation (i.e. operating the rail network as independent units, which provides the ability to increase frequency and reliability of services particularly during peak periods), and reduction of incident occurrence rate.
Delivery risk	Feasibility of construction, and risks in implementation.
Cost effectiveness	Delivery of value for money, taking into account capital costs and whole-of-life costs, including operations and maintenance.

A two-step decision process was used to evaluate the alternatives, as shown in Figure 6.1.



Source: Sydney's Rail Future (Transport for NSW, 2012a)

Figure 6.1 Sydney's Rail Future alternatives decision process

As shown in Figure 6.1, the first step in the evaluation of alternatives involved assessing whether existing rail operations should be maintained and improved (Rail Future A) or whether the existing network should be supported by a separate, independent 'differentiated' system to provide metro services (Rail Futures B, C, and D).

It was concluded that Rail Future A, which involves maintaining the existing rail network and continuing to use double-deck rolling stock, including for all future network expansions, would not

meet the estimated future demand, or address the existing issues with the rail network. Issues associated with implementing this alternative include:

- Existing bottlenecks would be retained – for example, growth in South Western Sydney and in the Sydney Airport precinct will place increasing pressure on the T2 Airport, Inner West & South Line, which shares track through the Sydney CBD with the T3 Bankstown Line.
- Congestion in the Sydney CBD – Without improvements, the CBD will experience significantly higher levels of congestion by 2031. By 2031, each of the three busiest CBD stations are expected to experience an increase of more than an additional 10,000 passengers per hour in the peak. In addition, the existing network capacity is insufficient to deal with the demand generated by development at Barangaroo.
- Capacity challenges – by 2031, if major capacity improvements are not made, the T1 North Shore, Northern & Western Line, the T2 Airport, Inner West & South Line, and the T3 Bankstown Line will reach maximum capacity or even exceed capacity.
- Capability challenges – the existing rail network, including junctions, train types, stations, platforms, and technology, does not have the capability to deal with the projected future demand.

The second step in the evaluation of alternatives involved analysing the differentiated service opportunities against the assessment criteria, which included:

- delivery of capacity increases in key sections of Sydney's rail network
- high-quality levels of service
- provision of significant improvements in operational reliability required to service Sydney's growth.

Key findings of the assessment are summarised in Table 6.4.

Table 6.4 Summary of the rail network alternatives assessment

Alternative	Assessment findings
Rail Future A – the suburban alternative	<p>This alternative would not meet the long-term capacity and service improvements required by the <i>NSW Long Term Transport Master Plan</i>, and would not meet customer expectations for reliability, improved journey times, increased service frequency and convenience.</p> <p>The main beneficiaries of this alternative would be the North Shore and East Hills lines. Benefits for the west and Illawarra (Sutherland) would be limited, and further investment would be required to make more than an incremental difference to services on the Western and Illawarra lines.</p>
Rail Future B – the rebuild alternative	<p>Although rebuilding the existing network would improve capacity in the medium term, it would not meet demand in the long term, because capacity would be restricted to the existing single train line across the Harbour Bridge.</p> <p>Conversion of the existing North Shore line to accommodate a metro line would create increased safety issues associated with greater congestion on the existing, already overcrowded CBD stations. In addition, the number of services using these stations would reduce network reliability and resilience.</p> <p>This alternative offers the lowest cross-harbour capacity of the alternatives evaluated.</p> <p>It presents a high risk in terms of reliability and network resilience as it involves bringing more trains through the CBD and Wynyard and Town Hall Stations and fails to relieve existing bottlenecks that constrain the ability to deliver capacity increases that will help meet future demand.</p>
Rail Future C – a metro network integrated with the existing rail network	<p>This alternative scored higher than Rail Future D, as it would deliver significant capacity increases, provide high-quality levels of service, and significant improvements in operational reliability.</p>

Alternative	Assessment findings
Rail Future D – an independent metro network	This alternative would only benefit customers along the new lines, and would not adequately address the future requirements of the rail network. It would result in marginal benefits in terms of service enhancement, capacity improvements, and improved operating efficiency on the existing rail network. This alternative would also be the most expensive, and would divert funding from service improvements on the existing rail network.

6.2.3 Preferred alternative

The analysis of alternatives undertaken for Sydney's Rail Future concluded that Rail Future A would not meet the requirements of the *NSW Long Term Transport Master Plan*. This alternative would not deliver capacity and service improvements, or deliver reliability, improved journey times and convenience. Rail Future A was therefore not progressed.

With respect to Rail Future B (converting T1 North Shore Line services across the Harbour Bridge to metro operations and rebuilding other parts of the existing network), the analysis concluded that this alternative would not alleviate safety issues associated with congestion at existing CBD stations, and would impact network reliability and resilience. This alternative had the lowest cross-harbour capacity of the evaluated alternatives, and was therefore discarded.

The analysis concluded that Rail Future C (a metro network integrated with the existing rail network) would be superior to Rail Future D (an independent metro network), and consequently Rail Future D was discarded.

Building a metro rail system that would integrate with the existing rail network was considered to provide more benefits and fewer disadvantages than the other alternatives. This alternative was therefore adopted as the preferred alternative for modernising Sydney's rail network, because it would:

- be more flexible and provide more frequent services
- provide the required capacity and flexibility to respond to growing demand for rail in Sydney
- create a more modern, resilient, and faster service
- deliver a seamless and less disruptive way of modernising Sydney's rail network
- deliver transport benefits more cost effectively.

6.3 Rail line conversion options

Based on the preferred strategic transport and rail network alternatives (described in Sections 6.1.4 and 6.2.3 respectively), a range of options were considered for the conversion of the rail line for the south-western component of Sydney Metro City & Southwest. These options involved conversion of part of the existing rail network (from just south of Central Station) to metro. The options were developed to maximise the value of existing rail infrastructure. Options involved various combinations of full or partial conversion to metro of the following rail lines:

- T2 Airport, Inner West & South Line
- T3 Bankstown Line
- T4 Eastern Suburbs & Illawarra Line
- T5 Cumberland Line.

The following functionality requirements were adopted to enable evaluation of the conversion options:

- Sydney Metro will be a segregated and independent system, where tracks would not be accessible by suburban, intercity, or freight services.

- Sydney Metro City & Southwest will use single deck trains (the same rolling stock specification as Sydney Metro Northwest).
- The Sydney Metro network will meet international single deck metro rail standards.
- Specifications for Sydney Metro City & Southwest will be consistent with and fully compatible with, the specifications for Sydney Metro Northwest.
- Sydney Metro City & Southwest will use automated train operation under supervision of an automated train control system (the same as for Sydney Metro Northwest).

6.3.1 First review of conversion options

The long list of feasible conversion options were assessed in terms of their ability to meet the key criteria provided in Table 6.3. The following options were short-listed for further consideration:

- Base Case – Sydney Metro on the T3 Bankstown Line to Cabramatta and Lidcombe, and the T4 Eastern Suburbs and Illawarra Line to Hurstville.
- Option 1 – Sydney Metro via the T4 Eastern Suburbs and Illawarra Line, and the T2 Airport, Inner West & South Line, to Hurstville and Revesby, with the T3 Bankstown Line remaining suburban but terminating at Central Station.
- Option 2 – Sydney Metro via the T2 Airport, Inner West & South Line only, with the T3 Bankstown Line remaining suburban but terminating at Central Station.
- Option 3 – Sydney Metro to Revesby via Airport only (T2 Airport, Inner West & South Line), with the T3 Bankstown Line and the T4 Eastern Suburbs and Illawarra Line remaining suburban.
- Option 4 – Sydney Metro to Revesby via Airport only (T2 Airport, Inner West & South Line), with the T3 Bankstown Line remaining suburban but terminating at Central Station.

The options were subject to a detailed assessment. The outcomes of the assessment are summarised in Table 6.5.

Table 6.5 Summary of the options assessment

Option	Evaluation	Finding
Base case	<ul style="list-style-type: none"> • Consistent with <i>Sydney's Rail Future</i> • Improved connectivity from the south and southwest to the CBD and North Shore/Macquarie Park • Strengthens travel and capacity within the Bankstown corridor • Allows wider suburban network to operate more effectively (especially additional capacity for the East Hills, South and Inner West Lines) • Provides relief to the Illawarra Line 	Assessed as having some disadvantages. Otherwise performs reasonably well and consideration should be given to whether variations are available that overcome identified disadvantages.
Option 1	<ul style="list-style-type: none"> • Improved connectivity from the south to the CBD and North Shore/Macquarie Park • Connectivity and a metro service to the International and Domestic Airports 	Assessed as having some disadvantages, as well as constructability issues. Has some advantages and consideration should be given to whether variations are available that overcome identified disadvantages.

Option	Evaluation	Finding
Option 2	<ul style="list-style-type: none"> The conversion of the Inner West Line to Homebush would lead to a reduction in capacity for the T1 Western Line, as T2 South Line services would need to merge with T1 Western Line services at Strathfield, reducing the capacity of both these lines The connection of the tunnel to the T2 Inner West Line tracks would be a complex construction in an extremely constrained urban residential environment The conversion of the T2 Inner West Line would result in driverless metro tracks operating in a six track corridor in parallel with suburban and intercity tracks. 	Assessed as inferior, particularly in terms of system capacity, and would have constructability challenges and high cost.
Options 3 and 4	<ul style="list-style-type: none"> The conversion of the T2 Airport Line to Revesby to metro operations would lead to a reduction of capacity for the T2 South Line to East Hills. Services from west of Revesby would need to operate via Sydenham, and combined with T3 Bankstown Line Services, there would be insufficient capacity to operate the 14 services per hour that would be required to meet demands west of Revesby The conversion of the T2 Airport Line to metro and the operation of this line with up to 30 trains per hour in peak periods, would be significantly higher capacity than would be required to meet demand The conversion of the T2 Airport Line would involve a complex break into operating tunnel, significant tunnel ventilation upgrades to allow for 30 trains per hour and a significant period of closure The ultimate operation of 30 trains per hour would be incompatible with the requirements of airport passengers with luggage, leading to longer dwell times and compromising the metro reliability. 	Assessed as providing excessive capacity for T2 Airport Line patronage, while inadequately addressing network demand and relieving broader network capacity constraints.

As a result of the assessment, options 2, 3 and 4 were discarded. A review of the remaining options led to the development of a number of sub-options for consideration:

















- Enhanced base case – extension of Sydney Metro tunnel from Central Station to Sydenham Station, conversion of the T3 Bankstown Line to metro operations between Sydenham and Bankstown stations, and safeguarding a future connection to Liverpool.
- Option 1, sub-option C – Sydney Metro via Airport to Hurstville and Revesby (with the T3 Bankstown Line remaining as suburban and continuing to operate around City Circle).
- Option 1, sub-option D – Sydney Metro via Airport to Hurstville and Revesby (with the T3 Bankstown Line remaining as suburban and terminating at Central Station).

6.3.2 Second review of conversion options





The remaining options were evaluated using a detailed, multi-criteria analysis which identified the enhanced base case and option 1D as the two best performing options. These final two options were then compared against the Sydney's Rail Future evaluation criteria, with the findings shown in Table 6.6.

Based on the assessment, the enhanced base case was identified as the best performing rail line conversion option.

Table 6.6 Preferred conversion options – comparative assessment findings

Criteria	Sub-criterion	Enhanced base case	Option 1D – Sydney Metro via Airport
Customer focus	Demand		
	Customer experience		
	Transport network integration		
Network capacity	Capacity		
Network resilience	Rail operations		
Delivery risk	Constructability		
Cost effectiveness	Affordability		
	Economic viability		

Legend:

-  Performs better than original base case
-  Performs significantly better than original base case
-  Performs worse than original base case
-  Performs significantly worse than original base case

6.3.3 Preferred conversion option

In summary, the enhanced base case option (which is equivalent to the Sydenham to Bankstown upgrade project) was adopted as the preferred rail line conversion option, based on the above assessment, for the following reasons.

- Increased capacity – the Sydenham to Bankstown upgrade will allow Sydney Metro services to continue through Sydney's CBD and across the harbour, facilitating the removal of the Bankstown Line from the City Circle and from the suburban network between Sydenham and Central Stations. This will provide substantial additional capacity for the T2 Airport, Inner West & South Line, by allocating all of the train paths on the City Circle to these lines. It will also significantly reduce platform and train overcrowding at Town Hall and Wynyard.
- Supports growth – the Department of Planning and Environment is investigating opportunities for urban renewal along the Sydenham to Bankstown corridor, to support Sydney's substantial population growth. A revised *Sydenham to Bankstown Urban Renewal Corridor Strategy* was placed on exhibition in June 2017. The Sydenham to Bankstown upgrade will support growth on the T3 Bankstown Line and the T2 Airport, Inner West & South Line, by providing much needed additional forecast demand capacity on both rail corridors. Strong population growth from Sydney's south is expected to see forecast demand exceed capacity on the T3 Bankstown Line by around 2023, on the T2 Inner West & South Line by around 2020, and on the Airport and South Line by around 2027. Both the Chatswood to Sydenham and the Sydenham to Bankstown components of the Sydney Metro City & Southwest project will provide critical congestion relief to these lines by 2024, and support long-term growth.
- Enhances reliability – network capacity and reliability from the south is constrained by multiple lines merging at Sydenham and Central stations. Redirecting rail services from the T3 Bankstown Line into Sydney Metro City & Southwest will improve reliability by reducing the number of rail network services sharing the same tracks.

- Simpler conversion – the T3 Bankstown Line is less complex to convert to metro operations and segregate from the existing rail network compared to the T4 Eastern Suburbs & Illawarra Line.
- Reduced infrastructure – it will be possible to connect Sydney Metro from Sydenham to Bankstown with minimal infrastructure compared to other lines, such as the T2 Airport, Inner West & South Line and the T4 Eastern Suburbs & Illawarra Line, which would require additional tunnels and tracks, and significant enabling works, such as alternative freight routes.
- Supports longer term network development – undertaking the Sydenham to Bankstown upgrade will support the opportunity for other extensions to the metro network in the future, such as an extension to Liverpool and/or a metro conversion of the T4 Eastern Suburbs & Illawarra Line to Hurstville/Mortdale.

6.3.4 Underground alignment

While not explicitly considered as an alternative in Sydney's Rail Future, an underground metro alignment was considered in preliminary feasibility investigations for Sydney Metro City & Southwest. Conceptually, this would involve extending the underground alignment from the Sydney CBD generally in a westerly direction with an interface at or in the vicinity of the existing Bankstown Station. Depending on the alignment chosen, other interfaces with the existing Sydney Trains network might also be possible.

Compared with the enhanced base case option however, this alternative would be significantly more expensive to construct without a corresponding ability to attract substantial additional patronage being in an area which is already well serviced by the T1 North Shore, Northern & Western Line, the T2 Airport, Inner West & South Line, and the T3 Bankstown Line, making the project economically unviable.

Also, unlike the preferred conversion option, an underground alignment would not facilitate the accessibility improvements proposed for the existing above ground stations on the T3 Bankstown line. This option was therefore inferior to the conversion option and was not considered further.

6.4 The 'do nothing' alternative

The 'do nothing' alternative would involve maintaining existing operations along the T3 Bankstown Line and not completing the Sydenham to Bankstown component of Sydney Metro City & Southwest. The 'do nothing' alternative would involve the T3 Bankstown Line continuing to operate as part of the Sydney Trains network, and Sydney Metro operating between Rouse Hill and Sydenham, rather than to Bankstown. Under this alternative, metro trains would need to terminate at Sydenham Station, and turn back (via an above ground turnback facility to the north of Sydenham Station), to provide a return service from Sydenham to Rouse Hill.

Implementing the 'do nothing' alternative would have the following issues:

- the full transport, city-building, and economic benefits of Sydney Metro City & Southwest (described in Section 5.3), and the benefits of the project would not be realised
- it would not adequately respond to the challenges posed by population growth in Sydney (refer to Section 5.1), or enable realisation of the urban renewal opportunities provided by the strategies summarised in Section 5.2
- existing rail network issues, constraints, and challenges would remain, including the existing limited network capacity of the Sydney Trains suburban network, crowding on trains and at existing CBD stations, and accessibility issues at stations between Marrickville and Bankstown (described in Section 5.1.1)
- it would not address the recognised need for Sydney Metro – as described in Section 5.1

- over 5,900 interchanges would need to occur at Sydenham Station, and additional infrastructure works would be required at Sydenham Station to allow metro trains to terminate and turn back
- there would be approximately 27,000 fewer trips on Sydney Metro in the one-hour AM peak, which would impact the effectiveness and viability of Sydney Metro between Sydenham and Rouse Hill.

Further information on the need for, and benefits of, the project is provided in Chapter 5. In the context of the analysis undertaken for *Sydney's Rail Future* and the *Transport Master Plan*, the 'do nothing' alternative is not considered viable, based on its failure to deliver solutions to the existing and future needs of the rail network.

6.5 Station design, location and upgrade options

6.5.1 Accessibility upgrade

Do minimum

The 'do minimum' option would involve retaining the existing platform 'gap' and installing new systems required for metro operations (including signalling, power and automatic train operation). This option would re-use most of the existing stations and track, as well as the existing overhead wiring infrastructure. This option would also involve continued use of ramps to provide accessible access on and off trains.

The 'do minimum' option would not satisfy relevant accessibility requirements (as per the *Disability Discrimination Act 1992* (DDA) and the *Disability Standards for Accessible Public Transport 2002* (DSAPT). This option would also provide a compromised outcome for Sydney Metro, with a significantly worse customer experience resulting from the use of the existing stations with limited upgrades, and no platform screen doors to improve safety. This compromise was considered unacceptable given the magnitude of the investment in Sydney Metro, as the customer experience would be substantially different and adverse, compared with the new metro stations and infrastructure elsewhere on the metro system.

Platform design

Two options were considered to meet relevant accessibility requirements of the DDA and DSAPT:

- straightening of platforms (demolition and rebuild as required)
- use of mechanical gap fillers (mechanisms that automatically narrow the 'gap' between the platform and the train when the train arrives at the platform).

Assessment of these options involved consideration of performance against the following criteria:

- provision of a safe, reliable, and efficient transport system
- place making and urban design outcomes
- heritage and property impacts
- relationship with, and implications on road, and rail bridges
- cost
- rail geometry required to support operations and constructability.

Straightening platforms would meet Sydney Metro, and operational requirements. Straightening of platforms was therefore identified as the preferred option, and is proposed at all stations, except for Dulwich Hill. At Dulwich Hill Station, extensive and costly civil engineering works would be required to provide a straight platform arrangement, with associated impacts. As a result, the retention of a

curved platform arrangement (with platforms rebuilt to support platform edge barriers) is currently proposed at Dulwich Hill Station, with mechanical gap fillers provided to satisfy accessibility requirements.

Transport for NSW would work with the contractor to determine whether an innovative solution can be developed in the detailed design phase to provide a straight platform at Dulwich Hill Station. The consistency of this option with the Environmental Impact Statement and any terms of approval would be considered. If the potential impacts of this option were not considered to be consistent, an application would be lodged seeking to modify the project.

6.5.2 Station location

Each station contributes significantly to its local community in terms of economic activity, productivity and accessibility. These three factors contribute to the social cohesion, social inclusion and community identity along the rail line. All existing stations are considered optimally located in terms of their topographic setting, road networks and natural features, and they respond to the optimal walking catchment for the station.

The benefits of potentially moving stations from their current location were therefore considered to be limited and was therefore not adopted. All stations along the T3 Bankstown Line would be retained in their current locations.

6.5.3 Consistency of station upgrades

The option of only upgrading some of the stations along the corridor was not considered practical, or appropriate for the Sydney Metro brand. It would also have the potential to isolate some customers who currently use train services along the line to access local centres for services, education, and employment. It would also not meet the demand and address the access issues described in Chapter 5 and referred to above.

Maintaining the existing catchment of train customers along the T3 Bankstown Line is critical to achieving the project objectives, including encouraging mode shift from cars and/or buses onto trains, delivering customers a more comfortable, reliable, and efficient train service, and contributing to the accessibility and connectivity of existing and future communities.

The preferred option for the project therefore involves upgrading all 10 stations along the T3 Bankstown Line from Marrickville Station to Bankstown Station (Sydenham Station would be upgraded as part of a modification to the Chatswood to Sydenham project).

6.6 Possession options

Some of the construction activities, such as major station works, track works, and bridge works, would need to be undertaken during rail possession periods (when trains are not operating) to minimise operational disruptions and rail worker safety risks. Project development to date and the assessment undertaken in this Environmental Impact Statement has assumed the possession periods would be repeated each year over the construction period, and the longer possession periods would generally target school holiday periods when transport demand is lower.

While alternative transport arrangements would be put in place to address customer needs during these periods, the closure of rail stations and/or the rail line would involve a level of disruption to customer journeys.

6.6.1 Possession options considered

During initial project planning and design development, five indicative rail possession options were considered, with a view to meeting delivery timeframes and minimising impacts on customers and the community more generally. The five options are listed in Table 6.7.

This initial planning identified that each option would involve use of the standard four weekend possessions per year scheduled by Sydney Trains. The options differ in terms of the use of additional possessions during school holiday periods (two and/or six week closures each year of construction), whether the final possession period would be shorter (around three to six months) or longer (at least six months), and whether additional station closures may be required (option 4 only).

Table 6.7 Possession and programming options considered

Option considered	Weekend possessions (four per year)	No. of two week closures required	No. of six week closures required	Additional closure required?	Final possession (months)
1	✓	3	1		3 to 6
2	✓	1	1		3 to 6
3	✓	None	1		3 to 6
4	✓	None	None	✓	6
5	✓	None	None		3 to 6

6.6.2 Assessment of possession options

The evaluation of options against key criteria concluded the following in relation to each option.

- Option 1 – from a delivery risk perspective, option 1 was preferred, however it would have a higher customer impact based on the total number of closure days.
- Option 2 – would have low delivery and cost risks, and a medium impact on customers, based on the total number of closure days.
- Option 3 – would have a higher delivery risk, as major reconstruction works would need to be undertaken at two to three stations during each period. With a closure during the Christmas/January school holiday period, this option provided the lowest customer impact. However, it would have a higher delivery risk, as major reconstruction works would need to be undertaken at two to three stations during each period.
- Option 4 – this option had a higher impact on customers, as it would require the longest closure of the line, although delivery and cost risks would be one of the lowest of all the options.
- Option 5 – this option, with minimum closure times, was discounted as it was not likely to be achievable, would be too risky, was likely to be the most costly, and would have a high impact on customers.

6.6.3 Preferred possession option

Option 2 was taken forward as the basis of the environment assessment, as it provides a reasonable balance between delivery risk and customer impact, had lower delivery and cost risks, and a medium impact on customers. This option would involve possession periods during the Christmas/January and July school holiday periods each year, and a final possession period of between three and six months.

The proposed possession program would be reviewed during tendering, detailed design, and construction planning to ensure the available possessions are sufficient to complete the works and to reduce the overall impacts on the community as far as possible. One of the key elements to this approach would be to use the competitive tendering process to identify alternative possession options that may deliver additional benefits relative to the environmental assessment carried out to date. These may include:

- A reduction in the total number of possession periods to reduce the number of changes to customer travel arrangements.
- Arrangements that would keep some stations open, to increase available construction windows whilst maintaining a rail service along the corridor, reducing the total distance customers would need to travel on temporary transport.
- Options that would deliver customer benefits, such as lifts and straightened platforms, earlier in the construction phase in advance of full metro operation.
- Options that would reduce the overall duration of the station and corridor works, to reduce the duration of other environmental impacts, such as noise and construction traffic impacts.

6.7 Preferred project

The preferred project was identified as an outcome of the evaluation of feasible alternatives and options described in Sections 6.1 to 6.6. The preferred option for the Sydenham to Bankstown upgrade component of Sydney Metro City & Southwest involves upgrading 10 existing stations west of Sydenham (Marrickville to Bankstown inclusive), and a 13 kilometre long section of the T3 Bankstown Line, between west of Sydenham Station and west of Bankstown Station, to improve accessibility for customers and meet the standards required for metro operations.

6.8 Potential future network expansion opportunities

Sydney Metro is planned to support programmed improvements and initiatives across the wider metropolitan rail network, and provide new connections, with progressive changes to the bus service operations. Sydney Metro City & Southwest integrates with the existing Sydney Trains network, light rail system, strategic bus corridors, and other transport modes, to allow efficient interchange at strategic locations, including Martin Place, Pitt Street, Central, Sydenham, and Bankstown stations.

As described in Chapter 5, upgrading the T3 Bankstown Line and converting it to metro would improve service reliability and frequency, support transfer between modes, and enable existing and future transport network capacity constraints to be addressed.

The NSW Government is implementing a coordinated program to provide rail and bus customers with more reliable services, and improve the integration of Sydney's transport network. For rail, this involves more modern trains, and more frequent express services, which would be enabled through infrastructure upgrades associated with the 'More Trains, More Services' program. This program is being staged to complement other system and rail capacity improvements, including Sydney Metro.

Sydney Metro forms the backbone of the NSW Government's vision for a modern transit system and improved travel for customers using Sydney's public transport system. Its implementation aligns with Sydney's growth strategy, providing much needed service capacity and travel option enhancements, which will benefit and transform public transport in Sydney.

The NSW Government is continuing to investigate improved transport connectivity across Western Sydney, which includes safeguarding a future extension corridor for Sydney Metro between Bankstown and Liverpool. In time, the Sydney Metro network would be extended by separate independent metro alignments, which would provide connectivity via strategic interchange points.

The NSW Government has announced that a new underground metro railway line will be built between Parramatta and the Sydney CBD to help cater for Sydney's growth. Sydney Metro West will provide a direct connection between the Parramatta and Sydney CBDs, linking communities not previously serviced by rail, as well as supporting growth between the two major CBDs. Sydney Metro West will integrate with long-term transport planning for Western Sydney, including rail needs associated with the Western Sydney Airport.

Further transport initiatives supported by the project include the NSW Government's target to encourage more people to walk and or cycle for part of their journey. The active transport strategy described in Chapter 10 (Operational traffic, transport and access), seeks to improve the walking and cycling mode share for all types of travel across Sydney. This would be promoted by improving active transport infrastructure and facilities, population growth, and improving access to and the overall experience at stations.

7. Design development and place making

This chapter describes how the design for the project was developed, and how it addresses key considerations and requirements. This includes a summary of place making, urban design, accessibility, and environmental considerations, including the way in which the design has evolved to avoid or minimise potential impacts, as well as refinements to the design resulting from stakeholder consultation.

The Secretary's environmental assessment requirements relevant to place making and urban design, and where they are addressed in this chapter and in the Environmental Impact Statement, are listed in Table 7.1. Further information on how the design was developed with respect to place making and urban design considerations is provided in the place making and urban design paper in Appendix H.

Table 7.1 Secretary's environmental assessment requirements – design development, urban design and place making

Ref	Secretary's environmental assessment requirements – design development, place making and urban design	Where addressed
2 Environmental Impact Statement		
2.1	The EIS must include, but not necessarily be limited to, the following: (j) a demonstration of how the project design has been developed to avoid or minimise likely adverse impacts	Section 7.3
14. Place making and urban design		
14.1	The Proponent must deliver functional 'place' outcomes of public benefit, inclusive of how the project integrates with proposed land use changes occurring within the corridor, and how it contributes to the accessibility and connectivity of existing and future communities (with specific consideration given to the Sydenham to Bankstown Urban Renewal Corridor Strategy (as updated)). This must be done in collaboration with the Department of Planning and Environment and Councils, and must include but is not limited to:	A summary of the results of the place making and urban design process is provided in this chapter. Further information is provided in the urban design and place making paper in Appendix H.
	(a) the defining of existing and proposed station precincts including implications for urban renewal	Section 7.2
	(b) identifying design principles, strategies and opportunities to enhance healthy, cohesive and inclusive communities (including consideration of government strategies and plans)	Section 7.3
	(c) the provision of infrastructure to support accessible paths of travel and interchange	Section 7.3.8
	(d) assessing the impact of the project on the urban and natural fabric	Section 7.3.4
	(e) incorporating the use of Crime Prevention Through Environmental Design (CPTED) principles during the design development process.	Section 7.2.5
14.2	The Proponent must describe the accessibility elements of the project including relevant accessibility legislation and guidelines and:	Sections 7.1, 7.2.4 and 7.3.8 describe how accessibility was considered as part of the design process. The potential impacts of the project on accessibility during construction and operation are considered in chapters 10 (Construction traffic, transport and access) and 11 (Operational traffic, transport and access).

Ref	Secretary's environmental assessment requirements – design development, place making and urban design	Where addressed
	(a) impacts on pedestrian access in and around stations and connecting streets (including consideration of land use change)	Sections 11.4.4 to 11.4.13
	(b) enhancing the accessibility of each station and the general vicinity of walking and cycling catchments	Section 7.3.8, 11.4.2, 11.4.4 to 11.4.13
	(c) the provision of infrastructure to support accessible paths of travel and interchange	Sections 7.3.8 and 11.4.4 to 11.4.13
	(d) impacts on cyclists (including the provision of and integration with active transport routes) and pedestrian access and safety	Sections 7.3.8 and 11.4.4 to 11.4.13
	(e) minimising barriers across the rail corridor and opportunities to integrate cycling and pedestrian elements with surrounding networks and in the project.	Section 7.2.4 and 11.4.3
14.4	The Proponent must provide artist impressions and perspective drawings of the project from key receiver locations to illustrate the project.	Section 8.1.

7.1 Design development

7.1.1 Approach

The design of the project commenced in September 2014. To date, developing the design has involved:

- preliminary evaluation and review of options – evaluation of key issues, potential options, and the feasibility of the project
- scoping design – options evaluation and systems definition, constraints analysis, and mapping
- definition design – option selection and preferred option development
- reference design – augmentation of the definition design to provide a considered basis for the project, with designs produced to support contract documentation.

The design of the project has evolved over these stages, with an increasing level of detail and incorporating a range of considerations and options at each stage.

The reference design is the current design for which approval is being sought and it forms the basis of the Environmental Impact Statement. The reference design has evolved over a period of about 18 months, and has involved many iterations and regular refining, particularly in relation to the design of station upgrades. The development of the design has been informed by the consideration of stakeholder and community feedback, as well as the findings of environmental studies.

A foundation element and core value in the development of the design has been that the Sydney Metro stations would meet the needs of all potential customers. Providing equality of access is crucial to social justice and inclusion for people with disabilities. As a result, design concepts have been continuously tested against accessibility requirements and legislation, including:

- *Disability Discrimination Act 1992* (DDA)
- *Disability Standards for Access to Public Transport* (DSAPT)
- Building Code of Australia (BCA)
- relevant Australian Standards.

7.1.2 Project setting

The project setting provides one of the primary design considerations. The project traverses a corridor of Sydney that has been undergoing continual transformation and renewal since its initial settlement.

Between Sydenham and Bankstown, centres of varying size and scale have developed around each of the stations, which were built from the 1890s to the 1930s.

The stations have played an important role in developing the local and regional economy, while enabling people to live, trade, and travel within and through the corridor, to access business, family, work, recreation, culture, leisure, health, education, shopping, and entertainment services. Tens of thousands of people pass through the stations each day.

In most cases, the stations are located at the centre of their surrounding communities and are the focal point for intensive activity, as well as integrated transport services. The existing stations and rail services have been the catalyst for higher densities of development, resulting in a broad range of uses and activity, and more people working and living close to the stations. Over time, these centres have developed a clear identity, and by virtue of mixed land uses, community facilities, and a good transport service, have developed a strong sense of place. As a result, place making has been a crucial consideration during design development.

7.2 Understanding place

The approach to place making for the project is based on a multi-faceted approach to the planning, design, and management of public spaces, which aims to create public spaces that promote people's health, happiness, and well-being.

The community gives increasing importance to proximity to high quality transport and the range of adjacent services and facilities. There are also significant demographic changes occurring in Sydney. These trends will continue in coming decades and will be supported by urban renewal plans for the corridor.

In this context, the project aims to build on and strengthen the existing role of each centre. This would be achieved by delivering upgraded stations, and providing improved transport services, that represent the next generation of rail service, with improved station design, universal accessibility, and faster and more frequent services, commensurate with the existing and future needs of the communities along the corridor.

Two key place making requirements have been adopted to develop the design:

- The stations have important functions as community places, in their own right and as a focal point within, or in close proximity to a town centre, thereby attracting a range of benefits and land uses, including:
 - reducing dependence on private vehicles
 - providing a public place for gathering commercial/retail and human interaction, and a focal point for surrounding communities
 - encouraging exercise, by promoting walking and cycling as an attractive form of transport to and from stations.
- The stations contribute to the surrounding urban environment or 'place' in which they are located, and can:
 - act a catalyst for the nature and form of development within each of their catchments
 - attract people wanting to live close to, or who are dependent on, public transport facilities, and they must therefore operate as intermodal exchanges to foster increased mode share for sustainable transport and to meet increasing demand

- act as a focal point in the local community which can draw people to an area, and enliven adjoining areas and support local businesses.

These place making requirements have been forged together and embedded in the design through a central focus on achieving high levels of safety and accessibility to maximise the attraction of people.

Key place making considerations are described in the following sections, including:

- urban design
- land use
- heritage
- access and connectivity
- crime prevention through environmental design
- environment and sustainability in design
- stakeholder and community feedback.

The design process and outcomes are summarised in Sections 7.3 and 7.4.

7.2.1 Urban design

The approach to the design of the stations is to incorporate architecture and design that projects an appropriate level of civic presence, and which continues to promote the role of the stations as urban centres, community places, and focal points as the communities evolve over the coming decades. The design of stations and associated interchanges needs to address accessibility, safety, and comfort, while retaining a strong identity, incorporating elements of station heritage, and providing for a modern rail service.

The design of the stations and surrounding interchange areas (including lighting, building placement, and landscape features) have taken into account crime prevention through environmental design (CPTED) principles, to ensure that the customer is safe on every part of the journey through the station. The designs also aim to contribute to healthy, cohesive and inclusive communities.

Attention has also been given to the areas between the stations that have the capacity to deliver and enhance health benefits and other important community outcomes, by safeguarding space in the design for an active transport corridor, which would contribute to the NSW Government's aspirations for a green grid throughout Sydney.

Station upgrades have been developed to meet a forecast demand for 2056 using a computer software model that was able to take into account multi-modal journeys (such as travelling by bicycle then train, bus and train, etc). The forecasts also took into account current and proposed future land use in the immediate vicinity of the station.

The design process involved a detailed analysis of the design and functioning of the existing stations, as well as the local context of each station and its contribution to place. This included:

- the street network
- current and future bus services and bus routes
- topography and terrain
- pedestrian movement and desire lines
- the existing character, scale, and function of the surrounding centre
- nearby attractors, including schools and colleges, sports facilities and open space, and major retail activities.

Public domain plans for centres that address the nature of existing and possible future interface activities were also considered.

7.2.2 Land use

Government strategies and policies

The District Plans developed by the Greater Sydney Commission sit within a broader strategic framework that will underpin amendments to Sydney's metropolitan strategy *A Plan for Growing Sydney*. The amended strategy conceptualises Greater Sydney as a metropolis of three cities.

The Sydenham to Bankstown corridor straddles the 'Central' and 'Western' cities, and falls within the Central and South Districts. The strategy notes that it is critical that the Central City has strong transport connections, with sufficient capacity, to the established Eastern City and the emerging Western City. The District Plans note that Sydney Metro will play a critical role in improving transport connections and capacity.

Further information on the strategic context for the project is provided in Chapter 6 (Project need).

Plans

The Department of Planning and Environment, in partnership with the Inner West Council and Canterbury-Bankstown Council, undertook a land use and infrastructure analysis as part of developing the draft *Sydenham to Bankstown Urban Renewal Corridor Strategy*. This aims to guide future planning of development and infrastructure delivery within this corridor over the next 20 years.

Planning for the corridor includes a focus on opportunities to develop low, medium, and high-rise residential, and mixed use projects, within walking distance of the stations. It also proposes new areas of open space on potentially surplus railway land and other underused areas, and promotes provision of an active transport link along the corridor.

Another focus is the quality of the public domain in residential streets and town centres, so that the future public realm supports anticipated housing and population densities. The quality and fine grain urban fabric of centres along the corridor is acknowledged, and the urban renewal corridor strategy recognises that these qualities should be retained.

Sydney Metro City & Southwest embodies the transport infrastructure goal of the urban renewal corridor strategy, and supports future development and infrastructure delivery within the Sydenham to Bankstown corridor.

7.2.3 Heritage

All stations within the project area are heritage listed, with three stations (Marrickville, Canterbury, and Belmore Stations) listed on the State Heritage Register.

The introduction of Sydney Metro on the T3 Bankstown Line constitutes the continuing evolution of the rail corridor through the introduction of the next generation of rail services and the fourth major intervention to this existing railway landscape.

The design of the stations has been developed with regard to the heritage values of the stations and the rail line overall, and has sought to:

- recognise and demonstrate the heritage significance of each phase of rail transport development along the line
- retain and conserve, wherever possible, elements of heritage significance, so that functional relationships can be understood and interpreted
- remove intrusive station elements that detract from the core heritage values

- adaptively reuse the retained and conserved heritage buildings for station and related functions
- carefully and clearly express the presence of Sydney Metro with new high quality design elements
- deliver a functionally viable line, stations, and precincts, while enhancing the legibility of key heritage values.

Key design responses to heritage considerations are summarised in Section 7.3.7.

7.2.4 Access and connectivity

An understanding of accessibility and connectivity considerations along the T3 Bankstown Line has informed design development.

Disability and elder access

As noted earlier, the provision of access for all people of all ability levels is not universally available across the stations between Marrickville and Bankstown. As a result, a core design focus is the need to recognise relevant accessibility guidelines and standards (including the DDA and DSAPT) and deliver design outcomes that resolve this. Providing good access for people with disabilities and the elderly, it also provides benefits for other passengers, such as parents with prams, and passengers travelling with luggage.

Station access hierarchy

Incorporating station access planning as an integral part of the design process is another key component of the overall customer experience and journey. Multiple travel modes would be used to access destinations, and customers need a seamless, well integrated, and safe journey. The station access hierarchy (shown in Figure 7.1) was used as the basis for the design of the stations and associated facilities.

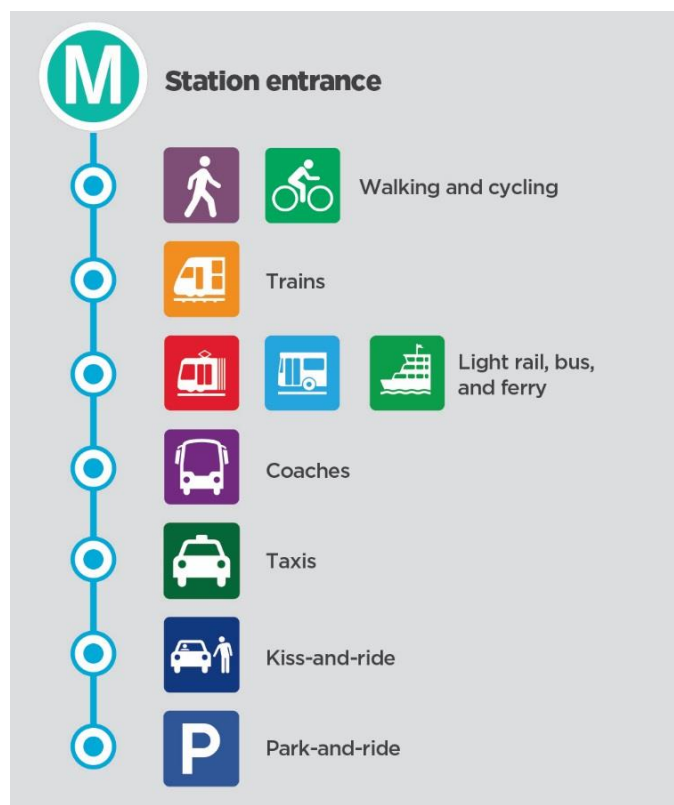


Figure 7.1 Station access hierarchy

The objective of the hierarchy is to ensure that the design of stations, and their integration with other transport modes, gives the highest priority to the most efficient and sustainable access modes. Walking and cycling are the highest priority access modes driving design development, followed by public transport, then taxis, kiss-and-ride, and finally park-and-ride (the lowest priority).

Minimising barriers to movement

The existing rail corridor represents a substantial barrier for north–south movements, with limited road and pedestrian crossings between Marrickville and Bankstown. Cross-corridor access is generally by way of existing road overbridges, and a small number of pedestrian only bridges. Some stations also provide pedestrian only cross-corridor access, however these are generally located close to existing road overbridges. The project design has maintained the existing level of cross-corridor access, and has identified opportunities to upgrade access, particularly in relation to road overbridges, as well as providing some new or additional crossings to improve cross corridor access at Dulwich Hill, Belmore, Punchbowl, Bankstown stations.

By considering pedestrian catchments and movements to, from, and around each station, the level and direction of pedestrian activity has been used to inform design development with respect to minimising barriers to movement.

7.2.5 Crime prevention through environmental design

The design of stations, interchange facilities, car parks, and accessible areas has been, and would continue to be, informed by CPTED principles. This involves incorporating, as a minimum, the three main CPTED strategies:

- natural access control
- natural surveillance
- territorial reinforcement.

The station designs have been developed with consideration given to these principles, to provide safe and secure places, with design response including passive and physical security.

Safety is a fundamental consideration for the design of all elements. To ensure that this has been addressed, Safety in Design workshops and safety reviews of design options were embedded into the design process.

7.2.6 Environment and sustainability in design

Environment led design

The approach to design development has included a focus on avoiding and/or minimising potential environmental impacts. In this regard, a feedback process has enabled findings from a number of the technical specialist studies to collectively build an understanding of the receiving environment to refine or modify elements of the project design. While all environmental assessments were considered in this process, of particular relevance have been findings relating to:

- traffic and transport
- noise
- heritage
- landscape and visual
- biodiversity
- socio-economic and business impacts.

A summary of how the design has avoided and/or minimised potential environmental impacts is provided in Section 7.5.

Sustainability based design

Transport for NSW has applied, and would continue to apply, relevant sustainability principles throughout the design and development of the project. The Sydney Metro City & Southwest Sustainability Strategy (Appendix F) provides the approach to sustainability for the whole of Sydney Metro City & Southwest, including relevant sustainability objectives, targets, and initiatives. These apply to the entire life-cycle, including reference design, detailed design, procurement, construction, and operation.

The following overarching sustainability initiatives indicate the intended level of sustainability achievements proposed for Sydney Metro City & Southwest that have influenced design development:

- reduce energy use and carbon emissions during operations
- improve shift towards lower carbon transport
- reduce sources of pollution and optimise control at source to avoid environmental harm
- accountability and public reporting on performance.

Resilience in design

Specific resilience measures (including climate change measures) that have guided decisions in the design process have included:

- shading of station concourses as far as practicable, for both summer and winter conditions
- secondary canopies at stairs, lifts, and entry points to concourses
- use (where practical) of generous tree canopies of drought tolerant species in landscaping of station areas
- integration (where feasible) of photo-voltaic systems in built elements to meet or reduce annual low-voltage operational demand
- harvesting and storage of rainwater for reuse
- inclusion of high efficiency fixtures and fittings in station buildings
- structural loading requirements for hail and other extreme weather events.

7.3 Design

The design has drawn on existing landscapes and heritage, cultural history, and the communities along the T3 Bankstown Line, revealing and enhancing the qualities of these places, making new connections between communities, and contributing to the regeneration of town centres.

7.3.1 Themes

The design philosophy is based on three themes:

- rediscover
- reconnect
- regenerate.

These themes have been applied to the urban design elements of the reference design as follows.

Rediscover

An ambition to rediscover existing qualities of the corridor reflects a number of the project's design objectives. Two primary qualities of the corridor are the heritage fabric of the rail line itself, and the diversity of its centres and communities. Design development has responded to this context to deliver an important public legacy for South West Sydney, by:

- revealing and repurposing heritage buildings and structures
- adding a new layer of high quality architecture and public spaces
- using and creating spaces attuned to local settings that will be a catalyst for wider urban renewal.

Reconnect

Renewal of the T3 Bankstown Line would allow the creation of a more integrated transport system and an enhanced customer experience for all users. Easy, accessible interchange between modes is part of the design, while improved walking and cycling facilities at, and between, stations would prioritise these modes. New links to town centres, across the corridor, and from station to station, would better connect communities, and build on existing landscape and open space qualities.

Regenerate

Updating the T3 Bankstown Line to 21st century standards would be a critical catalyst for the 10 town centres along the corridor. Thoughtful integration with existing landscape areas and provision of new links would foster connection and ease of travel in the region and locally.

Adding public spaces and public architecture of quality to these centres would be an important broader legacy of the project.

7.3.2 Objectives and principles

To help meet the transformational vision and aspirations of the project, five design objectives for the project were identified to guide decision making and the design process for the City & Southwest project. These objectives, together with their associated design principles and the design response, are shown in Table 7.2.

Table 7.2 Design objectives and principles

Design objectives	Design principles	Design responses
Objective 1: Ensuring an easy customer experience	Sydney Metro places the customer first. Stations are welcoming and intuitive with simple, uncluttered spaces that ensure a comfortable, enjoyable and safe experience for a diverse range of customers.	<ul style="list-style-type: none">• A safe, comfortable and pleasant journey to the station, between transport modes and on the train• Clear wayfinding and place making, values embedded in precinct design• Public spaces and local connections with high amenity value• Attractive station environments, when seen from the platform, concourses or the precinct

Design objectives	Design principles	Design responses
Objective 2: Being part of a fully integrated transport system	Sydney Metro is a transit-oriented project that prioritises clear and legible connections with other public and active transport modes within the wider metropolitan travel network that intersect with this new spine.	<ul style="list-style-type: none"> • Quality and frequency of service • Station legibility in precinct • Seamless interchange in station precincts • Application of the modal hierarchy with an emphasis on pedestrian priority • Clarity of wayfinding, timetable and modal information • Connections to walking, cycling and open space networks
Objective 3: Being a catalyst for positive change	Sydney Metro is a landmark opportunity to regenerate and invigorate the city with new stations and associated development that engage with the station areas, raise the urban quality, and enhance the overall experience of the city.	<ul style="list-style-type: none"> • Precinct design that responds to and supports local character, urban form and activity • Promotion of urban renewal close to stations to increase the number of available dwellings and jobs • Contribute to the rejuvenation of town centres • New or additional unpaid cross corridor connections in most station precincts.
Objective 4: Being responsive to distinct contexts and communities	Sydney Metro's identity is stronger for the unique conditions of centres and communities through which it passes. This local character is to be embraced through distinctive station architecture and public domain, that is well integrated with the inherited urban fabric of existing places.	<ul style="list-style-type: none"> • Drawing on the character of each locality in the design of each stations' public spaces, furniture, landscape and public art • Responding to the landscape character of the rail line and its town centres • Signature South Western line station architecture expressed in the context of the broader line-wide Sydney Metro identity
Objective 5: Delivering an enduring and sustainable legacy for Sydney	Sydney Metro is a positive legacy for future generations. A high standard of design across the corridor, stations and station areas, that sets a new benchmark, is vital to ensuring the longevity of the metro system, its enduring contribution to civic life, and an ability to adapt to a changing city over time.	<ul style="list-style-type: none"> • A modern, architecturally distinctive line that also celebrates and re-purposes heritage buildings and structures • Minimum environmental standards for renewable energy generation, and water harvesting and reuse • Open space and active transport links permanently added to south west Sydney's green space network

7.3.3 Design strategies

Urban design

The urban design strategies for the project, illustrated in Figure 7.2, express the design intent for station areas and the overall corridor. These strategies were developed in response to the general Sydney Metro design objectives, and have informed and guided the design on the project.

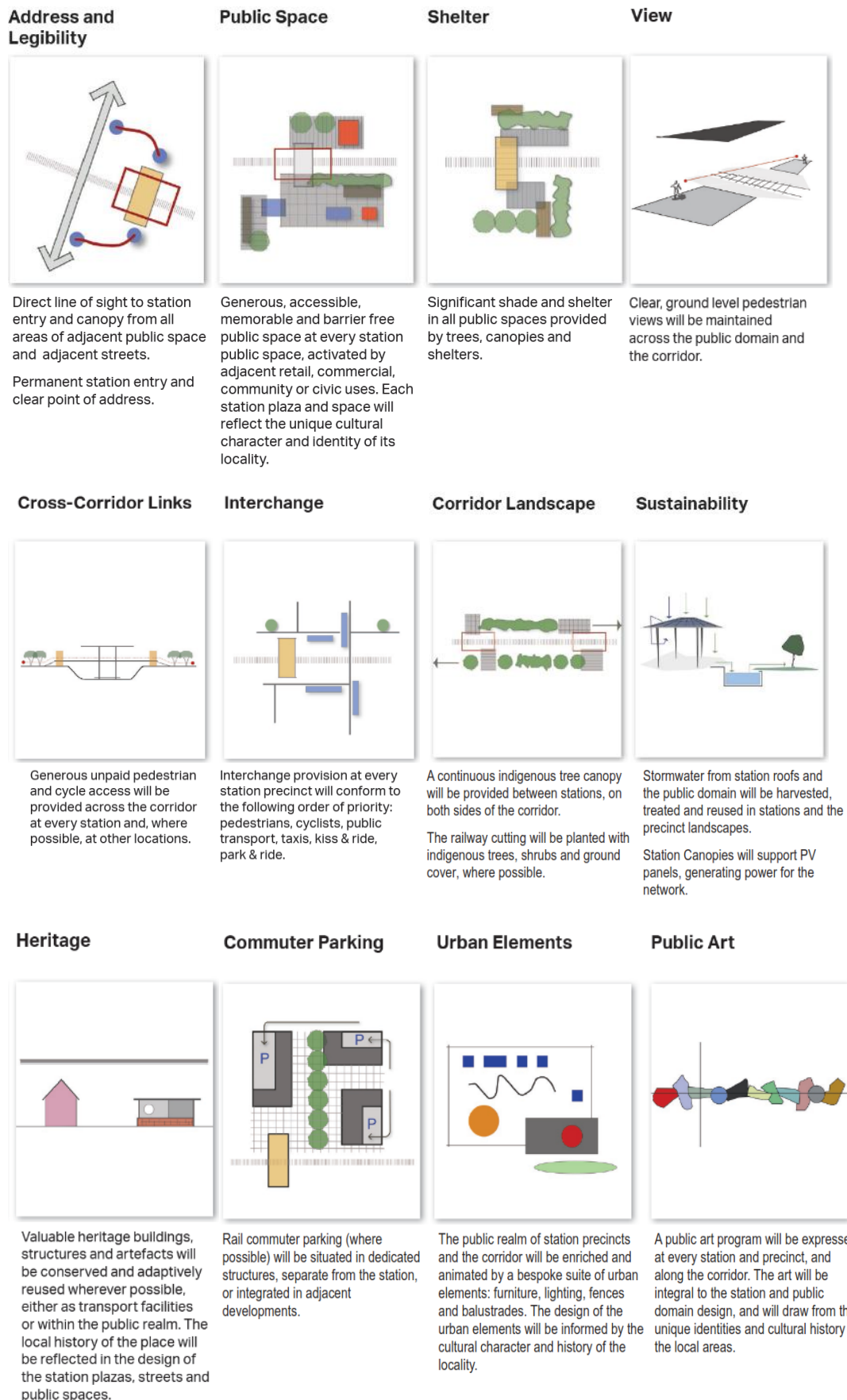


Figure 7.2 Urban design strategies for station areas and the corridor

Architectural design

To unify the different sections of Sydney Metro (Sydney Metro Northwest and Sydney Metro City & Southwest), Transport for NSW has established a coherent identity for metro infrastructure, whilst providing sufficient flexibility to respond to differences in local context and communities.

The overall architectural strategy is to introduce elegant, contemporary station structures, which complement existing station buildings (including heritage listed buildings), whilst ensuring that new development is clearly distinguishable from the earlier heritage fabric. The key architectural design strategies for stations are illustrated in Figure 7.3.

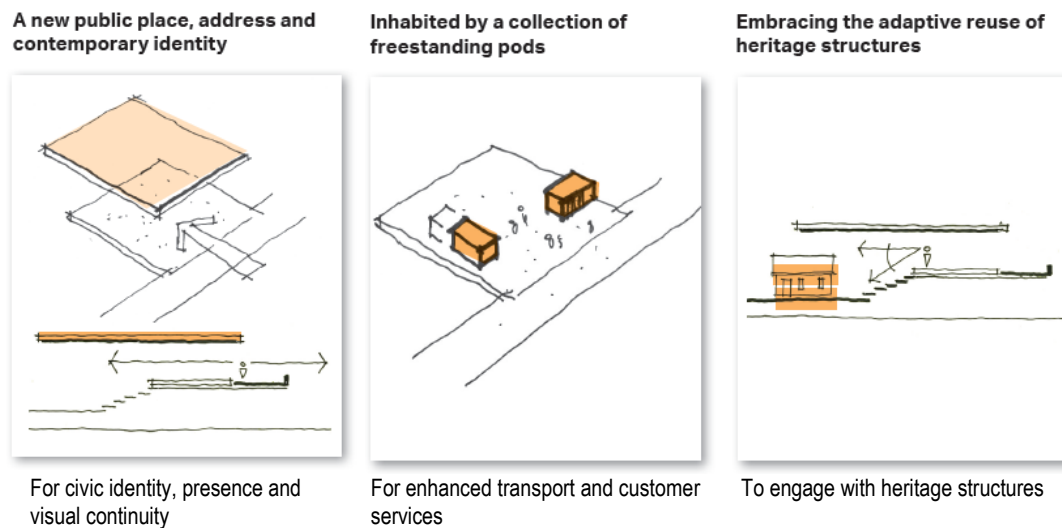


Figure 7.3 Key architectural design strategies for stations

New aerial concourses at stations have been designed so that they directly address retained heritage buildings. To ensure that impacts to existing platform buildings are minimised, the design strategy provides for an adequate offset between the contemporary new platform canopy and existing heritage canopies and awnings. This means that weather protection cannot be fully provided for a six car metro train, however, the minor gap in protection is considered to be acceptable, given the positive outcome in relation to retention of heritage buildings/structures.

A modular approach has been adopted for a number of station elements. The reasons for this are that it:

- provides a consistent approach across Sydney Metro as a whole
- minimises the construction period and time during possessions for services fit-out, and associated impacts to the local community, as pre-constructed parts can be brought to site and installed soon after
- provides for a high quality of finish via prefabricated modules, as well as ease of replacement (if and when required).

Canopies and concourses have been developed to suit the different platform types. This means that standard lifts, precast stair elements, and cladding panels can be used. Consistent branding, wayfinding, and signage would also be installed.

7.3.4 Urban and natural fabric

The urban and natural fabric of each place has been used to inform design development, and has taken into account:

- the existing urban context and infrastructure (including built form and public domain conditions, landscape elements, and existing and proposed services)

- planned initiatives in the locality.

More specifically, relevant criteria adopted for the project have guided the design in creating welcoming, secure, and easily maintained public domain spaces and station buildings, with an attractive 'sense of place', which responds to the distinct cultures of each station precinct. These criteria include:

- stations and associated spaces are to promote a welcoming image or identity that reinforces a positive sense of place within the locality
- station plazas are to reflect the local public realm context and character
- station public spaces are to be designed with a consistent hierarchy of landscape treatments to reflect local character and context, integrate within their settings, and provide attractive space and streetscapes
- fixtures, including furniture and lighting, are to enrich site context and sense of place and contribute to wayfinding
- a positive precinct image is to be developed around the particular heritage values of a place or by the qualities of the existing urban context.

For each station, the design was developed based on a comprehensive understanding of the existing place and urban context, and future place making opportunities. A comprehensive urban design analysis provided input, and the design process included consideration of:

- the design and functioning of the existing stations
- local urban context of each station, including:
 - land use and place, landscape, and urban fabric
 - culture and demographics
 - topography and terrain
 - heritage considerations
 - existing character, scale, and function of the surrounding centre
- nearby attractors, including schools and colleges, sports facilities and open space, and major retail destinations
- accessibility and connectivity, including:
 - the street network
 - current and future bus services and bus routes
 - interchange opportunities
 - pedestrian movement and desire lines
- the emerging character and likely built form of each centre, influenced by:
 - local area planning undertaken by the councils
 - regional strategic planning and district planning.

7.3.5 Design opportunities

Public domain

The public domain is a significant component of the station design. The interface between the station and surrounding streetscape needs to be well integrated and functional. The guiding principle for the design of the public domain has been the provision of hard and soft landscapes that establish high quality civic areas and an attractive public realm. The public domain for stations

would reflect and enhance the adjoining urban and landscape character, and be responsive to local conditions.

The public domain principles that have guided the development of the design include:

- The public domain design must represent a safe, clean, clutter free and functional environment that is visible and provides easy access for all users.
- The public domain design must deliver an integrated customer-focussed design that maximises a positive customer experience, including safe, legible, convenient, obstruction free environments, with direct and clear pedestrian routes.
- The public domain works associated with the stations must integrate seamlessly into the existing built environments and streetscapes, having regard to the existing and planned future context.
- Hard and soft landscaping design, species selection, and material palettes are to respond to and enhance the existing urban fabric of the station areas.
- Landscape treatments are to reinforce the identity for the stations, while also being functional and suitable for urban environments, considering maintenance and safety-in-design issues relevant to a transport customer environment, and adjacent road and public realm networks.

Station entrance/plaza areas

Stations would be set in well-designed station areas, which would provide an entrance to the stations, links with other forms of transport (such as bus stops and taxi ranks), and adequate room for circulation. Station area designs respond to their local settings and urban form, building on the diverse character of the surroundings.

Each station area design includes a main station forecourt or plaza to provide for safe and comfortable interchange between transport modes. Quality public art, furniture, landscaping, and pavements, tailored to the particular urban context, would be provided where space permits, together with opportunities for retail, civic, or community facilities to be included.

New station entries would be clearly visible and well connected to adjacent streets and town centres.

Healthy, cohesive and inclusive communities

One of the aims of place making is to create healthy, cohesive and inclusive communities. Healthy lifestyles and community cohesion are promoted by improved walking, cycling and transport access to a wide range of services and opportunities, while providing attractive and safe locations for people to meet and socialise. This in turn leads to communities that are more inclusive.

The ability of the project to promote healthy and cohesive communities can be achieved by aspects that have been integrated into the station designs. These include:

- providing access to, and facilities for, a variety of transport modes such as public transport, walking and cycling, which reduce dependence on private vehicles and encourage, and facilitate, the use of healthy transport alternatives
- provision of opportunities for people to meet, gather and circulate safely, and comfortably.

The project has been designed in accordance with a recognised modal hierarchy that favours public transport and walking/cycling over private vehicle use. This approach has clear health and social benefits, and enables access to an equitable range of safe, accessible transport services.

Public art

Successful public art recognises the particular character of a place, and in the transport context it can enrich the experience of the travelling public. As a component of amenity, and even beauty, of well-designed public spaces and infrastructure, public art can contribute to memorable journeys. As such, it should also support the growth of patronage on the network.

Public art can interface with other design disciplines to create a convincing line wide and station identity, legible wayfinding, meaningful heritage interpretation and safe public spaces. Locally resonant art pieces can build a sense of ownership by local communities, of their station and its public domain, which potentially adds to both the sustainability and meaning of these places.

The inclusion of art, its curation and production, would be a key feature of the ongoing design process. A public art strategy will be developed to incorporate appropriate curatorial and procurement processes for artistic excellence.

7.3.6 Future land use integration

While it is not the role of the project to undertake future land use planning for the corridor, the current design reflects the urban renewal corridor strategy and the role of the project in acting as a catalyst and enabler for future development.

In accordance with the corridor strategy, design responses unique to each station and local centre were developed, taking into account the distinctive character, setting, and context of each station. Additionally, to inform an understanding of urban renewal trends and opportunities, possible changes to land use, current development proposals, planning proposals, and approved plans were identified through consultation with the Department of Planning and Environment.

As the designs have developed, emerging proposals for the following elements particularly relevant to future land use integration have been shared with these agencies:

- station design/architecture
- the interchange area surrounding stations
- civil works between stations
- the active transport corridor
- introduction or upgrade of signalised or pedestrian crossings at station interchanges, to facilitate safe pedestrian movements between the stations and adjoining areas of future growth.

The project design recognises the role of the stations in the urban renewal process for the Sydenham to Bankstown corridor. To understand these future changes, Transport for NSW has consulted with the Department of Planning and Environment, and the Inner West and Canterbury-Bankstown councils on their relevant structure plans and strategies, as well as current development proposals, planning proposals, and approved plans.

This has been particularly important for rapidly changing centres such as Canterbury, Campsie, and Bankstown, where significant levels of development activity are already evident near stations.

7.3.7 Heritage

To reduce the potential heritage impacts, a number of heritage stakeholders have been involved in various iterations of the design. The approach to heritage elements has been to retain, wherever possible, existing significant items and/or elements, with particular focus given to those items listed on the State Heritage Register. As part of this process, Transport for NSW has ensured that retained heritage elements have a suitable purpose, and that their retention does not compromise the integrity of the station design and layout, or the safety and requirements of customers.

Iterations between the findings of the heritage assessment and the design development have resulted in changes to the design at five of the stations. This has enabled retention of heritage elements as summarised in Table 7.3. Further information on options considered and the justification for removal of heritage elements, where this is required, is provided in Section 5.3 of Technical paper 3 - Non-Aboriginal heritage.

Table 7.3 Overview of heritage based design changes

Location	Design changes
Marrickville Station	Significant design work was undertaken to reduce the potential heritage impacts, including the number of heritage elements impacted. As a result, the removal of Platform Buildings 1 and 2 and the booking office was avoided, and these elements are now retained in the project design.
Dulwich Hill Station	Changing the location of the entry and associated concourse avoided impacts on the platform building. However, this resulted in the separation and isolation of the overhead booking office, which would now be removed.
Hurlstone Park Station	Integration of the new entry with surrounding streets and town centre improves connectivity throughout the precinct. This limits the space available to provide a safe platform width and requires removal of Platform Building 1.
Canterbury Station	Significant design work was undertaken to reduce potential heritage impacts, including the number of heritage elements impacted. As a result, the removal of Platform Buildings 1 and 2 was avoided, and these elements are now retained in the project design. The relocation of the concourse/entry would avoid impacts on the Platform 1 Building, however this results in the separation and isolation of the overhead booking office, which would now be removed.
Belmore Station	Significant design work was undertaken to develop a design for the station that would enable retention of all existing elements of heritage significance, except for the station platforms. The project design also enables removal of the intrusive modern platform canopy structures.

7.3.8 Access, interchange and connectivity

Accessibility and connectivity have formed key considerations in the design process. the design principle is to 'ensure the stations and associated spaces are safe, efficient, universally accessible, legible and easy for customers and pedestrians'.

To determine which aspects need to be upgraded or improved, the design process involved a review of existing access and transport interchange arrangements for each station.

A description of the proposed station upgrade works is provided in Chapter 9 (Project description – operation). This includes works in the area immediately surrounding the stations.

In most cases, these works are driven by the need to make seamless and efficient connections to and from the stations. The works generally include the connections between transport modes and station entries, and facilities for pedestrians and cyclists. Planned improvements have been developed with regard to their location, including station entries, plazas and transport interchange facilities, and are formed around the station access hierarchy, highlighting the transport modes that should take precedence, and where feasible, to provide accessible paths.

The spatial reach and extent of the proposed works varies from station to station. Further information, including figures depicting the proposed works, are provided in Chapter 8. Accessible parking, taxi, and kiss and ride facilities would be located in areas identified as kerbside facilities on these figures. Some existing facilities would potentially be relocated based on the outcomes of consultation with key stakeholders.

Park and ride facilities have also been subject to similar considerations, although at certain stations, local topography and positioning of existing infrastructure means that achieving compliant access to these facilities is not always entirely possible.

7.3.9 Community enhancement

The project seeks to build on and strengthen the existing role of each centre by delivering new stations and services that represent a generational shift, with significantly improved station design, universal accessibility, faster and more frequent rail services, and integrated bus services.

The stations would incorporate architecture that projects an appropriate level of civic presence, which would promote the role of the stations as community focal points. The stations and areas surrounding them would be accessible, safe and comfortable, and have a strong identity, which complements a modern metro rail service.

Attention has also been paid to the areas between the stations that has the capacity to deliver important community outcomes.

In addition, the project design has taken into account work by the Department of Planning and Environment on 'finer grain' assessments of public domain opportunities in the areas surrounding each station. The design plans have also been scrutinised by an independent design review panel. Specifically, the location and design of station entries and forecourts, as well as other aspects of the station design, have responded to emerging urban renewal trends to make a positive contribution to place at each of the stations

One of the aims of the design development has been to provide the catalyst for creation of healthy and cohesive communities. Examples of positive contributions to place making, accessibility, and connectivity are provided in Table 7.4.

Table 7.4 Examples of community enhancements and positive contributions to place making

Location	Design aspect
All stations	All stations are designed to be fully accessible, with station entrances and concourses that comply fully with DDA requirements. The project includes provision of secure bike parking facilities at all stations, and future proofing for additional facilities at some stations. The provision of these facilities would help make bikes an attractive mode of transport to and from stations.
Marrickville	The project includes works to the Station Street station entrance to make it more accessible and inviting. There would also be improved access to Schwebel Street and Illawarra Road via an accessible ramp on Station Street (west). The existing walking/cycling path along the southern side of the rail corridor east of the station would be upgraded, to provide a safe link for pedestrians and cyclists.
Dulwich Hill	The northern station entrance would be relocated to be adjacent to the Dulwich Hill light rail stop to improve interchange between the two transport modes. Paths that form part of the connection would be made fully accessible.
Hurlstone Park	Provision of an enlarged station forecourt for safer gathering and interaction, and new pedestrian crossings to facilitate access to surrounding areas.
Canterbury	The new northern station entrance/plaza has been designed to provide connectivity with the future town centre and ongoing redevelopment in the vicinity of the station.
Campsie	An improved pedestrian area would be provided at the Beamish Street station entrance by widening footpaths and setting back the entrance from Beamish Street. A new shared area would be provided along a widened section of Lilian Lane on the southern side of the station, to assist with pedestrian and vehicular access, improve circulation from surrounding streets particularly from the south, and improve integration with an active transport corridor
Belmore	The proposed improvements to the Tobruk Avenue station frontage would improve connectivity with surrounding streets, the Burwood Road shopping area, and the Belmore Sports Ground. This would include integration of existing facilities with an active transport corridor. Accessible paths from Redman Parade would provide safe passage to Burwood Road and the existing pedestrian crossing

Location	Design aspect
Lakemba	Improved access, new station entrance forecourts, and upgrades to the existing courtyard and memorial space.
Wiley Park	New station entrance and public domain improvements would provide a more comfortable and safe station access.
Punchbowl	The proposed relocation of the station along the rail corridor to the east allows for a new station entrance and forecourt to The Boulevard. This would improve pedestrian access to the station, and improve safety by increasing visibility and opportunities for passive surveillance.
Bankstown	Construction of a new at-grade cross-corridor concourse is proposed, between the Sydney Trains and Sydney Metro stations, to provide access to the station, and public access across the corridor. This would also improve connectivity between Restwell Street and The Appian Way, including potential future redevelopment sites on either side of the rail corridor and the Bankstown Central Shopping Centre.
Entire corridor	The project has made provision for an active transport corridor at stations. Active transport corridor planning has been undertaken with regard to existing and planned cycle and pedestrian networks, maximising connections to local and regional routes, and potential links to a broad range of community and cultural facilities, and to natural areas (such as the Cooks River).

7.4 Responses to stakeholder and community feedback

7.4.1 Stakeholder feedback

The consultation process is described in Chapter 4 (Stakeholder and community consultation). The development of the design and environmental impact assessment has been informed in part by contributions from key stakeholders, including:

- Inner West Council
- Canterbury-Bankstown Council
- Sydney Trains and NSW Trains
- Australian Rail Track Corporation
- Roads and Maritime Services
- Sydney Coordination Office
- Department of Planning & Environment
- NSW Environment Protection Authority
- the Heritage Working Group
- utility providers (Transgrid, Ausgrid, Quenos, Sydney Water)
- Sydney Motorway Corporation.

A summary of how the design has responded to key issues raised during stakeholder consultation is summarised in Table 7.5.

Table 7.5 Project responses to stakeholder feedback

Stakeholder	Issue identified	Project response
Inner West Council	<ul style="list-style-type: none"> • Cumulative impacts of the project, WestConnex, and other major developments on flooding, drainage, local traffic, and transport during construction and operation, including approach to commuter parking • Availability of surplus rail corridor land for an active transport corridor and its integration with Council cycle and pedestrian planning, particularly around Marrickville station • Whether proposed bridge works could include provision for cycle paths (such as Illawarra Road and Livingstone Road, Marrickville) • Avoiding closure of multiple adjoining bridges over the rail corridor at the same time to ensure sufficient traffic circulation options • Ensuring that drainage and flood management works within the corridor integrate with Council flood mitigation works, particularly around Marrickville station • Seeking clarity on the sustainability strategy for Sydney Metro City & Southwest • Concern about the potential visual impacts of crash barriers and throw screens on road overbridges, and a desire to ensure they are visually pleasing, and do not become a graffiti target 	<ul style="list-style-type: none"> • Flood modelling has been undertaken to inform the design development process, and has taken into account current Council flood modelling. Transport for NSW is currently working with WestConnex to achieve an integrated drainage solution for both projects. Transport for NSW would continue to work with the Inner West Council to integrate with flood mitigation works around Marrickville Station. Further information is provided in Chapter 21. • Transport for NSW has been working with Council to understand local traffic and transport related issues. The detailed traffic and transport assessment undertaken for the Environmental Impact Statement included a position of 'no net loss' of commuter parking. Transport for NSW would continue to work with Council to develop Interchange Access Plans and manage the impacts on parking. Further information, including relevant mitigation measures, is provided in Chapters 10 and 11. • The route of an active transport corridor has been identified, and the project has been designed to incorporate parts of this within the station areas. Further information is provided in Section 8.1.4. • Integration of active transport opportunities are being considered within the station precincts and along the rail corridor where practicable. There are constraints relating to existing bridges, particularly widths. Nevertheless, Transport for NSW would work with councils on cycle opportunities where feasible and reasonable. • Transport for NSW would work with relevant road authorities, including councils, in relation to potential impacts on the road network. A mitigation measure has been included in Section 10.5 to restrict works from being carried out simultaneously on adjacent bridges, where feasible and reasonable. • Chapter 24 describes Transport for NSW's approach to sustainability. The Sydney Metro City & Southwest Sustainability Strategy is included in Appendix F. • All overbridges would be provided with parapet throw screens and vehicle collision barriers to provide an upgraded level of safety and security for customers. The design of bridges would be in accordance with relevant design standards and Sydney Metro performance specifications.
Canterbury Bankstown Council	<ul style="list-style-type: none"> • Station and interchange designs should create a strong relationship with existing town centres and station environs, and place making opportunities, especially having regard for future growth around centres under the NSW Government's urban renewal strategy for the Sydenham to Bankstown corridor 	<ul style="list-style-type: none"> • The design development process has considered urban design, place making, and public domain aspects at each station, as discussed in Section 7.1. As noted below, Transport for NSW has, and would continue to, discuss urban renewal opportunities with the Department of Planning and Environment, with reference to the aims of the draft Sydenham to Bankstown Urban Renewal Corridor Strategy. Transport for NSW would continue to work with Council on the development of station design and interchange access plans.

Stakeholder	Issue identified	Project response
	<ul style="list-style-type: none"> • The layout and design of the station entry should consider appearance from the public domain, presenting a safe and welcoming environment • Opportunity to provide an underground station at Bankstown Station to assist with connectivity, permeability, and cohesion in the Bankstown town centre, reducing the barrier created by the existing rail corridor • Sufficient space at station entries should be provided to manage projected patronage figures, particularly at stations such as Campsie, which will experience considerable additional population growth • Retention of low intensity commuter parking close to station entries (such as Bankstown station) • Ensuring that station entries provide opportunities for activation (e.g. northern entry to Punchbowl station within local park) 	<ul style="list-style-type: none"> • Design guidelines (refer Section 7.7 and Appendix C) have been developed. These include objectives, principles for customer experience, safety, and place making, which would continue to guide the detailed design process. • The project does not propose an underground station for Bankstown, however the design incorporates a pedestrian link to address connectivity between the northern and southern side of the Bankstown town centre. An alternative station design has been safeguarded for the future (including potential underground platforms). Transport for NSW will contribute to a study being undertaken by the Department of Planning and Environment, and Canterbury-Bankstown Council, to determine a master plan and business case for the Bankstown town centre, including how the station fits with the centre. The study will be funded by Transport for NSW and Canterbury-Bankstown Council. • The project design has been informed by projected patronage modelling (refer to Chapter 10) and has taken into account population growth, including as a result of initiatives under the draft Sydenham to Bankstown Urban Renewal Corridor Strategy. • Adjustments would be required to car parking, including on-street parking and dedicated commuter parking, generally in the vicinity of stations. These impacts are considered in Chapters 10, 11, and 18. The project has been designed to minimise impacts on existing parking areas, and Transport for NSW would continue to work with Canterbury-Bankstown Council in the development of Interchange Access Plans and on managing the impacts on parking (relevant mitigation measures are provided in Sections 10.5, 11.5 and 18.4). • Design development has considered opportunities for activation within each station precincts. As detailed in the design guidelines (Appendix C), a key design driver at Punchbowl was the creation of a northern plaza with paths and landscaping to improve circulation and amenity in Warren Reserve.
Sydney Trains and NSW Trains	<ul style="list-style-type: none"> • Wider rail network operations and the design of future suburban rail timetables • Scope of track and civil works • Possession regimes and construction staging • Maintaining level of service during construction • Asset ownership post commissioning 	<ul style="list-style-type: none"> • Transport for NSW has and would continue to work with Sydney Trains in relation to design options and configuration of possessions to balance the conversion of the T3 Bankstown Line stations and rail systems with the safety of rail workers, minimising impacts on Sydney Trains operations. A key objective for Transport for NSW (including Sydney Trains) is to minimise disruption to the travelling public. • The Temporary Transport Strategy and mitigation measures commit to an ongoing process of consultation with Sydney Trains through the detailed design and construction phase to manage these issues (refer Appendix G and Section 10.5).

Stakeholder	Issue identified	Project response
Australian Rail Track Corporation	<ul style="list-style-type: none"> • Construction and operational interface • Possession regimes and construction staging • Segregation of works adjacent to the freight line, including segregation fence maintenance responsibilities • Maintaining ARTC operations during construction 	<ul style="list-style-type: none"> • Assessment of various options and configuration of possessions has been undertaken to balance the conversion of the T3 Bankstown Line stations and rail systems with the safety of rail workers, minimising impacts on ARTC operations. • As described in Section 4.4, ongoing consultation would be undertaken during construction planning and detailed design. • A segregation fence is proposed between the metro tracks and ARTC freight tracks, between west of Marrickville Station and west of Campsie Station. The design has also accommodated ARTC's needs in terms of ongoing maintenance access.
Roads and Maritime Services and Sydney Co-ordination Office	<ul style="list-style-type: none"> • Transport integration and road network modifications • Proposed bridge works and staging of temporary closures during construction, including the duration of closures of the Illawarra Road overbridge 	<ul style="list-style-type: none"> • Construction compounds and construction haulage routes have been carefully selected to ensure that vehicles are directed to suitably classified roads (i.e. for use by heavy vehicles) via the shortest route and, where possible, minimising the distance travelled through residential areas. • The traffic, transport and access assessment considers the potential impacts during construction, and the results are summarised for each station in Chapter 10. • Transport for NSW would work with relevant road authorities to minimise the potential impacts of the project (including bridge closures) on the road network. Potential impacts of bridge works are considered in Chapter 10, and relevant mitigation measures are provided, including restricting works from being carried out simultaneously on adjacent bridges where feasible and reasonable. • Construction methodologies would continue to be refined to minimise the number of heavy vehicle movements required. • The Temporary Transport Strategy has been developed in consultation with Roads and Maritime and the Sydney Coordination Office to outline the process for developing temporary transport management plans to manage works and alternative transport arrangements during station closures and possession periods. These plans would be developed in consultation with relevant roads authorities and the Sydney Coordination Office. • With respect to the Illawarra Road overbridge, potentially longer closures (up to one month) are being investigated. Any proposals for longer closures would be confirmed at a later date, and would be subject to additional impact assessment if required.
Department of Planning and Environment	<ul style="list-style-type: none"> • Urban renewal opportunities with reference to the aims of the draft Sydenham to Bankstown Urban Renewal Corridor Strategy • Integration of active transport corridor into the urban renewal strategy 	<ul style="list-style-type: none"> • Transport for NSW has and would continue to work with Department of Planning and Environment to integrate station designs with the urban renewal planning process. Details of the work undertaken to date in the development of the designs for each stations is described in the Place Making and Urban Design Technical Paper (Appendix H) and summarised in this chapter.

Stakeholder	Issue identified	Project response
	<ul style="list-style-type: none"> Integration of linear parkland opportunities along the rail corridor with the urban renewal corridor strategy Dwelling, population, and employment outcomes expected from the urban renewal strategy and implications for Sydney Metro patronage 	<ul style="list-style-type: none"> The route of an active transport corridor has been identified, and the project has been designed to incorporate parts of this within the station areas. Further information is provided in Section 8.1.4. Section 3 of the design guidelines (Appendix C) also addresses this issue.
NSW Environment Protection Authority	<ul style="list-style-type: none"> Approach and methodology for the operational rail noise modelling undertaken for the Environmental Impact Statement 	<ul style="list-style-type: none"> The approach and methodology for the operational noise assessment has been prepared in accordance with relevant guidelines and in consultation with NSW Environment Protection Authority. The Noise and Vibration Assessment (provided in Technical paper 2 and summarised in Chapter 13) identified receivers that would be potentially affected by operational noise, and which may require mitigation such as noise barriers or at property treatment. The provision of noise barriers has been considered as part of the design. The final location of barriers and/or at property treatment would be confirmed during detailed design.
Office of Environment and Heritage	<ul style="list-style-type: none"> Design of each of the station precincts, including options and justification for proposed heritage impacts Ongoing involvement through the design development process Opportunities for reuse of retained heritage buildings 	<ul style="list-style-type: none"> The design development process has considered heritage aspects at each station. This is described in Chapter 7 and in the Non-Aboriginal Heritage Assessment (Technical paper 3). The potential impacts are described in Chapter 14. The proposed design addresses the need to deliver accessible stations that meet the operational requirements of the Sydney Metro system, whilst minimising impacts on heritage. Transport for NSW would continue to work with the Office of Environment and Heritage and other heritage stakeholders during the ongoing design development process. A mitigation measure has also been provided in Section 14.4 to require that a heritage architect to review designs as part of the Design Review Panel. The development of station designs has considered the heritage values of the stations and the line overall, and has sought to adaptively reuse the retained and conserved heritage buildings for station and related functions (refer to Section 7.3.7, Technical paper 3, and Chapter 14).
Office of the Government Architect (OGA)	<ul style="list-style-type: none"> Station precinct design Integration of active transport corridor into the urban renewal strategy Integration of linear parkland opportunities along the rail corridor with the urban renewal strategy 'Finer grain' analysis of opportunities for public domain improvements around stations 	<ul style="list-style-type: none"> As described in Chapter 7 and in Appendix H, the design development process has considered urban design, place making and public domain aspects at each station. As noted above, Transport for NSW has and would continue to discuss urban renewal opportunities with the Department of Planning and Environment with reference to the draft Sydenham to Bankstown Urban Renewal Corridor Strategy and its implications on station designs. The route of an active transport corridor has been identified, and the project has been designed to incorporate parts of this within the station areas. Further information is provided in Section 8.1.4. Section 3.3 of the design guidelines (Appendix C) also addresses this issue.

Stakeholder	Issue identified	Project response
Utility providers including Transgrid, Ausgrid, Qenos, and Sydney Water	<ul style="list-style-type: none"> Confirmation of the location of trunk utilities affected by project Proposed utility relocations, adjustments, and design refinements to minimise disruption 	<ul style="list-style-type: none"> The location of trunk utilities has been determined at the current stage of design, based on Dial Before You Dig plans, utility data including as-built surveys, and local authority and council records. Preliminary consultation has also been held with Sydney Water, Ausgrid, Telstra, Axiom, TPG, and Qenos. A Utilities Management Framework has been prepared as part of the Environmental Impact Statement (refer to Section 9.10 and Appendix I). This framework adopts a risk-based approach to avoiding and/or minimising impacts associated with the relocation and/or adjustment of public utilities affected by the project. A key step would be the detailed design response to potential conflicts with a public utility, including whether the utility can be avoided.
Sydney Motorway Corporation	<ul style="list-style-type: none"> Confirming the extent of project interfaces in relation to WestConnex. 	<ul style="list-style-type: none"> Transport for NSW is currently working with WestConnex to achieve an integrated drainage solution for both projects.

7.4.2 Community feedback

Transport for NSW is committed to working with community and stakeholder groups to maximise the benefits of the project and deliver improved environmental outcomes.

As noted in Section 4.2, the project team met with the Hurlstone Park Association and the Save Dully Action Group, and received feedback on a range of issues including what they value about their area, the concept station design, pedestrian access and building materials.

The feedback was used to help review and influence the station concept designs. Table 7.6 indicates project refinements undertaken in response to community feedback.

Table 7.6 Project responses to community feedback

Station	Project response
Dulwich Hill Station	<ul style="list-style-type: none"> Redesign of shops on concourse and positioning of stairs and lifts. Use of natural materials and retention of natural rock face where possible. Minimising the scale of the concourse and canopies where possible, having regard to customer requirements.
Hurlstone Park Station	<ul style="list-style-type: none"> Minimising the scale of the concourse and canopies where possible, having regard to customer requirements. Redesigned arrangement to keep the entrance on the Crinan Street overbridge (same as existing), which would be located in a new plaza area. Concourse and access stairs moved east, away from remaining heritage building on Platform 2. Ongoing investigations with Council during detailed design on improvements to the plaza area. Extension of new footpath pavement into Crinan Street/Duntroon Street. Use of natural materials and retention of natural rock face where possible.

The former Canterbury Bowling and Community Club site is proposed for use during construction as a compound and site office (work site 8 – refer to Section 9.8). Transport for NSW has been in contact with one of the groups using this facility (which is leased from Canterbury-Bankstown Council) during the preparation of the Environmental Impact Statement. Initially, the entire site was proposed for the work site. In response to the feedback received, Transport for NSW has committed to a reduction in the size of this work site to enable users to continue to use the building on the site. Transport for NSW would work closely with Canterbury-Bankstown Council and users of the facility to manage how it would be used during construction.

7.5 Impacts avoided

The approach to design development has included a focus on avoiding and/or minimising the potential for impacts during all key phases of the process. Specific design responses to avoid or minimise potential impacts (both construction and operational) are summarised in Table 7.7 and Table 7.8.

Table 7.7 Construction impacts avoided or minimised through design

Environmental aspect	Design response
Traffic and transport	<ul style="list-style-type: none"> Careful selection of construction haulage routes to ensure that vehicles are directed to suitably classified roads (i.e. for use by heavy vehicles) via the shortest route and, where possible, minimising the distance travelled through residential areas. Selection of construction compounds to minimise their number and therefore the number of haulage routes required. Minimising impacts on existing parking areas. Considering the construction methodologies to minimise the number of heavy vehicle movements required. Development of the Temporary Transport Strategy to guide the implementation of measures to minimise the potential impacts to the road network and station areas associated with replacing trains with buses during possession periods.
Noise	<ul style="list-style-type: none"> Construction compound layout and siting of equipment, with consideration given to minimising noise impacts to sensitive receivers. Arrangement of haulage routes to minimise the use of local roads.
Heritage	<ul style="list-style-type: none"> Placement of construction compounds within already cleared areas (such as car parks) to avoid impacting heritage sites and items, particularly where land is only required for construction.
Property and land use	<ul style="list-style-type: none"> Use of public land has been maximised for construction work sites and compounds located outside of the rail corridor.
Visual	<ul style="list-style-type: none"> Construction work sites and compounds have been positioned to minimise the need for vegetation clearance where possible. Retaining trees within the station areas has also been considered as part of the concept design.
Biodiversity	<ul style="list-style-type: none"> Placement of construction compounds within already cleared areas (such as car parks) where possible to minimise the need for further vegetation clearance, particularly where land is only required for construction Positioning of construction areas to avoid impacts on Downy Wattle, a threatened species listed under both the TSC and EPBC Acts, located to the west of Punchbowl Station within the rail corridor.
Socio-economic and business impacts	<ul style="list-style-type: none"> Designing the project to minimise the potential for noise, air, and visual quality amenity impacts during construction and operation, including the implementation of design responses summarised in this table. Construction planning has sought to minimise impacts on the community through the positioning and use of construction equipment and working times. Development of the Temporary Transport Strategy to guide the implementation of alternative transport arrangements during possession periods.
Waste	<ul style="list-style-type: none"> Reuse of materials where possible (including spoil and ballast) to minimise waste generation.

Table 7.8 Operational impacts avoided or minimised through design

Environmental aspect	Design response
Traffic and transport	<ul style="list-style-type: none"> Designing the project with regard to urban design, place making and accessibility considerations, as described in Section 7.2. Designing the project, including upgraded stations and other facilities, with regard to current and future expected demand, and in accordance with the Sydney Metro requirements.
Noise	<ul style="list-style-type: none"> Provision of new noise barriers and adjustments (including lengthening or increasing the height) to existing noise barriers located in areas where operational airborne noise is required to be mitigated in line with the <i>Rail Infrastructure Noise Guideline</i> (EPA, 2013).
Heritage	<ul style="list-style-type: none"> As described in Sections 7.2.3 and 7.3.7, significant work has been undertaken to minimise the heritage impacts of the project.
Hydrology and flooding	<ul style="list-style-type: none"> Incorporating drainage infrastructure that reduces the incidence of flooding.
Biodiversity	<ul style="list-style-type: none"> The siting of project infrastructure was refined to avoid impacts on the Downy Wattle.
Property and land use	<ul style="list-style-type: none"> Future land use and strategic planning were considered as part of the design process (as described in Section 7.3.6) Designing the project to minimise land requirements and the need for acquisition. Designing stations to minimise the impacts on, and complement, surrounding land uses.
Socio-economic and business impacts	<ul style="list-style-type: none"> Designing the project to maximise opportunities to activate existing local centres, with regard to urban design and place making considerations, as described in Sections 7.2 and 7.3. Designing the project to minimise the potential for noise and visual quality amenity impacts during operation, including the implementation of design responses summarised in this table. Minimising land requirements and the need for acquisition. Retaining existing station locations in close proximity to local centres. Maintaining connectivity on key routes in and around the local centres. Designing the project to maximise accessibility and safety, as described in Sections 7.2.5 and 7.3.8.

7.6 Summary of key design outcomes

A summary of the key design and place making outcomes achieved for each station is provided in Table 7.9. Further information is provided in Appendix H.

Table 7.9 Key design outcomes

Location	Design aspect	Outcome
Marrickville	Local public domain	<ul style="list-style-type: none"> The Station Street shared zone would add a new, intimate public space to the public domain of the Illawarra Road precinct Renewal of the southern access path and the Station Street shared zone would improve the station interface with local streetsp
	Connectivity and access	<ul style="list-style-type: none"> Improvements to crossing conditions at Illawarra Road, and Schwebel and Warburton streets Proposed cycle route on Warburton and Schwebel streets and Leofrene Avenue The southern station access path upgrade would improve access to the station from the east

Location	Design aspect	Outcome
		<ul style="list-style-type: none"> Addition of an accessible ramp on Station Street (west) to overcome the non-compliant grade
	Catalyst	<ul style="list-style-type: none"> Marrickville station and associated public space would be a potential stimulus for further redevelopment in the area surrounding the station The Station Street shared zone creates an intimate public space away from Illawarra Road
	Interchange/ accessibility	<ul style="list-style-type: none"> Secure access and sheltered bike parking in Station Street in dedicated facilities Taxi and kiss and ride bays in the Station Street shared zone Accessible ramp on Station Street (west) providing an accessible path to the Illawarra Road bus stops and the Schwebel Street accessible parking bays On-road cycle route on streets adjacent to Station Street
Dulwich Hill	Local public domain	<ul style="list-style-type: none"> Generous pedestrian / interchange zone north of the station on Bedford Crescent serving both the station and the light rail stop Paved area to south of station connecting Wardell Road to Ewart Lane
	Connectivity and access	<ul style="list-style-type: none"> New cross corridor connection Accessible approaches to station Improved link to the light rail stop and Jack Shanahan Park Upgrade of cycleway through station precinct
	Catalyst	<ul style="list-style-type: none"> Broad public connections to the new station concourse Improved public domain has the potential to generate wider urban improvements in conjunction with council Southern area has the potential to act as a catalyst for adjacent north facing development sites A range of town centre sites have redevelopment potential
	Interchange/ accessibility	<ul style="list-style-type: none"> At grade accessible connection between interchange area and station concourse Lift from concourse to light rail stop Accessible path from station area to Wardell Road crossing Secure access and bike parking in southern area
Hurlstone Park	Local public domain	<ul style="list-style-type: none"> Widened approaches to new concourse Kerb extension at road overbridge crossing would improve sightlines New crossings on Duntroon Street (south) and Crinan Street (north)
	Connectivity and access	<ul style="list-style-type: none"> Accessible approach on southern side of station Potential active transport connection in corridor east of the station and on-road south and west of the station
	Catalyst	<ul style="list-style-type: none"> Broad public connections to new station entries Improved public domain has the potential to generate wider streetscape improvements in the retail village and proposed heritage conservation areas
	Interchange/ accessibility	<ul style="list-style-type: none"> At-grade accessible connection between Crinian/Duntroon Street interchange area and station concourse Accessible path to bus stops from southern entry Bike parking in Floss Street (north)
Canterbury	Local public domain	<ul style="list-style-type: none"> Promotion of a new town centre, led by Canterbury-Bankstown Council and the Department of Planning and Environment, to the west of the Canterbury Road precinct Maintenance of station address/legibility from Canterbury Road through architectural expression of station canopy Futureproofing for a potential future station entrance on Charles Street as part of any future developments along Charles Street
	Connectivity and access	<ul style="list-style-type: none"> New pedestrian crossing on Broughton Street in line with new station entrance would provide a connection to existing and potential development areas to the north

Location	Design aspect	Outcome
	Catalyst	<ul style="list-style-type: none"> Proposed interchange area on Broughton Street would create a comfortable, attractive public forecourt to the station
	Interchange/ accessibility	<ul style="list-style-type: none"> The Broughton Street interchange would provide comfortable, accessible connections to bus stops, taxi, and kiss and ride bays, accessible parking, and secure access and sheltered bike parking The Canterbury Road entry would provide accessible connections to bus stops on Canterbury Road and bike parking facilities
Campsie	Local public domain	<ul style="list-style-type: none"> The station would reinforce Beamish Street as the central spine of the town centre The proposed retail on the station concourse and the station canopy would maintain the consistent street wall of Beamish Street across the alignment New retail on the eastern side of Beamish Street would further activate the street (the use of the retail space would be subject to a separate approval process)
	Connectivity and access	<ul style="list-style-type: none"> Generous eight metre setback to create a station forecourt and ease pedestrian congestion in front of the station New station entry and footpath upgrade on North Parade Landscaped shared zone on southern approach to station on a widened Lilian Lane
	Catalyst	<ul style="list-style-type: none"> New station and high frequency service would contribute to urban renewal of the Campsie town centre Improved public domain on Beamish Street, Lilian Lane, and North Parade has the potential to generate wider precinct improvements Maintaining the station address on Beamish Street would keep the station as the central focus of the precinct
	Interchange/ accessibility	<ul style="list-style-type: none"> Greater concentration of interchange opportunities adjacent to station Maintenance of existing bus stops and services New taxi bays next to North Parade station entry Kiss and ride on North Parade New kerbside as part of the new elevated platform on the eastern side of Beamish Street Bike parking near the northern entrance on North Parade A new shared zone along Lillian Lane between Beamish and Dewar streets A potential cycle route along Lilian Street and Lilian Lane and South Parade
Belmore	Local public domain	<ul style="list-style-type: none"> A generous station area and shared zone on Tobruk Avenue Tobruk Avenue/Bridge Road/Burwood Road would become a signalised intersection, improving vehicle, pedestrian, and cycling connectivity from east to west The crossing and shared zone would link the proposed on-road cycle route on Bridge Road to the shared path through the Belmore Sports Ground
	Connectivity and access	<ul style="list-style-type: none"> A new cross corridor concourse connection A landscaped urban area would connect the station, the Burwood Road shopping area, and the linear parkland of the Belmore Sports Ground The area would include retail development, bike parking, public seating, artwork, and landscaping The distinctive, elevated canopy would ensure the station is legible in the precinct
	Catalyst	<ul style="list-style-type: none"> The station would contribute to the renewal of the town centre. Zoning proposals allow for shop-top housing along Burwood Road and a mixture of medium and high density development near the station

Location	Design aspect	Outcome
	Interchange/ accessibility	<ul style="list-style-type: none"> The Tobruk Avenue shared zone would consolidate taxi and kiss and ride bays immediately adjacent to the station area Bike parking would be provided Bus stops on Burwood Road would remain within walking distance of the station area
Lakemba	Local public domain	<ul style="list-style-type: none"> The existing station entrances would be retained The existing elevated concourse would be retained with a minor expansion on the western side to accommodate additional station buildings/facilities The war memorial would be retained Tree planting could build on the Mediterranean theme apparent in the northern area Connection to active transport corridor along the southern side of the station, along The Boulevard west of Haldon Street, and along the rail corridor boundary east of Haldon Street
	Connectivity and access	<ul style="list-style-type: none"> A new footpath is proposed on the southern side of Railway Parade, adjacent to the existing car parking area leading to the station entrance The proposed active transport corridor would provide an on-road cycle route adjacent to Lakemba Station
	Catalyst	<ul style="list-style-type: none"> The improved public domain around the station would contribute to the wider urban renewal of the precinct
	Interchange/ accessibility	<ul style="list-style-type: none"> Re-grading the southern area would create an accessible connection to taxi bays and the Haldon Street bus stops The existing bus stops on The Boulevard, Railway Parade, and Haldon Street (south) would be retained New kerbside facilities on Railway Parade and on The Boulevard, east of the new station entrance, with accessible paths to station Bike parking would be provided
Wiley Park	Local public domain	<ul style="list-style-type: none"> Station with two new entrances away from King Georges Road The new entrances on The Boulevard and from the Stanlea Parade walkway near King Georges Road would provide safe access A new elevated concourse would provide more space for pedestrian circulation Linear areas with bike parking and public amenities north and south of the station
	Connectivity and access	<ul style="list-style-type: none"> Landscaped pedestrian approaches to the station from the west The station design would create a more permeable entry arrangement, with entry from the north and south Links with an active transport corridor along The Boulevard
	Catalyst	<ul style="list-style-type: none"> The new station and its associated areas would introduce a new urban design standard
	Interchange/ accessibility	<ul style="list-style-type: none"> At-grade accessible connection to the interchange area on The Boulevard Secure access and sheltered bike parking on both station platforms Shared path as part of a future active transport corridor on the southern station approach
Punchbowl	Local public domain	<ul style="list-style-type: none"> The new station area on The Boulevard would provide a generous public space for the centre Pedestrian and cycle paths would connect to the station area and the adjacent car park New paths and an accessible ramp in Warren Reserve would connect the station area to Punchbowl Road and Urunga Parade A new pedestrian crossing on Punchbowl Road north-east of Bruest Place would provide safe connections to Bruest Place and to the north of the precinct

Location	Design aspect	Outcome
	Connectivity and access	<ul style="list-style-type: none"> Large station entrance areas would create clear view corridors to the station The distinctive station canopy would be visible from the centre and the Punchbowl Road overbridge
	Catalyst	<ul style="list-style-type: none"> The recent development pattern evident on The Boulevarde and Punchbowl Road could extend throughout the town centre New station area has the potential to promote new retail activity
	Interchange/ accessibility	<ul style="list-style-type: none"> The eastbound bus stop on The Boulevarde moved closer to the new station area east of Arthur Street A new crossing on Punchbowl Road to the eastbound bus stop, and to school bus stops on Bruest Place New taxi and kiss and ride bays on The Boulevarde, and the taxi bays on Arthur Street would remain Dedicated kiss and ride and accessible parking bays on Urunga Parade One accessible bay provided on The Boulevarde Bike parking provided at both station entrances
Bankstown	Local public domain	<ul style="list-style-type: none"> Existing station areas would be extended eastwards to serve the entrance to the metro station, providing additional public amenities Provision of a wide concourse across the corridor The southern area extension would provide an improved setting for the heritage listed Parcels Building
	Connectivity and access	<ul style="list-style-type: none"> The existing Sydney Trains' concourse would remain New at-grade corridor crossing at the eastern end of the existing Sydney Trains platform would provide access to both the Sydney Trains and new Sydney Metro platforms New access paths servicing commuter parking east of the station Southern access path doubling as active transport shared path
	Catalyst	<ul style="list-style-type: none"> New station and high frequency service would reinforce Bankstown's strategic role in Sydney's south-west The station has the potential stimulate urban renewal and housing development in the centre, building on recent development on South Terrace
	Interchange/ accessibility	<ul style="list-style-type: none"> Bus interchange would remain on South Terrace and North Terrace Changes to taxi, and kiss and ride zones on North Terrace existing kerbside facilities (i.e. taxi rank) on northern side of North Terrace would be retained Bike parking provided on both sides of the station within the new station plazas Active transport link on southern side of the alignment

7.7 Detailed design guidelines

Transport for NSW will continue to develop the project to a greater level of detail in conjunction with the appointed design contractor. Transport for NSW will challenge the contractor to develop innovative solutions to detailed design and construction to achieve improved outcomes.

To guide the progression of the project design from the current reference design through the detailed design phase, Transport for NSW has prepared the Sydenham to Bankstown Design Guidelines, which are included in full in Appendix C. The purpose of those guidelines is to ensure that as the detailed design progresses, it would incorporate the strategies and principles embedded in the reference design, which is the subject of this Environmental Impact Statement.

The guidelines establish the on-going design approach by guiding the design of the interface between stations and their surrounding localities, including:

- station entries
- transport interchange facilities (bicycle facilities, bus stops, kiss and ride, taxi ranks, and connections to existing rail and light rail infrastructure)
- landscaping and other public domain elements
- rail corridor works including rail cuttings and embankments
- station and service buildings.

The detailed design and construction methodology proposed to deliver the project would be assessed for consistency with this Environmental Impact Statement and the terms of any approval granted by the Minister for Planning. If the detailed design or construction impacts are not considered to be consistent with any approval granted for the project, an application to modify the project would be lodged.

Additional development above or adjacent to the stations would be subject to separate planning approval.

8. Project description – operation

This chapter provides a description of the project once it is operational, including the key infrastructure/project features proposed, their main features, and how the project would operate. Proposed acquisition requirements are also described. The Secretary's environmental assessment requirements addressed in this chapter are listed in Table 8.1. A full copy of the assessment requirements and where they are addressed in the Environmental Impact Statement is provided in Appendix A.

Table 8.1 Secretary's environmental assessment requirements – project description

Ref	Secretary's environmental assessment requirements – project description	Where addressed
2.1(b)	A description of the project, including all components and activities (including ancillary components and activities) required to construct and operate it.	This chapter provides a description of the components and activities required to operate the project. A description of how the project is likely to be constructed is provided in Chapter 9.
14.4	The Proponent must provide artist impressions and perspective drawings of the project from key receiver locations to illustrate the project.	Section 8.1

8.1 Project infrastructure and features

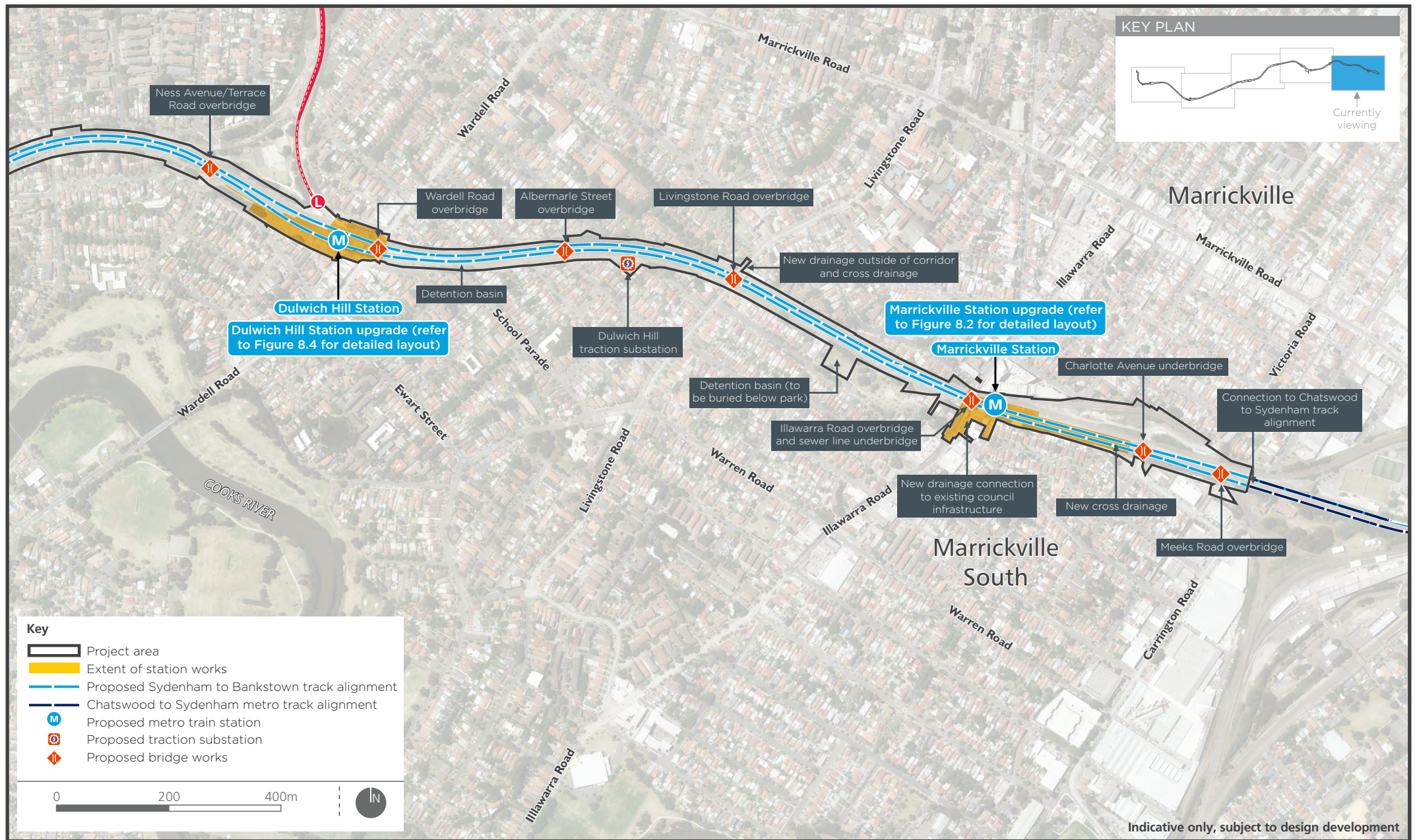
The main infrastructure and features that form part of the project are described in this section, and are shown in Figure 8.1. These include:

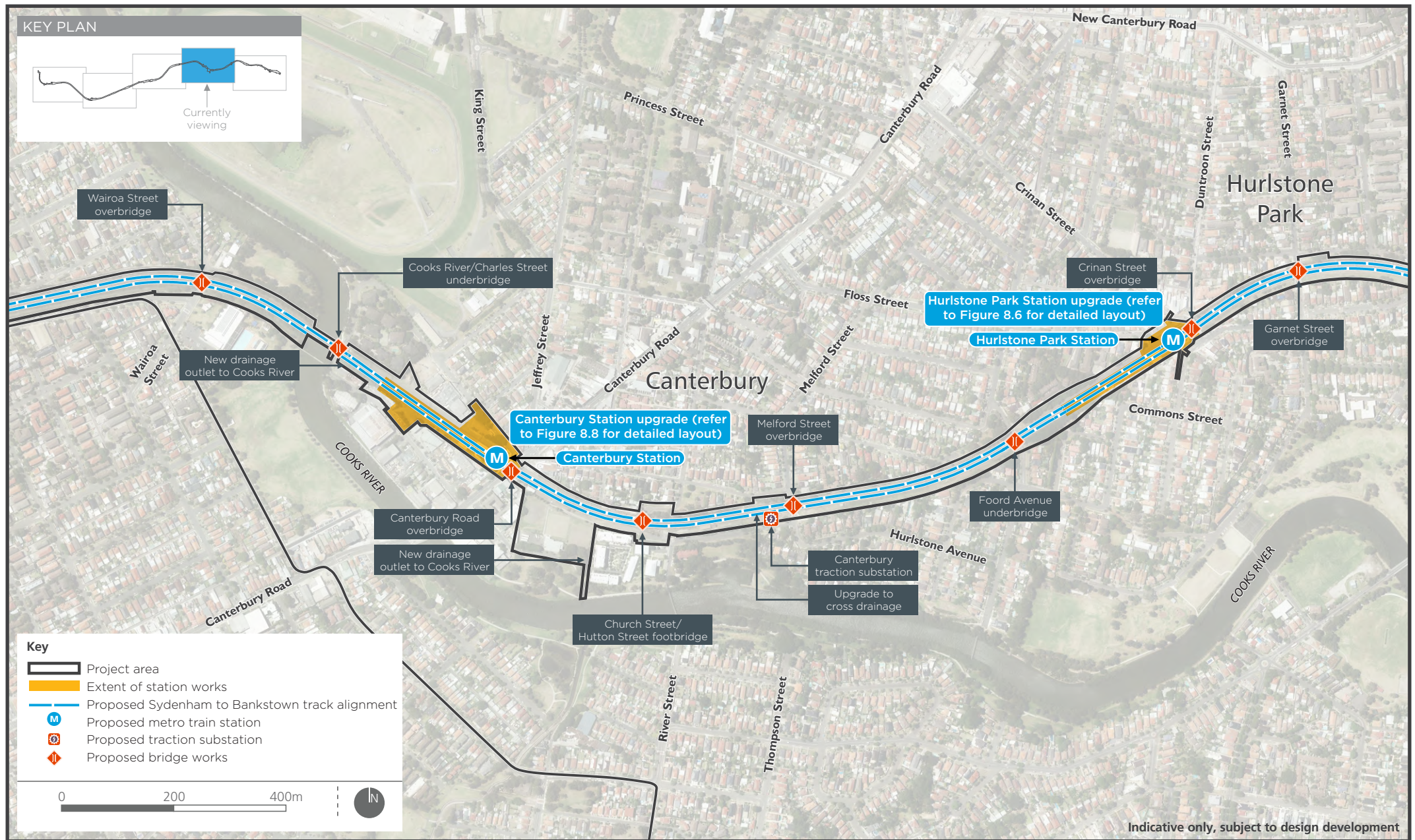
- works to upgrade the 10 stations and station areas between Marrickville and Bankstown (inclusive), to meet the standards required for accessible public transport
- works to meet the standards required for metro services, including:
 - station works
 - track and rail system facility works
 - other works along the rail corridor.

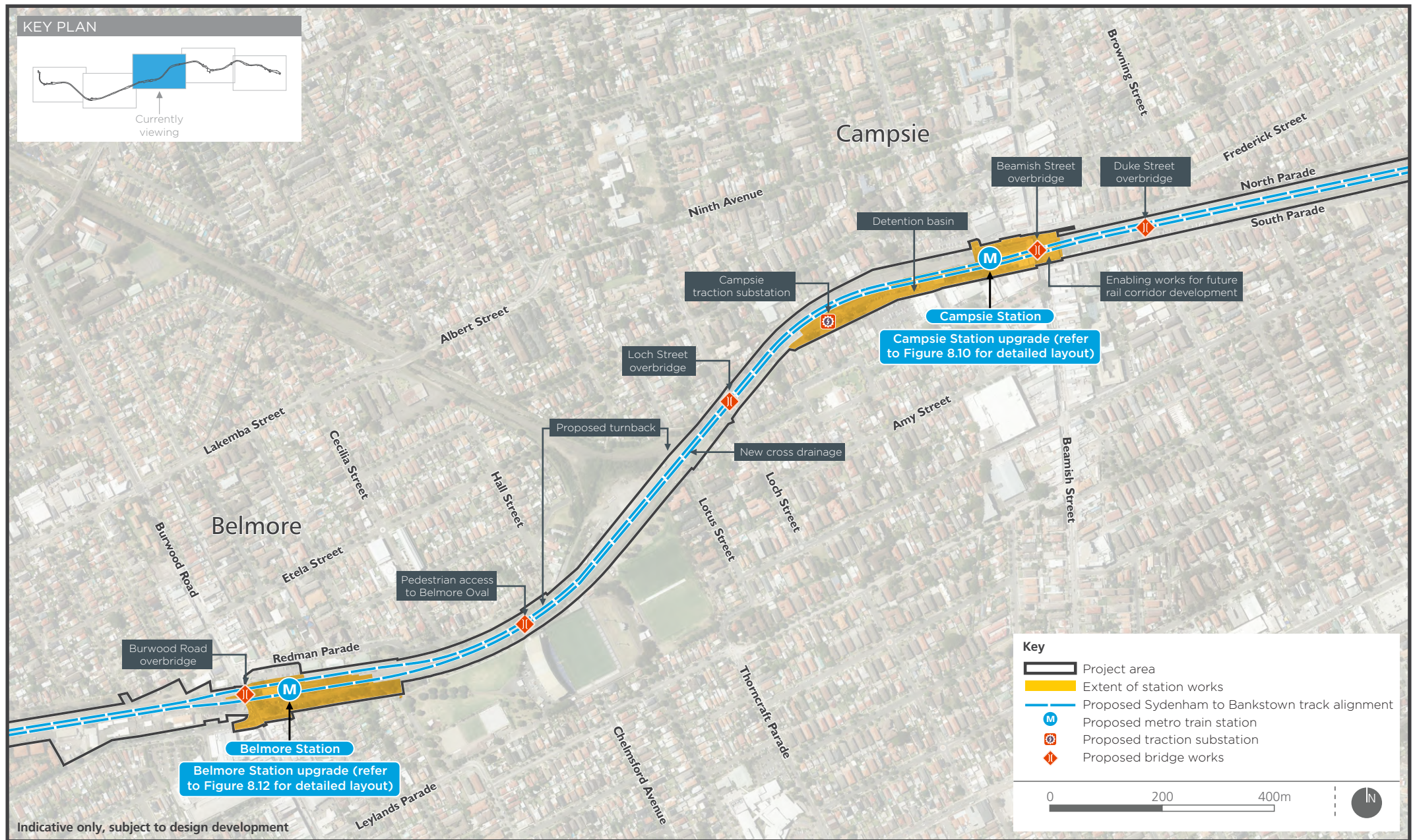
It is noted that the project scope described in this chapter is based on the level of design developed to date. Detailed design would include further engineering, construction planning, and detailed assessment work, and would be subject to further input from key stakeholders and the community.

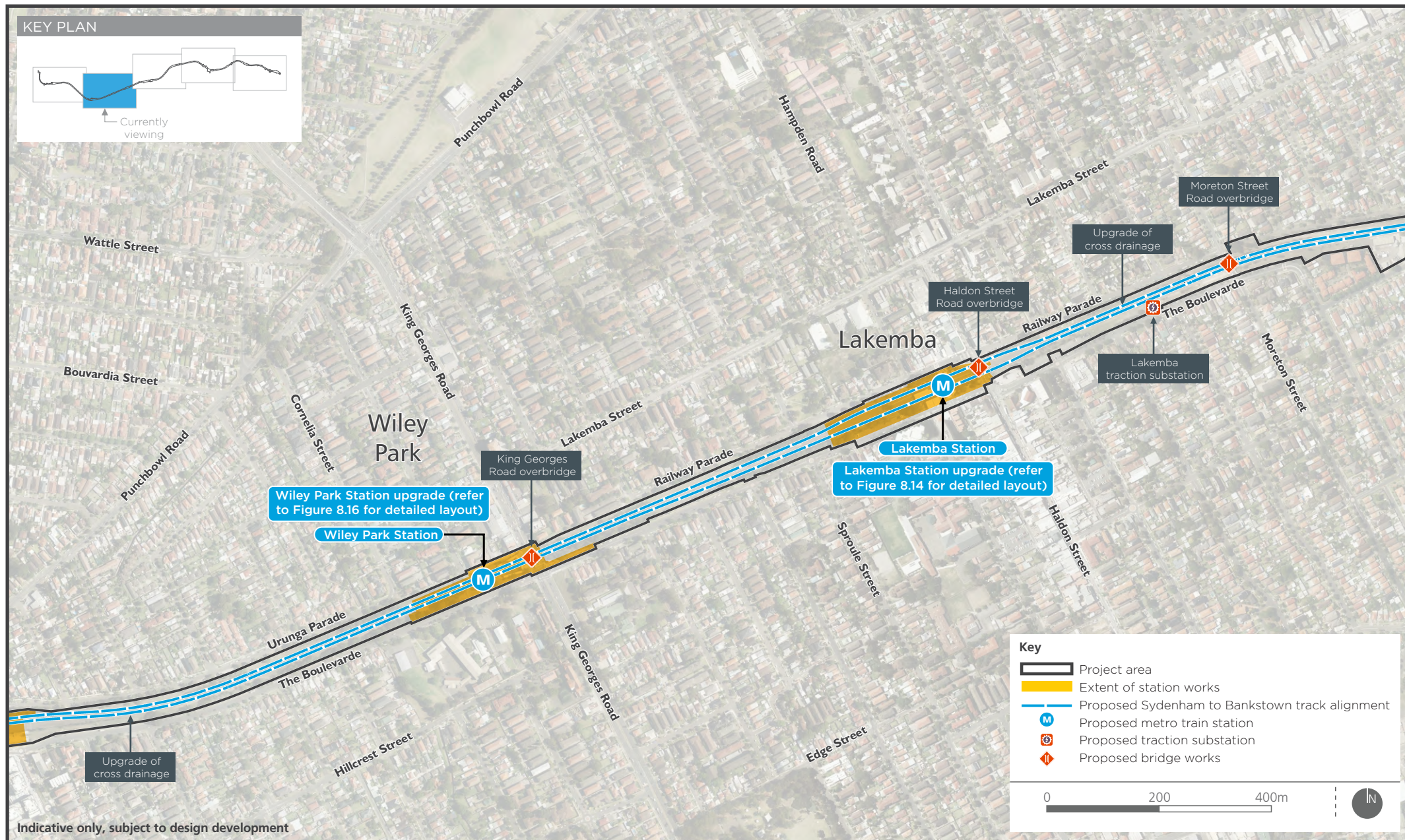
A description of how the design for the project (as described in this chapter) was developed is provided in Chapter 7 (Design development and place making).

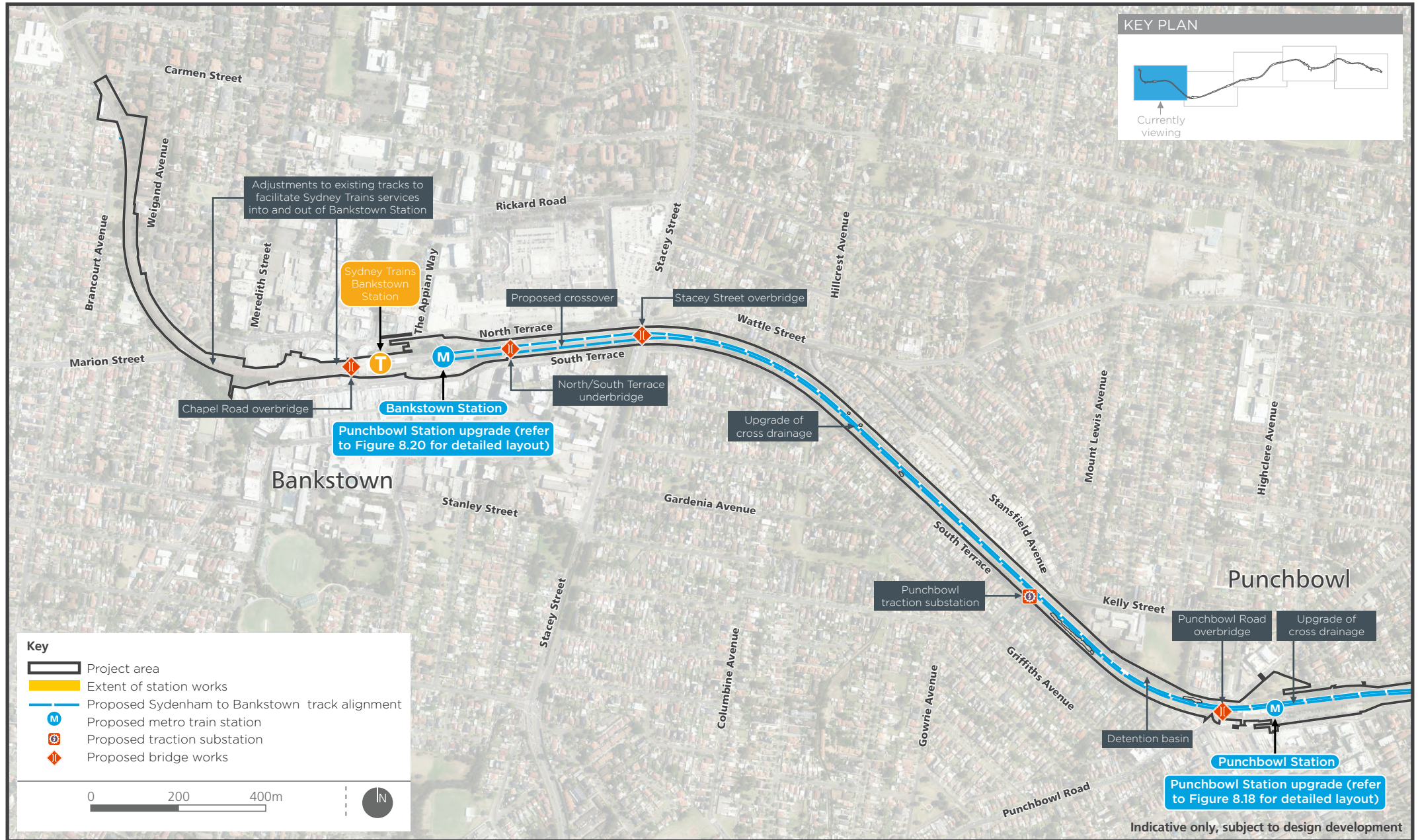
Any design modifications that occur as a result of matters arising during the exhibition of this Environmental Impact Statement would be identified in a submissions report or a preferred infrastructure report.











8.1.1 Works to upgrade stations

The project includes upgrading the 10 stations between Marrickville and Bankstown, as required, to meet legislative requirements for accessibility of public transport, including the requirements of the *Disability Discrimination Act 1992* and the *Disability Standard for Accessible Public Transport 2002*. The stations and surrounding areas are being designed to provide safe and efficient interchange between transport modes, including minimising conflicts between pedestrians, cyclists, buses, and vehicles. Common elements and design features would be incorporated into the station designs as required.

The works required at each station depend on the nature and condition of the existing facilities, and generally include:

- platform works, which could include:
 - removing and replacing platforms in the same or adjusted locations
 - extending platforms along the rail corridor (in line with the existing corridor and tracks) to provide space to straighten the platform
 - replacing the existing platform with level, straighter platforms
- new station concourse areas and station entrance locations, including:
 - new stairs and ramps
 - new or relocated lifts to access the station and station platforms, and to link various transport nodes
- provision of station buildings on platforms or at station entrances, including control and communication rooms, toilets, staff facilities, storerooms, and offices (where practical, heritage buildings would be retained and adaptively reused)
- provision of canopies for shade and shelter – this would involve providing an elevated cover over part or all of the exposed areas at stations (such as concourses, platforms and stairwells), and would include a range of styles depending on the station
- signage and wayfinding within and around the station.

Works would also be undertaken in the areas around the stations (i.e. the station area) to better integrate with other modes of transport, improve travel paths, and meet statutory accessibility requirements. This would include:

- enhancements to footpaths in the vicinity of station entrances and transport interchange areas
- landscaping and street furniture particularly within the areas near station entrances and along the corridor
- provision of new and/or relocated bicycle parking facilities
- new, upgraded or relocated parking and kerb side facilities, including accessible parking, kiss and ride, and taxi facilities.

A more detailed description of the works proposed at each station is provided in the following sections. These descriptions include reference to heritage elements at the existing stations. Further information on how heritage considerations were taken into account during the design is provided in Section 7.3.7. The potential impacts on heritage listed items are considered in Chapter 14 (Non-Aboriginal heritage).

The design development process for the station upgrades is described in Chapter 7. This includes a description of the key design principles and design considerations. The exact nature of the works

required at each station would be confirmed as an outcome of the detailed design process, which would be informed by the design guidelines provided in Appendix C.

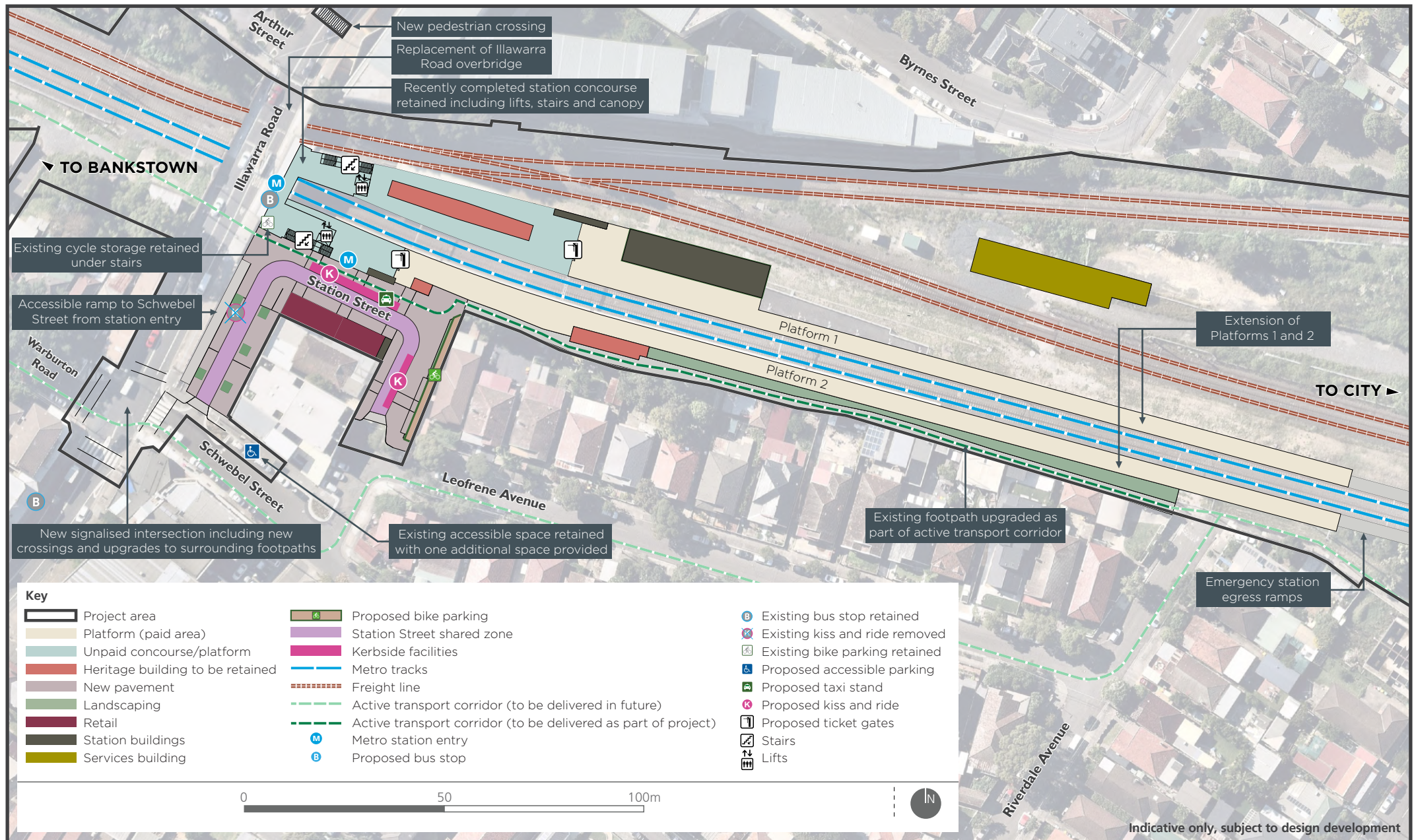
Marrickville Station

Marrickville Station is located east of the Illawarra Road overbridge. The station area is bound to the north by a multi-storey residential apartment building, located on the corner of Illawarra Road and Byrnes Street, to the south by Station Street and residential dwellings fronting Leofrene Avenue, and to the west by Illawarra Road. The station entrance is on Illawarra Road.

Marrickville Station was recently upgraded as part of Transport for NSW's Transport Access Program. The key works proposed as part of the project are shown on Figure 8.2 and summarised in Table 8.2. An artist's impression is provided in Figure 8.3.

Table 8.2 Marrickville Station key design elements

Feature	Description
Station works	
Station entry/exit	<ul style="list-style-type: none"> The existing station entrance from Illawarra Road would be retained and upgraded. The existing lifts would also be retained. The existing at-grade entry from Station Street to platform 2 would be retained and upgraded to include a new entry canopy.
Platform details	<ul style="list-style-type: none"> The existing heritage listed platforms would be straightened and extended to the east.
Station buildings	<ul style="list-style-type: none"> The existing station buildings, including the recently completed elevated concourse and associated canopy would be retained. New station buildings would be provided on platforms 1. Heritage station buildings on platforms 1 and 2 would be retained. The former booking office on platform 2 would be retained. New retail space would be provided in Station Street (the use of the space would be subject to a separate approval process).
Station area	
Public transport integration	<ul style="list-style-type: none"> All bus stops would be retained in their current locations, including the southbound bus stop on Illawarra Road which was recently relocated as part of the upgrades to the station.
Access	<ul style="list-style-type: none"> A new shared zone on Station Street would be provided, allowing access to the southern station entrance. This entrance and the new shared zone would form a new station plaza which would form part of an active transport corridor. The signalisation of Warburton Road, Schwebel Street and Illawarra Road intersection is proposed, including the installation of pedestrian crossings. The existing signalised crossing of Illawarra Road outside the station would be removed. A pedestrian crossing would be provided on Illawarra Road immediately north of Arthur Street. The existing cycle route along the southern side of the rail corridor would be rerouted along Schwebel Street, Leofrene Avenue, and Riverdale Avenue. A new accessible ramp would be provided from the southern station entrance to Schwebel Street along Station Street.
Kerbside uses, bike parking	<ul style="list-style-type: none"> New kerbside facilities would be provided within the new Station Street shared zone/plaza area on both the northern and western sections of the new shared zone. A new bike storage/parking area would be provided along the eastern side of the Station Street plaza with the existing facility retained.
Car parking	<ul style="list-style-type: none"> Loss of two on-street parking space on Schwebel Street due to new kerbside facilities.





Dulwich Hill Station

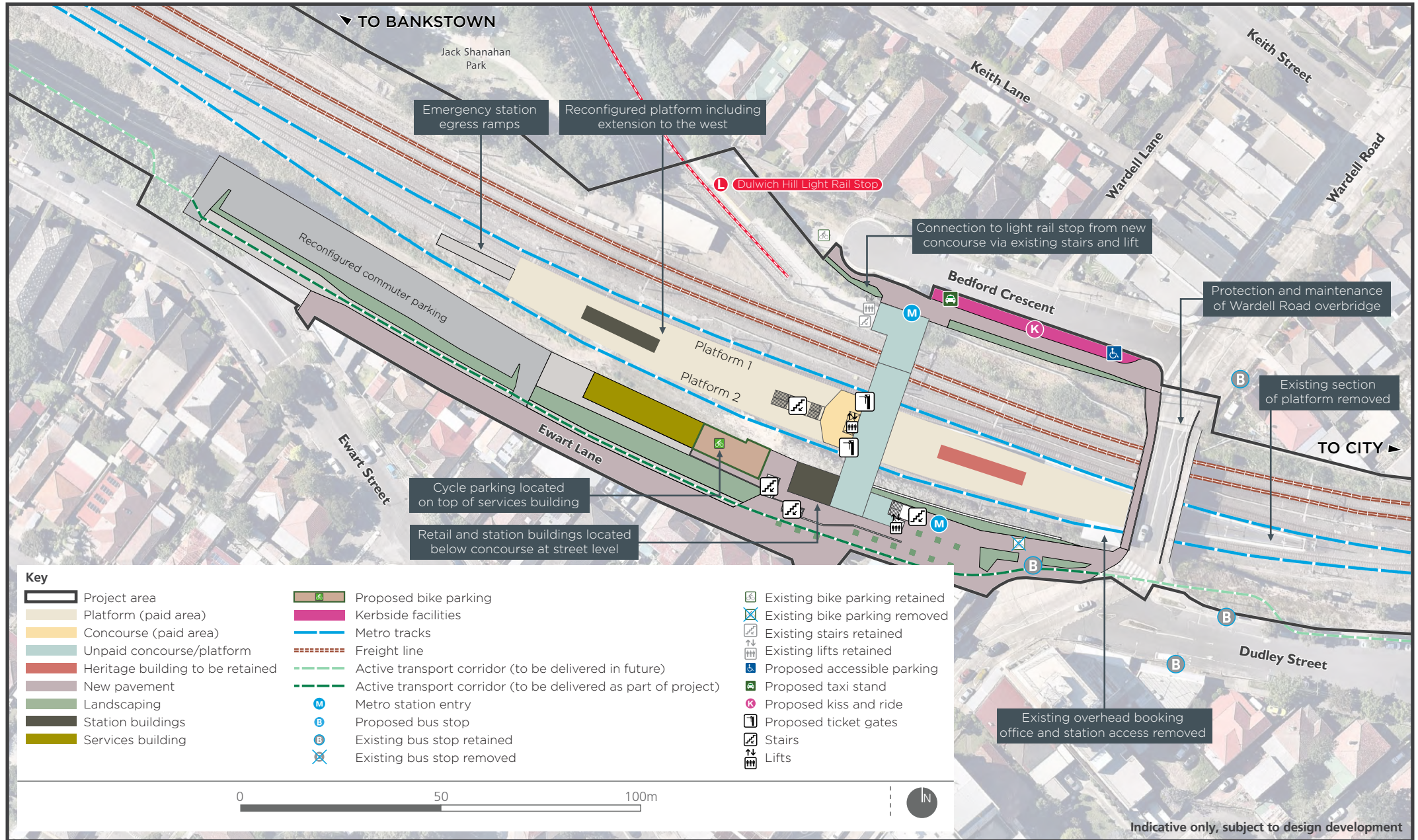
Dulwich Hill Station is located west of the Wardell Road overbridge. The station area is bounded by Bedford Crescent to the north, Ewart Lane to the south, and Wardell Road to the east. The station entrance is on Wardell Road.

The key works proposed as part of the project are shown in Figure 8.4 and summarised in Table 8.3. As described in Section 6.5.1, Transport for NSW would work with the contractor to determine whether a straight platform arrangement can be provided as part of the design of Dulwich Hill station.

An artist's impression is provided in Figure 8.5.

Table 8.3 Dulwich Hill Station key design elements

Feature	Description
Station works	
Station entry/exit	<ul style="list-style-type: none">• The existing station entrance would be removed.• A new elevated station concourse would be provided and would connect with the existing stairs and lift to the Dulwich Hill light rail stop. The concourse would be accessed from two new station entrances at Bedford Crescent (northern side) and adjacent to Ewart Lane (southern side).
Platform details	<ul style="list-style-type: none">• The heritage listed platforms would be rebuilt in their current locations and extended to the west. A portion of the existing platform east of Wardell Road would be removed.
Station buildings	<ul style="list-style-type: none">• New station facilities would be provided within the new concourse structure and within a new building located on the platform.• As part of the removal of the existing station entrance, the heritage listed overhead booking office would be removed. A description of how the design has been refined to minimise impacts on heritage is provided in Section 7.3.7.• The existing heritage station building on the platform would be retained.• New retail space would be provided within the southern station entrance below the new concourse (the use of the space would be subject to a separate approval process).
Station area	
Public transport integration	<ul style="list-style-type: none">• The existing bus stops located on Dudley Street and Wardell Road would be retained.• The new concourse would connect the existing lift and stairs to the Dulwich Hill light rail stop.
Access	<ul style="list-style-type: none">• A new public plaza would be provided between the proposed southern station entrance and the existing pedestrian crossing on Wardell Road.• Ewart Lane would be widened/upgraded adjacent to the new southern station entrance to improve vehicular access to the reconfigured Ewart Lane car park.• Pathways would be provided along Ewart Lane, Ewart Street, and Dudley Street, to form part of an active transport corridor.
Kerbside uses, bike parking	<ul style="list-style-type: none">• New kiss and ride, taxi, and accessible parking would be provided on the southern side of Bedford Crescent.• New bike parking facilities would be provided on the upper level of the proposed services building.
Car parking	<ul style="list-style-type: none">• Loss of 10 on-street parking spaces on Bedford Crescent due to new kerbside facilities.





Hurlstone Park Station

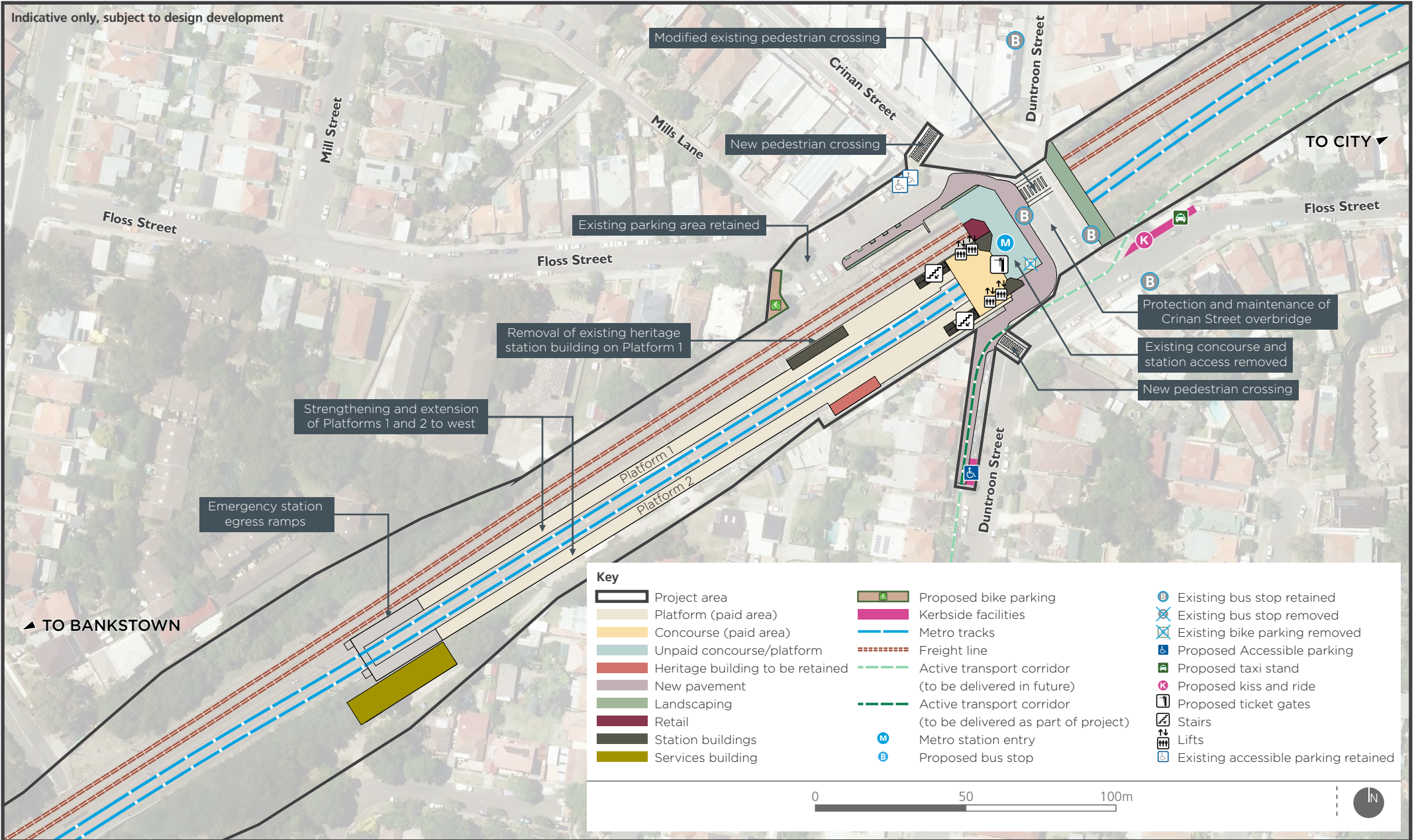
Hurlstone Park Station is located to the west of the Crinian Street overbridge. The station area is bounded by Crinian and Floss streets and residential dwellings to the north, Duntroon Street and residential dwellings to the south, and Crinian Street to the west (on the bridge). The station entrance is on the overbridge.

The key works proposed as part of the project are shown in Figure 8.6 and summarised in Table 8.4.

An artist's impression is provided in Figure 8.7.

Table 8.4 Hurlstone Park Station key design elements

Feature	Description
Station works	
Station entry/exit	<ul style="list-style-type: none">• The existing station entrance on the overbridge would be upgraded.• A new enlarged, elevated station concourse would be provided in the same location to provide an enlarged station forecourt area and entry set back from the road.
Platform details	<ul style="list-style-type: none">• Heritage listed platforms would be rebuilt, straightened, and extended to the south-west along the rail corridor, generally in their existing locations.
Station buildings	<ul style="list-style-type: none">• New station buildings would be located within the concourse and on platforms.• The existing heritage listed overhead booking office and heritage building on platform 1 would be removed. A description of how the design has been refined to minimise impacts on heritage is provided in Section 7.3.7.• The existing heritage station building on platform 2 would be retained.• New retail space would be provided as part of the new concourse (the use of the retail space would be subject to a separate approval process).
Station area	
Public transport integration	<ul style="list-style-type: none">• The existing bus stops on the overbridge would be retained.
Access	<ul style="list-style-type: none">• New pedestrian crossing facilities would be provided adjacent to the new southern station entrance and on Crinan Street just north of Floss Street.• The existing pedestrian crossing on the overbridge would be modified to improve pedestrian flow by including more space on the southwestern side.• Connection to an active transport corridor along the western side of Duntroon Street (south of rail corridor).
Kerbside uses, bike parking	<ul style="list-style-type: none">• New kerbside facilities would be located near the southern station entrance on Floss Street, on the eastern side of the overbridge adjacent to the station.• New bike parking areas would be provided in Floss Street on the northern side of the rail corridor.• The existing accessible parking spaces on Floss Street would be retained, and a new accessible space would be provided on Duntroon Street.
Car parking	<ul style="list-style-type: none">• Loss of five on-street parking spaces on Duntroon Street (south) and Floss Street (east) due to new kerbside facilities.





Canterbury Station

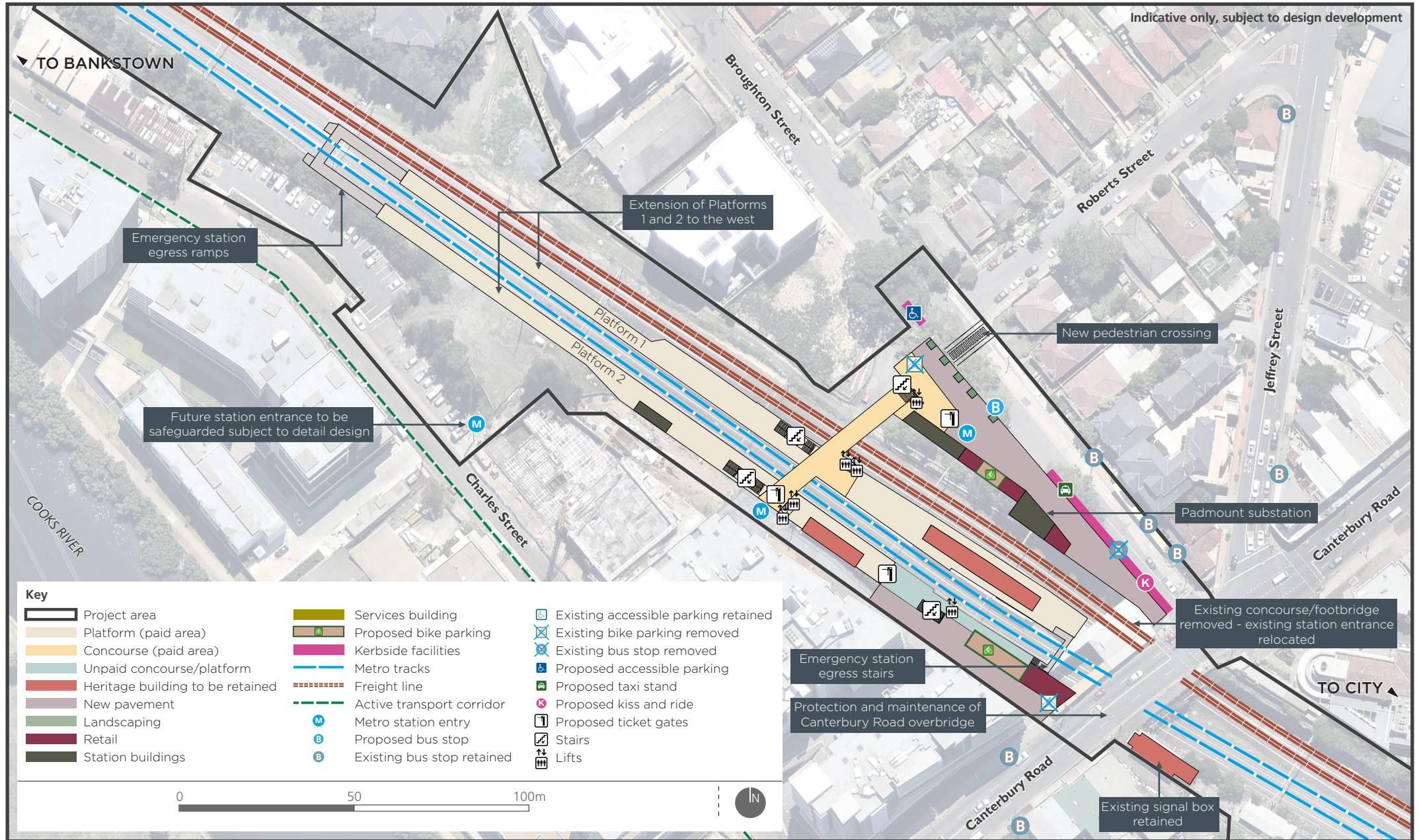
Canterbury Station is located to the north-west of the Canterbury Road overbridge. The station area is bounded by Broughton Street to the north, a large mixed use development fronting Charles Street to the south, and Canterbury Road to the east. The station entrance is on Canterbury Road.

The key works proposed as part of the project are shown in Figure 8.8 and summarised in Table 8.5.

An artist's impression is provided in Figure 8.9.

Table 8.5 Canterbury Station key design elements

Feature	Description
Station works	
Station entry/exit	<ul style="list-style-type: none"> The existing station entrance on Canterbury Road would be relocated to the western side of the rail corridor and provide access to platform 2. A new elevated station concourse would be provided about 150 metres west of Canterbury Road. A new station entrance would be provided on Broughton Street providing access to platforms 1 and 2. The design provides for a potential future station entrance on Charles Street, to enable access to platform 2.
Platform details	<ul style="list-style-type: none"> The heritage listed platforms would be rebuilt and extended to the north-west.
Station buildings	<ul style="list-style-type: none"> The heritage listed footbridge and overhead booking office would be removed. A description of how the design has been refined to minimise impacts on heritage is provided in Section 7.3.7. The heritage listed buildings on platforms 1 and 2 would be retained. The existing heritage listed signal box on the south-eastern side of the Canterbury Road overbridge would be retained. New station buildings would be provided at the station entrance on Broughton Street. New retail space would be provided at the station entrances at Broughton Street and Canterbury Road (the use of the retail space would be subject to a separate approval process).
Station area	
Public transport integration	<ul style="list-style-type: none"> All existing bus stops would be retained, with the exception of one stop on Broughton Street, which is to be relocated to the new Broughton Street entrance. A new bus shelter would be provided at the station entrance on Broughton Street.
Access	<ul style="list-style-type: none"> Connection to an active transport corridor located along Charles Street via Canterbury Road. A new pedestrian crossing would be provided on Broughton Street in line with new station entrance.
Kerbside uses, bike parking	<ul style="list-style-type: none"> Kerbside facilities would be provided on Broughton Street adjacent to the new station entry, including new accessible parking on Broughton Street. New bike parking areas would be provided within the new station plaza areas on Broughton Street and Canterbury Road.
Car parking	<ul style="list-style-type: none"> Loss of two on-street parking spaces on Broughton Street to provide new accessible parking spaces.





Campsie Station

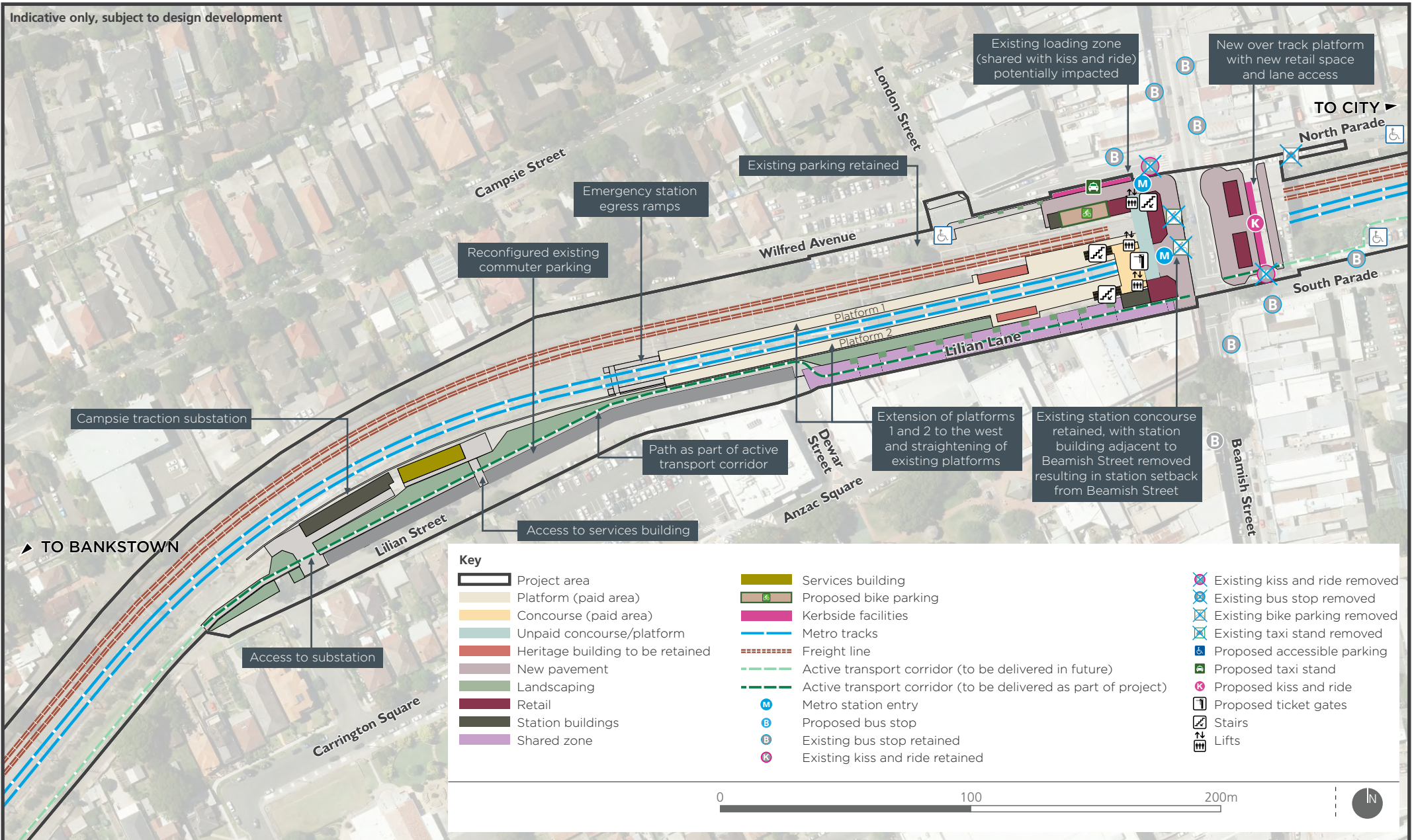
Campsie Station is located to the west of the Beamish Street overbridge. The station area is bounded by Lilian Lane/South Parade to the south, Wilfred Avenue/North Parade to the north, and Beamish Street to the east. The station entrance is located on the overbridge.

The key works proposed as part of the project are shown in Figure 8.10 and summarised in Table 8.6.

An artist's impression is provided in Figure 8.11.

Table 8.6 Campsie Station key design elements

Feature	Description
Station works	
Station entry/exit	<ul style="list-style-type: none"> The existing station entrance at Beamish Street would be upgraded. A new station entry would be provided on North Parade. A new enlarged, elevated station concourse would provide more space for pedestrian circulation and pedestrian movement along Beamish Street. The part of the existing concourse built in 2001 would be retained.
Platform details	<ul style="list-style-type: none"> The heritage listed platforms would be rebuilt, straightened and extended to the west.
Station buildings	<ul style="list-style-type: none"> The heritage listed overhead station concourse and footbridge (except the part built in 2001) would be removed. A description of how the design has been refined to minimise impacts on heritage is provided in Section 7.3.7. The existing heritage listed buildings on platforms 1 and 2 would be retained. New station facilities would be provided within the new concourse. New retail space would be provided at the station entrance on North Parade and on the eastern side of Beamish Street (the use of the retail space would be subject to a separate approval process).
Station area	
Public transport integration	<ul style="list-style-type: none"> Existing bus stops located in the vicinity of the station would be retained.
Access	<ul style="list-style-type: none"> A new shared zone would be provided along Lilian Lane between Beamish and Dewar streets. This would form part of an active transport corridor.
Kerbside uses, bike parking	<ul style="list-style-type: none"> New kerbside facilities would be provided on the southern side of North Parade, adjacent to the northern station entrance. The existing kerb facilities on the northern side of South Parade would be removed. New kerbside facilities would be provided as part of the new elevated platform on the eastern side of Beamish Street. The existing accessible parking on North Parade, Wilfred Avenue, and South Parade would be retained. New bike parking facilities would be provided near the northern station entrance on North Parade, and on the southern side of the station concourse.
Car parking	<ul style="list-style-type: none"> The existing parking area along the northern side of Lilian Lane would be reconfigured, which would result in the provision of 80 additional commuter car parking spaces. The new kerbside facilities would result in the loss of about 20 on-street car parking spaces on North Parade and South Parade.





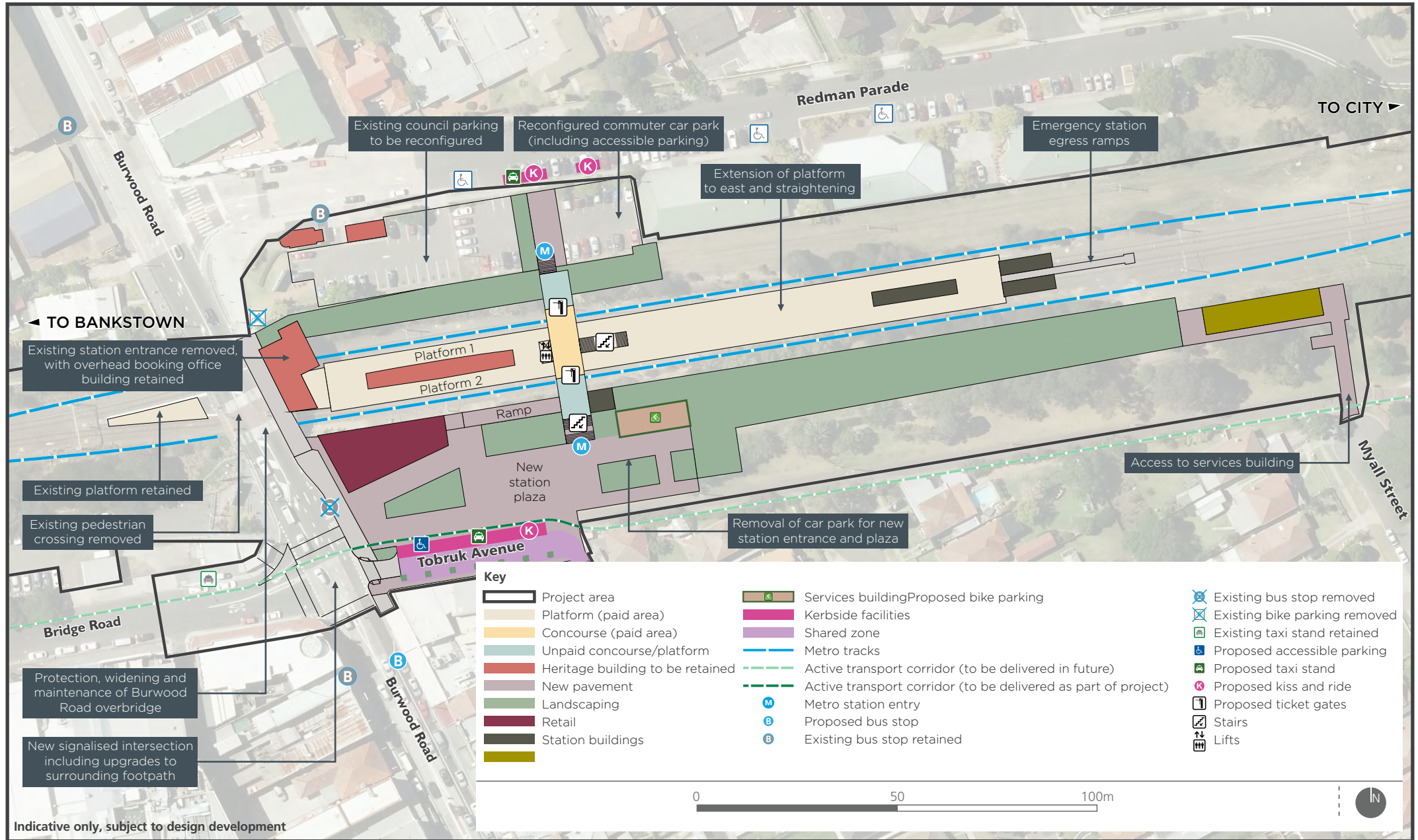
Belmore Station

Belmore Station is located to the east of the Burwood Road overbridge. To the north and south, the station area is bounded by commuter car parks fronting Redman Parade and Tobruk Avenue respectively. To the west, the station area is bounded by Burwood Road. The existing station entrance is located on the Burwood Road overbridge.

The key works proposed as part of the project are shown in Figure 8.12 and summarised in Table 8.7. An artist's impression is provided in Figure 8.13.

Table 8.7 Belmore Station key design elements

Feature	Description
Station works	
Station entry/exit	<ul style="list-style-type: none"> The existing station entrance would be removed. A new station entrance and plaza would be provided at Tobruk Avenue to the south and a new entrance provided to Redman Parade to the north. A new elevated concourse would be provided to the east of the heritage platform building.
Platform details	<ul style="list-style-type: none"> The heritage listed platforms would be rebuilt, straightened and extended to the east.
Station buildings	<ul style="list-style-type: none"> New station buildings would be provided within the concourse and at the eastern end of the platform. The existing heritage listed platform building would be retained. The existing overhead booking office would be retained. The existing stairs from the overhead booking office to the platform would be removed. Existing heritage buildings located within the car park to the north of the station would be retained. New retail space would be provided as part of the new station plaza on Tobruk Avenue (the use of the retail space would be subject to a separate approval process).
Station area	
Public transport integration	<ul style="list-style-type: none"> The existing northbound bus stop on Burwood Road would be retained. The southbound stop on Burwood Road would be relocated to the south of Tobruk Avenue.
Access	<ul style="list-style-type: none"> The existing signalised crossing on Burwood Road at the station entrance would be removed, and a new signalised intersection would be provided at the Tobruk Avenue, and Burwood Road intersection. The new signalised intersection would include pedestrian crossings. New pathways would be provided on Tobruk Avenue to connect to an active transport corridor along Bridge Road, and the existing pathways along the southern side of the rail corridor.
Kerbside uses, bike parking	<ul style="list-style-type: none"> Tobruk Avenue would be extended and widened to provide a shared zone, including new taxi and kiss and ride facilities. A new bike parking area would be provided within the new plaza on Tobruk Avenue.
Car parking	<ul style="list-style-type: none"> Potential impacts to commuter parking and council parking on the northern side of existing station due to new northern station entrance. Removal of existing council off-street car park located south of the station, resulting in the loss of 48 spaces. Loss of five on-street spaces on Tobruk Avenue due to the provision of kerbside facilities





Lakemba Station

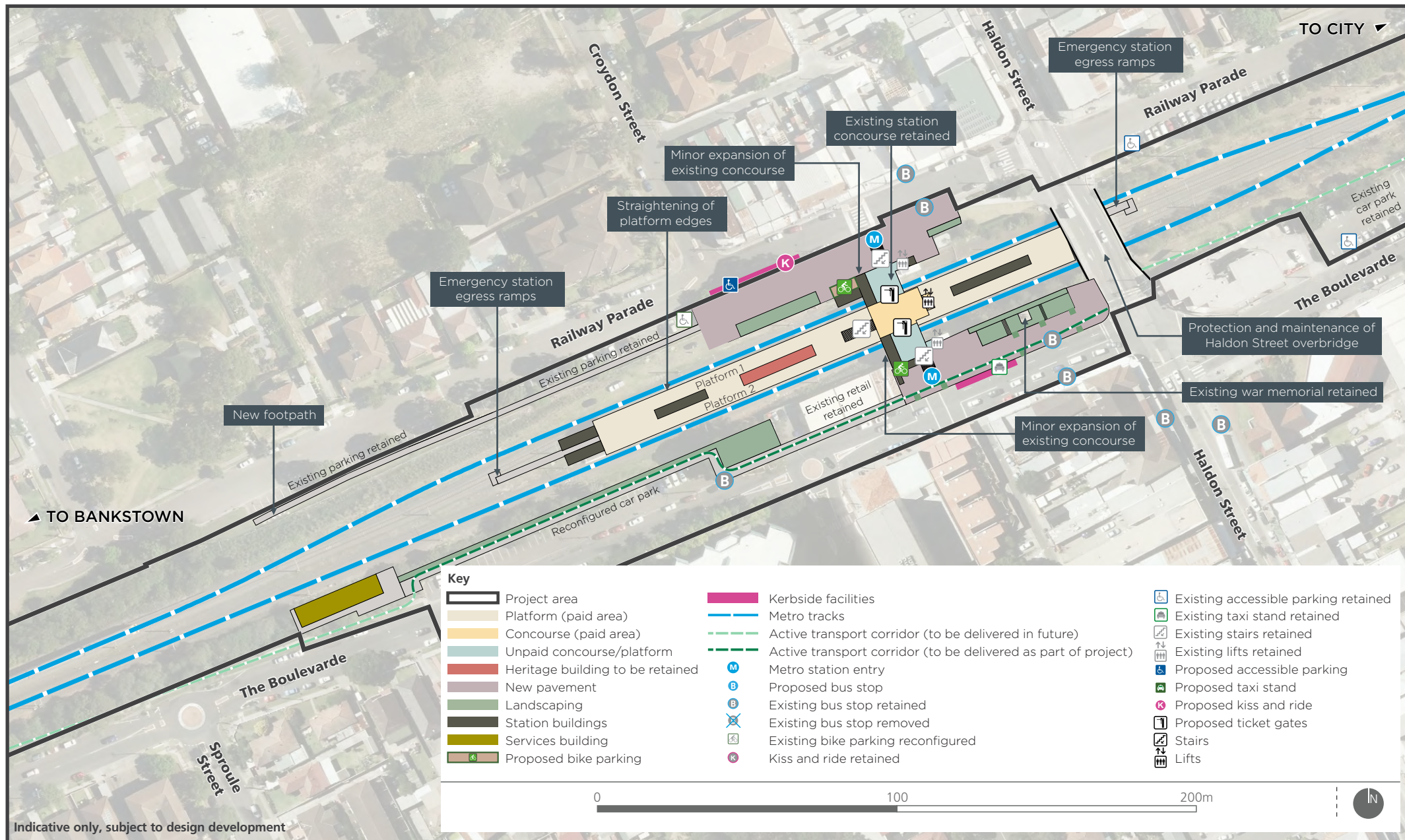
Lakemba Station is located about 60 metres to the west of the Haldon Street overbridge. The station area is bounded by Railway Parade to the north and The Boulevarde to the south. Access to the station is provided off Railway Parade and The Boulevarde.

The key works proposed as part of the project are shown in Figure 8.14 and summarised in Table 8.8.

An artist's impression is provided in Figure 8.15.

Table 8.8 Lakemba Station key design elements

Feature	Proposed
Station works	
Station entry/exit	<ul style="list-style-type: none">• The existing station entrances on Railway Parade and The Boulevarde would be retained.• The existing elevated concourse would be retained with a minor expansion on the western side to accommodate additional station buildings/facilities.
Platform details	<ul style="list-style-type: none">• The heritage listed platform would be rebuilt and straightened.
Station buildings	<ul style="list-style-type: none">• New station buildings would be provided in the concourse, on the platform and would also be provided adjacent to the Railway Parade entrance.• The existing heritage station building on the platform would be retrofitted.
Station area	
Public transport integration	<ul style="list-style-type: none">• The existing bus stops located on The Boulevarde, Railway Parade, and Haldon Street (south) would be retained.
Access	<ul style="list-style-type: none">• A connection would be provided to an active transport corridor along The Boulevarde east of Haldon Street, and along the rail corridor boundary east of Haldon Street.• A new footpath is proposed on the southern side of Railway Parade, adjacent to the existing car parking area leading to the station entrance.
Kerbside uses, bike parking	<ul style="list-style-type: none">• New kerbside facilities would be provided on Railway Parade and on The Boulevarde, east of the new station entrance.• New bike parking areas would be provided on either side of the rail corridor adjacent to the existing station entrances.
Car parking	<ul style="list-style-type: none">• Loss of seven spaces on Railway Parade due to the provision of kerbside facilities.





Wiley Park Station

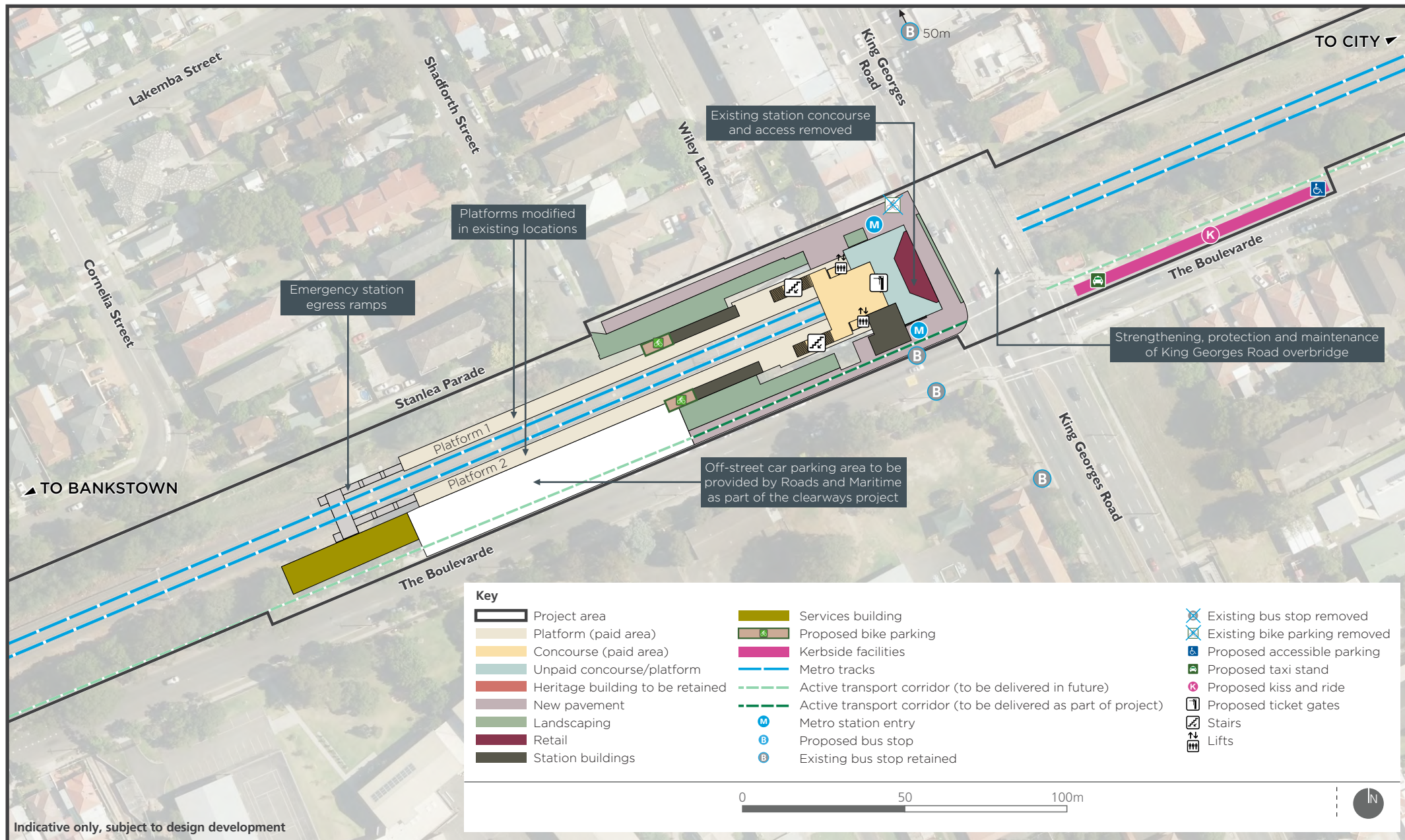
Wiley Park Station is located to the west of the King Georges Road overbridge. The station area is bounded by Stanlea Parade walkway to the north, by King Georges Road to the east and The Boulevarde to the south. The station entrance is located on the overbridge.

The key works proposed as part of the project are shown in Figure 8.16 and summarised in Table 8.9.

An artist's impression is provided in Figure 8.17.

Table 8.9 Wiley Park Station key design elements

Feature	Description
Station works	
Station entry/exit	<ul style="list-style-type: none"> The existing station entrance on King Georges Road would be removed. Two new entrances would be provided on The Boulevarde and from the Stanlea Parade walkway near King Georges Road. The existing station concourse would be removed, and a new structure would be installed in the same location. A new elevated concourse would be built to provide more space for pedestrian circulation.
Platform details	<ul style="list-style-type: none"> The heritage listed platform would be rebuilt, straightened and extended to the west.
Station buildings	<ul style="list-style-type: none"> New station buildings would be provided within the southern side of the new concourse, on platforms 1 and 2 and adjacent to The Boulevarde. The existing heritage listed overhead booking office, concourse and platform buildings would be removed to enable the new facilities to be provided. A description of how the design has been refined to minimise impacts on heritage is provided in Section 7.3.7. New retail space would be provided in the new concourse along King Georges Road (the use of the retail space would be subject to a separate approval process).
Station area	
Public transport integration	<ul style="list-style-type: none"> No changes would be made to existing bus stops.
Access	<ul style="list-style-type: none"> Connection to an active transport corridor on the southern side of the station, along The Boulevarde east of Haldon Street, and along the rail corridor boundary west of Haldon Street.
Kerbside uses, parking	<ul style="list-style-type: none"> New bike parking areas would be provided on either side of the rail corridor, adjacent to the platforms. Kerbside facilities would be provided on the northern side of The Boulevarde, east of King Georges Road.
Car parking	<ul style="list-style-type: none"> Land within the rail corridor on the northern side of The Boulevarde would be used to provide replacement off-street parking as part of the King Georges Road clearways project undertaken by Roads and Maritime Services. Loss of 10 spaces in The Boulevarde, to the east of King Georges Road due to the reconfiguration of kerbside facilities.





Punchbowl Station

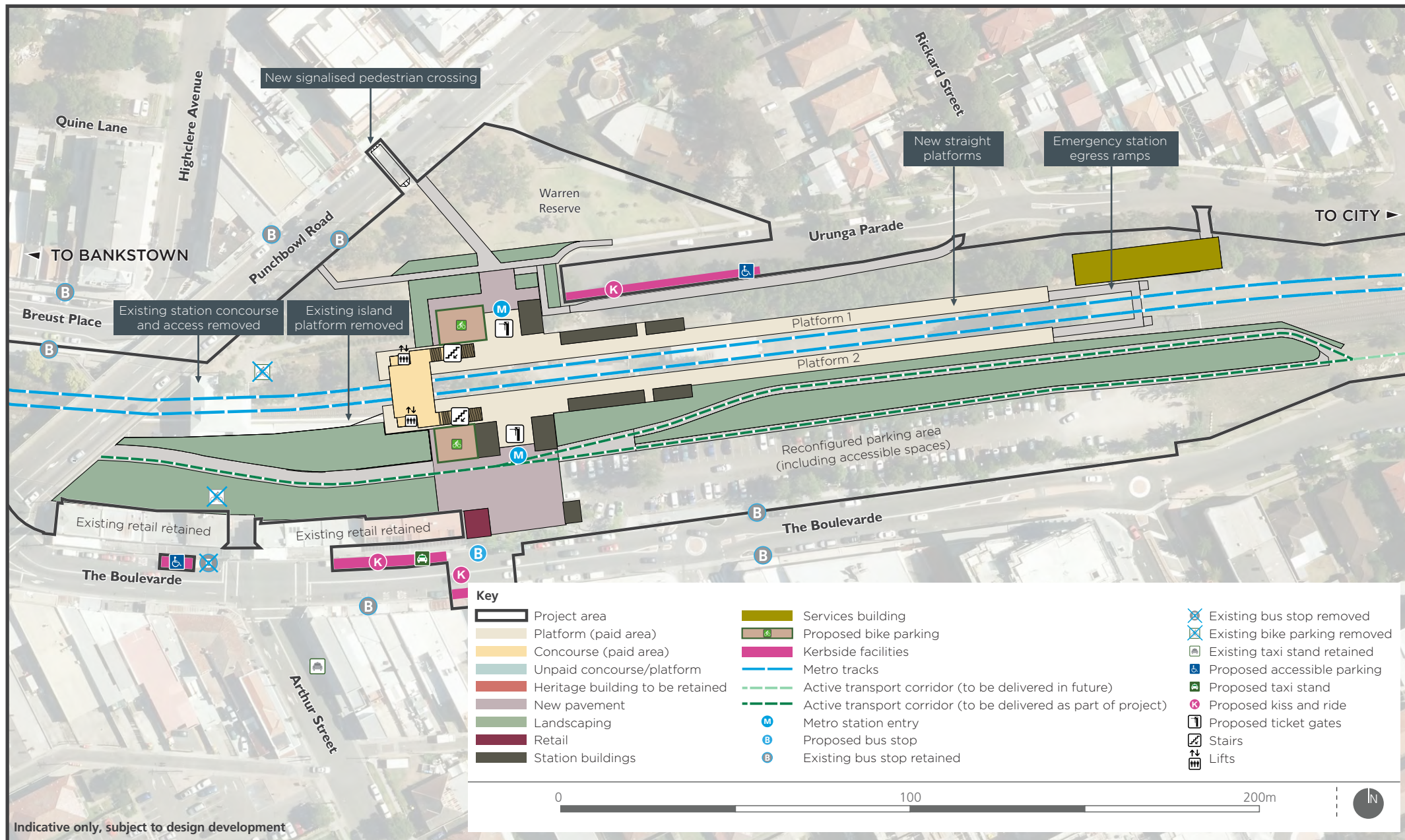
Punchbowl Station is located to the east of the Punchbowl Road overbridge. The station area is bounded by commercial land uses and a car park fronting The Boulevard to the south, Warren Reserve and Urunga Parade to the north, and Punchbowl Road to the west. The station entrances are located on Punchbowl Road (via Warren Reserve) to the north, and The Boulevard to the south.

The key works proposed as part of the project are shown in Figure 8.18 and summarised in Table 8.10.

An artist's impression is provided in Figure 8.19.

Table 8.10 Punchbowl Station key design elements

Feature	Description
Station works	
Station entry/exit	<ul style="list-style-type: none"> The existing station entrance would be removed. Two new station entrances would be provided from The Boulevard (to the south) and adjacent to Warren Reserve to the north. The new southern entrance would be located within a new station plaza. A new elevated bridge would be constructed to provide access between the two platforms.
Platform details	<ul style="list-style-type: none"> The heritage listed platform would be rebuilt, straightened and extended to the east. A portion of the existing platform to the west of the new concourse would be removed.
Station buildings	<ul style="list-style-type: none"> New station buildings would be provided at the station entrances and platforms. The heritage listed station buildings and overhead booking office would be removed. A description of how the design has been refined to minimise impacts on heritage is provided in Section 7.3.7. New retail space would be provided within the southern station plaza adjacent to The Boulevard (use of this space would be subject to separate approval).
Station area	
Public transport integration	<ul style="list-style-type: none"> The existing bus stops on Punchbowl Road would be retained. The existing eastbound bus stop on The Boulevard would be relocated east of Arthur Street, adjacent to the new station entry.
Access	<ul style="list-style-type: none"> Paths located in the vicinity of the station between the rail corridor and The Boulevard would form part of an active transport corridor.
Kerbside uses, bike parking	<ul style="list-style-type: none"> New bike parking areas would be provided on either side of the corridor at the station entrances. Kerbside facilities would be provided on both sides of The Boulevard adjacent to the southern station entrance. Kerbside facilities would be provided along the southern side of Urunga Parade to the east of the northern station entrance. A new pedestrian crossing would be provided on Punchbowl Road north-east of Bruest Place.
Car parking	<ul style="list-style-type: none"> The existing commuter car park located on the northern side of The Boulevard would be reconfigured to maintain the availability of commuter parking. Loss of 20 parking spaces on Urunga Parade and The Boulevard due to the reconfiguration of kerbside facilities.





Bankstown Station

Bankstown Station is located to the east of the Bankstown City Plaza overbridge. The station area is bounded by North Terrace to the north, South Terrace to the south, and Bankstown City Plaza to the west. The station entrance is on Bankstown City Plaza.

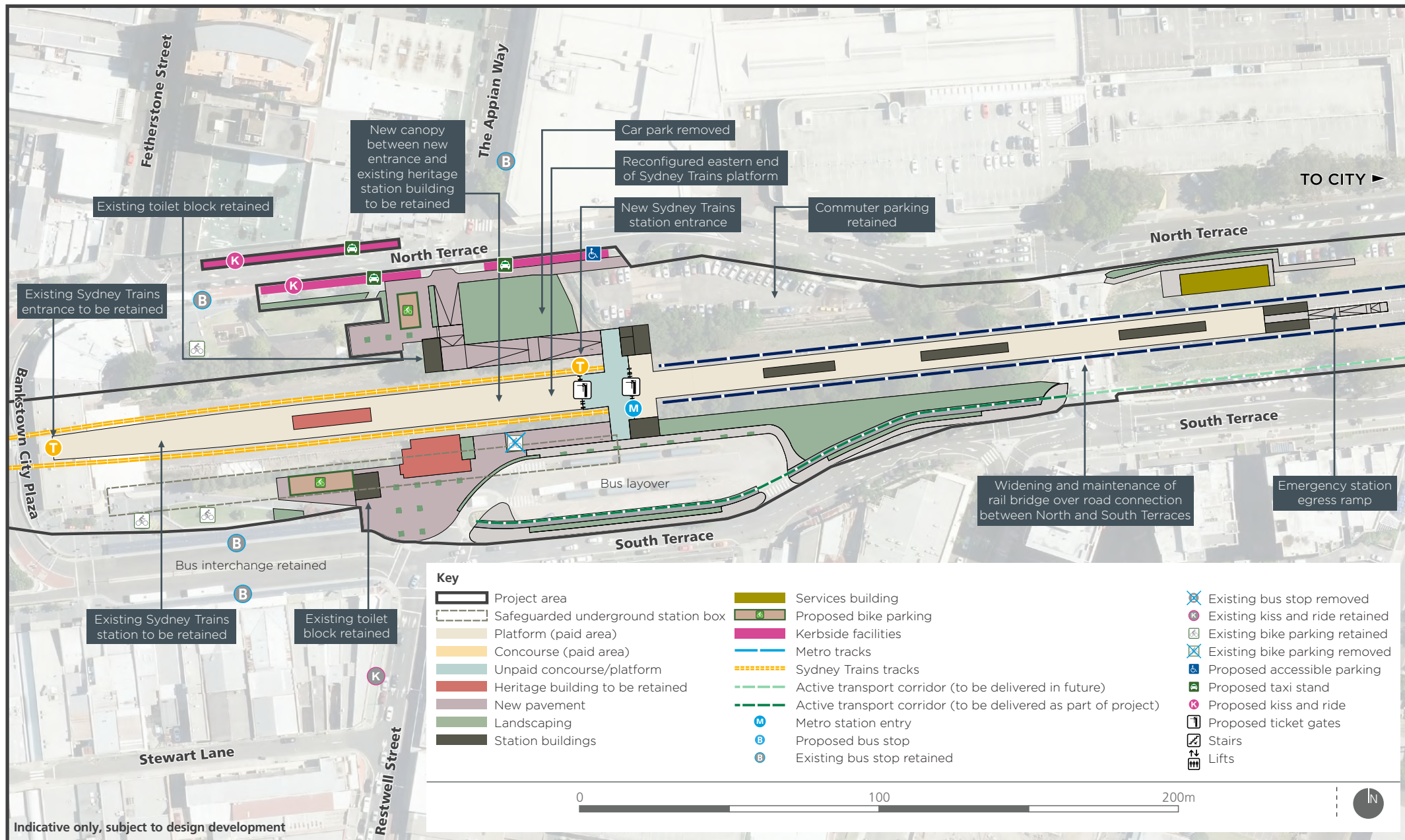
A new Sydney Metro station would be constructed to the east and adjoining the existing Sydney Trains Bankstown Station.

The key works proposed as part of the project are shown in Figure 8.20 and summarised in Table 8.11. Figure 8.20 also shows how the design safeguards for a potential future underground station.

An artist's impression is provided in Figure 8.21.

Table 8.11 Bankstown Station key design elements

Feature	Proposed
Station works	
Station entry/exit	<ul style="list-style-type: none">• The existing Sydney Trains station entrance at Bankstown City Plaza would be retained.• A new at-grade corridor crossing would be provided at the eastern end of the existing Sydney Trains platform and would provide access to both Sydney Trains and new Sydney Metro platforms.• New station plazas would be constructed at station entrances on both sides of the rail corridor.
Platform details	<ul style="list-style-type: none">• The heritage listed Sydney Trains platforms would be retained with minor modifications required at the eastern end.• New Sydney Metro platforms would be constructed to the east of the new at-grade corridor crossing.
Station buildings	<ul style="list-style-type: none">• All station buildings (including the heritage listed station building and Parcels Office) on the Sydney Trains platforms would be retained.• A new canopy would be constructed over the Sydney Trains platform between the new station entrance and the existing platform building.
Station area	
Public transport integration	<ul style="list-style-type: none">• The bus layover area on South Terrace would be retained with minor adjustments to accommodate the new station entrance.• The bus interchange area on South Terrace, near the existing station entrance, would be retained.• The existing bus stop on the northern side of station on North Terrace would be retained.
Access	<ul style="list-style-type: none">• The pedestrian/shared paths located along South Terrace would form part of an active transport corridor.• A new 'at grade' corridor crossing would be provided at the eastern end of the existing Sydney Trains platform and would provide access to both Sydney Trains and new Sydney Metro platforms.
Kerbside uses, bike parking	<ul style="list-style-type: none">• Changes would be made to kerbside facilities and parking along North Terrace, between the new station entrances and the existing entrance. Existing kerbside facilities (i.e. taxi rank) on northern side of North Terrace would be retained.• New bike parking would be provided on both sides of the station within the new station plazas.
Car parking	<ul style="list-style-type: none">• Removal of existing car park located adjacent to the Appian Way off North Terrace, resulting in the loss of 10 off-street spaces.





8.1.2 Works to convert stations and the rail line to Sydney Metro operations – station and track works

The works described in this section are required to upgrade the T3 Bankstown Line, including the stations in the project area, to enable metro train services to operate.

Station works

To operate metro services, the following works would be required in addition to those described in Section 8.1.1:

- installation of platform screen doors on each side of all platforms which would open at the same time as the train doors once an arriving train has stopped, and would close simultaneously with the train doors
- fixed or mechanical gap fillers on platforms (where required) to ensure that the gap and height difference between the platform and the train is minimal – these devices automatically narrow the gap when the train arrives at the platform
- provision of operational facilities for Sydney Metro (such as station services buildings – described below).

Station services buildings

New services buildings would be located at all stations to house communications equipment, signalling equipment, electrical equipment and other rail systems equipment. Services buildings would be located where possible on land within the existing rail corridor close to the stations. The indicative locations of these buildings is shown in the figures provided in Section 8.1.1. Final locations would be confirmed during detailed design.

Track and rail system facility works

Track works

The project would use the existing Sydney Trains tracks where possible. In some locations, there may be a need to upgrade/replace the existing track, which would involve replacing the rails, sleepers, fastenings and ballast. The track may need to be replaced because of its condition and in some locations, particularly around stations, the alignment of the tracks would need to be adjusted to align with the new or straightened platforms.

Changes to the track alignment would be undertaken:

- around Bankstown Station to facilitate the separation of the metro tracks from the Sydney Trains network
- at the location of the new turnbacks and crossovers
- at other stations to ensure the tracks align with new platforms.

Works to realign sections of the track would generally occur within the existing rail corridor.

Track works would also include connecting to the metro tracks being provided west of Sydenham Station as part of the Chatswood to Sydenham project.

An indicative cross section of the rail corridor following implementation of the project is provided in Figure 8.22.

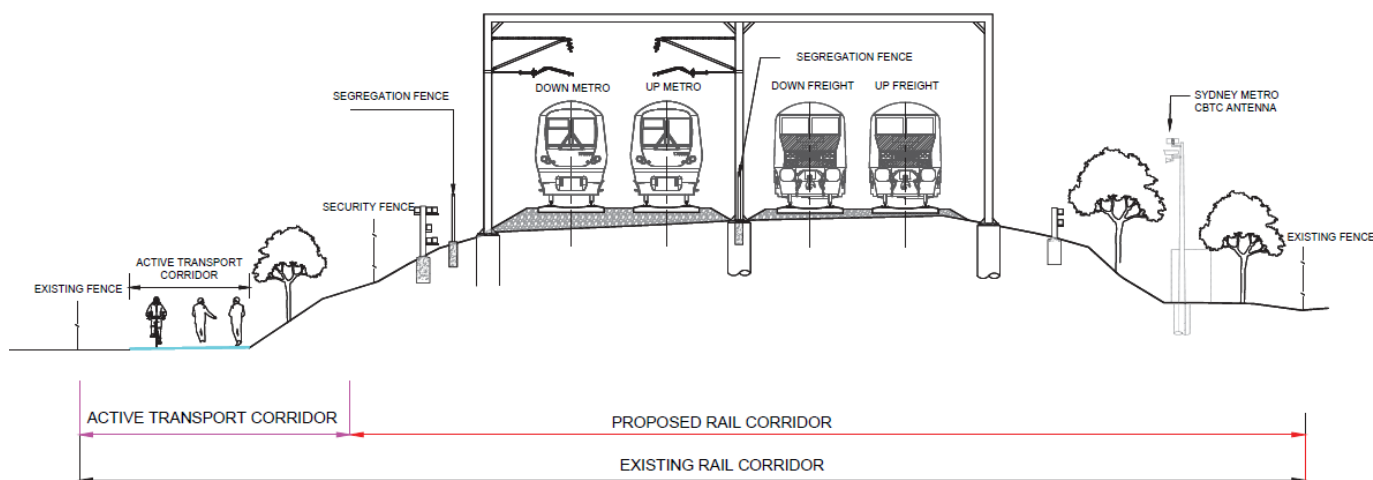


Figure 8.22 Indicative cross section of corridor

Turnback and crossover facilities

Turnback facilities allow trains to change direction while crossover facilities allow a train on one track to cross over to the other track. Installation of these features would facilitate train movement within the rail corridor. New turnback and crossover facilities are likely to be required at the following locations:

- new turnback between Campsie and Belmore
- replacement of the existing track crossover to the east of Bankstown Station
- a reconfigured rail junction and turnback to the west of Bankstown Station for Sydney Trains services.

The turnbacks and crossover facilities would involve the installation of new rails, sleepers, fastenings, and ballast, and new switches at crossover locations.

Signalling and train control

All sections of the Sydney Metro network would use advanced signalling technology to support safe operations. This would be controlled from the Sydney Metro Trains Facility at Tallawong Road, Rouse Hill. The system would:

- control the stopping of trains at stations
- ensure trains stop at the correct location on the platform
- control train speed
- initiate the opening and closing of train and platform screen doors.

Communications systems and masts

The project would include an integrated information system to communicate with customers or metro staff via audio and visual links at each station and on trains. The communications equipment would be housed within designated services areas at each station. Equipment for radio communications, customer telecommunications, closed-circuit televisions, and emergency warning systems would be housed in the service areas at each station.

To facilitate automated operations, telecommunications masts would be positioned along the rail corridor at about 250 metre intervals. The height of each mast would vary between three to six metres. Masts would consist of a concrete or steel pole.

Other track and rail system works

The following work would also be undertaken as part of the track and rail system facility works:

- adjustment of existing track alignments and overhead wiring along the line to meet Sydney Metro operational requirements, Sydney Trains requirements, and freight operational requirements
- adjustment of existing Sydney Trains rail systems, including removal of existing junctions to segregate the metro tracks from Sydney Trains tracks, and removal of redundant Sydney Trains systems (e.g. signalling, communications)
- utility and rail system protection and relocation works within the construction footprint and public areas.

With the exception of the utility protection and relocation works described in Section 9.10, these works would take place within the rail corridor.

8.1.3 Works to convert stations and the rail line to Sydney Metro operations – other works

Upgrading bridges along the rail corridor

A total of 17 road overbridges and two pedestrian footbridges/walkways (excluding those forming part of station concourses) are located within the project area. A number of the overbridges directly adjoin the stations. There are also 10 underbridge structures that support the rail tracks over roadways and waterways, and one pedestrian underpass. A list of the bridges along the corridor where works are required is provided in Table 8.12.

Upgrades would be required to a number of the bridge structures to meet current design standards, Sydney Metro operation specifications, and (in some locations) to suit the amended track alignment. In addition, all overbridges would be provided with parapet throw screens and vehicle collision barriers to provide an improved level of safety and security for customers. The locations of the bridges proposed to be upgraded are shown in Figure 8.1.

The project would involve works to each of these bridges, however the type of works required would vary as shown in Table 8.12, and would be confirmed during detailed design. Changes to the scope may be required based on the outcomes of investigations that would inform the final design. The bridge upgrade works would generally consist of one or more of the following:

- Bridge replacement – full bridge replacement would be required due to track realignment, insufficient widths, structural issues, to improve precinct gradients, or to meet metro standards.
- Strengthening – strengthening of existing bridge piers, abutments, bridge decks and primary steel elements.
- Protection – providing enhanced protection to existing bridge piers, over-height vehicle crash protection beams adjacent underbridge structures, vehicle collision protection to overbridge parapets, and installation of parapet throw screens.
- Widening – widening would generally be required where the track alignment has been adjusted. A combination of existing embankment strengthening and new retaining walls may also be required.
- General maintenance – to ensure long-term durability of the bridge structures, maintenance works would include preparation and re-painting of steel elements and, where appropriate, raking out and re-pointing of masonry, and waterproofing works to bridge decks.
- Retaining wall works – replacement of existing retaining walls or installation of new walls.

The project scope includes the replacement of two bridges – the Illawarra Road overbridge in Marrickville, and the Albermarle Street overbridge in Dulwich Hill.

Protection and maintenance works are proposed at the Church Street/Hutton Street footbridge in Canterbury, and the Duke Street footbridge in Campsie.

Table 8.12 Works to overbridges and underbridges

Bridge	Replacement	Strengthening	Protection	Widening	Maintenance	Retaining wall
Overbridge						
Illawarra Road overbridge, Marrickville	●					
Livingstone Road overbridge, Marrickville			●		●	
Albermarle Street overbridge, Dulwich Hill	●					
Wardell Road overbridge, Dulwich Hill			●		●	
Garnet Street overbridge, Hurlstone Park			●		●	
Crinan Street overbridge, Hurlstone Park			●		●	
Church/Hutton Street footbridge, Canterbury			●		●	
Melford Street overbridge, Canterbury			●		●	
Canterbury Road overbridge, Canterbury			●		●	
Beamish Street overbridge, Campsie			●		●	
Duke Street footbridge, Campsie			●		●	
Loch Street overbridge, Campsie			●		●	
Burwood Road overbridge, Belmore			●	●	●	●
Moreton Street overbridge, Belmore					●	
Haldon Street overbridge, Lakemba			●		●	●
King Georges Road overbridge, Wiley Park		●	●		●	
Punchbowl Road overbridge, Punchbowl					●	●
Stacey Street overbridge, Bankstown			●		●	●
Chapel Road overbridge, Bankstown			●		●	
Underbridge						
Meeks Drive underbridge, Marrickville		●			●	
Canal 1/M24, Marrickville					●	
Canal 2/M24, Marrickville					●	
Charlotte Avenue underbridge, Marrickville		●	●		●	
Ness Avenue/Terrace Road underbridge, Dulwich Hill			●		●	
Sewer line underbridge, Marrickville					●	
Foord Avenue underbridge, Hurlstone Park					●	
Cooks River/Charles Street underbridge, Canterbury			●		●	
Wairoa Street underbridge, Campsie			●		●	●
Pedestrian access to Belmore Sports Ground		●		●	●	●
North/South Terrace underbridge, Bankstown				●	●	

Traction power supply

The Sydney Metro network traction power system would be designed to operate as an independent standalone system, segregated from the Sydney Trains network. All Sydney Metro traction power infrastructure would be controlled and monitored from the Sydney Metro Trains Facility at Rouse Hill.

Substations

Five new traction substations are required to power the metro trains. These would all be located within the existing rail corridor in the following locations:

- Dulwich Hill – southern side of the railway corridor at Randall Street
- Canterbury – southern side of the railway corridor, north of Hutton Street and west of the Melford Street overbridge
- Campsie – southern side of the railway corridor, north of Lilian Street and east of Carrington Street
- Lakemba – southern side of the railway corridor, north of The Boulevarde and west of Taylor Street
- Punchbowl – southern side of the railway corridor, north of South Terrace and east of Scott Street.

The proposed locations of these substations are shown on Figure 8.1. These locations are indicative, and the final locations would be confirmed during detailed design.

The substations would be above ground, and would be positioned within a secure compound within the rail corridor. The compound would include a parking area for one or two vehicles, and a loading dock for deliveries.

Traction power supply cable

To provide a reliable source of power to the new traction substations, a 33 kilovolt high voltage electricity supply cable is proposed between the Campsie traction substation and the existing Ausgrid Canterbury electrical substation, which is located about one kilometre south of Canterbury Station in Earlwood.

The route for the power supply cable would be about 3.5 kilometres long, and would be located within the following road reserves:

- Beamish Street
- South Parade
- Phillips Avenue
- Canterbury Road
- Fore Street
- Burlington Avenue
- Karool Avenue/ River Street
- Spark Street
- Mooney Avenue.

The alignment would also traverse Hughes Park to the south of the Canterbury substation. The indicative alignment is shown on Figure 2.1.

Maintenance access

Maintenance access to the rail corridor would be generally similar to the existing situation. Where the ARTC operated freight line is located within the corridor (between east of Marrickville Station and west of Campsie Station) the metro tracks would be accessed from the southern side of the corridor only, and the freight rail tracks would be accessed from the northern side of the corridor. For other sections of the corridor, the metro tracks would be accessed from both sides of the corridor.

Access to the rail corridor would be via existing access gates wherever possible. There are currently about 70 gates along the southern side of the corridor and about 55 gates along the northern side of the corridor. These access points are a mix of pedestrian and vehicular gates. Changes to existing accesses or provision of new access gates may be required to provide:

- access to new key infrastructure such as turnouts, station services buildings, and substations
- change of access type (for example, change from pedestrian to vehicular access)
- additional emergency access/egress points.

Some access points would include provision for access by rail-mounted vehicles.

The need for new access points (including for ARTC tracks) would be determined during detailed design.

Security

Security fencing

Security fencing would be installed as part of the project. This would comprise a new security fence along both sides of the rail corridor. In addition, a segregation fence would be installed between the metro tracks and ARTC freight tracks, between west of Marrickville Station and west of Campsie Station.

Security fencing would be a minimum of two metres above ground level in height, and would be constructed from palisade or close-spaced welded mesh. Controlled access points would be provided at appropriate locations.

The design and type of fencing would be confirmed during detailed design, based on relevant Asset Standards Authority standards. Where practicable, fencing would be integrated with noise barriers (described below) where these are required.

Trackside intruder detection system

A trackside intruder detection system, consisting of non-mechanical protection measures, would be installed throughout the rail corridor. Closed circuit television would form part of the system, and would monitor all automatic control areas and stations. These would be fitted to the telecommunications masts positioned along the corridor.

Noise barriers

Noise barriers would be required in some locations to mitigate operational noise impacts. Noise modelling undertaken for the Environmental Impact Statement has identified preliminary locations where noise barriers are potentially required. The final location of barriers would be confirmed during detailed design. Further information is provided in Chapter 13 (Operational noise and vibration).

Noise barriers would be designed in accordance with the design guidelines (Appendix C). The design of the barriers would form part of an integrated line-wide design process to ensure a consistent approach. Materials would be selected to ensure that the barriers are robust, vandal-

resistant, and resilient from damage from vegetation. The design would be simple in form, and the use of textures and patterns would be avoided where possible.

Consultation with relevant stakeholders (including the local community) would be undertaken, to ensure that the design of barriers considers visual amenity.

Drainage

The project would include drainage works to ensure that stormwater is efficiently conveyed within and across the corridor to the surrounding stormwater drainage system. This would include new and modified drainage infrastructure, consisting of trunk stormwater and intertrack drainage.

Track drainage

New or augmented track drainage would be constructed as required within the project area, where:

- existing overland flooding issues are present and not adequately addressed by existing drainage infrastructure
- proposed changes to the track alignment mean that new track drainage infrastructure would be required.

Cross drainage

Modification of cross drainage infrastructure (i.e. infrastructure that crosses the rail corridor into which track drainage drains) would be required at a number of locations. This would include upgrading crossings and construction of new crossings, and would involve (where required):

- extension of cross drainage infrastructure
- augmentation to improve existing capacity constraints
- full removal and replacement.

In addition to the drainage works proposed within the rail corridor, new drainage infrastructure would be provided outside the rail corridor in the following locations:

- at Marrickville Station – drainage infrastructure would be provided to connect to the existing stormwater network in Schwebel Street
- at the junction of Livingstone Road and Hollands Avenue – drainage infrastructure would be provided to convey existing overland flows into the rail corridor drainage network
- east of Canterbury Station – drainage infrastructure would be provided to convey stormwater from the rail corridor to the Cooks River
- west of Canterbury Station – a new drainage outlet would be provided to the Cooks River.

Detention basins

Four drainage detention basins are proposed to hold water from minor flood events. The proposed basins are listed in Table 8.13. The size of, and need for, the basins would be confirmed during detailed design. In some circumstances, it may be more feasible to provide new drainage, or augment existing drainage within surrounding areas, rather than construct the basins. The final form of the drainage to be provided would be confirmed during detailed design, and would consider the requirements of the Utilities Management Framework described in Section 9.10.

Table 8.13 Location and sizing of proposed detention basins

Location	Approximate volume (m ³)
McNeilly Park on the southern side of the corridor west of Marrickville Station	8,000
Southern side of the rail corridor between Dulwich Hill and Hurlstone Park stations	800
Southern side of rail corridor west of Campsie Station	2,500
Northern side of rail corridor west of Punchbowl Station	1,700

8.1.4 Active transport corridor and rail corridor development

Active transport corridor

Sydney Metro will contribute to a new active transport corridor

As part of the project, Transport for NSW would work with the Department of Planning and Environment to support the development of an active transport corridor along its alignment, including walking and cycling infrastructure. Transport for NSW would deliver sections of the active transport corridor around stations.

The active transport corridor will provide a major east-west spine and include:

- pedestrian footpaths
- separated cycleways
- shared footpaths
- designated pedestrian and cyclist road crossings.

The corridor will use existing active transport networks where possible, like the existing footpaths located between Belmore Station and Belmore Sports Ground. Where existing infrastructure is not available, new infrastructure will be located on land currently within the rail corridor, or within existing open space areas (subject to the availability of land).

The design and implementation of the active transport corridor will be undertaken in consultation with local councils, local community groups, bicycle user groups, and relevant NSW Government departments and utility owners.

The location of the active transport corridor will be integrated with future development plans outlined in the draft *Sydenham to Bankstown Urban Renewal Corridor Strategy*.

Some sections of the active transport corridor, such as in-between stations, will be delivered separately by others. Space has been provided in the project design to allow for delivery of future parts of the corridor.

An indicative alignment for the active transport corridor is shown on Figure 11.2. The proposed location of the active transport corridor in the vicinity of stations is shown in the figures in Section 8.1.1.

Future rail corridor development

Rail corridor development is one potential use for residual land. This could involve development integrated with stations, adjacent to stations, or over or adjacent to the rail corridor, where existing in-corridor development is to be removed, or where suitable residual land is identified.

The project has been designed to ensure that the potential for future development is considered by incorporating footings, columns, beams, retaining walls, and other enabling structures and service

infrastructure to support any future buildings. The project includes enabling works to support future rail corridor development adjacent to Beamish Street opposite Campsie Station. The project includes construction of a new platform and columns for a potential future development to replace the existing retail/commercial building complex located on land owned by the NSW Government (RailCorp). These enabling works would also include the construction of a new lane (roadway) over the rail corridor for use as a kiss and ride facility. Figure 8.10 shows the location of the new lane and the indicative positioning of retail opportunities in this location.

Any residual land not required for the operation of the project would potentially be available for redevelopment. Where residual land is available, Transport for NSW would review the opportunities for any possible future uses (including the active transport corridor described above). Any surplus land not required for future developments could potentially be sold in accordance with Transport for NSW's property disposal guidelines.

The project also includes the provision of retail space at a number of stations (as shown on the figures in Section 8.1.1). The project includes construction of the retail spaces, however use of the spaces would be subject to a separate planning approval process.

8.2 Property requirements

The project would mainly be located on land that forms part of the existing rail corridor and adjacent road reserves owned by the NSW Government or the relevant local council. The design of the project has minimised the need to acquire land and properties. However, in some cases, there has been no alternative to the acquisition or the leasing of land. Acquisition requirements are described below.

8.2.1 Land requirements

The project would require the full acquisition of three privately owned lots under one ownership (near Marrickville Station), and the use of three portions of publicly owned land (near Marrickville and Punchbowl stations). Land acquisition requirements are summarised in Table 8.14 and public land requirements are summarised in Table 8.15. Land requirements summarised in the tables are shown in Figure 8.23.

Table 8.14 Land acquisition requirements for the project

Acquisition details						Number of interests affected	
Location	Project feature	Lot to be acquired and address	Partial/full acquisition	Owner	Existing land use / occupancy	Free-hold	Lease-hold
Marrickville Station	Station area works	Lot 10 DP 10198 1 Leofrene Avenue	Full	Private	Residential (land occupied by a residential dwelling subject to a lease)	1	1
		Lot 11 DP 746611 2 to 4 Station Street	Full	Private	Mixed use site	1	1
		Lot 10 DP 710424 6 to 12 Station Street	Full	Private		1	3

Table 8.15 Public land requirements for the project

Location	Project feature	Lot and address	Requirements	Owner	Existing land use/occupancy
Marrickville Station	Station area works	Untitled Carriageway Land in Station Street	Partial	Public	Infrastructure (access road)
Punchbowl Station	Station area works	Lot 7 DP 18474 Lot 76 DP 5701 752 to 764 Punchbowl Road	Partial	Public	Warren Reserve

8.2.2 Cessation of commercial leases on NSW Government owned land

In addition to the land acquisition requirements described in Section 8.2.1, to undertake the proposed station upgrade works, the project would require access to land which is currently subject to about 37 existing commercial leases at seven stations, on land owned by the NSW Government (RailCorp).

Access to leased land would be required at the following six stations: Dulwich Hill, Belmore, Lakemba, Wiley Park, Canterbury, and Punchbowl stations. The project would require the cessation of the leases at these stations.

To upgrade Campsie Station, some commercial buildings surrounding the station need to be removed. These buildings, and the land on which they are located, are owned by RailCorp. The land on which they are located is bounded by North Parade, Beamish Street, and Lilian Lane (to the west of Beamish Street), and North Parade, Beamish Street, and South Parade (to the east of Beamish Street). There are about 31 existing commercial leases for part of these buildings.

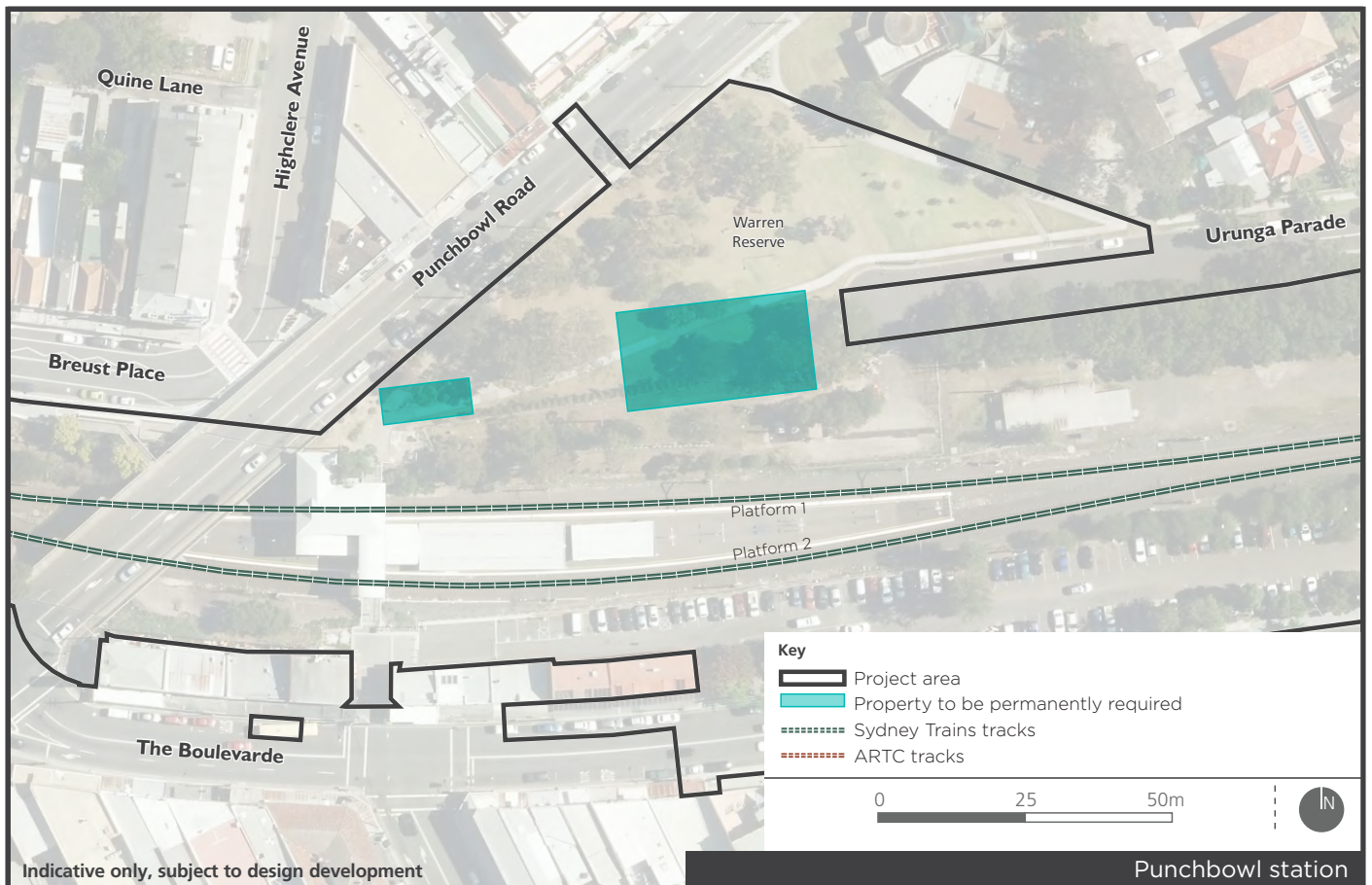
These leases are with the NSW Government (RailCorp) as the owner of the relevant buildings/spaces. All the impacted leases would be ceased in accordance with lease agreements held with the NSW Government.

8.2.3 Temporary lease of property

Additionally, some areas of land would need to be temporarily leased or occupied for construction compounds and other work sites during construction of the project (refer to Section 9.8 for further details of construction compounds and work sites). The majority of these sites would be located within the rail corridor, which would minimise the potential for direct impacts on land use and property. There would however be some construction compounds and work sites located outside the rail corridor. These areas are generally located within road reserves or other council owned land. Following further design development, consultation would be undertaken with the relevant landowner to arrange leasing of the required piece of land.

8.2.4 Land access

Existing commercial leases may expire before access is required or early termination rights may be used. In some limited circumstances, access to public land may be obtained using statutory powers of access. Acquisition of land by agreement or compulsory acquisition would be considered where appropriate.



8.2.5 Acquisition process

Transport for NSW is bound by NSW Government legislation to act according to specific procedures when acquiring property. This legislation encourages the acquisition of land by agreement rather than by compulsory acquisition wherever possible.

Independent valuers assess the current market value for each property being acquired. In addition to the market value of the property, assessment can be made of any additional costs that can reasonably be incurred as a result of an acquisition, such as stamp duty, professional costs (e.g. legal fees, valuation fees, etc.), relocation costs, losses resulting from severance, and losses relating to disturbance.

The valuation informs the offer made to the property owner. Transport for NSW would work collaboratively with property owners to ensure that the acquisition process is fair, reasonable and as easy as possible.

8.3 Operation of the project

The project would operate in conjunction with Sydney Metro Northwest and the Sydney Metro City & Southwest Chatswood to Sydenham project, which, subject to the modification described in Section 1.1, is proposed to extend from Chatswood Station to Sydenham Station.

The Sydney Metro network, including the stations, trains and railway line, would be operated and maintained under a public private partnership, with ownership of the infrastructure remaining with the NSW Government.

8.3.1 Timing

Sydney Metro Northwest will be operational between Cudegong Road and Chatswood stations by 2019. Sydney Metro City & Southwest would be fully operational by 2024, with the opportunity of operation commencing in two phases. Initially, Sydney Metro Northwest services would be extended by the City & Southwest project, and would operate from Chatswood Station to Sydenham Station. Some months later, metro operations would extend from Sydenham Station to Bankstown Station, with both phases planned to be completed before the end of 2024. The opportunity for phased opening of the project would enable metro trains to operate from Cudegong Road Station to Sydenham Station prior to the final conversion of the T3 Bankstown Line to metro operations.

8.3.2 Service frequency, capacity, and transfers

Once the project is operational, Sydney Trains services would no longer operate along the T3 Bankstown Line between Sydenham and Bankstown stations. Customers would be able to interchange with Sydney Trains services at Sydenham and Bankstown stations. Sydney Trains services from Bankstown Station to Liverpool and Lidcombe stations would not be affected, and these services would continue to operate. Further information on the potential impacts of the project on existing Sydney Trains services and travel patterns on the Sydney Trains network is provided in Section 11.4.2.

At opening, six car metro trains would operate at least every four minutes during peak periods (averaging around 15 trains per hour) and at least every ten minutes in the off peak periods.

The project would initially have the capacity to move around 23,000 people per hour in each direction in peak periods. When required to meet increased demand, capacity could be increased to cater for around 40,000 people per hour in each direction. This would be achieved by increasing trains from six car sets to eight car sets, and increasing the service frequency up to 30 trains per hour through the Sydney CBD in peak periods.

This ultimate capacity forms part of the scope of the project for this Environmental Impact Statement.

8.3.3 Hours of operation

The first metro service to depart Cudgegong Road Station (Sydney Metro Northwest) and Bankstown Station (Sydenham to Bankstown upgrade) would arrive at Central Station in the early morning. The last metro service to arrive at Cudgegong Road and Bankstown stations would depart Central Station around midnight, and potentially later on weekends. The operating hours and service levels could be extended to accommodate planned special events, in conjunction with other Sydney public transport services.

The operating hours would be determined as part of the development of service schedules for the project, taking into account customer and maintenance access requirements.

8.3.4 Train types

Trains operating on the Sydney Metro network would be new-generation, single-deck metro trains (similar to those being introduced on Sydney Metro Northwest). The trains will deliver a fast, safe and reliable journey for customers, with high performance standards and good customer amenities. The key features of these trains include:

- fully automated trains, with passengers able to see from one end of the train to the other
- three doors per side per carriage, for faster boarding and alighting
- provision of accessible priority seating for those with a disability or using a wheelchair or mobility device, the elderly or those travelling with a pram or luggage
- emergency intercoms inside trains and customer service assistants at every station and moving throughout the network day and night
- two multi-purpose areas per train for prams, luggage, and bicycles
- on-board real time travel information and live electronic route maps
- level access between the platform and train
- air conditioning
- a new generation of fast, safe and reliable metro trains.

An eight car, single-deck Sydney Metro train has a capacity of about 1,500 passengers which is greater than an existing eight car, double-deck train. With a greater capacity per train and higher service frequency, the Sydney Metro network would be able to move more passengers per hour than existing trains.

Sydney Metro trains also allow customers to get on and off at stations faster, which reduces the time a train is stopped at each station and enables reduced travel times. Platform screen doors at stations would keep objects and people away from the platform edge and allow trains to get in and out of stations much faster. Using modern signalling technology and fully automated trains is also more efficient and would increase the capacity of the metro network.

8.3.5 Seating

Sydney Metro trains contain a mix of seating and standing areas, as well as multi-purpose areas for prams and luggage. Seating on trains would be padded and covered with fabric to improve passenger comfort.

The proposed seating layout would allow for between 5,500 and 6,000 seats per hour in each direction. The seating layout also includes wide aisles to make it easier for customers to get in and

out of seats, and in and out of trains, which is further facilitated by the provision of three doors on each side of each carriage.

As an added safety benefit, metro customers will be able to see from one end of the train to the other from their seats, as no doors will divide the carriages.

An indicative image of a metro train interior is provided in Figure 8.24.



Figure 8.24 Indicative Sydney Metro train interior

8.3.6 Ticketing and pricing

The existing Opal electronic ticketing system will be used on the Sydney Metro network, which will allow for a ticketing system integrated with all other modes of public transport (Sydney Trains operated trains, buses, ferries, and light rail services). This system would be installed at all stations.

Fares for Sydney Metro would be set by the NSW Government. Ticket pricing for all transport in NSW is determined by the Independent Pricing and Regulatory Tribunal of New South Wales (IPART), and by NSW Government policy. The NSW Government reviews this pricing annually and may consider a change to the Opal policy at any time. Sydney Metro service pricing would be reviewed in line with the pricing review process for other forms of transport.

8.3.7 Stabling and maintenance

The stabling and maintenance of metro trains would occur at two locations:

- Tallawong Road at the Sydney Metro Trains Facility (constructed as part of Sydney Metro Northwest)
- Sydenham at the Sydney Metro Trains Facility South (proposed to be constructed as part of the Chatswood to Sydenham project).

The Sydney Metro Trains Facility is proposed to be the primary stabling facility for the overall metro network as it would contain the heavy maintenance facilities required to manage the system.

The Sydney Metro Trains Facility South is proposed to be located about 750 metres north-east of the existing Sydenham Station. This facility would provide for overnight stabling of Sydney Metro trains, and light reactive maintenance activities to minimise the need to send trains to the Sydney Metro Trains Facility.

8.3.8 Emergency and incident management

The operational management plan for the project would include procedures for incident and emergency management.

9. Project description – construction

This chapter provides a description of the indicative construction methodology for the project. This includes an outline of the construction process and likely activities; the proposed approach to avoiding or minimising impacts during construction; the estimated construction resources that would be required; and an indicative construction program. The chapter also provides information on the proposed approach to out of hours work; utilities management during construction; and the alternative transport arrangements that would be implemented during temporary closures of the stations and track required during construction. The Secretary's environmental assessment requirements relevant to construction, and where they are addressed in this chapter and in the Environmental Impact Statement, are listed in Table 9.1.

Table 9.1 Secretary's environmental assessment requirements – project description

Ref	Secretary's environmental assessment requirements – project description	Where addressed
2. Environmental Impact Statement		
2.1 (b)	A description of the project, including all components and activities (including ancillary components and activities) required to construct and operate it.	This chapter provides a description of how the project is likely to be constructed. A description of the components and activities required to operate the project is provided in Chapter 8.
Noise and vibration		
8.2	The EIS must include a framework for both an Out of Hours Works Strategy and the development of an Out of Hours Works Plan which incorporates community consultation.	Section 9.7.4 and 12.6.1
Transport and traffic		
13.1	The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to: (g) access constraints and impacts on public transport, pedestrians and cyclists including: <ul style="list-style-type: none"> alternative transport arrangements for customers during rail possessions and closure of the rail line (including how the Temporary Transport Plan will be developed in consultation with relevant Councils and the community) 	Alternative transport arrangements are described in Section 9.11. Potential impacts are assessed in Section 10.3.2.
Utilities		
16.1	The Proponent must identify and assess potential impacts on key identified active or disused public trunk utilities infrastructure (including communications, electricity, gas, and water and sewerage).	Section 9.10
16.2	Where impacts on utilities are expected, the Proponent must prepare a utilities management framework, to identify a management strategy for options, including relocation or adjustment of the utilities.	Section 9.10 and Appendix I
16.3	The utilities management framework must identify ways in which opportunities to integrate with and support initiatives adopted by Councils and utilities providers and how access to assets will be maintained during construction.	Section 9.10 and Appendix I

9.1 Overview

9.1.1 Key construction stages

Construction of the project would broadly involve the following key stages:

- enabling works (described in Section 9.2)
- main construction works, including track and station works (described in Sections 9.3 to 9.5)
- finishing works – involving demobilisation, rehabilitation and landscaping (described in Section 9.6.1)
- testing and commissioning (described in Section 9.6.2), including final conversion to Sydney Metro systems.

The construction methodology presented in this chapter is indicative and would continue to be modified and refined as the design process continues. A final construction methodology and program would be developed by the construction contractor when appointed.

Key construction areas, including the proposed construction compounds, work sites, and haul routes proposed for use during construction, are shown in Figure 9.1.

Construction of the project would commence once all necessary approvals are obtained (anticipated to be in 2018), and upgraded stations would be progressively delivered until 2024.

9.1.2 Approach to avoiding or minimising impacts during construction

Construction planning

Design development has included a focus on avoiding and/or minimising the potential for impacts during all key stages of construction. The indicative construction methodology described in this chapter has been developed with consideration given to the environmental constraints and issues identified during the early stages of the design and environmental assessment process. Further information on how the design was developed to avoid or minimise impacts is provided in Chapter 7 (Design development and place making).

Construction environmental management

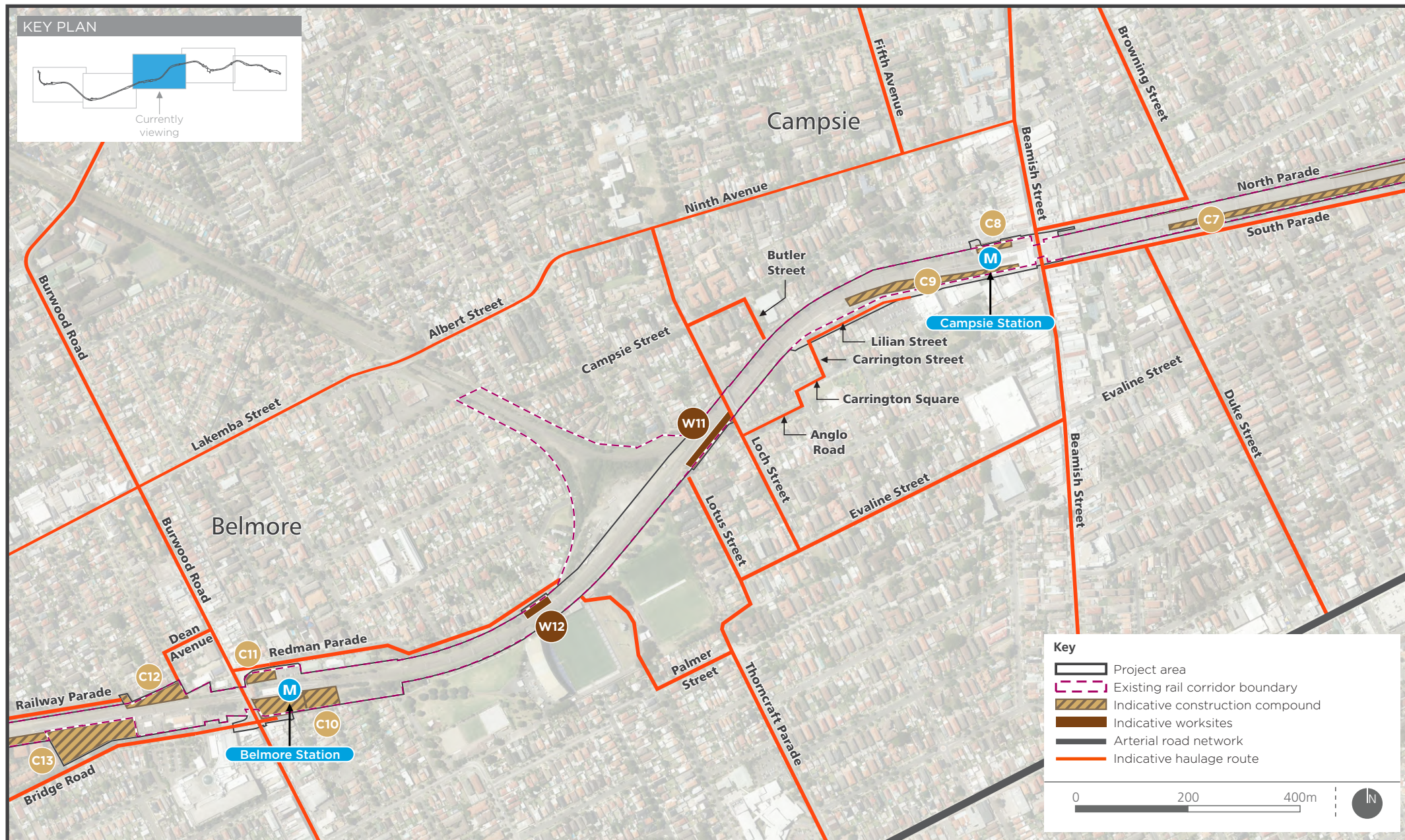
A Construction Environmental Management Framework (provided in Appendix D) has been developed to define the approach to environmental management and monitoring during construction of Sydney Metro City & Southwest as a whole. The framework is a linking document between the planning approval documentation and the construction environmental management documentation (including the Construction Environmental Management Plan), which would be developed and implemented by the construction contractor/s.

A Construction Noise and Vibration Strategy (provided in Appendix E) has been developed to show how construction noise and vibration will be managed for Sydney Metro City & Southwest as a whole. The strategy provides a framework for managing construction noise and vibration impacts in accordance with the *Rail Infrastructure Noise Guideline*, to provide a consistent approach to management and mitigation across all Sydney Metro projects.

Further information on the approach to environmental management during construction is provided in Chapter 28 (Synthesis of the Environmental Impact Statement).







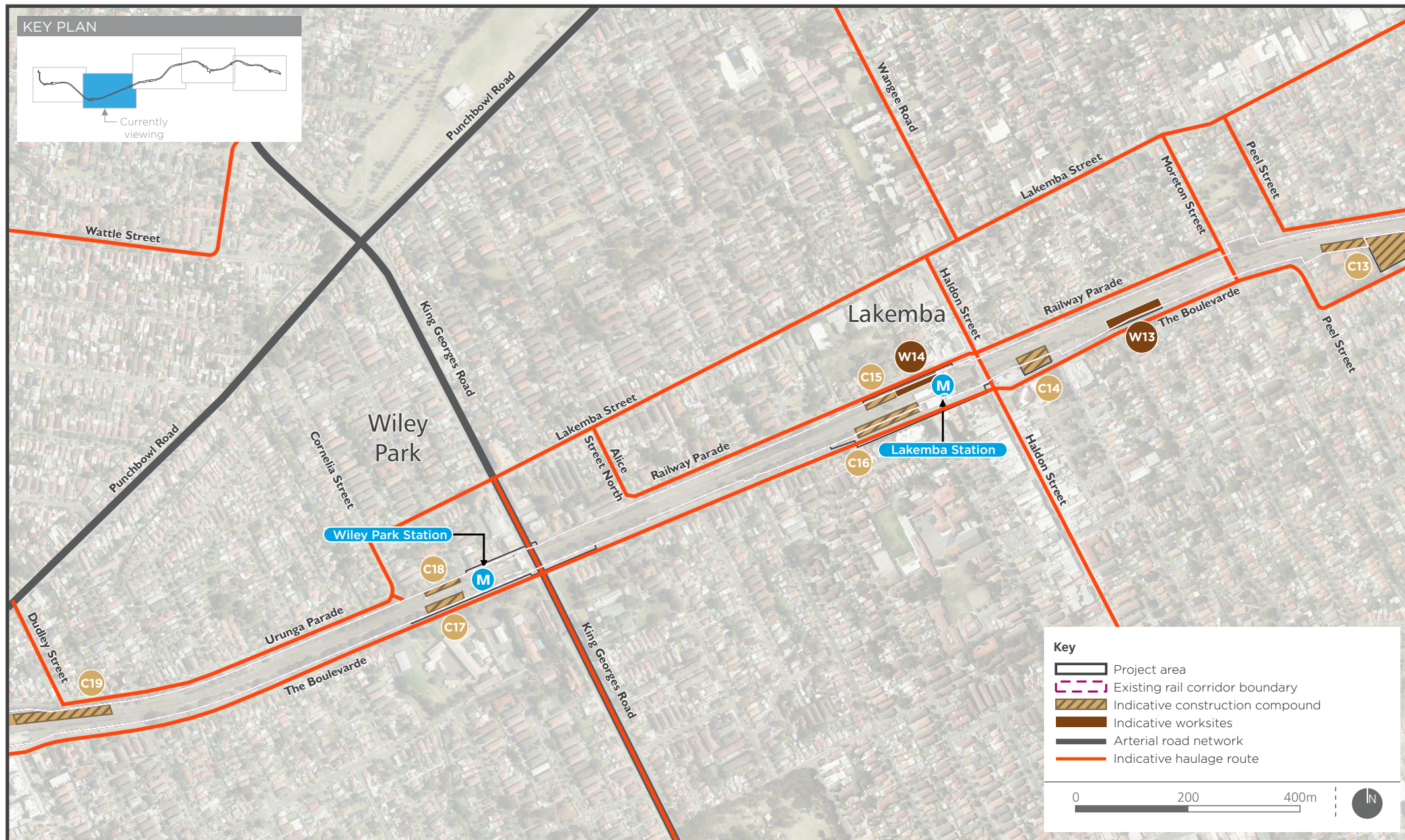




FIGURE 9.1

9.2 Enabling works

Enabling works for major infrastructure (also known as early works) are typically carried out before the start of substantial construction to establish key construction sites and provide protection to the public where required.

9.2.1 Site establishment

Site establishment works are expected to include:

- carrying out heritage investigations, protection and archival recordings in accordance with the construction environmental management plan
- install site environment management and traffic controls in accordance with the construction environmental management plan
- establishing construction compounds and work sites
- supplying power, water and other utilities to construction compounds and other areas within the construction work area (whether temporary or permanent supplies)
- relocating, adjusting and protecting utilities and services affected by the project
- removing buildings and other structures where required (further information is provided in Section 9.2.2)
- potential remediation works (subject to identification of contaminated materials)
- adjusting or removing Sydney Trains rail infrastructure (signalling, communication routes) within the rail corridor
- vegetation clearance (as required) within the rail corridor
- undertaking minor piling works on platforms to assist with later concourse works.

9.2.2 Building removal works

The project would require the removal of a number of buildings and structures at each station. In addition to station buildings and structures, four other buildings would need to be removed, including:

- three commercial buildings (two located at Marrickville Station and one at Campsie Station)
- one house (located at Marrickville Station).

A number of Sydney Trains buildings (e.g. section huts) located along the corridor would also need to be removed. The need for removal of these buildings would be confirmed during detailed design.

Removal works would be carried out by licensed contractors. Typically, building removal would involve:

- establishment of hoarding, scaffolding and protection barriers around the perimeter of the site of the building to be removed
- all services into the buildings would be decommissioned, made safe and redundant
- soft stripping of internal building materials
- demolition of the building using an excavator, bobcat, cranes or other conventional methods following a top-down approach
- temporary propping and/or waterproofing provided for structural integrity of adjacent structures.

A hazardous materials analysis would be carried out prior to stripping and demolition of the main structure. Hazardous materials would be removed and disposed of in accordance with relevant legislation, codes of practice, and Australian Standards.

Materials such as bricks, tiles, timber, plastics and metals would be sorted where practicable and sent to a waste facility with recycling capabilities.

9.2.3 Transport network adjustments

Enabling works for transport infrastructure, including roads, would reduce the duration of construction works and associated disruptions to traffic and surrounding land uses. The indicative transport network adjustments proposed to be undertaken as part of enabling works would generally include:

- road modifications to facilitate the movement of construction vehicles, and improve the operation of rail replacement buses during possessions periods and station closures, such as redesigned intersections and road layouts, kerb modifications, turn restrictions, changes to line marking, signage, and restrictions on parking at intersections
- optimisation of traffic signals to facilitate network management, including phase adjustments, bus priority measures, and geometry upgrades
- provision of minor access roads to construction compounds and work sites from the road network and access gates into the rail corridor (where required)
- temporary relocation of pedestrian and cycle paths and the provision of property access
- temporary relocation of some existing bus stops and associated facilities, bus service rerouting, and installation of infrastructure to support temporary bus services (such as new bus stops and shelters)
- relocation of kerbside facilities, including taxi ranks, mail zones, loading zones, and associated modifications to advisory signage
- relocation of pedestrian access points into stations and improvements to walkways and lighting, wayfinding, and information signage
- changes to parking, including on and off street parking and access changes
- installation of monitoring devices such as CCTV, to aid real-time traffic monitoring and improved incident response.

Some of this work would be undertaken in advance of the commencement of major station and corridor construction activities, while some works will continue concurrently with this more substantial construction.

These adjustments would be confirmed during detailed design and construction planning. The assumed adjustments to transport infrastructure, which form the basis for the construction traffic and transport assessment, are considered in Chapter 10 (Construction traffic, transport and access).

9.3 Station works

9.3.1 Outline methodology

Station works would be staged to suit operational requirements and the availability of possession periods.

To minimise the construction timeframes at each station, stations would be constructed using modular design elements where possible. The modular approach involves the installation of structures (e.g. station buildings, canopies) comprising modularised components. All structures would be constructed using base pieces which can be assembled differently on each site to suit station requirements.

The modular approach would be used to enable each station to be assembled quickly on site and minimise the number of possessions required to complete the works. This would reduce the overall construction period at each station. The use of a modular approach also allows for some works to be undertaken during non-possession periods.

The following general work activities would be undertaken for a typical station upgrade:

- Site establishment and enabling works:
 - establishment of site compound (erect fencing, tree protection zones, site offices, amenities and plant/material storage areas, etc)
 - relocation of services/seats/bins on platforms.
- Lift and stairs construction:
 - erection of hoardings
 - removal/demolition of existing structures (existing canopies, shelters and stairs etc)
 - construction of footings/foundations for new stairs and lift shafts (on platforms)
 - construction of footings/foundations for new stairs and lift shafts (outside platforms areas)
 - fit out of stairs, canopies and anti-throw screens
 - installation of lifts
 - installation of fixtures, lighting and CCTV cameras for areas affected by construction works.
- Platform/building and concourse works:
 - construction of station and services buildings (including mechanical/electrical/building fit-out)
 - platform rebuilding, straightening, extending and resurfacing
 - station area works
 - upgrade of existing roads and footpaths
 - reconfiguration of bus, taxi and kiss and ride areas
 - landscaping, painting and paving works.
- Finalisation:
 - landscaping and public domain works, including installation of new bus shelters, seats, bins, wayfinding signage to the station.
- Testing and commissioning:
 - various activities to test and commission power supplies, lifts, lighting, modifications to station services, ticketing systems and communication and security systems.

9.3.2 Tree removal and management

The project would involve trimming or removing trees in the vicinity of stations to facilitate the upgrades of stations and station areas. A tree is defined by Australian Standard AS 4373-2007 as 'A long lived woody perennial plant growing to greater than (or usually greater than) three metres in height, with one or relatively few main stems or trunks'.

Table 9.2 provides an estimate of the number of trees with the potential to be affected within station areas, based on a preliminary survey conducted. The final number of trees that may need to be trimmed or removed in each area would be confirmed during detailed design and final construction planning. Minimising impacts to trees would be a key obligation incorporated into the construction contract.

Table 9.2 Number of trees at stations with the potential to be impacted

Station	Native trees	Exotic trees	Total trees
Marrickville	64	24	88
Dulwich Hill	13	6	19
Hurlstone Park	18	25	43
Canterbury	43	13	56
Campsie	35	13	48
Belmore	105	25	130
Lakemba	67	21	88
Wiley Park	47	61	108
Punchbowl	82	55	137
Bankstown	97	79	176

Note: The table presents the maximum number of trees around stations with the potential to be impacted during construction. The final numbers would be confirmed during detailed design. It does not include other trees along the corridor that may also need to be removed as part of general vegetation removal in the rail corridor (refer to Section 9.4.5 and Chapter 22).

Impacts to trees would be minimised wherever practicable. Where removal of trees is unavoidable, trees would be replaced in accordance with the tree management strategy for the project, which would be prepared in consultation with relevant stakeholders (including local councils). The tree management strategy for construction would be used to guide the management of trees that need to be removed, protected, or trimmed. The strategy would address:

- minimising the need for tree removal
- protection of trees being retained
- replacement of trees being removed.

The strategy would provide for the following

- consideration of all options to minimise the need for tree removal and to retain as many trees as possible
- preparation of comprehensive tree reports (by a qualified arborist) for trees requiring protection, pruning, or removal, to guide the approach to managing trees
- measures to minimise damage to, and ensure the health and stability of, trees to be retained, in accordance with *AS4970-2009 Protection of trees on development sites*

- replacement of trees where removal cannot be avoided, in accordance with the following general principles:
 - replacement of removed trees on a two for one ratio
 - provision of replacement trees to achieve similar outcomes as those removed where possible, such as screening, amenity, etc
 - tree species, and minimum tree size and height, as agreed with the relevant council
 - trees to be planted within or in close proximity to the project area, or in another location determined in consultation with the relevant council
 - trees planted in the vicinity of stations would be in accordance with the Station Design and Precinct Plans for the project.

9.4 Corridor works

9.4.1 Track works

As described in Chapter 8 (Project description – operation), the project would involve upgrading/realigning the existing track in some locations. This would generally occur near stations due to the straightening of platforms and for other reasons. There may, however, also be a requirement to upgrade or replace track elsewhere between stations following further investigations to be undertaken as part of detailed design. The scope of civil works would include:

- earthworks and track formation
- retaining walls
- stormwater drainage
- new overhead wiring structures.

Rail work would involve:

- removing existing fastenings, rail and sleepers
- placement of ballast (consisting of either recycled or new ballast) and sleepers on the formation
- tamping and profiling the ballast around the sleepers and to a smooth alignment
- installing, fixing, and welding the rails to the sleepers
- installing cable and equipment, including signalling, communications and electrical systems
- installing overhead wiring for rolling stock
- installing fire and life safety systems (including walkways connecting to emergency egress and fire hydrant systems)
- installing track drainage.

9.4.2 Bridge upgrades and replacement

It is anticipated that most bridges would be able to remain partially open to traffic during the installation of new traffic barriers and anti-throw screens, replacement of existing parapets, and waterproofing of bridge decks. In some locations, depending on the works, full closures would be required, particularly where a replacement bridge is required.

Construction would typically involve:

- relocation of utilities to a new alignment (some utilities would be terminated at the bridge abutments)

- close bridge or lanes depending on requirements
- existing parapets being removed down to the existing bridge slab
- existing asphalt removed from bridge deck to allow cleaning and waterproofing of the deck
- precast parapet sections being positioned with the use of cranes and fixed to the bridge deck, throw screens would be prefabricated prior to installation
- asphalt being applied to roadway surface along with any line marking
- installation of any barriers, drainage, screens on to bridge
- bridge tie-ins being adjusted to match the new bridge roadway surface levels
- the bridge or lanes being reopened to traffic
- footpaths being periodically closed to allow for the reinstatement of services within the bridge.

In the event a bridge needs to be replaced, the following additional works would be undertaken following the closure of the bridge and prior to any finishing works:

- installation of new abutment extension piles, using piling rigs positioned on either side of the bridge to reduce the duration of construction
- excavation of the new abutment during possession periods
- demolition of the bridge deck during possession periods
- installation of new bridge beams to span the tracks
- installation of concrete slab for bridge deck followed by waterproofing of deck.

The potential bridge closures and indicative route diversions required to undertake the bridge works are described in Section 10.3.3. These would be confirmed during detailed design and construction planning.

9.4.3 Timing of corridor works

Works that cannot be safely undertaken while trains are operating would be undertaken during possession periods to ensure the safety of workers and train customers. The timing of any bridge works that require a possession would take into account the impacts of any bridge closures on the operation of the Temporary Transport Strategy. It has been assumed that bridge works would not be undertaken during any July or Christmas/summer holiday possessions. Avoiding these periods would mean that bridge works would not occur during periods when the Temporary Transport Strategy buses are operating.

Works between Marrickville and west of Campsie stations where the freight tracks are located would need to be undertaken during possessions periods, which would also include possession of the freight tracks. These works would generally be limited to weekend possession periods when both Sydney Trains and ARTC possessions periods are available. Any additional possession periods required for the freight tracks would be confirmed during construction planning in consultation with ARTC.

The section of the rail corridor from east of Belmore to Bankstown stations does not contain any freight tracks. As a result, works in this section would not be restricted to possession periods for the freight tracks, and could be undertaken during the Sydney Trains weekend possessions. Works would also be timed to be during April and September school holiday periods, when the Temporary Transport Strategy would not be in operation.

Further information on construction timing and possession periods is provided in Section 9.7.

9.4.4 Embankments, cuttings and retaining walls

The project would require upgrades to existing embankments and cuttings to provide for:

- realignment of existing tracks
- extension of station platforms
- installation of civil infrastructure, station services buildings and substations
- general maintenance or upgrade where required to ensure each structure is sound.

Retaining walls may be required in the vicinity of stations to suit the new metro tracks or to support new infrastructure. The exact positioning and size of retaining walls would be determined during detailed design.

Construction of the project would require rock anchors, which would be installed under or near to, adjacent properties. These activities are common for developments in urban areas and Transport for NSW has an established procedures for informing affected property owners and addressing issues that arise. These procedures align with safety requirements, relevant legislation and industry best practice.

9.4.5 Removal of vegetation within the rail corridor

The biodiversity assessment was undertaken based on the assumption that all vegetation within the rail corridor would need to be removed to construct the project, with the exception of identified areas of the threatened species Downy Wattle (shown in Figure 9.1), which are located within the rail corridor between Punchbowl and Bankstown stations.

Based on this assumption, about 17.3 hectares of vegetation (not including vegetation classed as exotic grassland) would need to be removed, including:

- one hectare of native vegetation
- 7.3 hectares of planted native vegetation
- nine hectares of exotic scrub and forest.

This vegetation would potentially include trees that provide screening along the corridor for surrounding properties. The need to clear vegetation would be reviewed by the construction contractor/s and minimised wherever practicable.

Where removal of trees is unavoidable, trees would be replaced in accordance with the tree management strategy, which would be prepared prior to the commencement of construction, in consultation with relevant stakeholders (including local councils). The strategy would be used to guide the management of trees that need to be removed, and to consider options for their replacement. A summary of this strategy is provided in Section 9.3.2.

Further information on the potential impacts of the project on biodiversity, and measures proposed to mitigate the potential impacts (including the biodiversity offset strategy), are provided in Chapter 22 (Biodiversity).

9.5 Associated infrastructure

9.5.1 Substations and station services buildings

Construction of substations and services buildings would generally involve:

- enabling works (as described in Section 9.2)
- earthworks to provide a level site

- piling works and site excavation for in-ground services:
 - use of piling rigs to construct piles required for ground slab
 - excavation of building and bund yard areas for construction of in-ground pits and conduits
 - excavation for oil/water separator tank and related services (for substations)
- preparation of concrete slab in location of substation or services building
- buildings would potentially be prefabricated off-site and delivered and installed on a concrete slab or would be constructed on site using prefabricated segments of the building
- fit out, including connection to the electrical network for substations
- connection to the overhead wiring structures which would require some trenching activities, (the size and location of trenches would be confirmed during detailed design)
- finishing, testing and commissioning as described in Section 9.6.

9.5.2 Traction power supply cable

Construction of the proposed traction power supply feeder from Campsie Station to Ausgrid's Canterbury Substation in Earlwood would be undertaken generally via trenching along the alignment. The use of horizontal directional drilling to install the cable would potentially be used in the following locations to minimise impacts:

- at Canterbury Road due to high traffic volumes
- between River Street and Karool Avenue due to a substantial change in elevation between the two streets - at this location, there is also a local heritage item which would need to be considered.

The alignment also crosses Cup and Saucer Creek on Fore Street, Canterbury, via an existing bridge. This crossing would involve integrating the cable into the bridge structure, and works within the creek would not be required. The final design of this crossing would be confirmed during detailed design.

9.6 Finishing, testing and commissioning

9.6.1 Finishing works

At the end of the construction phase, the contractor would remove construction equipment from the construction sites. Where relevant, sites that were occupied temporarily and do not form part of the operational footprint would be rehabilitated and revegetated.

As part of the operational readiness phase, the contractor would progressively deliver the station upgrades described in Chapter 8. Typically, this would involve the progressive removal of construction equipment, site sheds, hoardings and other temporary construction site elements.

Landscaping and finishing works would be undertaken at permanent operational sites. All construction work sites, compounds and access routes would be returned to the same or better condition than prior to construction commencement. Site reinstatement and rehabilitation would be undertaken progressively during the works, and would include the following activities:

- demobilise site compounds and facilities
- remove materials, waste and redundant structures from the works sites
- forming, and stabilising of spoil mounds
- decommission temporary work site signs
- remove temporary fencing

- establish permanent fencing
- decommission site access roads that are no longer required
- restoration of disturbed areas as required, including revegetation where required.

Site rehabilitation would be undertaken in accordance with the construction environmental management plan, guided by the Construction Environmental Management Framework, as described in Section 9.1.2 and Chapter 28.

9.6.2 Conversion to Sydney Metro systems and testing and commissioning

During this last stage of construction, the rail line would be converted to Sydney Metro systems. This would include works such as the installation of new signalling systems, controls, communication systems, and platform screen doors.

Testing and commissioning (checking) of the rail line and communication/signalling systems would be undertaken to ensure that all systems and infrastructure are designed, installed, and operating according to Sydney Metro's operational requirements.

The rail systems at each site (stations and services facilities) would be commissioned progressively as standalone entities. This would include:

- removal of any redundant Sydney Trains assets
- installation of platform screen doors and gap fillers.

Once all services are installed, testing and commissioning of the whole system would occur in three stages:

- collection of safety and quality assurance documentation and commissioning of readiness checks
- installation and operation tests and checks
- final inspection, site acceptance tests, commissioning and validation of individual systems.

During the final stages of commissioning, test trains would run on the line to test the signalling system and controls and the traction power supply.

This final stage of conversion and commissioning works would be undertaken during the final extended period rail possession (refer to Section 9.7.2). Alternative transport arrangements for rail customers would be implemented during this period (refer to Section 9.11).

9.7 Construction program and timing

9.7.1 Program

An indicative construction program is provided in Figure 9.2.

Construction of the project would commence once all necessary approvals are obtained (anticipated to be in 2018). Upgraded stations would be progressively delivered from 2019 until 2024, with the main station upgrade works estimated to take about two years for each station, however, the works would be spread across the entire project construction period (depending on the extent of works required). Works to upgrade other infrastructure, such as bridges, embankments and drainage, would also occur during this period to improve the reliability of services.

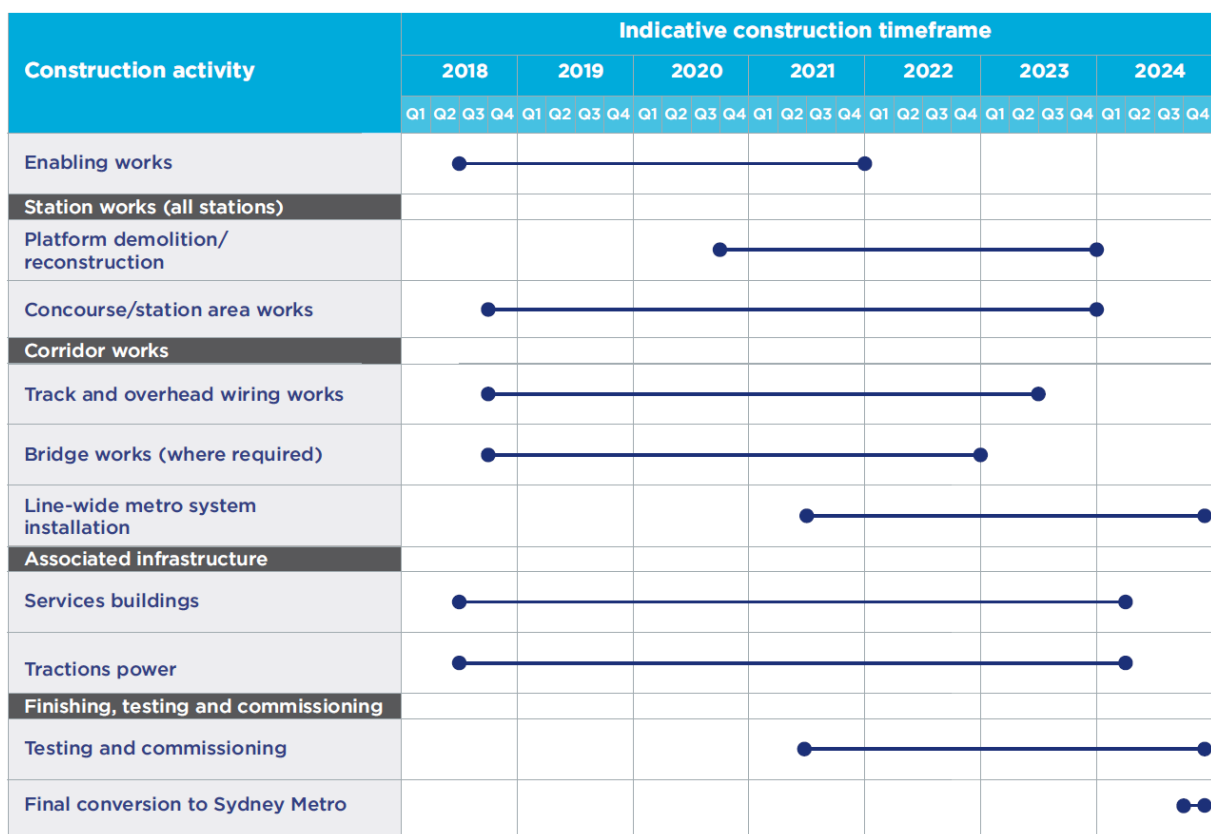


Figure 9.2 Indicative construction program for the project

Station works would potentially be staggered throughout the overall construction period so that not all stations would be constructed at once. This would mean that most stations would be open to customers for the majority of the construction period. Where possible, closure of stations would only occur during possession periods, however there is potential for some closures between possession periods (described in Section 9.7.2). A typical construction program for station works is provided in Figure 9.3.

Sydney Trains services would continue to operate to each station throughout the construction period (excluding during possessions or any other closure periods).

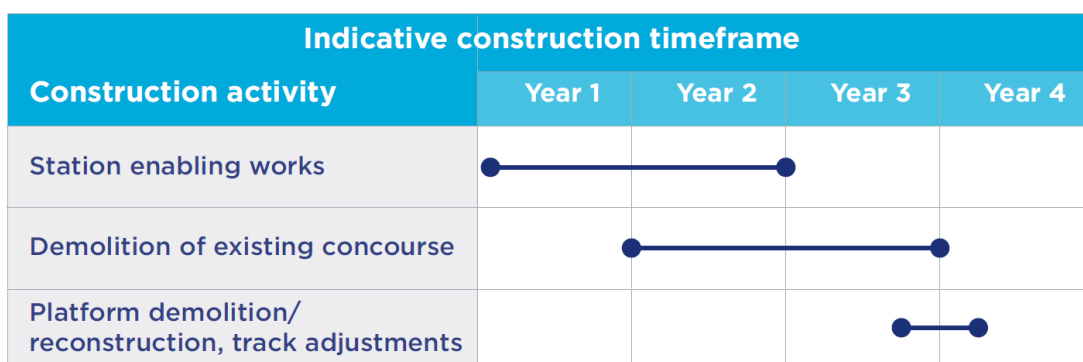


Figure 9.3 Indicative construction program for station works

9.7.2 Rail possession periods

Some construction works would need to be undertaken during rail possession periods when trains are not operating, to ensure that works are carried out as efficiently as possible and that worker safety is maintained. This would include possessions of both the Sydney Trains tracks, and the

freight tracks located between Marrickville and west of Campsie stations. Works that would need to be undertaken during possession periods include:

- major station works and activities on stations which cannot be undertaken during operation of the network
- track works
- activities requiring the temporary possession of roads or to accommodate road network requirements (including bridge works) to minimise safety impacts and inconvenience to commuters.

Options considered to minimise the number of possessions required to undertake construction, including the final extended possession period, are described in Section 6.6.

This indicative possession program would be reviewed during detailed design in line with construction planning to ensure the available possessions are sufficient to complete the works. The schedule of possessions would be reviewed to reduce the overall impacts to the community as far as possible.

During each possession period when the rail lines are closed, alternative transport arrangements would be implemented to ensure that rail customers can continue to reach their destinations. A description of the proposed temporary transport arrangements that would be implemented during these periods is provided in Section 9.11.

Outside the possessions described below (for both Sydney Trains and freight lines) services would operate in parallel within any construction works not located close to the operational tracks.

Standard possessions

Sydney Trains currently schedules routine maintenance possessions on four weekends each calendar year. Subject to detailed construction planning, these scheduled maintenance possessions would also be used to complete project works.

School holiday possessions

This would involve a six week possession of the T3 Bankstown Line during the Christmas school holiday period each year between 2019 and 2024, and two-week school holiday possessions of the T3 Bankstown Line in July each year. Opportunities to minimise the number of school holiday possessions would be further investigated during detailed design and following appointment of the construction contractor.

The assessment assumes the use of 10 school holiday possession periods over the construction period. These would be in addition to the standard possessions outlined above. It is proposed to undertake possessions during school holiday periods because there is:

- lower patronage on the Sydney Trains network generally and this would reduce inconvenience for school children and parents
- less traffic on the surrounding road network, which would assist the efficient operation of rail replacement bus services
- increased availability of buses and drivers for rail replacement bus services
- increased rail capacity available on other lines to accommodate customers who would normally travel on the T3 Bankstown Line.

Freight track possessions

The section of the rail corridor between east of Marrickville and west of Campsie is shared with freight tracks managed by ARTC. ARTC currently has four weekend possessions a year available

for maintenance of the corridor. These periods coincide with the standard Sydney Trains possessions described above.

Given the proximity of the ARTC tracks, any works required would need to be undertaken during these possessions, unless otherwise agreed with ARTC.

Consultation would be undertaken with ARTC throughout the construction phase to ensure there are no impacts on the operation of freight services.

Final possession

Once the stations have been upgraded, there would need to be a final possession period of between three and six months in duration. This final possession period is to enable the works that can only be completed once Sydney Trains services are no longer operating, and would include works such as the installation of new signalling, communication systems, and platform screen doors. It would involve full closure of the line to enable it to be converted to Sydney Metro systems, as described in Section 9.6.2.

The duration of the final possession would be as short as practicable to bring Sydney Metro trains into service. The duration of this possession would be refined in consultation with relevant stakeholders, and the community would be informed of any proposed changes once they are confirmed.

9.7.3 Temporary station closures

The temporary closure of individual stations, outside of possession periods, would be considered during detailed construction planning. Closures could potentially occur overnight when stations are not in use, or between possessions for a period of up to several weeks. Closures would generally be considered at stations with lower patronage, and where this would enable construction activities to be undertaken faster resulting in less overall impact on customers. Temporary rail replacement buses would be provided during these periods in accordance with the alternative transport arrangements described in Section 9.11.

Prior to any closures, the community (including customers) would be notified about any proposed changes to access.

9.7.4 Working hours including out of hours work framework

The scale and complexity of works required will mean that works will need to be undertaken during recommended standard working hours as well as at other times including: weekends, public holidays and in the evening and night time.

During non-possession periods, the majority of works would be undertaken during recommended standard hours as defined by the *Interim Construction Noise Guideline* which are:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and public holidays: no work.

Activities resulting in impulsive or tonal noise emissions would be limited to these hours, except as permitted by an environment protection licence which would be obtained once the project is approved.

During possession periods (described in Section 9.7.2), works may be undertaken 24 hours per day, and involve working both during and outside the recommended standard hours.

During these periods, the use of highly noise intensive equipment (such as hydraulic breakers and ballast tampers) would generally be limited to daytime and evening periods (between 7am and 10pm), unless technical constraints exist such as:

- works requiring a rail shut down
- requirements of relevant road authorities, emergency services, or the Sydney Coordination Office.

Out of hours work framework

The approach to out of hours work would involve preparing an Out of Hours Work Strategy to guide the assessment, management, and approval of works outside recommended standard hours. The strategy would be developed to ensure that out of hours works are managed effectively during construction, to avoid incidents and reduce impacts to the community as a result of out of hours work. It would:

- be consistent with the Construction Noise and Vibration Strategy for the project (described in Section 9.1.2), which includes a requirement for out of hours work to be included in the Construction Noise Impact Statements required under the strategy
- be prepared in accordance with the conditions of approval for the project
- take into account the results of the construction noise assessment, described in Chapter 12 (Construction noise and vibration)
- address the requirements of the environment protection licence for the project
- provide guidance for the preparation of out of hours work plans for each construction work site and for key works (including for each station), which would be prepared in consultation with key stakeholders (including the EPA) and the community.
- document procedures to control potential impacts
- identify responsibilities for implementation and management including managing complaints.

The strategy would be prepared in consultation with key stakeholders (including the EPA) and be approved prior to works commencing.

9.8 Construction compounds, work sites and access

The project area includes all areas required to construct the project. The majority of construction would be located within the rail corridor from west of Sydenham to west of Bankstown.

Within the project area, a number of construction compounds would be required to support construction activities at stations, and at other key locations where civil works are required. In addition to the compounds, a number of work sites would also be used to facilitate construction of certain project elements e.g. bridge works.

For the purposes of the Environmental Impact Statement, it is assumed that construction activities would occur along the entire length of the rail corridor within the project area. Construction activities would include clearing and grubbing, fencing, stockpiling, and material laydown. These activities would move progressively along the project area.

There would also be established work areas within the project area. Work in these areas could include activities such as excavation, piling, and structural concreting.

Plant used for these activities would include vacuum trucks, cranes, generators, scissor lifts, piling rig, water tankers, and excavators.

Construction activities at these sites could occur concurrently at different locations along the project area.

Further information on the indicative construction activities within the project area is provided in Sections 9.2 to 9.6.

9.8.1 Construction compounds

Construction compounds would be required at each station to support construction activities and associated works. The location of construction compounds is shown on Figure 9.1. A summary of each compound is provided in Table 9.3.

Construction compounds would generally include site offices, worker amenities (such as toilets, change rooms, meal rooms, shower facilities and first aid facilities), workshops, material storage and lay down areas (including dangerous goods storage), plant and vehicle parking, loading and removal areas, and site security facilities.

Compounds would generally be located on land owned by RailCorp, mainly located within the rail corridor. Some compounds would need to be located on land outside of the rail corridor on other public land (i.e. owned by a government agency or council).

Table 9.3 Construction compound locations

Map Ref	Location	Existing use	Duration of use ¹
C1	Victoria Road, Marrickville	Rail corridor	Long term
C2	Station Street, Marrickville	Retail	Long-term
C3	Ewart Lane, Dulwich Hill	Rail corridor, parking	Long-term
C4	Floss Street, Hurlstone Park	Roads reserve and rail corridor	Long-term
C5	Broughton Street, Canterbury	Rail corridor and rail uses	Long-term
C6	Charles Street, Canterbury	Rail corridor, parking	Long-term
C7	South Parade, Campsie	Rail corridor	Long-term
C8	North Parade/Wilfred Avenue, Campsie	Rail corridor, road reserve with parking	Long-term
C9	Lilian Street, Campsie	Rail corridor, parking	Long-term
C10	Tobruk Avenue, Belmore	Rail corridor, open space	Long-term
C11	Redman Parade, Belmore	Parking and rail corridor	Long-term
C12	Railway Parade, Belmore	Rail corridor, open space	Long-term
C13	Bridge Road, Belmore	Sydney Trains maintenance facility	Long-term
C14	The Boulevarde, Lakemba	Rail corridor, parking	Short-term
C15	Railway Parade, Lakemba	Rail corridor, parking	Short-term
C16	The Boulevarde, Lakemba	Rail corridor, parking	Short-term
C17	The Boulevarde, Wiley Park	Rail corridor, road verge	Long-term
C18	Urunga Parade, Wiley Park	Rail corridor, road verge	Long-term
C19	Urunga Parade, Punchbowl	Rail corridor	Long-term
C20	Urunga Parade, Punchbowl	Rail corridor, road reserve	Long-term
C21	The Boulevarde, Punchbowl	Parking and corridor	Long-term
C22	Bruest Place, Punchbowl	Rail corridor	Long-term
C23	South Terrace, Bankstown	Rail corridor	Long-term
C24	North Terrace, Bankstown	Rail corridor, road reserve	Long-term

Note: 1. Short-term: area is to be used for up to about 18 months. Long-term: area is to be used for over 18 months and potentially for the entire construction period.

9.8.2 Work sites

In addition to the compounds and general construction activities within the rail corridor, there are also a number of other sites where construction activities would be undertaken, or where support would be provided for other construction areas. These sites, which would be generally located outside the rail corridor, are shown in Figure 9.1 and are listed in Table 9.4.

Table 9.4 Work sites located outside of the rail corridor

Map ref	Location	Existing use	Proposed use	Duration of use ¹
W1	Myrtle Street, Marrickville	Rail corridor and vacant land on residential property	Support for station works and relocation of services	Short-term
W2	McNeilly Park, Marrickville	Open space (recreational/public park)	Drainage works (detention basin)	Short-term
W3	Livingstone Road bridge	Roadway	Drainage works	Short-term
W3a	Albermarle Street bridge	Roadway/ rail corridor	Bridge works	Short-term
W4	Dulwich Hill	Rail corridor and Council car park	Crane location for construction of station	Intermittent short-term use throughout construction
W5	Terrace Road bridge	Rail corridor and road verge	Bridge works	Short-term
W6	Garnet Street/The Parade, Dulwich Hill	Rail corridor and road verge/informal parking	Bridge works	Short-term
W7	Melford Street/Canberra Street, Hurlstone Park	Rail corridor and road reserve	Bridge works	Short-term
W8	Close Street, Canterbury	Former Canterbury Bowling and Community Club (now leased for community purposes)	Support for Canterbury Station works including car parking	Short-term
W9	Charles Street, Canterbury	Rail corridor and car park	Station works	Short-term
W10	South Parade at Wairoa Street, Canterbury	Rail corridor and road verge	Bridge works	Short-term
W11	Lillian Lane, Campsie	Rail corridor and road verge	Bridge works	Short-term
W12	Redman Parade, Belmore	Rail corridor and road reserve	Bridge works	Short-term
W13	The Boulevarde	Rail corridor and road verge	Substation works	Short-term
W14	Railway Parade, Lakemba	Rail corridor and car parking	Station works	Short term

Note: 1. Short-term: area is to be used for up to about 18 months. Long-term: area is to be used for over 18 months and potentially for the entire construction period.

Work sites 2 and 8 are proposed on sites that are used by the community (McNeilly Park and the former Canterbury Bowling and Community Club, respectively). As a result, further detail is provided in Figure 9.4 to assist the community understand the potential construction layout and associated impacts (for example, site access points, construction areas), and the area of site available for continuing use.



9.8.3 Environmental management at construction compounds and work sites

Compounds and work sites would be managed in accordance with the approach to environmental management for construction as a whole (described in Section 9.1.2). Environmental controls would be implemented at all sites, in accordance with the construction environmental management plan. Impacts to trees would be minimised wherever practicable. Trees would be managed in accordance with the tree management strategy for the project, described in Section 9.3.2.

9.8.4 Approach for selecting additional construction compounds and work sites

Although every endeavour has been made to identify sufficient space needed for construction, the construction contractor may require additional construction compounds and/or work sites to those described above. This could include changes to the extent of compound or work sites.

Additional or alternative location compounds and/or work sites would be determined based on the following criteria:

- located more than 50 metres from a waterway, unless an erosion and sediment control plan is developed and implemented
- have ready access to the road network
- be located to minimise the need for heavy vehicles to travel on local streets and/or through residential areas
- be located on relatively level land
- be separated from the nearest residences by at least 200 metres, unless reasonable and feasible noise and light spill mitigation measures are implemented
- not require native vegetation clearing beyond that already required for the project
- not have any more than a minor impact on heritage items beyond those already assessed for the project
- not unreasonably affect the land use of adjacent properties
- be above the five per cent annual exceedance probability flood level, unless a contingency plan to manage flooding is prepared and implemented
- provide sufficient space for the storage of raw materials to minimise, to the greatest extent practical, the number of deliveries required outside standard daytime construction hours.

Any additional compounds or work sites would potentially require additional land outside the rail corridor. Consultation would be undertaken with any impacted landowners (including councils) to discuss any additional land requirements. As described in Section 8.2.3, leases would be entered into as required.

9.8.5 Access to construction compounds and work sites

Construction areas would be generally accessed via existing corridor gates along the rail corridor. In some locations new gates would also be installed.

Preliminary access routes to the construction compounds, work sites and the rail corridor in general are shown in Figure 9.1.

9.8.6 Worker parking

Some parking would be provided for construction workers within compounds and/or work sites where practicable. However, these spaces would generally be no more than 10 per compound or

work site. Opportunities for additional construction worker parking would be investigated during detailed construction planning, particularly for larger sites.

9.8.7 Temporary site hoarding and fencing

Erection of site hoarding and fencing would be required to provide temporary enclosure of work sites and work areas to ensure the safety of the public.

Hoardings/fencing would be required in and around areas of heavy pedestrian usage, potentially including the temporary closure and/or diversion of pedestrian thoroughfares as well as management of pedestrians around work sites and past work site access points. Hoardings/fencing may also be erected to protect buildings or structures and to provide protection from dust and debris generated during construction.

The type of hoarding or fencing used would be further developed during detailed design and would consider the following principles:

- Reflect the context within which the construction sites are located and are sensitive to existing visual characteristics of neighbouring areas.
- Include artwork, graphics and images to enhance the visual appearance of temporary works in high visibility locations. This may include Sydney Metro advertising or public awareness campaigns.
- Provide community information, including contact numbers for enquiries or complaints.
- Ensure safety for vehicles and pedestrians is not compromised, with the principles of Crime Prevention through Environmental Design to be applied in the design of hoarding or fencing.
- Minimise impacts of visibility of businesses in the vicinity, where not possible signage would be provided to direct people to any obscured businesses
- Be regularly inspected and kept clean and free of dust build up. Graffiti would be removed or painted over promptly.
- Consider use of chain-link or similar style of steel fencing in areas with limited public interface (i.e. away from stations).

An example of the style of hoarding which would be used is provided in Figure 9.5.



Figure 9.5 Indicative hoarding to be used at compounds and work sites

9.8.8 Preliminary haulage routes

Preliminary identification of haulage routes has been undertaken with consideration to the sensitive nature of surrounding residential areas. Preliminary haulage routes have been identified for each construction compound and other site access points likely to be required. The preliminary routes are shown on Figure 9.6 at a regional scale, and in more detail on Figure 9.1. The routes were developed to minimise impacts on residential streets as far as possible, while providing the most

direct route to the arterial road network. Where possible, routes avoid movements through town centres, such as the Marrickville town centre located on Illawarra Road.

These preliminary haulage routes would be reviewed during detailed design and confirmed following appointment of the construction contractor. In general, vehicle movements would be scheduled to be undertaken outside peak periods and in some locations (e.g. near Wiley Park and Punchbowl stations where schools are nearby), outside school start and finish times. However, there would be a need for some vehicle movements during these periods.

9.8.9 Construction traffic volumes

Construction traffic would include heavy and light vehicles associated with spoil and waste removal, material deliveries, and the arrival and departure of construction workers. The indicative construction traffic volumes are based on the following vehicle types:

- light vehicles – up to 4.5 tonnes
- heavy vehicles – 12.5 metres long, greater than 4.5 tonnes.

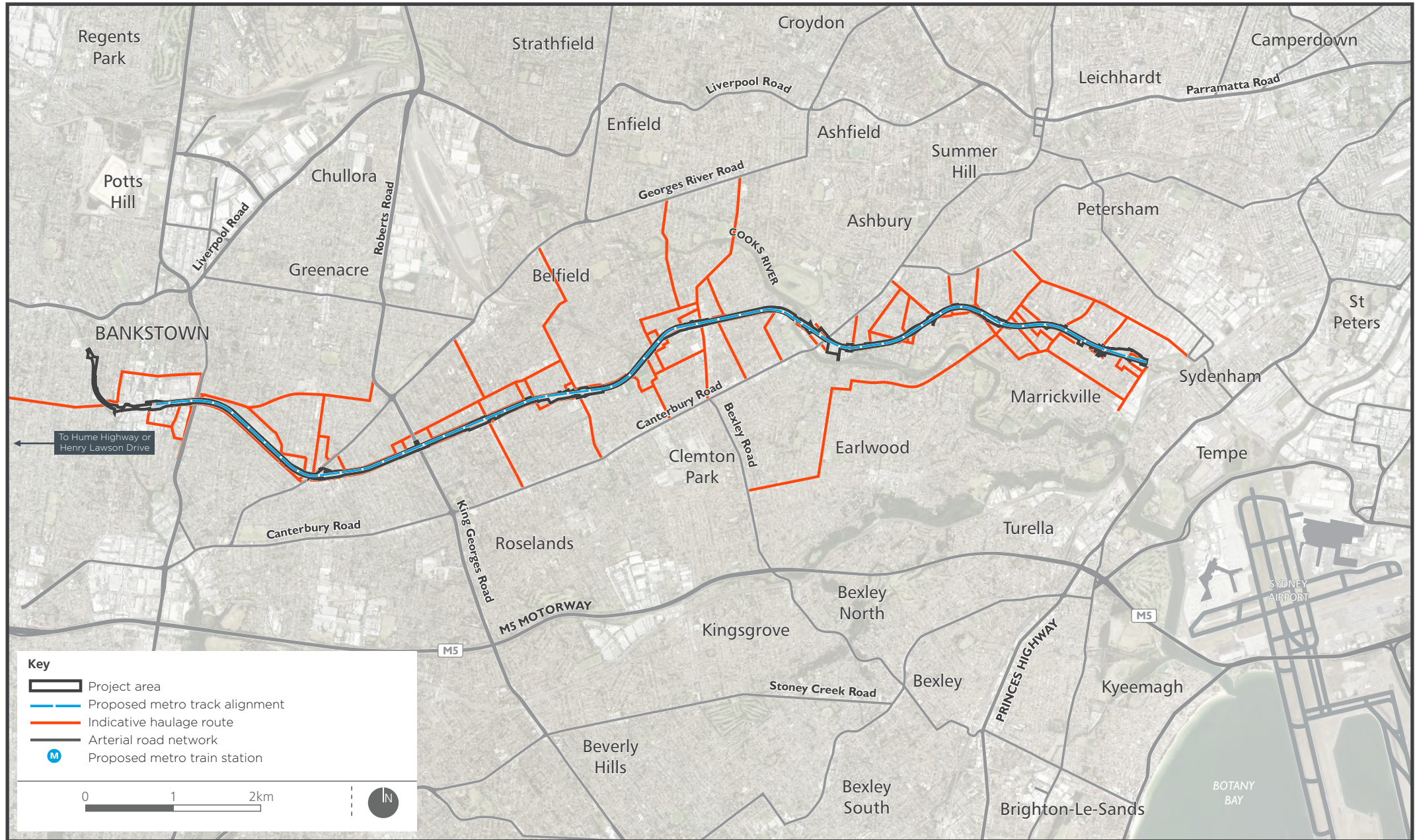
Estimated traffic volumes are summarised in Table 9.5. These volumes are indicative of possession periods when vehicle movements would be at their maximum. Vehicle volumes are expected to approximately halve during non-possession periods.

The frequency of vehicle movements during construction would be further determined during detailed construction planning which would be undertaken following the appointment of a construction contractor.

Table 9.5 Estimated construction traffic volumes during possession periods

Construction compound	Vehicles per hour - AM peak (7.30 - 8.30am) ¹		Vehicles per hour - PM peak (4.15 - 5.15pm) ¹		Heavy vehicles per hour outside recommended standard hours ¹	
	Heavy vehicles ²	Light vehicles ³	Heavy vehicles	Light vehicles	Evening (6pm - 10pm)	Night (10pm - 7am)
Marrickville	20	20	20	20	18	18
Dulwich Hill	20	20	20	20	18	18
Hurlstone Park	20	20	20	20	18	18
Canterbury	20	20	20	20	18	18
Campsie	20	20	20	20	18	18
Belmore	20	20	20	20	18	18
Lakemba	20	20	20	20	18	18
Wiley Park	20	20	20	20	18	18
Punchbowl	20	20	20	20	18	18
Bankstown	20	20	20	20	18	18

Notes: 1. Figures are for possession periods, which represent the worst-case situation, and represent two-way total traffic volumes.



9.9 Workforce and construction resources

9.9.1 Workforce

During non-possession periods, it is estimated that a workforce of approximately 470 people would be required on average, with up to 700 people required during peak construction activity. During possession periods, it is estimated that a workforce of approximately 715 people would be required on average, with up to 1,540 people required during peak construction activity. An indicative breakdown of workforce staffing per station area is provided in Table 9.6.

The workforce would be encouraged to use public transport to reduce the number of vehicles accessing and needing to park in the project area. The majority of worker vehicles are likely to access the site outside the morning and afternoon traffic peaks.

Table 9.6 Indicative construction workforce estimates

Location	Non-possession periods		Possession periods	
	Peak	Average	Peak	Average
Marrickville Station	60	40	130	65
Dulwich Hill Station	60	40	130	65
Hurlstone Park Station	60	40	140	65
Canterbury Station	75	50	160	75
Campsie Station	75	50	160	75
Belmore Station	60	40	130	60
Lakemba Station	60	40	130	60
Wiley Park Station	60	40	130	60
Punchbowl Station	60	40	130	60
Bankstown Station	135	90	300	130

9.9.2 Materials and water usage

A variety of materials would be required to construct the project. The major items and indicative quantities are listed in Table 9.7.

Reconditioning of ballast would be undertaken where required, particularly areas subject to track alignment changes. It is expected that roughly 60 per cent of ballast is likely to be considered suitable for reuse in the rail corridor.

It is estimated that about 85,000 cubic metres of fill material would be required to construct the project. It is expected that all, or the vast majority of, fill material could consist of spoil excavated from the project area.

Further information on spoil generation and waste management for the project is provided in Chapter 26 (Waste management).

Table 9.7 Indicative material and water usage estimates

Location	Concrete (m ³)	Steel (tonnes)	Water (litres)	Ballast (tonnes)
Marrickville Station	600 to 800	100 to 150	500,000	0
Dulwich Hill Station	600 to 800	100 to 150	500,000	7,880
Hurlstone Park Station	600 to 800	100 to 150	400,000	3,505
Canterbury Station	600 to 800	100 to 150	350,000	1,071
Campsie Station	600 to 800	100 to 150	1,100,000	4,869

Location	Concrete (m ³)	Steel (tonnes)	Water (litres)	Ballast (tonnes)
Belmore Station	400	100 to 150	500,000	5,427
Lakemba Station	600 to 800	100 to 150	700,000	3,987
Wiley Park Station	600 to 800	100 to 150	400,000	0
Punchbowl Station	600 to 800	100 to 150	1,000,000	6,885
Bankstown Station	800	50	600,000	2,934
Corridor between Bankstown to Punchbowl	400	80	1,200,000	6,000

9.9.3 Construction plant and equipment

An indicative list of the plant and equipment expected to be used during construction is provided in Table 9.8. The actual plant and equipment used at each work site would be further refined during the detailed design stage and upon appointment of the construction contractor.

9.9.4 Site servicing requirements

Utilities such as water, power, sewer and telecommunications would need to be supplied to work areas. Generally, these utilities are located close to the sites (such as the adjacent footpath) and the supply is considered 'business as usual' for utility companies. The proposed approach to utilities management is described in Section 9.10.

Table 9.8 Indicative construction plant and equipment

Scenario	Back hoe	Ballast tamper	Bobcat	Cable trailer and truck	Cable winch	Compressor	Concrete pump	Concrete truck	Diamond saw	Excavator	Excavator with	Franna crane	Generator	Hand tools	Horizontal direction	Mobile crane (300	Mobile crane (50	Piling rig (bored)	Roller (non-vibratory)	Scissor lift	Semi Trailer	Truck	Water tanker	Welding equipment
General work sites			✓			✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓			✓	✓	✓
Corridor works - ground and track		✓	✓			✓				✓	✓	✓	✓	✓		✓	✓		✓		✓	✓	✓	✓
Corridor works - track support systems	✓	✓	✓									✓	✓	✓			✓			✓		✓		✓
Station work sites			✓			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Bridge work sites			✓			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Substation work sites			✓				✓	✓		✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	
Power supply feeder			✓	✓	✓						✓	✓			✓							✓		

9.10 Utilities management

The potential impacts on key utilities, and the proposed approach to managing utilities during construction, are considered in this section.

9.10.1 Utilities identification

There are a number of active and disused utilities located within and/or crossing the project area (either underground, aboveground or via existing road overbridges) with the potential to be affected by construction of the project.

The location of trunk utilities has been based on Dial Before You Dig searches; and a review of utility data, including as-built surveys, and agency and council records. Preliminary consultation has also been held with utility owners, including Sydney Water, Ausgrid, Telstra, Axicom, TPG, and Qenos.

The following utility owners have assets which may require adjustment, protection, and/or relocation as part of the project:

- Sydney Water:
 - potable water mains
 - stormwater drains and channels
 - wastewater mains/tunnels including potentially disused assets
- Ausgrid:
 - underground electricity cables (potentially up to 132 kilovolts)
 - 33 kilovolt underground electricity cables
 - high voltage underground electricity cables
 - low voltage overhead and underground electricity cables
 - abandoned underground cables
- Qenos:
 - high pressure gas main (currently filled with inert nitrogen gas)
- Jemena:
 - high pressure gas main (primary and secondary mains)
 - medium pressure gas main
 - low pressure gas main
- Telstra:
 - underground cables
 - underground and above ground service connections (i.e. to stations)
 - optic fibre underground cables
 - underground copper wire
 - vacant cable conduits
- NBN:
 - network cables
- Optus:
 - underground optic fibre cables

- Inner West and Canterbury-Bankstown councils:
 - stormwater channels
 - underground stormwater pipes
 - drainage culverts.

A number of the above assets are positioned within or below the existing road overbridges crossing the rail corridor.

9.10.2 Potential impacts and management framework

A Utilities Management Framework (provided in Appendix I) has been prepared, adopting a risk-based approach to avoiding and/or minimising impacts associated with the relocation and/or adjustment of public utilities affected by the project. The framework provides a consistent approach to the assessment and management of public utilities relocation/adjustment across all project activities. An outline of the framework is provided below.

The utilities management framework comprises the following steps:

- confirm affected utilities
- design response to potential conflict with a public utility including whether the utility can be avoided
- detailed assessment of requirements to meet utility owners specifications
- integration with utility owners through the Sydney Metro Utilities Working Group
- environmental assessment Australian Standard for risk management - *AS/NZS ISO 31000:2009, Risk management - Principles and guidelines*
- construction management which identifies typical mitigation measures successfully adopted by Transport for NSW on similar projects
- rehabilitation and re-instatement protocols following utility relocation/adjustment in roadways, footpaths and open space areas
- communications and notifications that can be expected and how these would be managed.

9.11 Alternative transport arrangements

9.11.1 Temporary transport strategy

Transport for NSW has developed a Temporary Transport Strategy (provided in Appendix G) which describes the process for planning the integrated, multi-modal transport network changes required during possessions of the T3 Bankstown Line to enable construction of the project.

The strategy outlines a number of components for alternative public transport arrangements by rail and bus during construction, to minimise impacts to customers during station closures and/or possession periods. The strategy provides:

- objectives for customers and bus services
- customer markets to be served by temporary transport management plans
- potential options to maintain public transport connections to and from affected rail stations
- potential impacts associated with temporary transport options and the level of assessment to be provided in temporary transport management plans
- temporary transport facilities and measures required to support the implementation of temporary transport management plans, ensuring accessible services are provided

- the process for developing temporary transport management plans, including stakeholder and community consultation
- performance outcomes for temporary transport management plans.

The strategy would continue to be informed by stakeholder and community input, with the approach refined based on understanding customer needs and ongoing development of alternatives to deliver improved customer outcomes.

9.11.2 Temporary transport management arrangements

Guided by the Temporary Transport Strategy, temporary transport plans would be prepared for each possession period prior to works being undertaken, to manage the alternative transport arrangements. The temporary transport plan would define the initiatives to be implemented to assist customers affected by closures of the rail line, and the measures to minimise potential impacts associated with proposed alternative arrangements.

Each temporary transport plan would define the processes by which the impacts created by closures of the T3 Bankstown Line, and the operation of temporary train and bus services, would be managed. Each temporary transport plan would comprise a temporary transport service plan and a temporary transport management plan.

Each temporary transport plan would include consideration of the following:

- increasing rail service frequencies on the T2 Inner West Line (between Lidcombe and the CBD) and the T2 Airport and East Hills Line (between Revesby and the CBD)
- delivering a temporary bus service plan to carry customers from T3 Bankstown Line stations to stations on the T2 Airport, Inner West & South Line, including increasing the frequency of existing bus services at specific locations acknowledging that customers may prefer to use those instead of rail replacement services
- improving cycle facilities at stations on other lines
- potential road network enhancements and infrastructure improvements to support additional bus operations, such as:
 - directional signs to/from the rail station;
 - bus route information displays;
 - temporary seating and marquees for weather protection;
 - relocation of bus stop poles; and
 - changes to bus zone signs.
- reviewing the facilities and commuter parking provision at stations on other lines that passengers may use
- the need to cater for special events such as New Years Eve during the Christmas shutdowns or NRL games held at Belmore Oval as to adequately handle crowds, this would include coordination with event organisers, the Sydney Coordination Office, councils and the Transport Management Centre.

To apply the learnings from previous temporary transport plans, development of the first temporary transport plan for the project would include a review of the temporary transport plan for the Sydney Metro City & Southwest Epping to Chatswood project, which will have concluded by that time. Subsequent temporary transport plans for the Bankstown to Sydenham project would be developed with consideration given to the ones that preceded it, in an ongoing process of revision and refinement. Development of the plans would also include consultation with key stakeholders.

Where a plan identifies the need for additional infrastructure to support its implementation, the need for additional assessment and approval for the infrastructure would be determined in line with the approach to design refinements for the project (described in Section 28.2), and specified in the plan.

A number of different approaches are available for providing temporary bus services. Each approach would form a component of the temporary transport plan. These components, shown in Figure 9.7, include:

- buses that stop at all stations along the corridor
- buses that only stop at a limited number of stations before continuing an express service to the end of journey location
- buses that move passengers to another rail line such as the T2 Airport, Inner West & South Line, and T1 North Shore, Northern & Western Line
- an increase in the frequency of existing bus services at specific locations, acknowledging that customers may prefer to use those instead of the rail replacement bus service.

Further details of these options and the process and criteria that would be used to inform decision making when multiple temporary transport service options are available for each possession period are outlined in Appendix G Temporary Transport Strategy.

9.11.3 Changes resulting from temporary transport arrangements

Closure of the stations between Marrickville and Bankstown during possessions would result in a number of flow-on effects to the Sydney Trains network and the need for operational changes beyond this section of the line, including at Birrong and Yagoona stations. Changes may also occur at stations on the T2 Airport, Inner West & South Line between Revesby and Sydenham, and between Strathfield and Redfern. Changes may also occur at stations on the T4 Eastern Suburbs & Illawarra Line.

Adjustments to rail services would need to be put in place to reallocate capacity across the network, including some expected additional capacity that may be provided on the T2 Airport, Inner West & South Line.

Similarly, changes to bus routes and facilities, and car parking arrangements, may result from the need to provide temporary bus zones near stations, and/or to provide temporary park and ride facilities at other locations supported by the temporary bus services.

Further discussion and assessment of the potential impacts of alternative transport arrangements on the suburban rail network and road users and facilities is provided in Chapter 10.

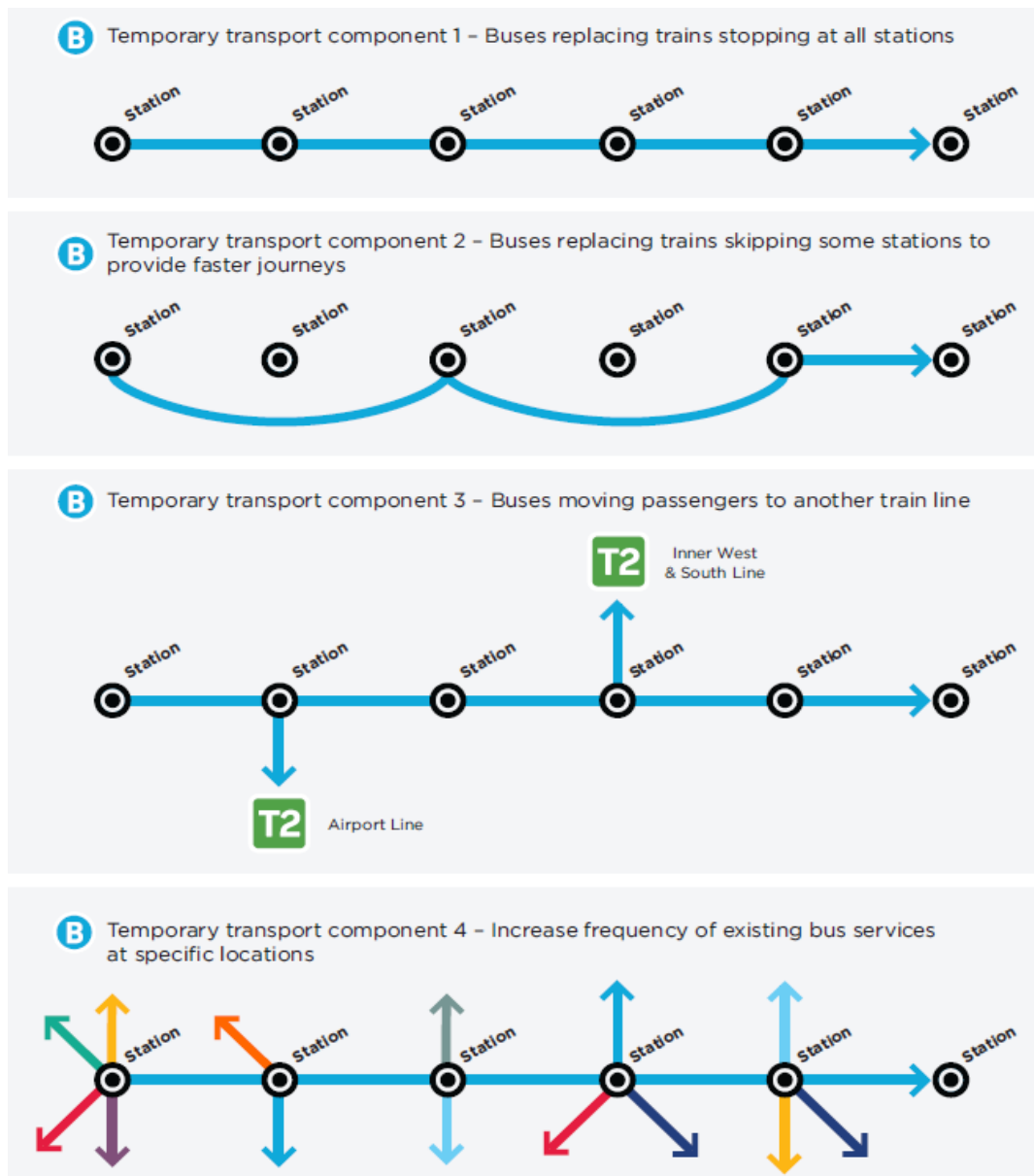


Figure 9.7 Temporary transport plan components

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> Volume 1A