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

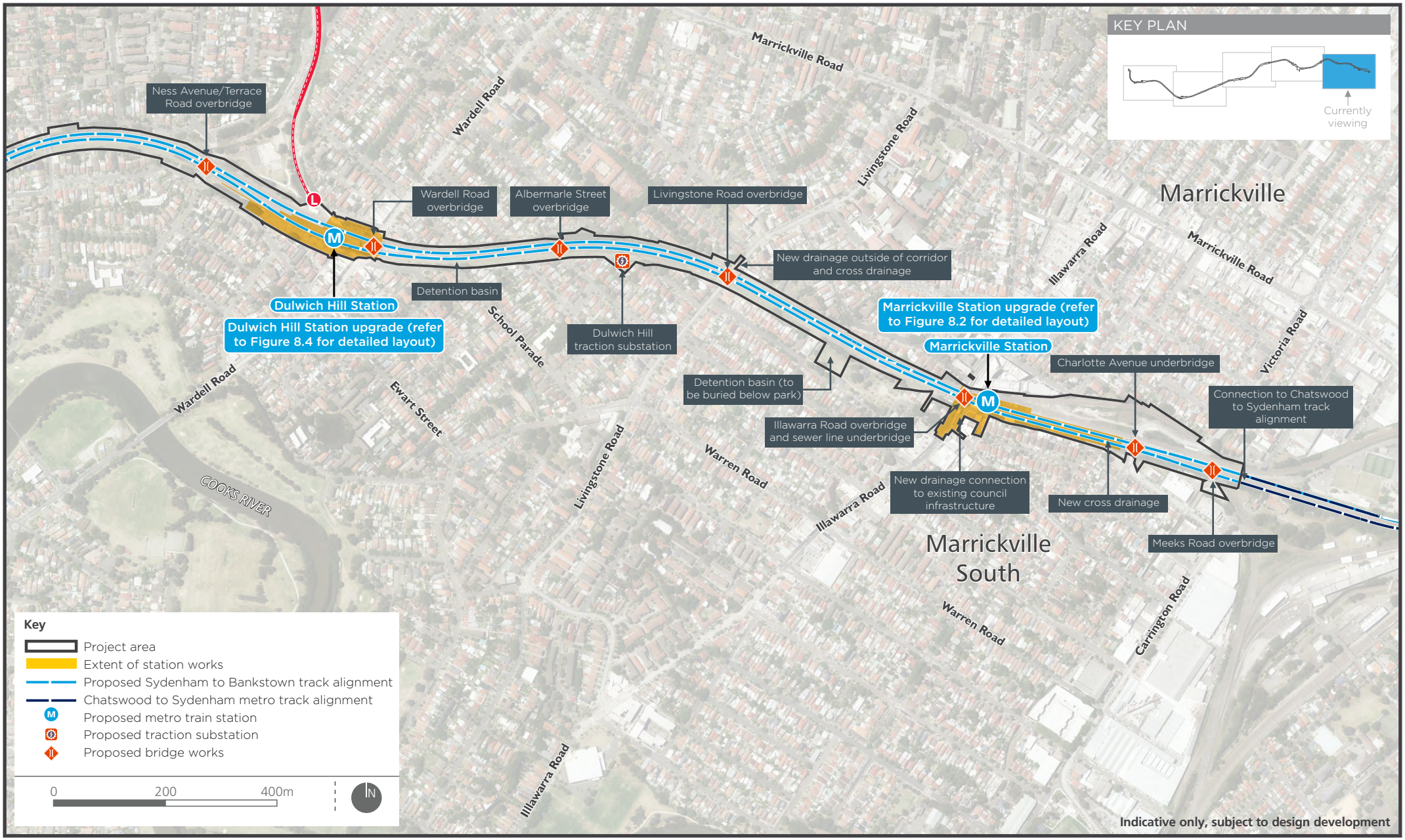
The main infrastructure and features that form part of the project are described in this section, and are shown in Figure 8.1. These include:

- 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).

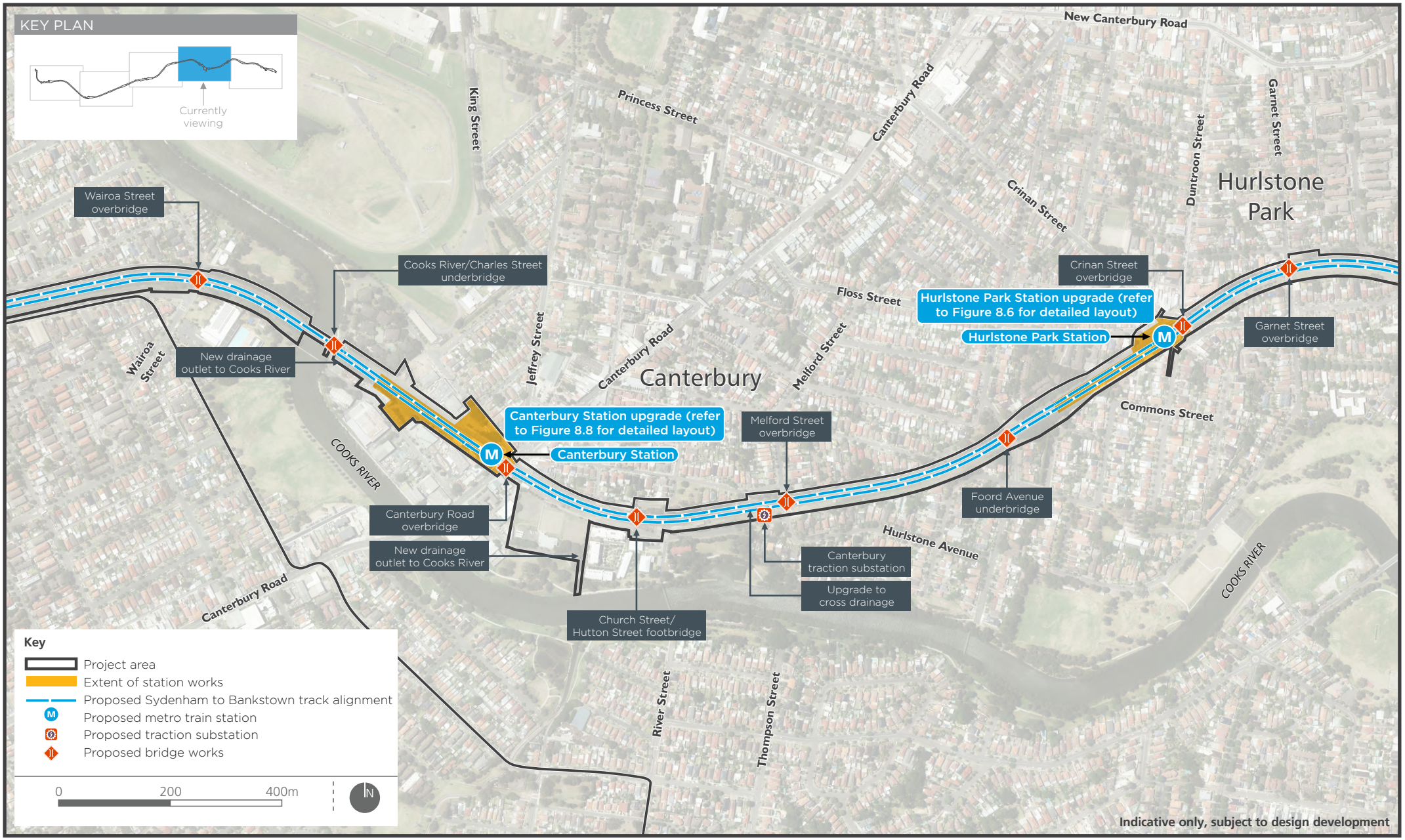
Any design modifications that occur as a result of matters arising during the exhibition of this Environmental Impact Statement would be identified in a submissions report or a preferred infrastructure report.



sydney METRO | city & southwest

Project infrastructure and features - map 1

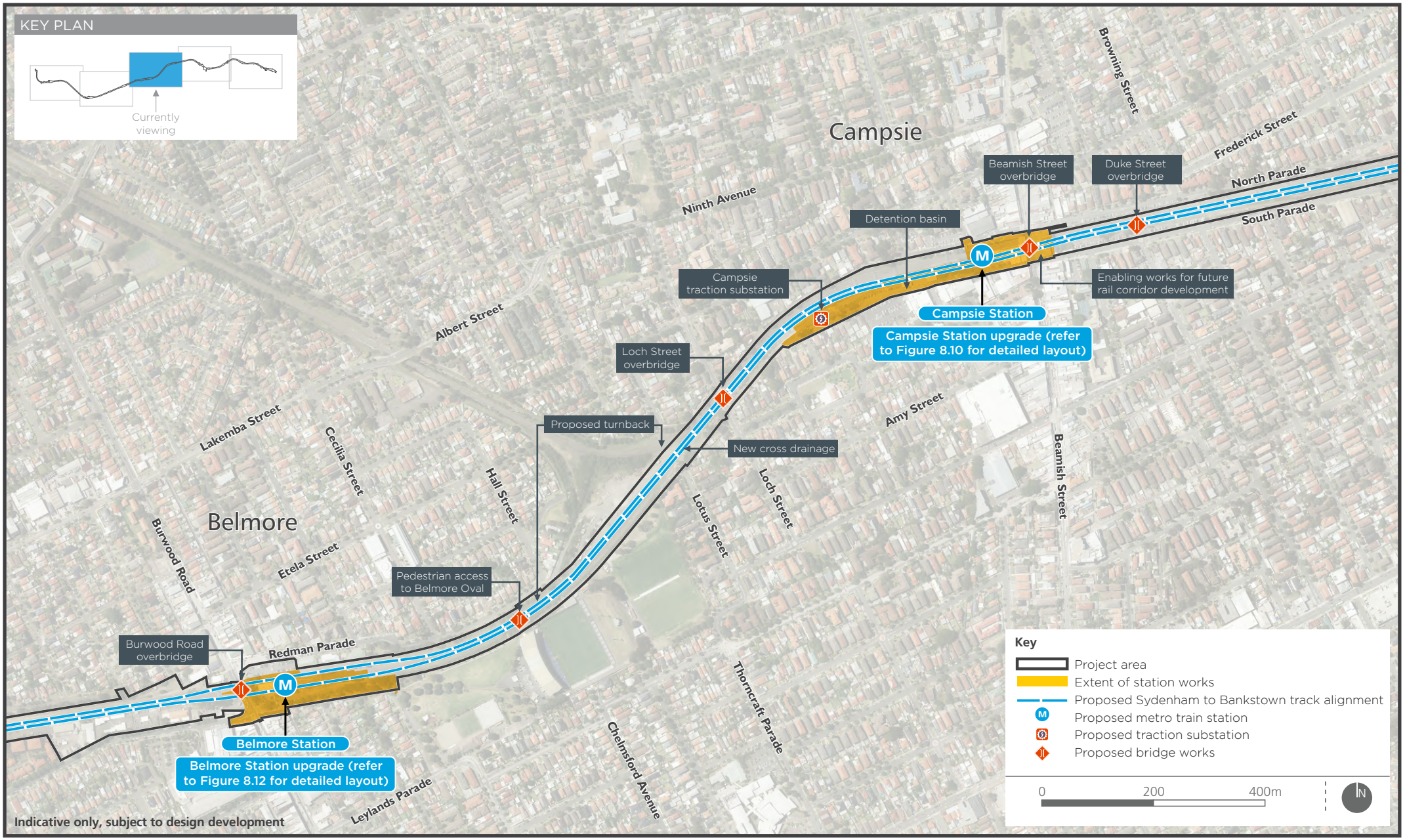
FIGURE 8.1



sydney METRO | city & southwest

Project infrastructure and features - map 2

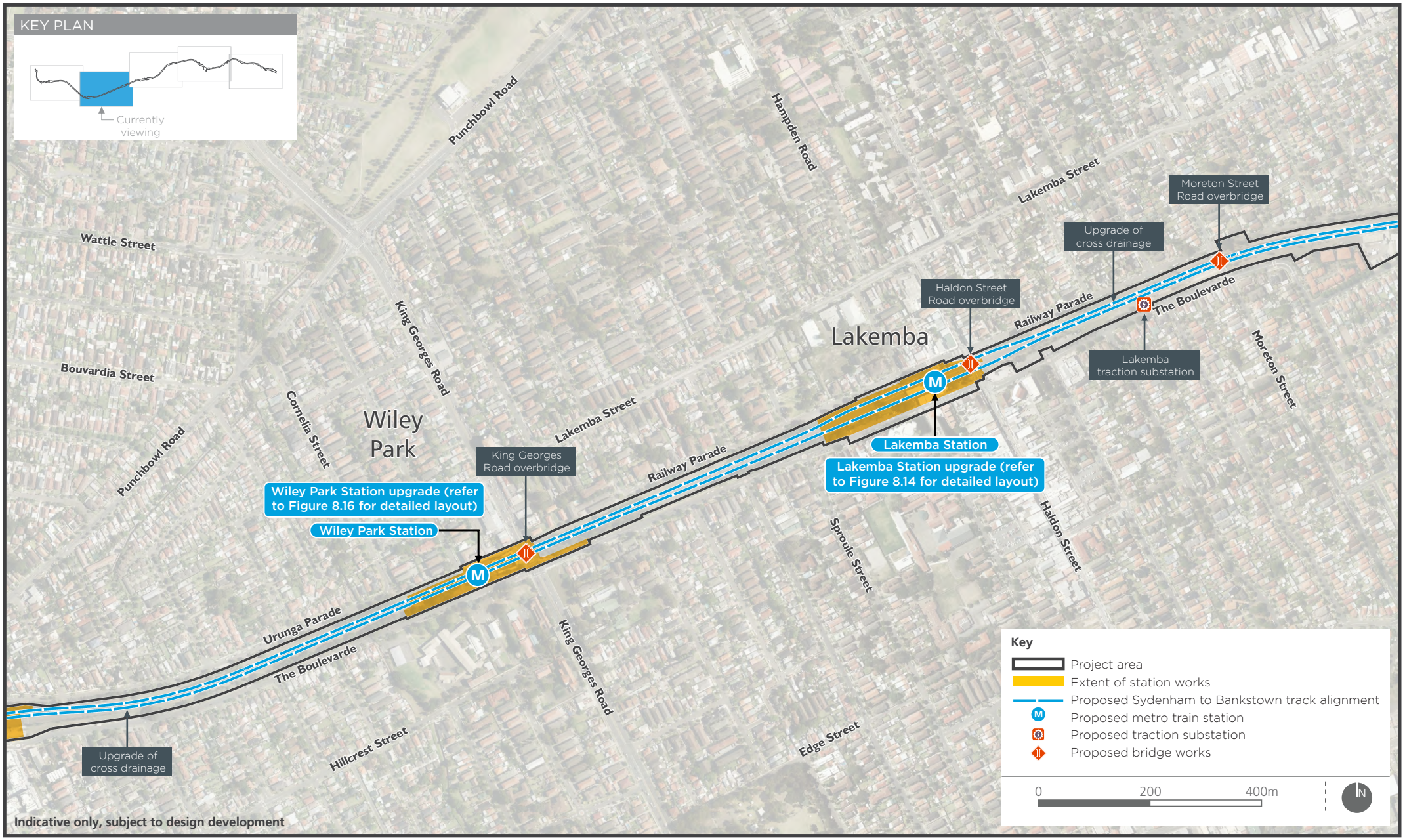
FIGURE 8.1



sydney METRO | city & southwest

Project infrastructure and features - map 3

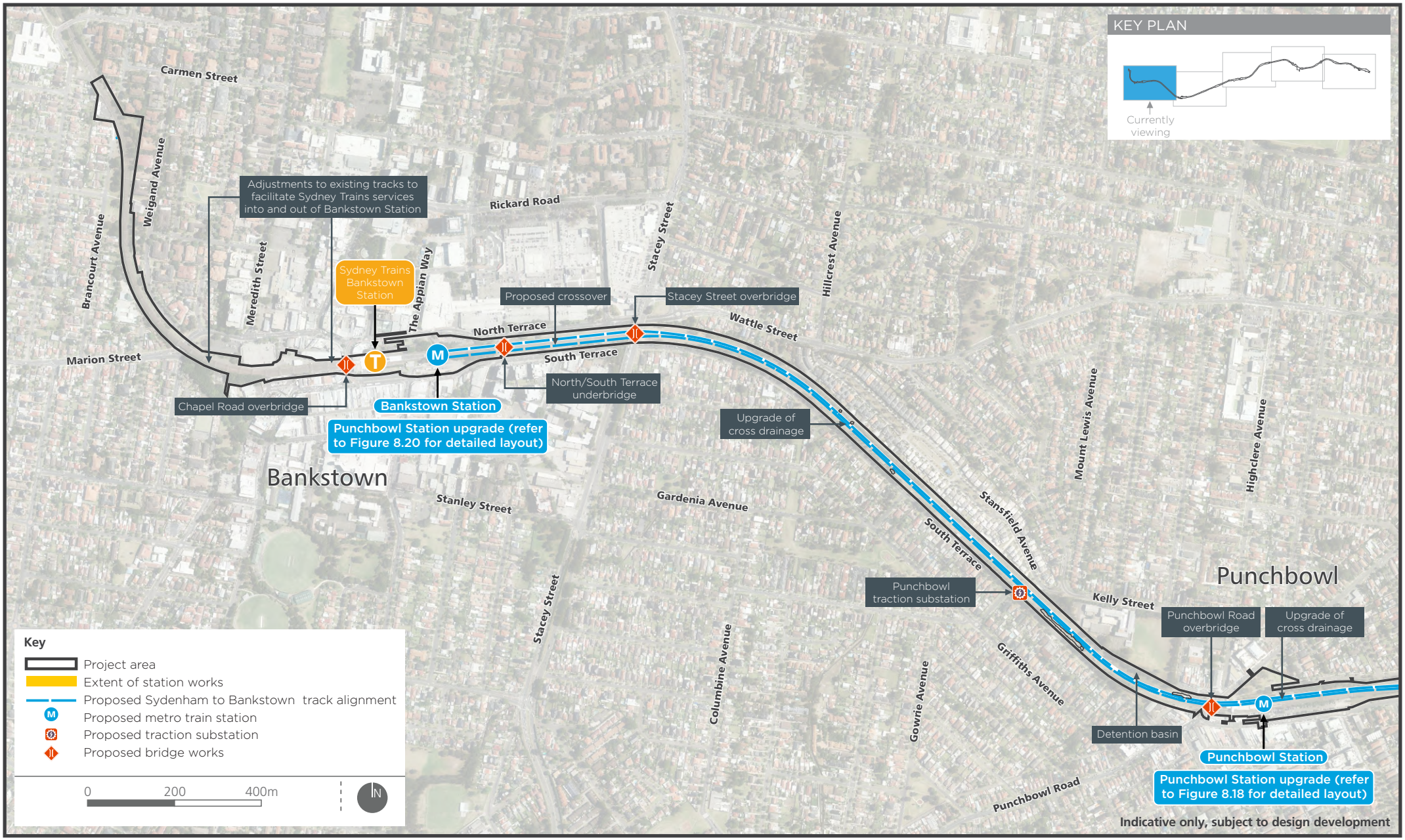
FIGURE 8.1



sydney METRO | city & southwest

Project infrastructure and features - map 4

FIGURE 8.1



Project infrastructure and features - map 5

FIGURE 8.1

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.

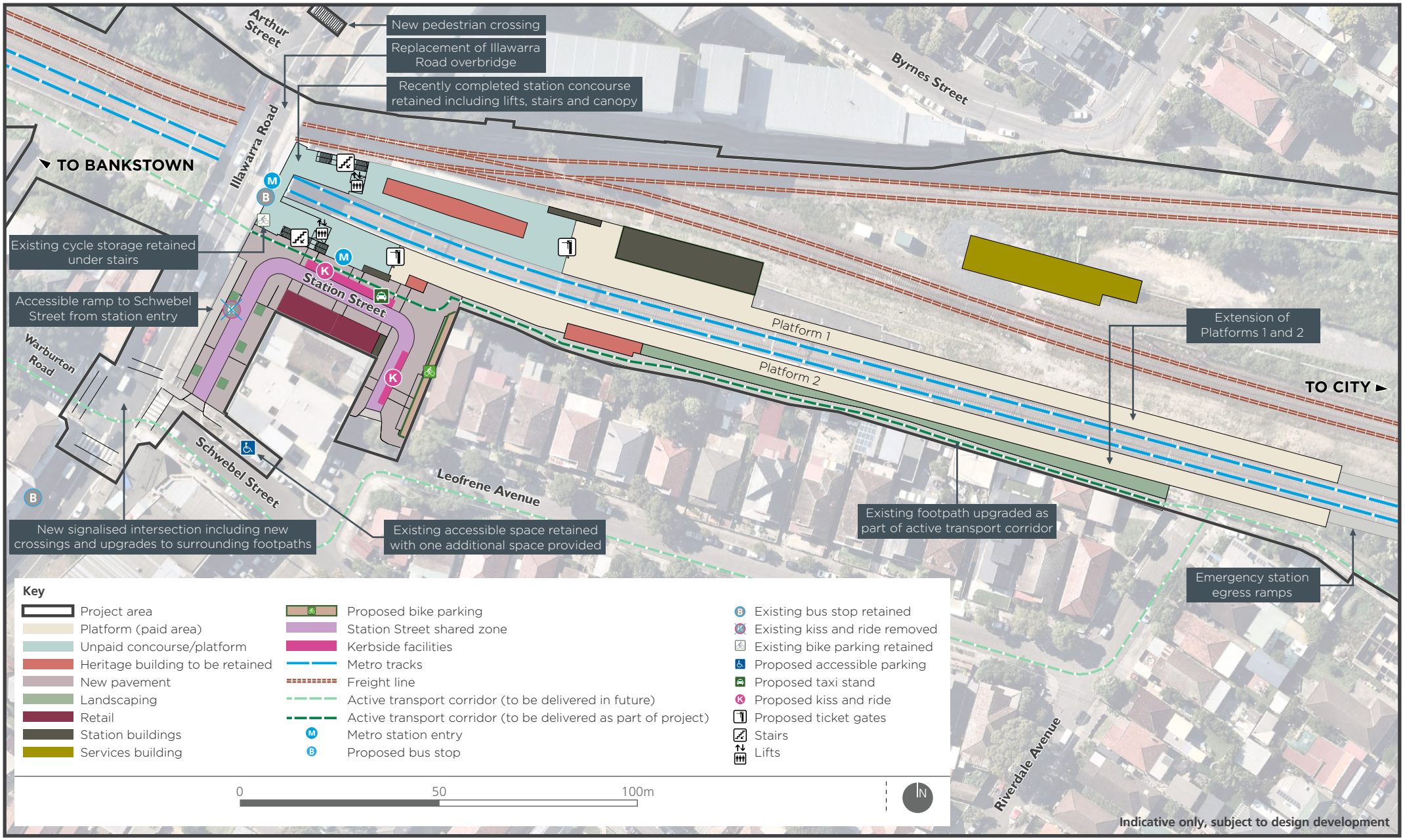
Marrickville Station

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	• 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	• The existing heritage listed platforms would be straightened and extended to the east.
Station buildings	• 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	• 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	• 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	• 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	• Loss of two on-street parking space on Schwebel Street due to new kerbside facilities.



sydney METRO | city & southwest

Marrickville Station - indicative layout of key design elements

FIGURE 8.2

sydney METRO | city & southwest

Marrickville Station - artist's impression

FIGURE 8.3

Dulwich Hill Station

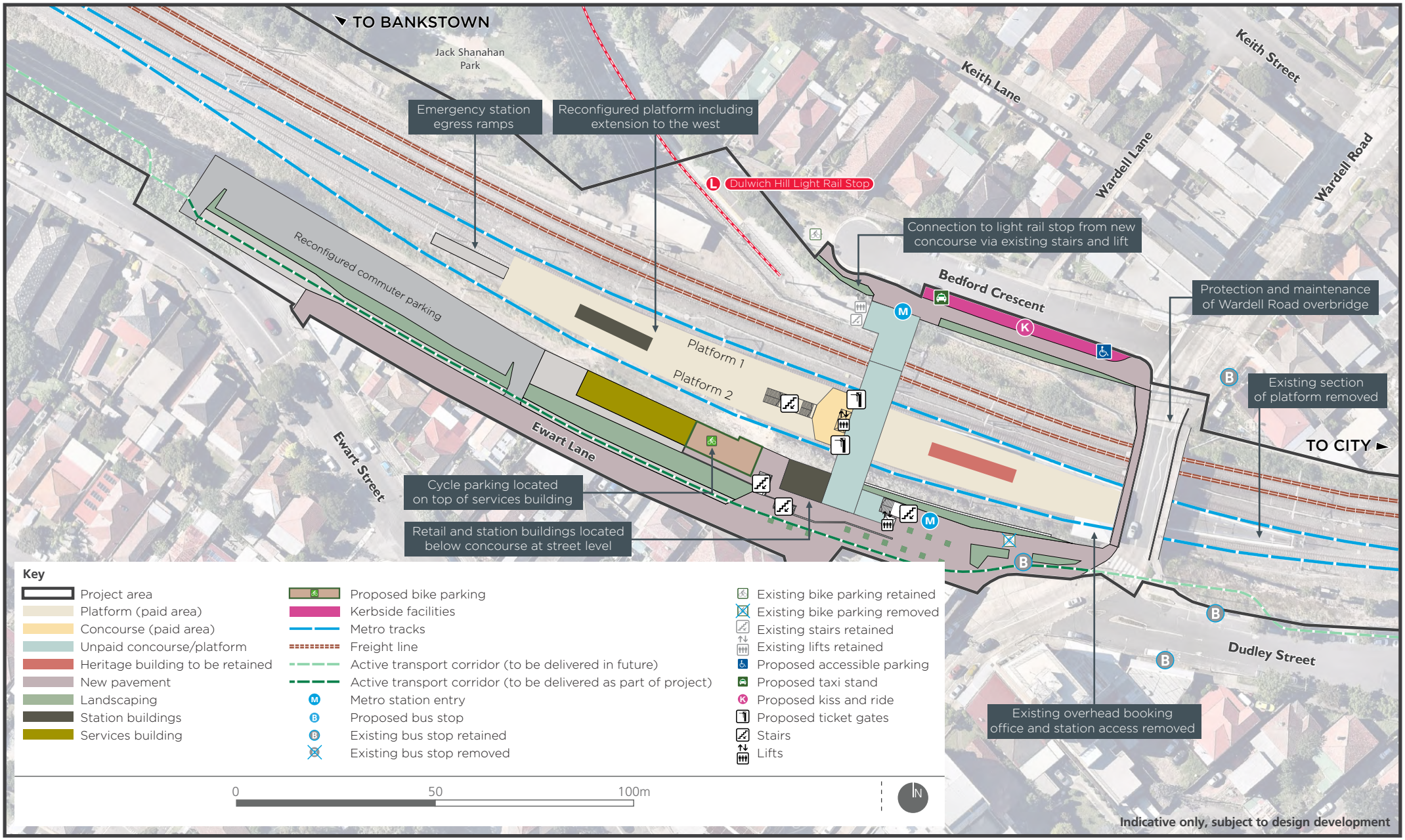
Dulwich Hill Station is located west of the Wardell Road overbridge. The station area is bounded by Bedford Crescent to the north, Ewart Lane to the south, and Wardell Road to the east. The station entrance is on Wardell Road.

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	• 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	• 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	• 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	• 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	• 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	• 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	• Loss of 10 on-street parking spaces on Bedford Crescent due to new kerbside facilities.



sydney METRO | city & southwest

Dulwich Hill Station - indicative layout of key design elements

FIGURE 8.4

sydney METRO | city & southwest

Dulwich Hill Station - artist's impression

FIGURE 8.5

Hurlstone Park Station

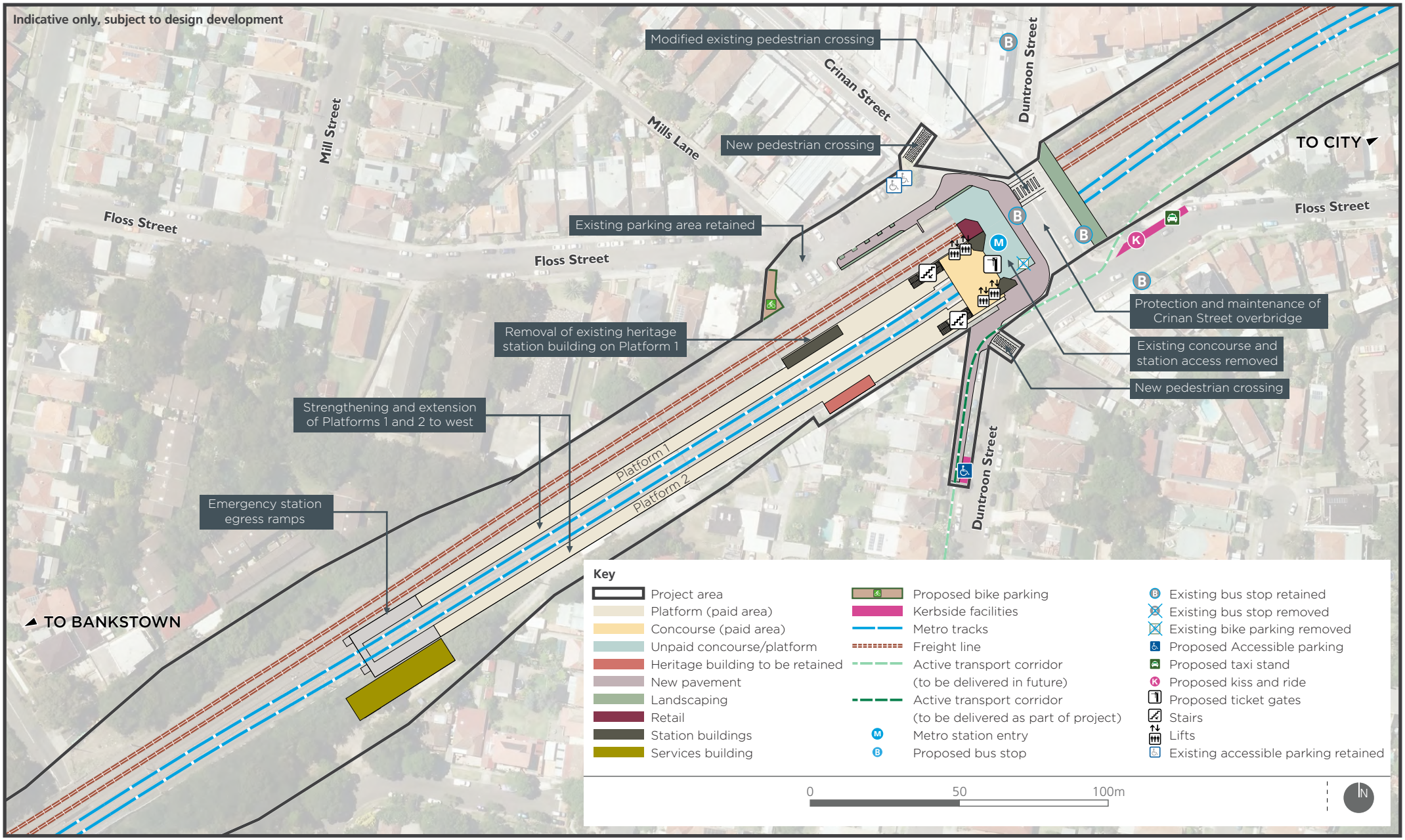
Hurlstone Park Station is located to the west of the Crinian Street overbridge. The station area is bounded by Crinian and Floss streets and residential dwellings to the north, Duntroon Street and residential dwellings to the south, and Crinian Street to the west (on the bridge). The station entrance 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	• 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	• Heritage listed platforms would be rebuilt, straightened, and extended to the south-west along the rail corridor, generally in their existing locations.
Station buildings	• 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	• The existing bus stops on the overbridge would be retained.
Access	• 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	• 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	• Loss of five on-street parking spaces on Duntroon Street (south) and Floss Street (east) due to new kerbside facilities.



sydney METRO | city & southwest

Hurlstone Park Station - indicative layout of key design elements

FIGURE 8.6

sydney METRO | city & southwest

Hurlstone Park Station - artist's impression

FIGURE 8.7

Canterbury Station

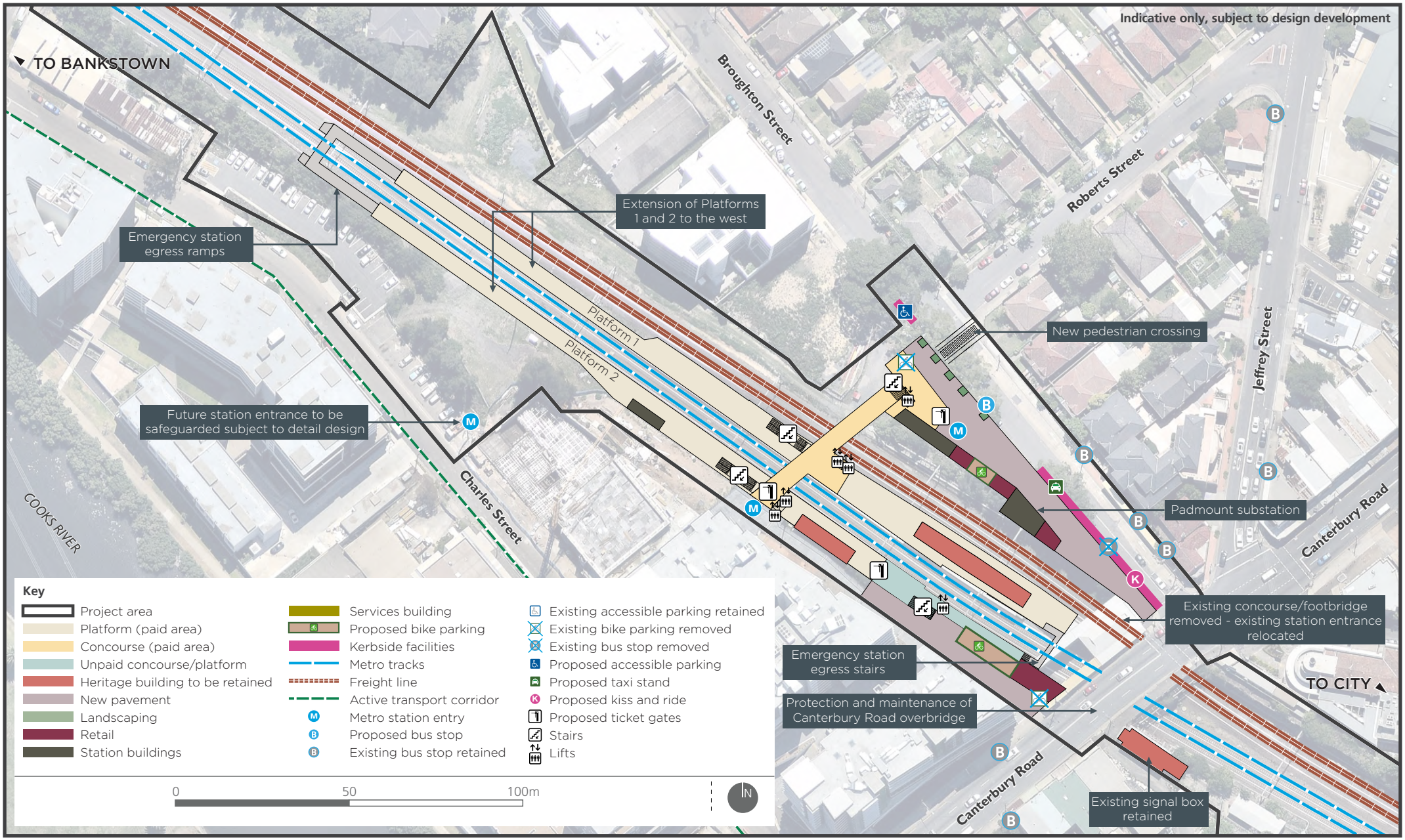
Canterbury Station is located to the north-west of the Canterbury Road overbridge. The station area is bounded by Broughton Street to the north, a large mixed use development fronting Charles Street to the south, and Canterbury Road to the east. The station entrance is on Canterbury Road.

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	• 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	• The heritage listed platforms would be rebuilt and extended to the north-west.
Station buildings	• 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	• 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	• 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	• 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	• Loss of two on-street parking spaces on Broughton Street to provide new accessible parking spaces.



sydney METRO | city & southwest

Canterbury Station - indicative layout of key design elements

FIGURE 8.8

sydney METRO | city & southwest

Canterbury Station - artist's impression

FIGURE 8.9

Campsie Station

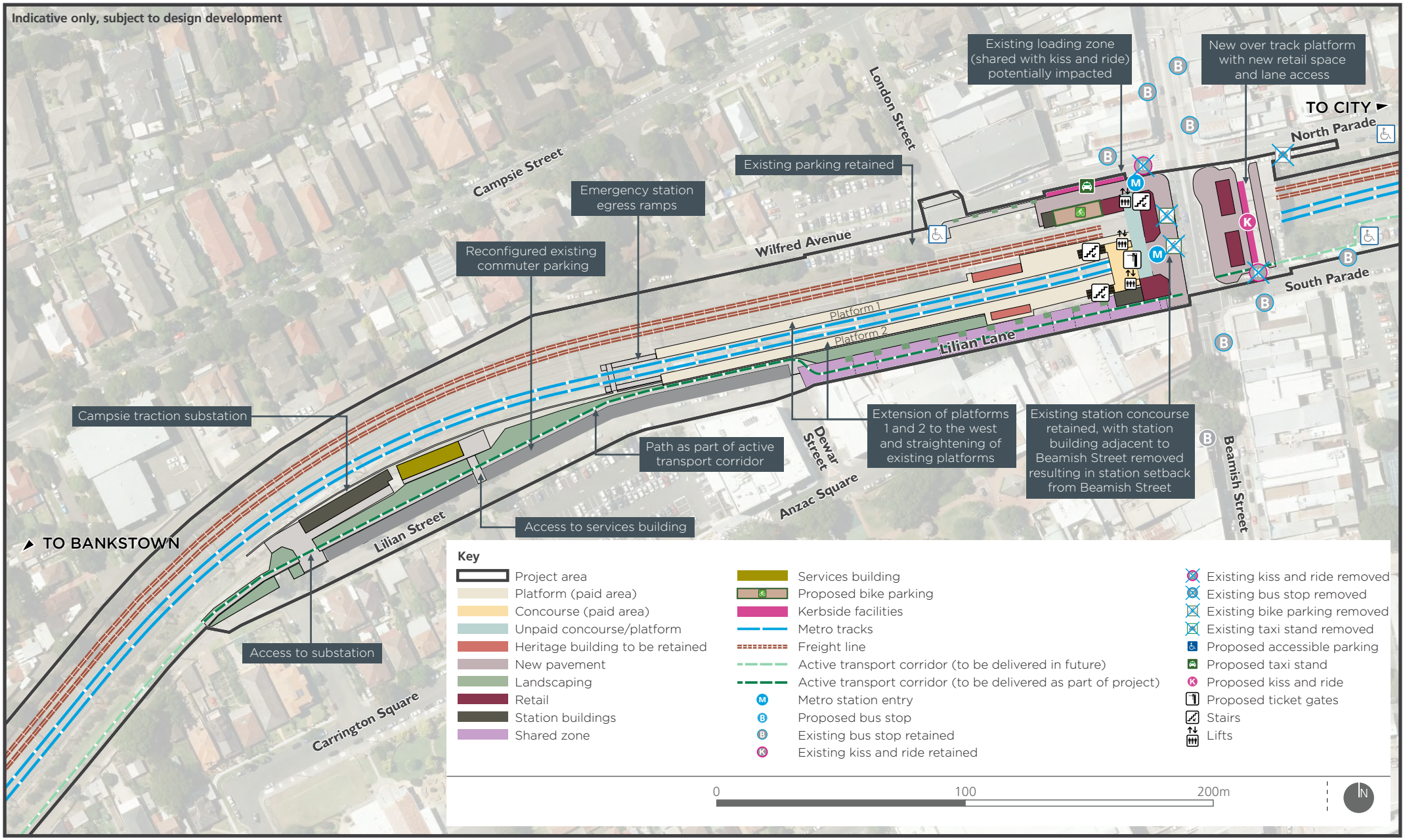
Campsie Station is located to the west of the Beamish Street overbridge. The station area is bounded by Lilian Lane/South Parade to the south, Wilfred Avenue/North Parade to the north, and Beamish Street to the east. The station entrance is located on the overbridge.

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	• 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	• The heritage listed platforms would be rebuilt, straightened and extended to the west.
Station buildings	• 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	• Existing bus stops located in the vicinity of the station would be retained.
Access	• 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	• 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	• 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.



sydney METRO | city & southwest

Campsie Station - indicative layout of key design elements

FIGURE 8.10

sydney METRO | city & southwest

Campsie Station - artist's impression

FIGURE 8.11

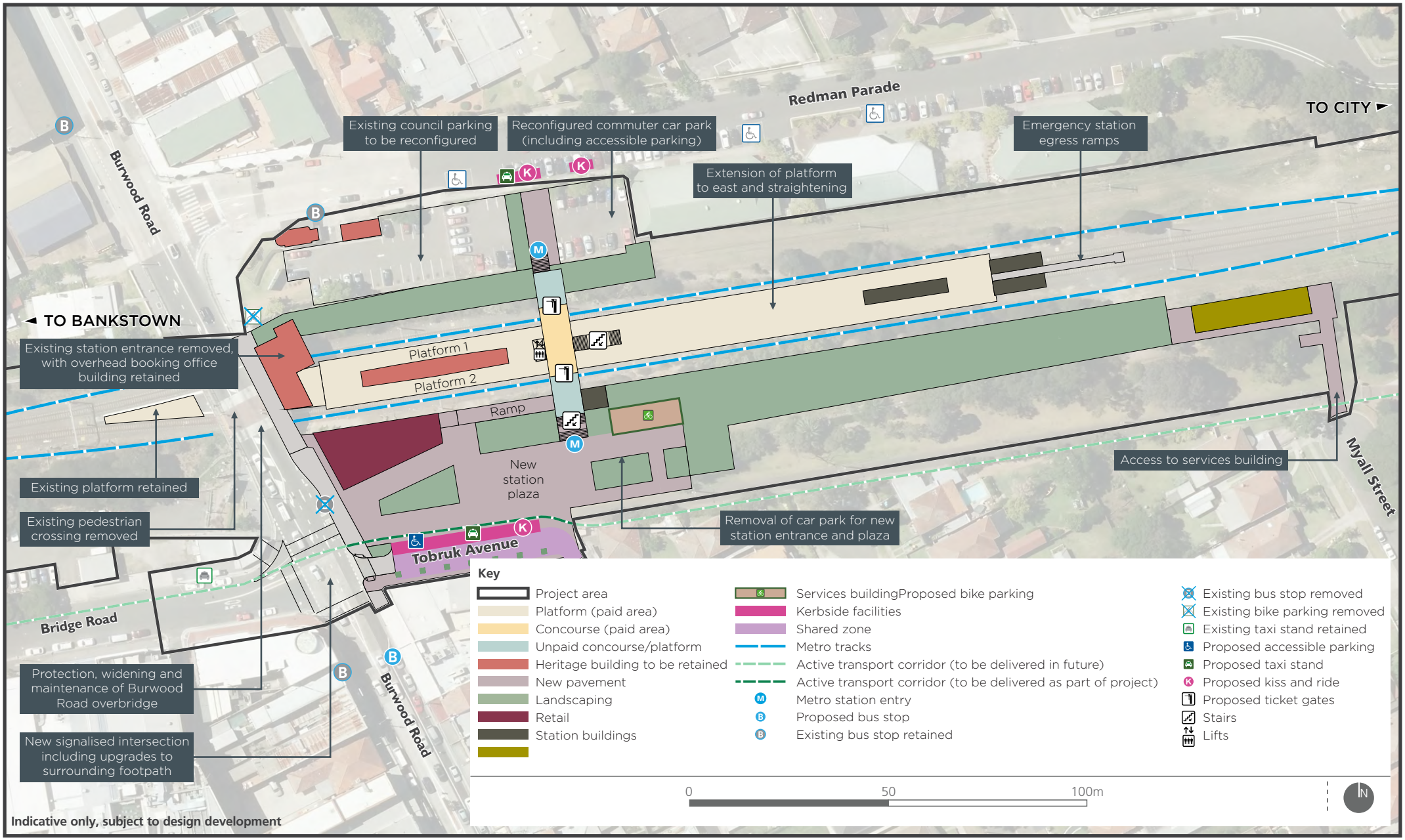
Belmore Station

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	• 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	• The heritage listed platforms would be rebuilt, straightened and extended to the east.
Station buildings	• 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	• 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	• 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	• 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	• 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



sydney METRO | city & southwest

Belmore Station - indicative layout of key design elements

FIGURE 8.12

sydney METRO | city & southwest

Belmore Station - artist's impression

FIGURE 8.13

Lakemba Station

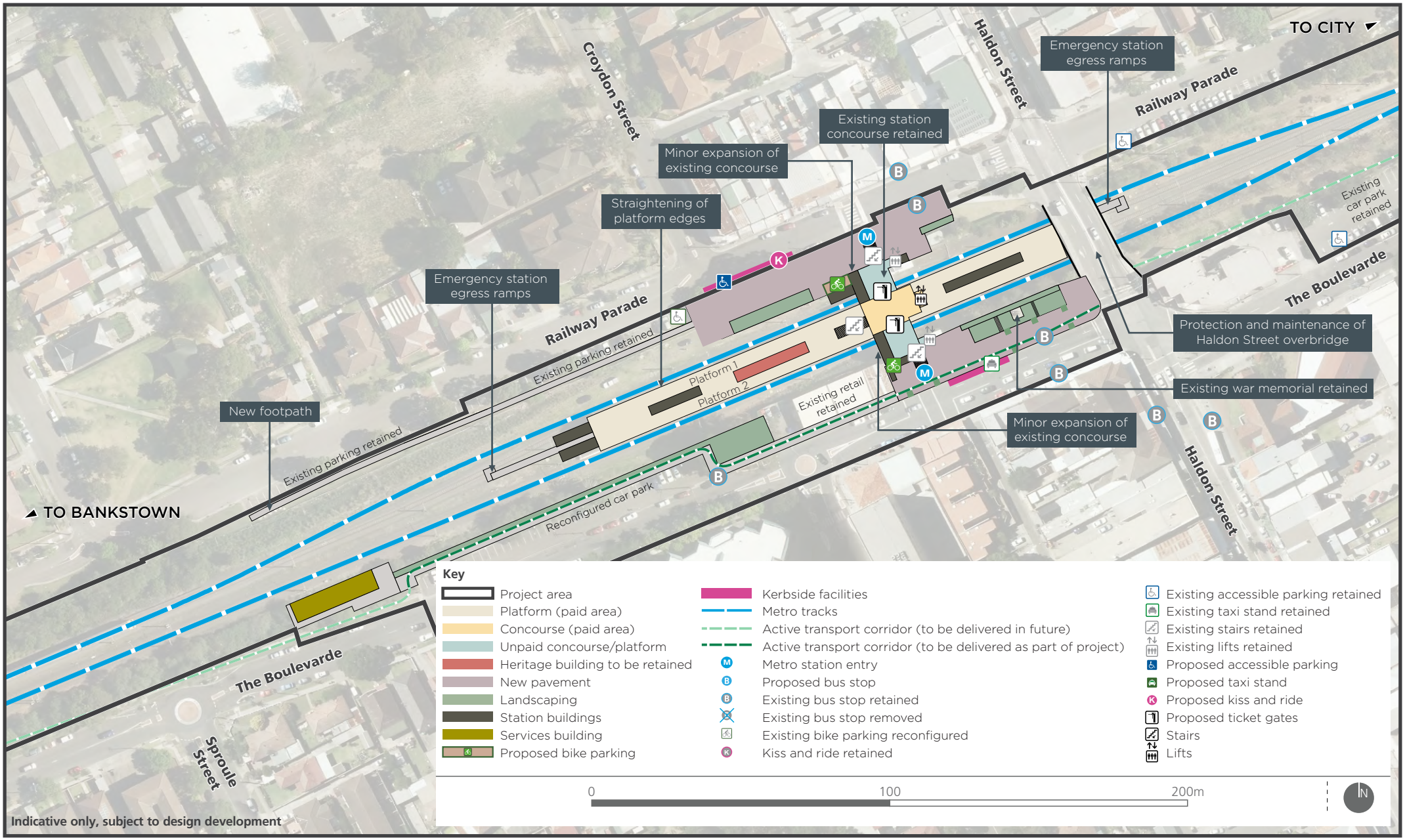
Lakemba Station is located about 60 metres to the west of the Haldon Street overbridge. The station area is bounded by Railway Parade to the north and The Boulevarde to the south. Access to the station is provided off Railway Parade and The Boulevarde.

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	• 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	• The heritage listed platform would be rebuilt and straightened.
Station buildings	• 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	• The existing bus stops located on The Boulevarde, Railway Parade, and Haldon Street (south) would be retained.
Access	• 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	• 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	• Loss of seven spaces on Railway Parade due to the provision of kerbside facilities.



sydney METRO | city & southwest

Lakemba Station - indicative layout of key design elements

FIGURE 8.14

sydney METRO | city & southwest

Lakemba Station - artist's impression

FIGURE 8.15

Wiley Park Station

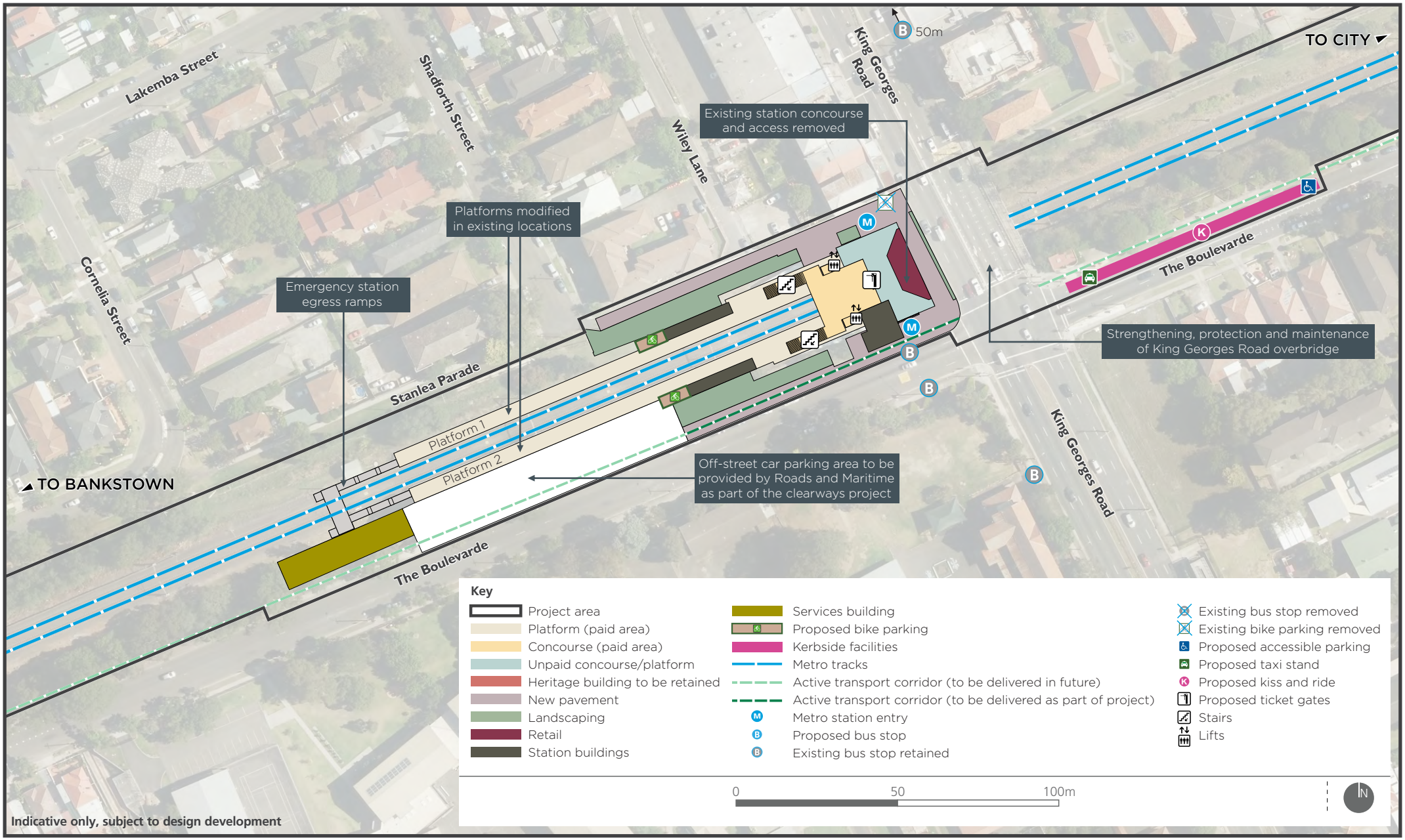
Wiley Park Station is located to the west of the King Georges Road overbridge. The station area is bounded by Stanlea Parade walkway to the north, by King Georges Road to the east and The Boulevarde to the south. The station entrance is located on the overbridge.

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	• 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	• The heritage listed platform would be rebuilt, straightened and extended to the west.
Station buildings	• 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	• No changes would be made to existing bus stops.
Access	• 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	• 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	• 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.



sydney METRO | city & southwest

Wiley Park Station - indicative layout of key design elements

FIGURE 8.16

sydney METRO | city & southwest

Wiley Park Station - artist's impression

FIGURE 8.17

Punchbowl Station

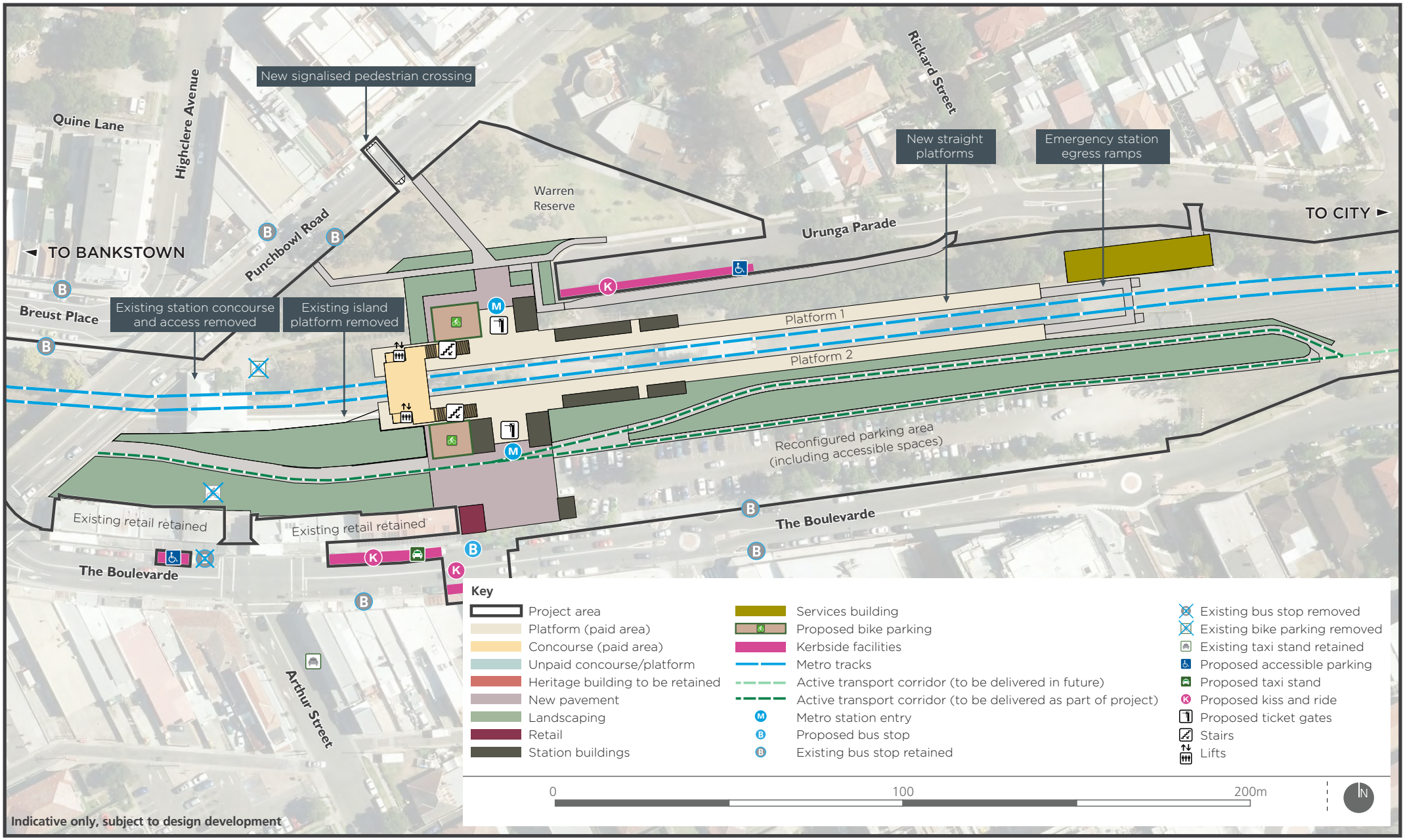
Punchbowl Station is located to the east of the Punchbowl Road overbridge. The station area is bounded by commercial land uses and a car park fronting The Boulevarde to the south, Warren Reserve and Urunga Parade to the north, and Punchbowl Road to the west. The station entrances are located on Punchbowl Road (via Warren Reserve) to the north, and The Boulevarde 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	• The existing station entrance would be removed. • Two new station entrances would be provided from The Boulevarde (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	• 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	• 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 Boulevarde (use of this space would be subject to separate approval).
Station area	
Public transport integration	• The existing bus stops on Punchbowl Road would be retained. • The existing eastbound bus stop on The Boulevarde would be relocated east of Arthur Street, adjacent to the new station entry.
Access	• Paths located in the vicinity of the station between the rail corridor and The Boulevarde would form part of an active transport corridor.
Kerbside uses, bike parking	• 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 Boulevarde 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	• The existing commuter car park located on the northern side of The Boulevarde would be reconfigured to maintain the availability of commuter parking. • Loss of 20 parking spaces on Urunga Parade and The Boulevarde due to the reconfiguration of kerbside facilities.



sydney METRO | city & southwest

Punchbowl Station - indicative layout of key design elements

FIGURE 8.18

sydney METRO | city & southwest

Punchbowl Station - artist's impression

FIGURE 8.19

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.

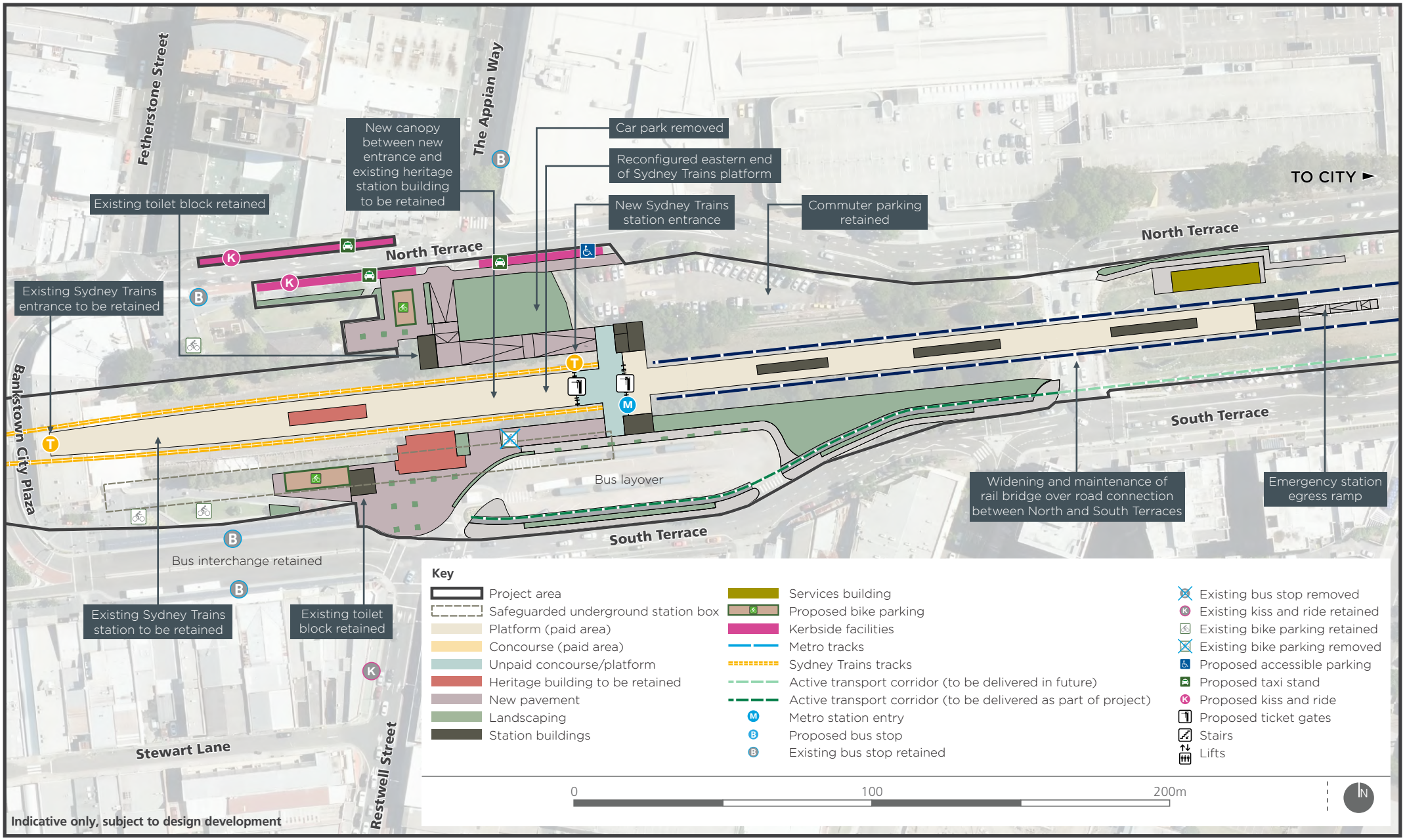
A new Sydney Metro station would be constructed to the east and adjoining the existing Sydney Trains Bankstown Station.

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	• 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	• 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	• 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	• 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	• 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	• 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	• Removal of existing car park located adjacent to the Appian Way off North Terrace, resulting in the loss of 10 off-street spaces.



sydney METRO | city & southwest

Bankstown Station - indicative layout of key design elements

FIGURE 8.20

sydney METRO | city & southwest

Bankstown Station - artist's impression

FIGURE 8.21

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.

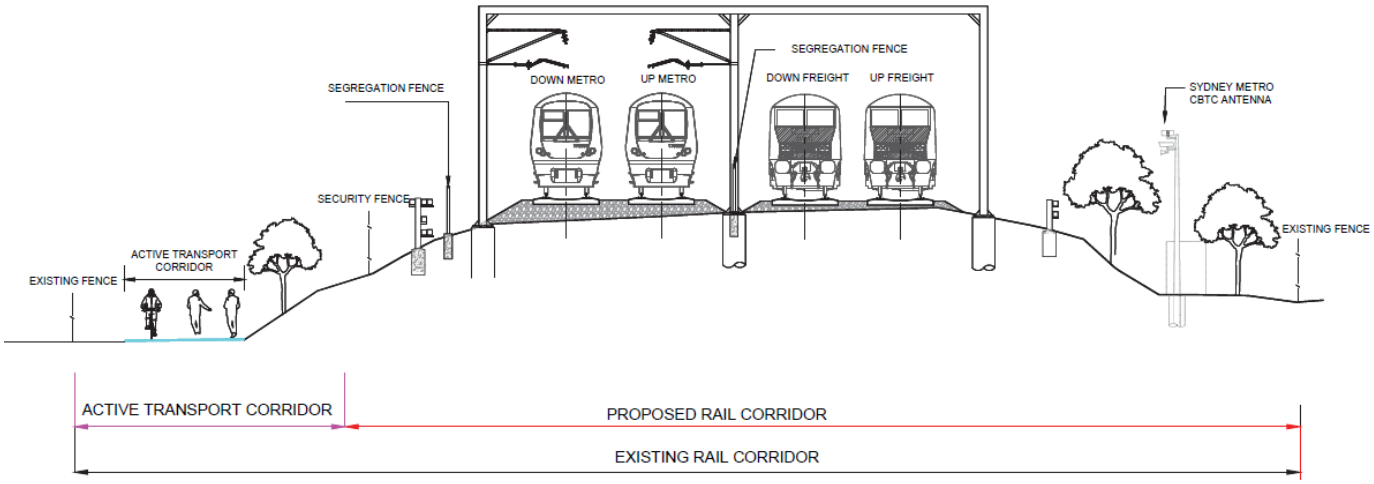


Figure 8.22 Indicative cross section of corridor

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.

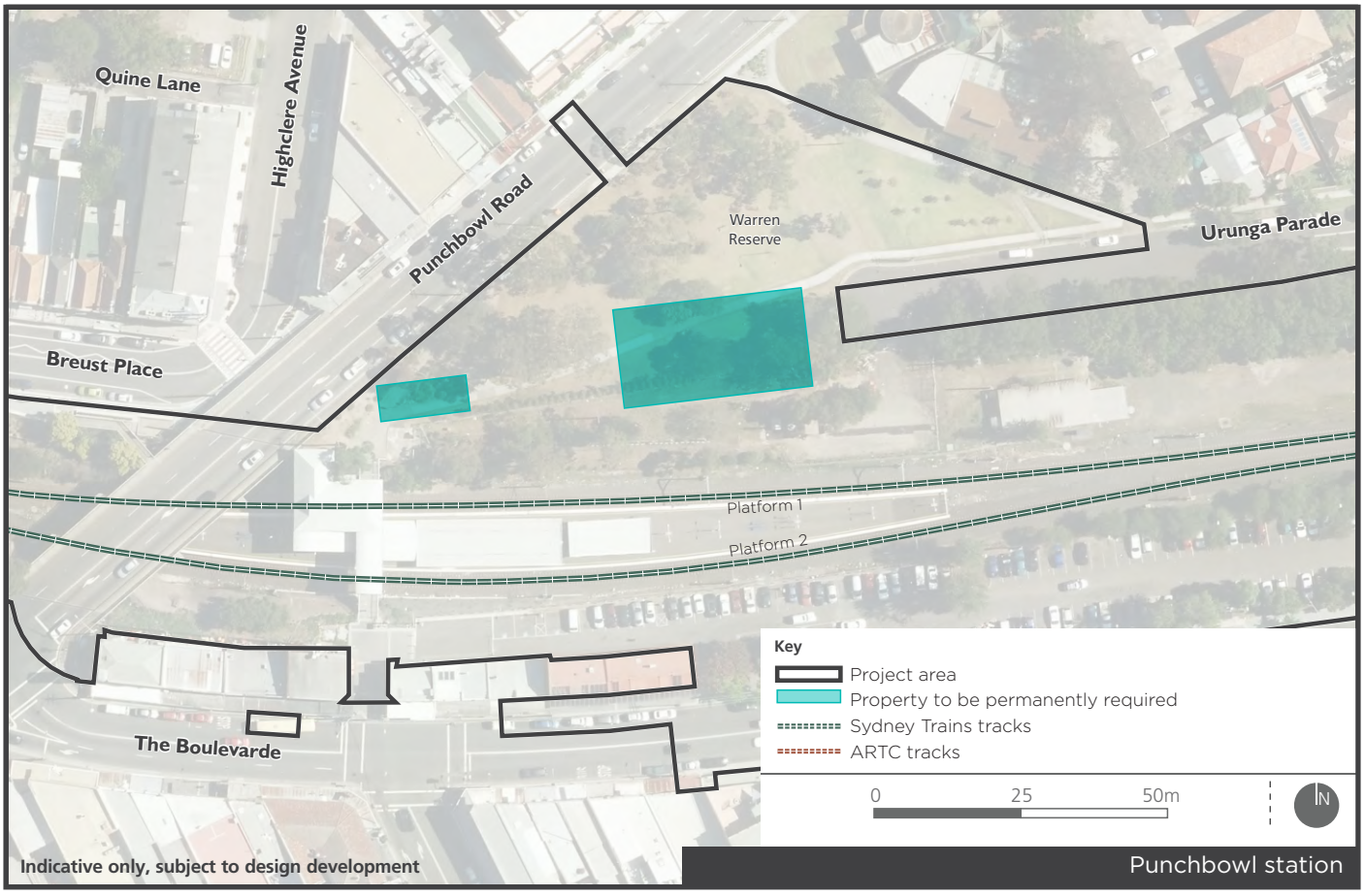
These leases are with the NSW Government (RailCorp) as the owner of the relevant buildings/spaces. All the impacted leases would be ceased in accordance with lease agreements held with the NSW Government.

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.



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Property acquisition at Marrickville and Punchbowl stations

FIGURE 8.23

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 Cudgegong 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 Cudgegong 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: • 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).

sydney METRO | city & southwest

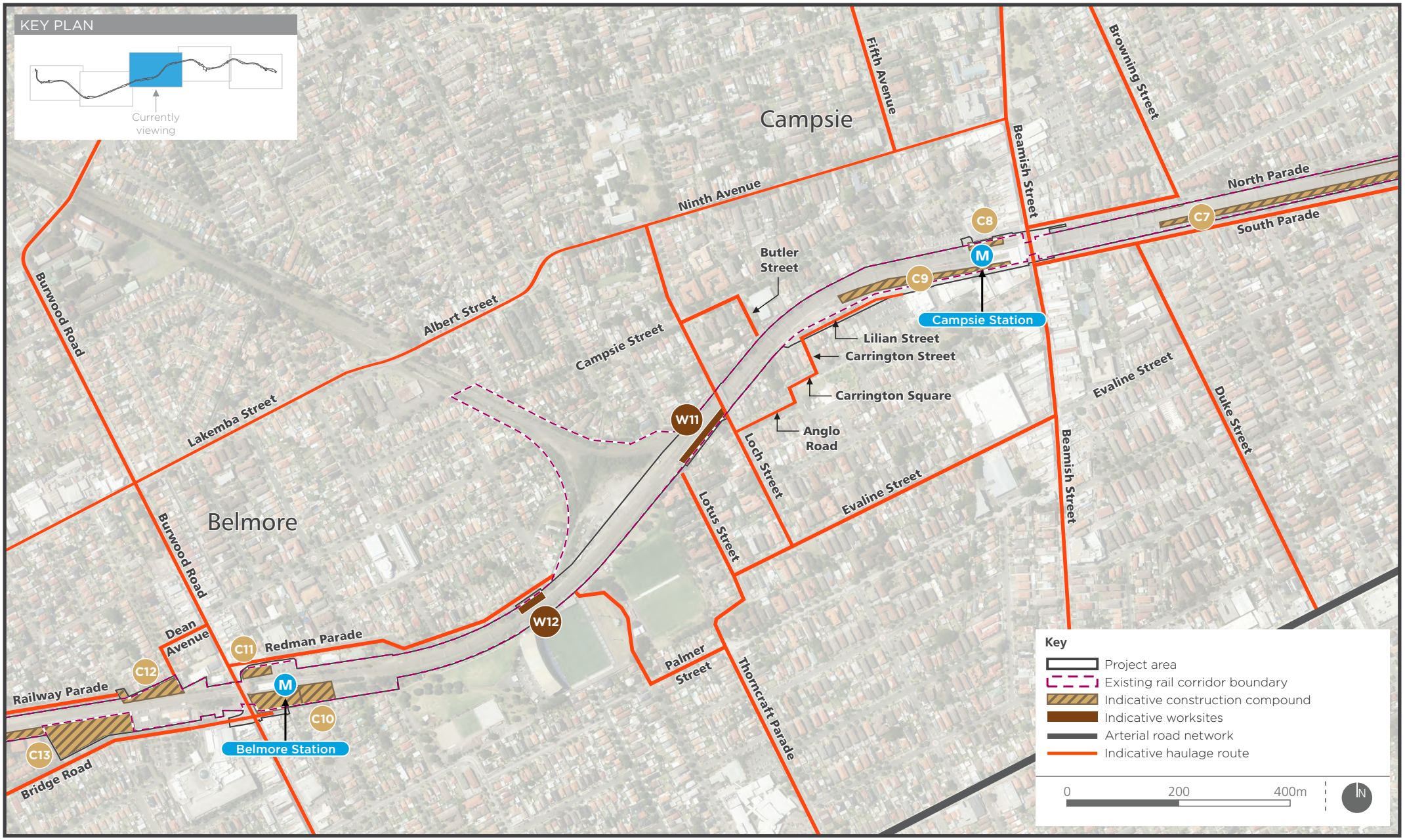
Project area - construction activities - map 1

FIGURE 9.1

sydney METRO | city & southwest

Project area - construction activities - map 2

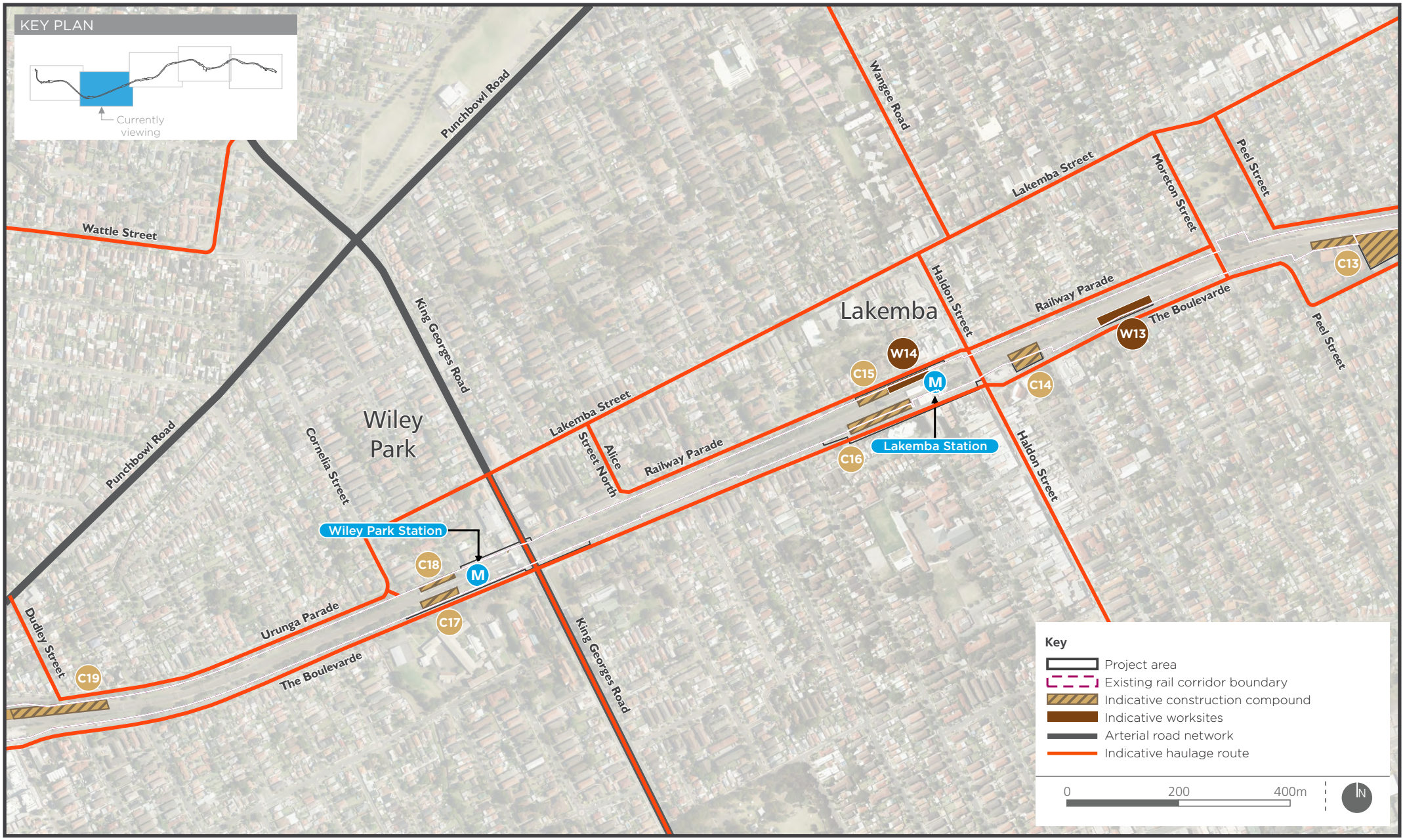
FIGURE 9.1



sydney METRO | city & southwest

Project area - construction activities - map 3

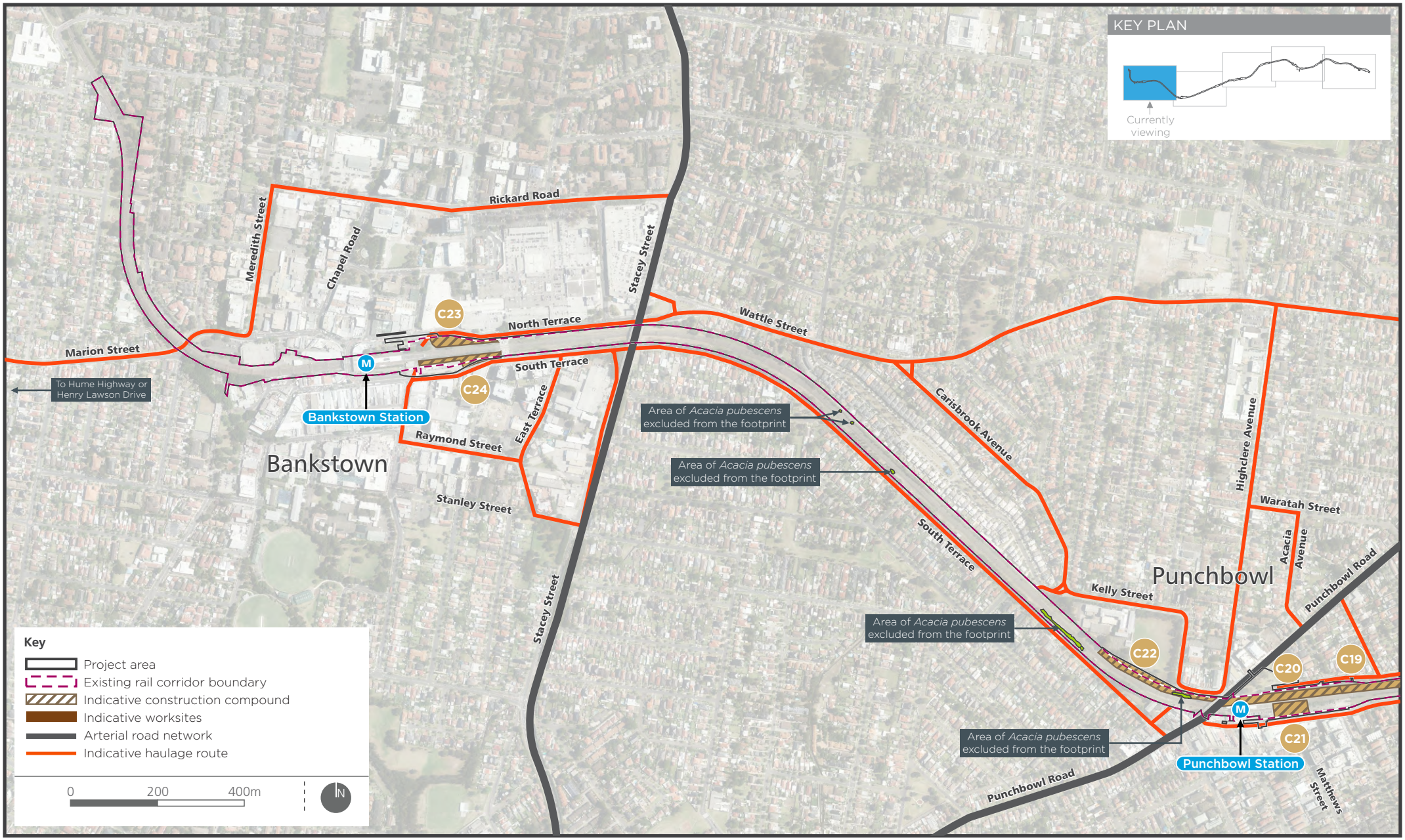
FIGURE 9.1



sydney METRO | city & southwest

Project area - construction activities - map 4

FIGURE 9.1



sydney METRO | city & southwest

Project area - construction activities - map 5

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.

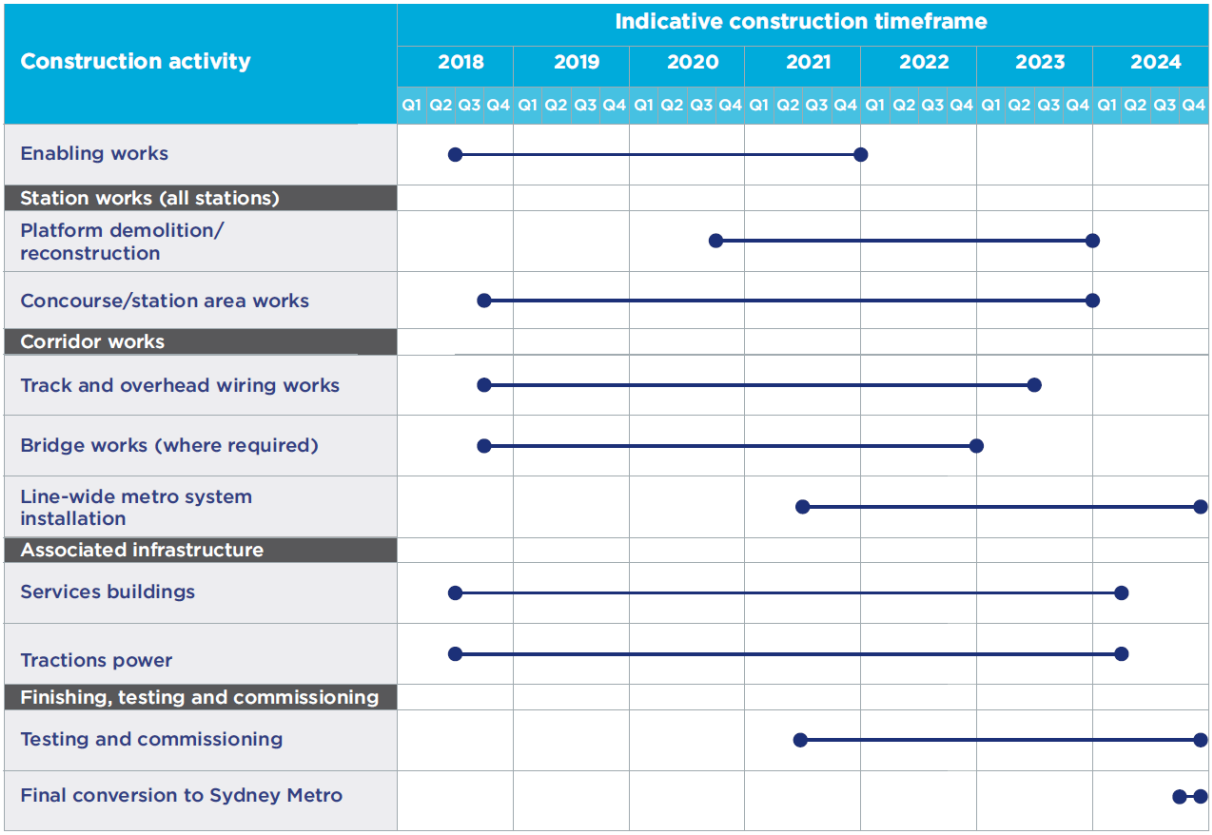


Figure 9.2 Indicative construction program for the project

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).

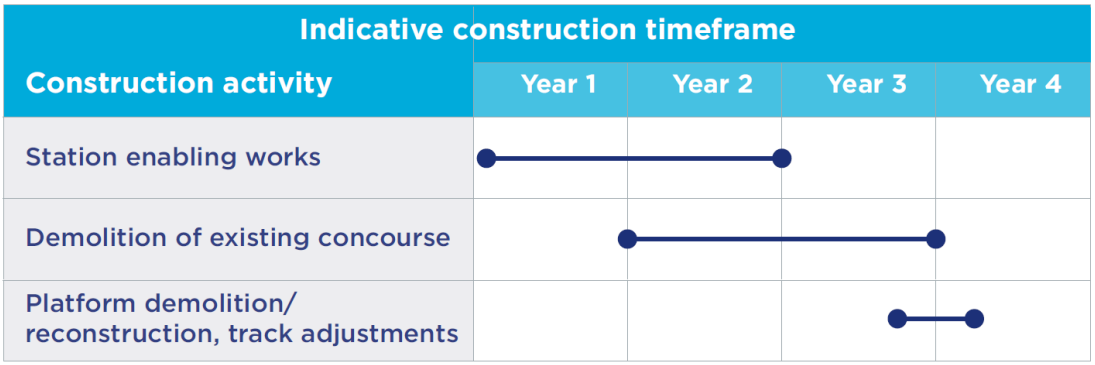


Figure 9.3 Indicative construction program for station works

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, whichwould 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.

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Indicative layout for work sites 2 and 8

FIGURE 9.4

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.

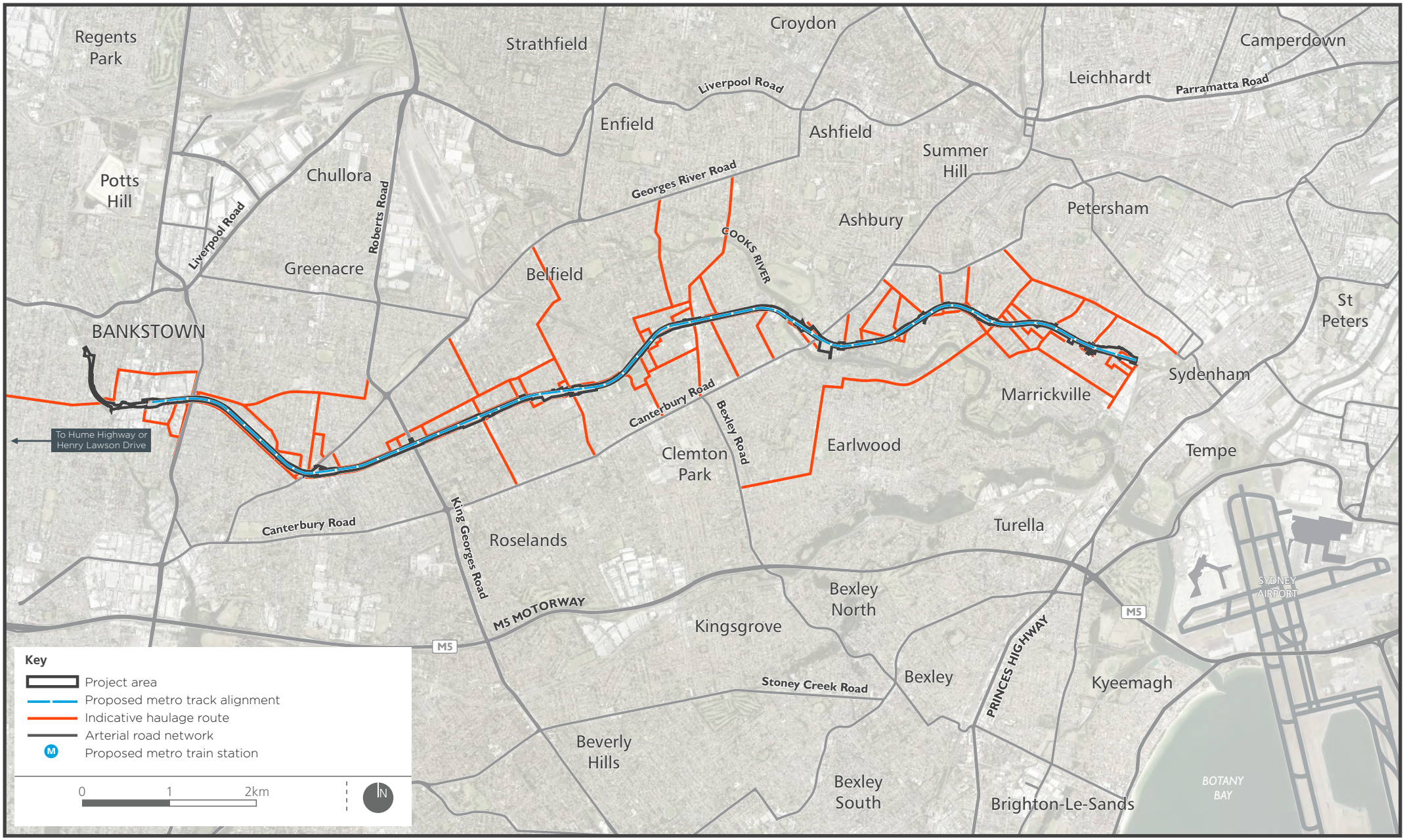
Estimated traffic volumes are summarised in Table 9.5. These volumes are indicative of possession periods when vehicle movements would be at their maximum. Vehicle volumes are expected to approximately halve during non-possession periods.

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

	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]	
Construction compound	**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.



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Preliminary haulage routes

FIGURE 9.6

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 protect.

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.

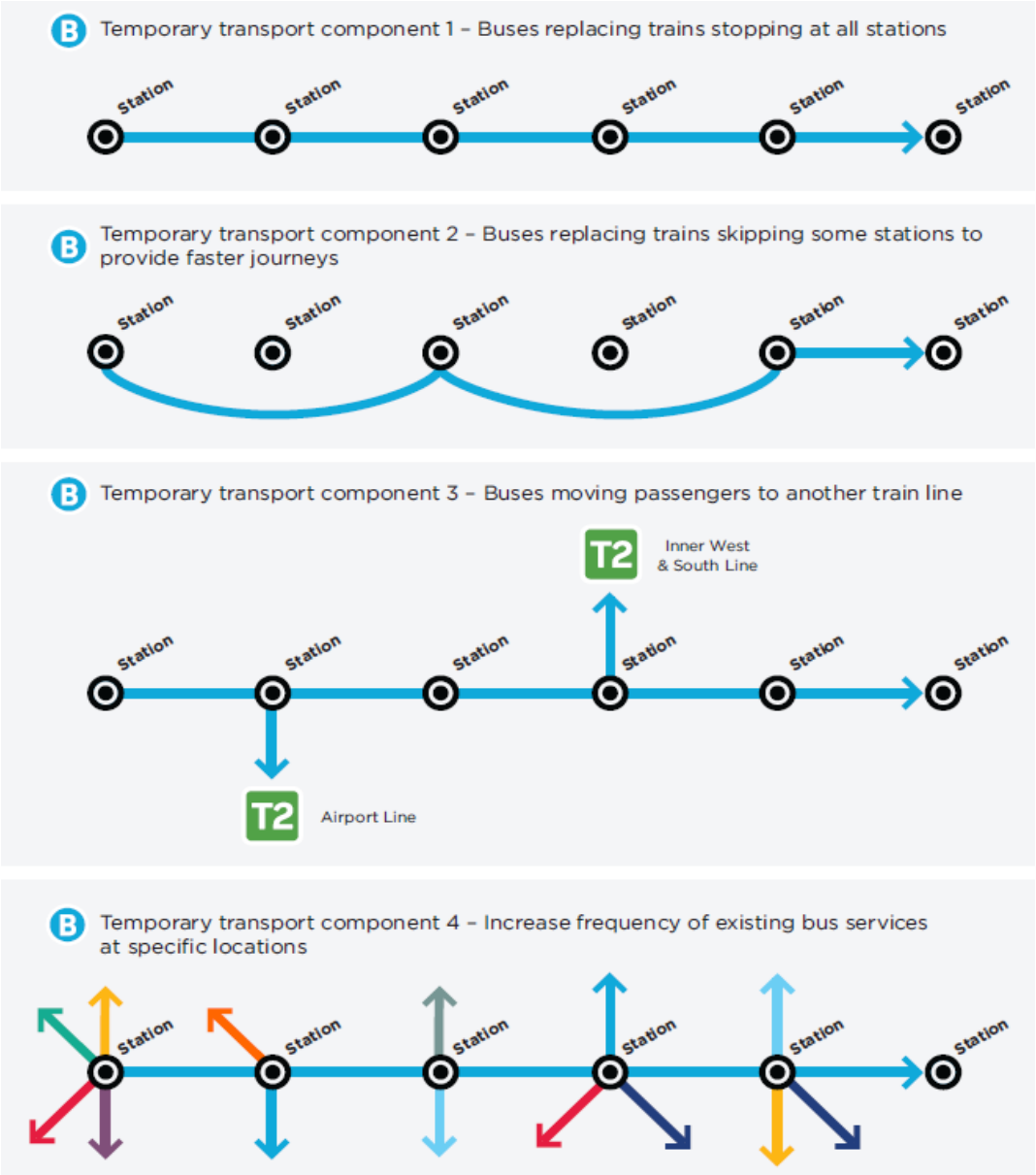

Figure 9.7 Temporary transport plan components