

SYDENHAM TO BANKSTOWN

SUBMISSIONS AND PREFERRED INFRASTRUCTURE REPORT

> Appendix B - Preferred project description

Transport for NSW
Sydney Metro City & Southwest
Sydenham to Bankstown upgrade
Submissions and Preferred Infrastructure Report
Preferred project description
Final

June 2018

Table of contents

1.	Preferred project description – operation	1
1.1	Preferred project infrastructure and features	1
1.2	Property requirements	37
1.3	Operation of the preferred project.....	38
2.	Preferred project description – construction	42
2.1	Overview	42
2.2	Enabling works.....	48
2.3	Station works.....	50
2.4	Corridor works.....	52
2.5	Associated infrastructure	53
2.6	Finishing, testing and commissioning	54
2.7	Construction program and timing.....	55
2.8	Construction compounds, work sites and access.....	59
2.9	Workforce and construction resources	67
2.10	Utilities management	70
2.11	Alternative transport arrangements.....	71

Table index

Table 1.1	Marrickville Station key design elements	9
Table 1.2	Dulwich Hill Station key design elements	12
Table 1.3	Hurlstone Park Station key design elements	15
Table 1.4	Canterbury Station key design elements	18
Table 1.5	Campsie Station key design elements.....	20
Table 1.6	Belmore Station key design elements	22
Table 1.7	Lakemba Station key design elements	24
Table 1.8	Wiley Park Station key design elements.....	26
Table 1.9	Punchbowl Station key design elements	29
Table 1.10	Bankstown Station key design elements	31
Table 1.11	Overbridges and underbridges where works are proposed.....	35
Table 2.1	Number of trees at stations with the potential to be impacted	51
Table 2.2	Construction compound locations.....	60
Table 2.3	Work sites located outside of the rail corridor.....	61
Table 2.4	Estimated construction traffic volumes during possession periods	67
Table 2.5	Indicative construction workforce estimates	67

Table 2.6	Indicative material and water usage estimates.....	68
Table 2.7	Indicative construction plant and equipment.....	69

Figure index

Figure 1.1	Preferred project infrastructure and features	2
Figure 1.2	Marrickville Station – indicative layout of key design elements	10
Figure 1.3	Marrickville Station – artist's impression	11
Figure 1.4	Dulwich Hill Station – indicative layout of key design elements	13
Figure 1.5	Dulwich Hill Station – artist's impression	14
Figure 1.6	Hurlstone Park Station – indicative layout of key design elements	16
Figure 1.7	Hurlstone Park Station – artist's impression	17
Figure 1.8	Canterbury Station – indicative layout of key design elements	19
Figure 1.9	Campsie Station – indicative layout of key design elements	21
Figure 1.10	Belmore Station – indicative layout of key design elements	23
Figure 1.11	Lakemba Station – indicative layout of key design elements	25
Figure 1.12	Wiley Park Station – indicative layout of key design elements	27
Figure 1.13	Wiley Park Station – artist impression	28
Figure 1.14	Punchbowl Station – indicative layout of key design elements	30
Figure 1.15	Bankstown Station – indicative layout of key design elements	32
Figure 1.16	Indicative Sydney Metro train interior	40
Figure 2.1	Preferred project area – construction activities.....	43
Figure 2.2	Indicative construction program for the preferred project	56
Figure 2.3	Indicative construction program for station works.....	56
Figure 2.4	Indicative layout for work site 7	63
Figure 2.5	Indicative hoarding to be used at compounds and work sites	65
Figure 2.6	Preliminary haulage routes	66
Figure 2.7	Temporary transport management plan components	74

1. Preferred project description – operation

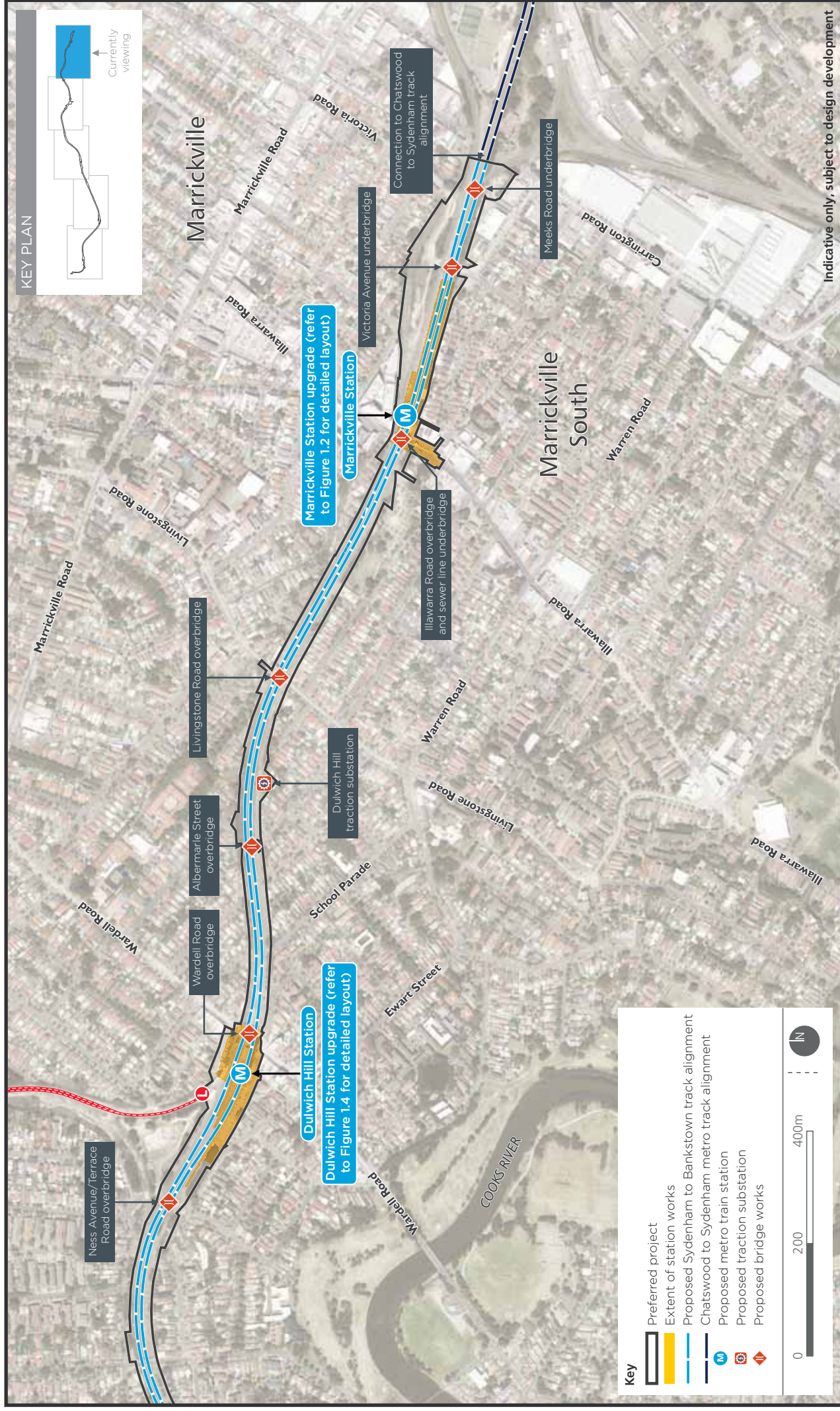
This section provides a description of the preferred project's operational features, and how the preferred project would operate. The preferred project's construction description is provided in Section 2.

1.1 Preferred project infrastructure and features

The main infrastructure and features that form part of the preferred project are described in this section, and are shown in Figure 1.1. These include:

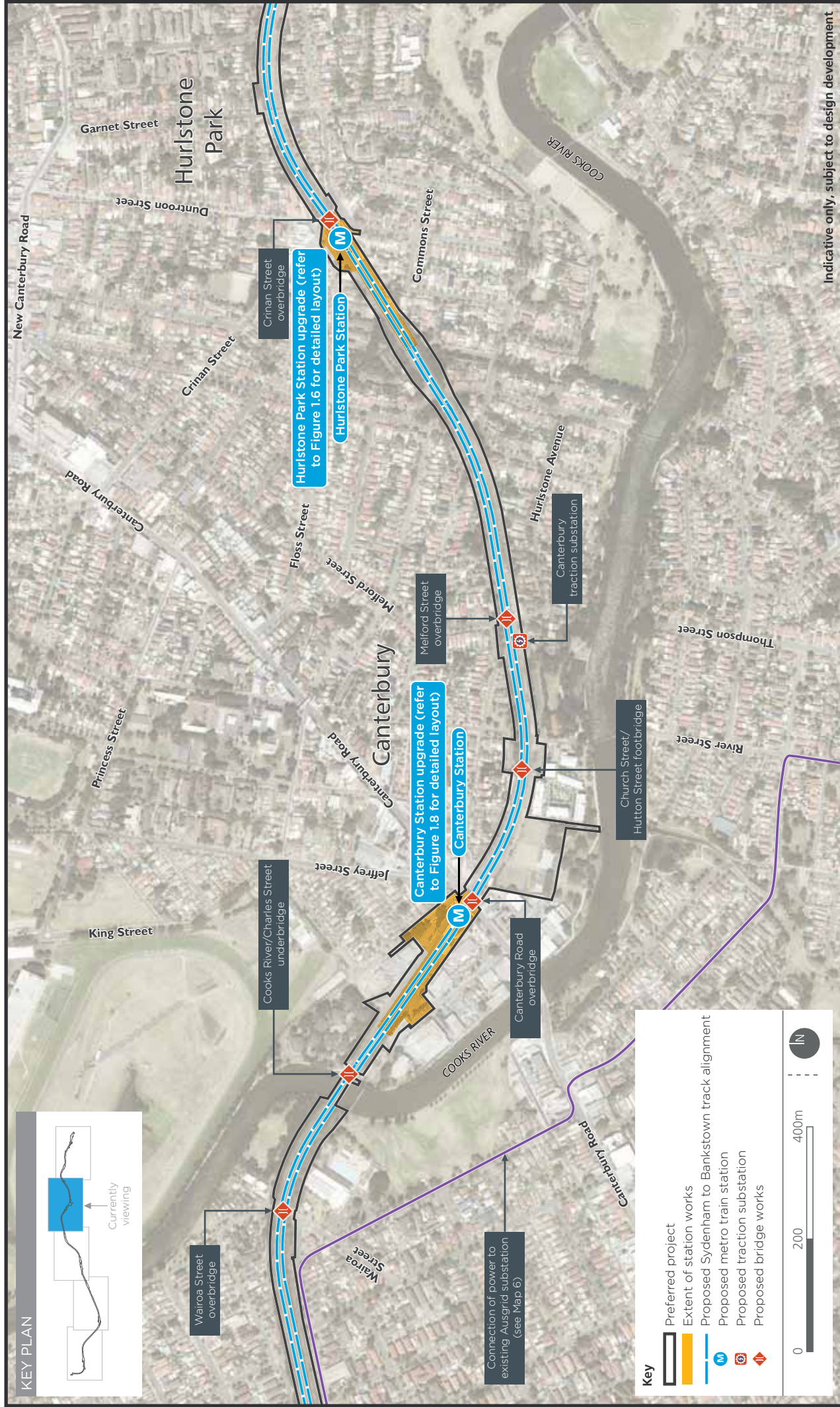
- works to upgrade the 10 stations and station areas between Marrickville and Bankstown (inclusive) and to provide lifts at stations where there are none currently
- works to allow for a metro service to Bankstown, including:
 - station works
 - track and rail system facility works
 - other works to support metro operations.

It is noted that the project scope described in this section 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 consultation with the community.



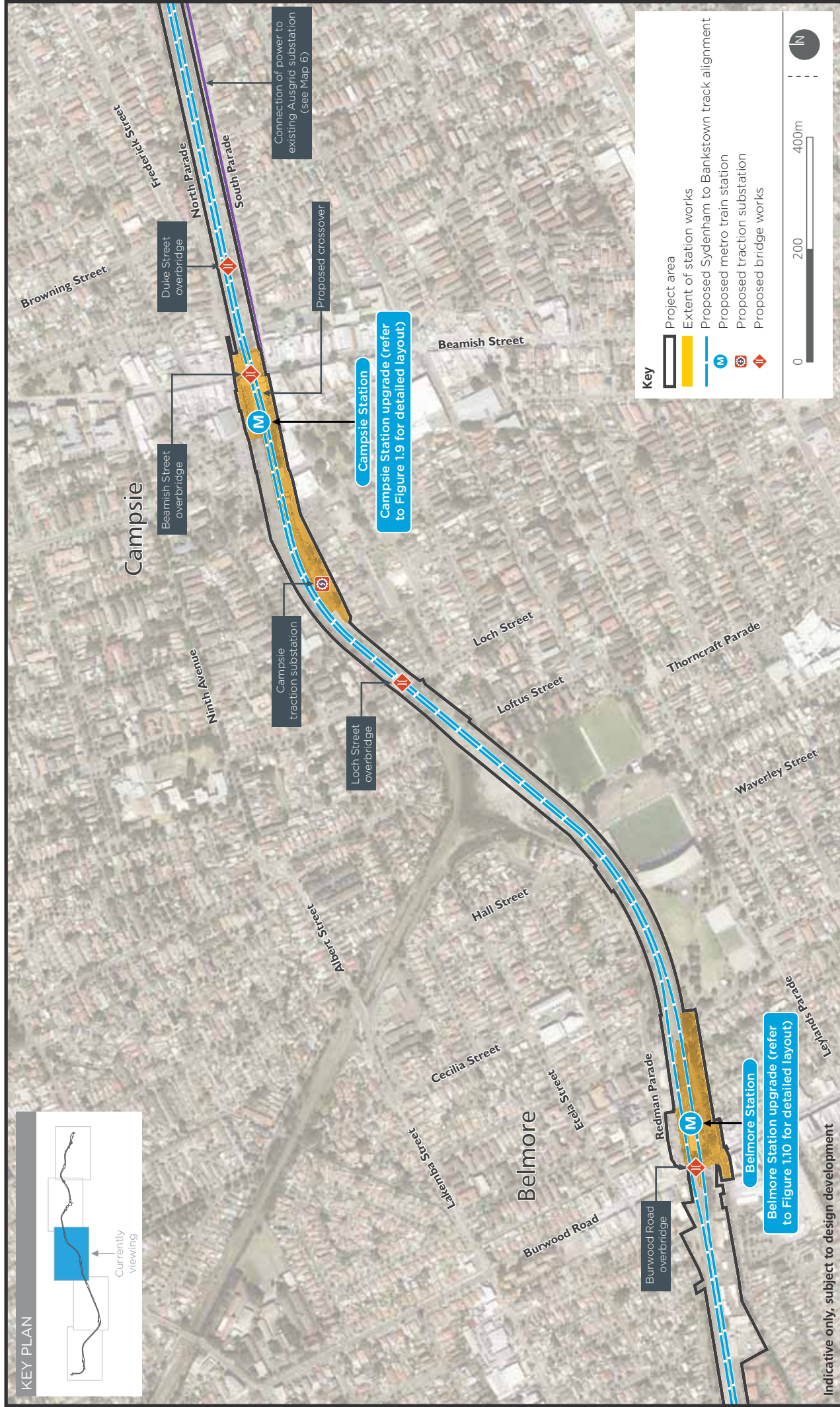
Preferred project infrastructure and features - map 1

FIGURE 1.1



Preferred project infrastructure and features - map 2

FIGURE 1.1



Preferred project infrastructure and features - map 3

FIGURE 1.1

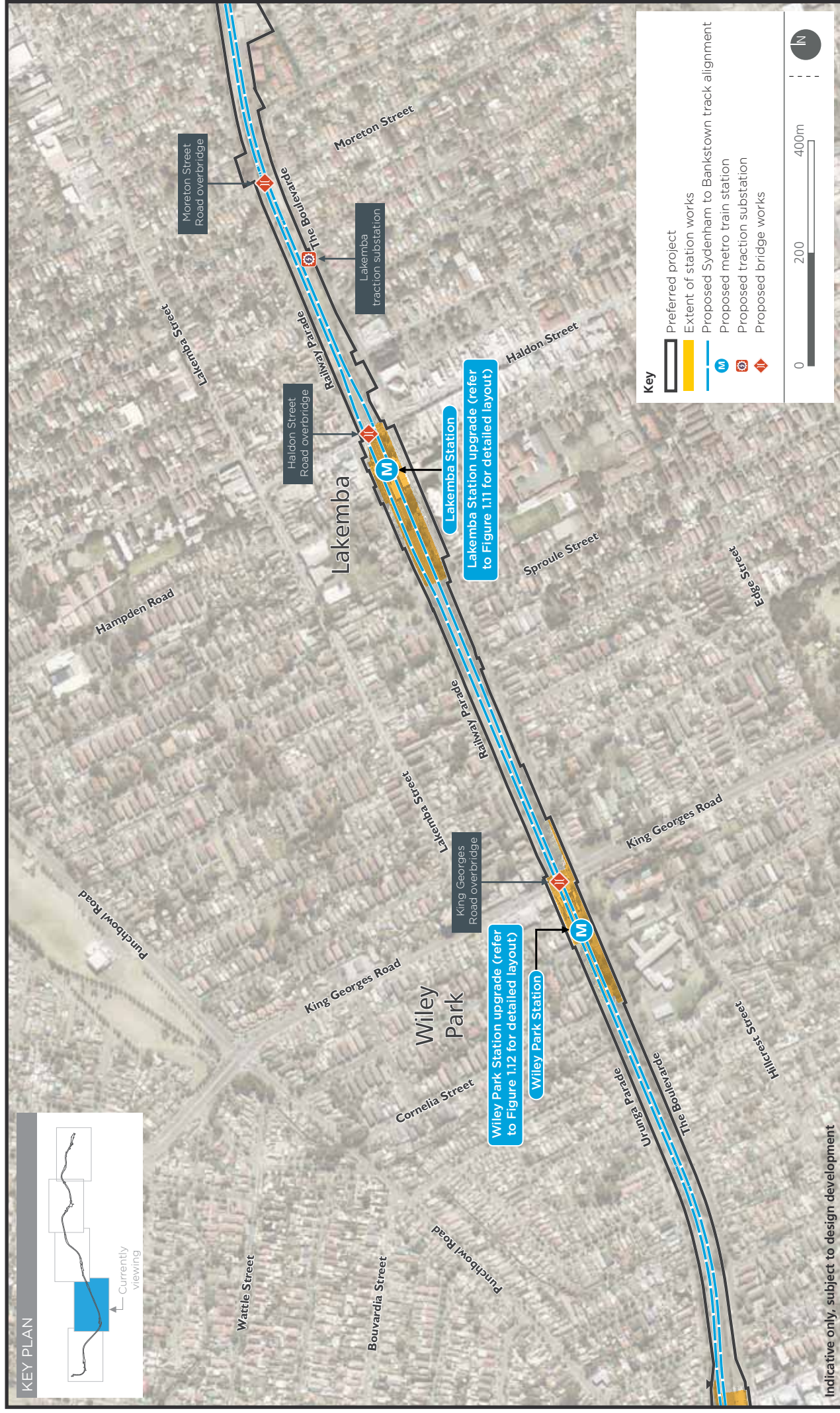
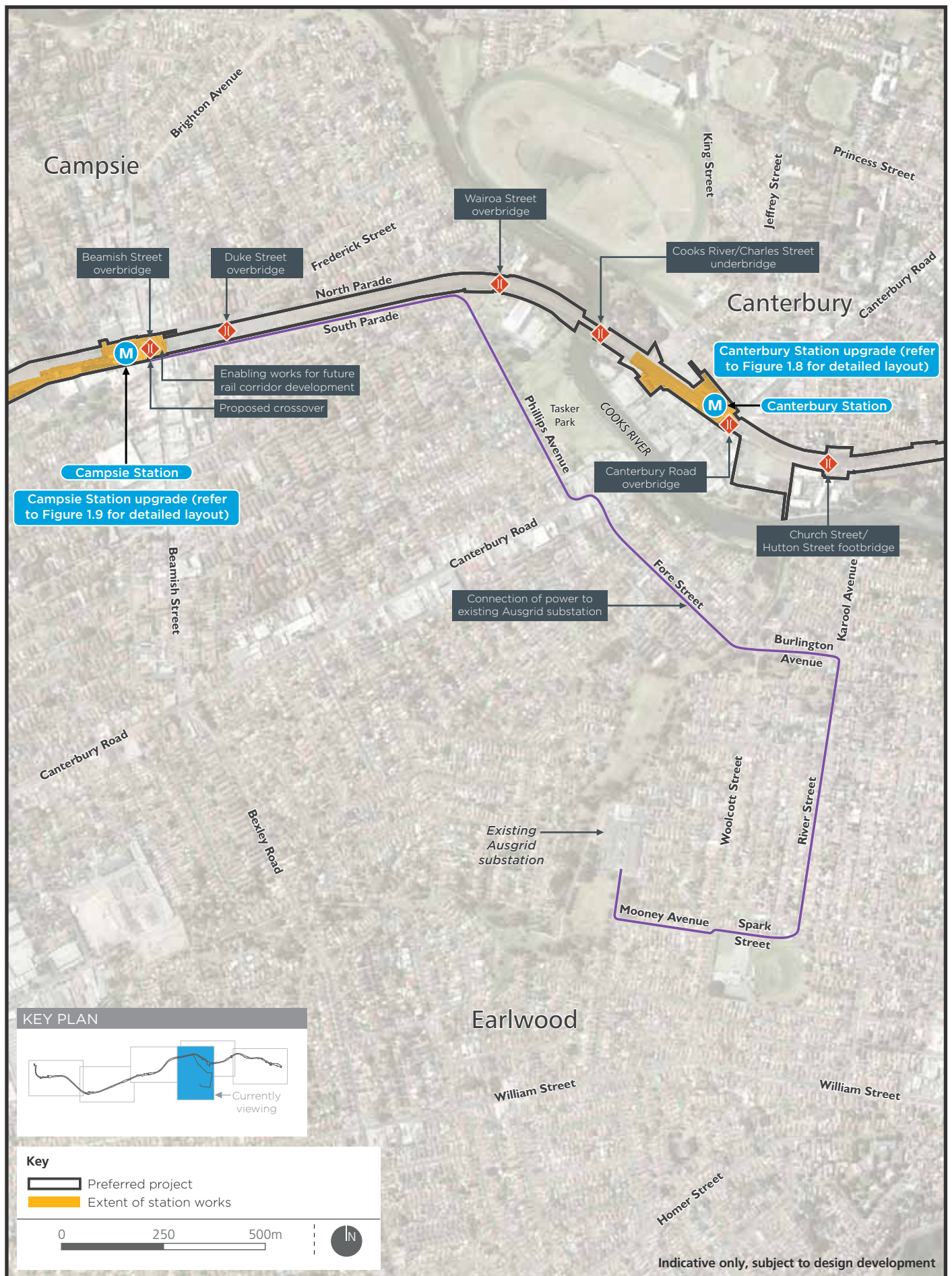


FIGURE 1.1



Preferred project infrastructure and features - map 5

FIGURE 1.1



1.1.1 Works to upgrade stations

The preferred project includes upgrading the 10 stations between Marrickville and Bankstown.

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

- platform works, which could include:
 - re-levelling of the platforms to provide a consistent height and finish
 - provision of platform screen doors
 - provision of emergency egress ramps
- new lifts to access the station and station platforms at stations that do not currently have lift access
- refurbishment/repurposing of station buildings on platforms or at station entrances, including control and communication rooms, toilets, staff facilities, storerooms, and offices
- provision of accessible toilets
- renewing/revitalising of station interiors and exteriors, where required
- signage and wayfinding at 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. This would include:

- enhancements to footpaths / paving and lighting in the vicinity of station entrances
- 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. 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 *Around the Tracks: urban design for heavy and light rail* (Transport for NSW, 2016).

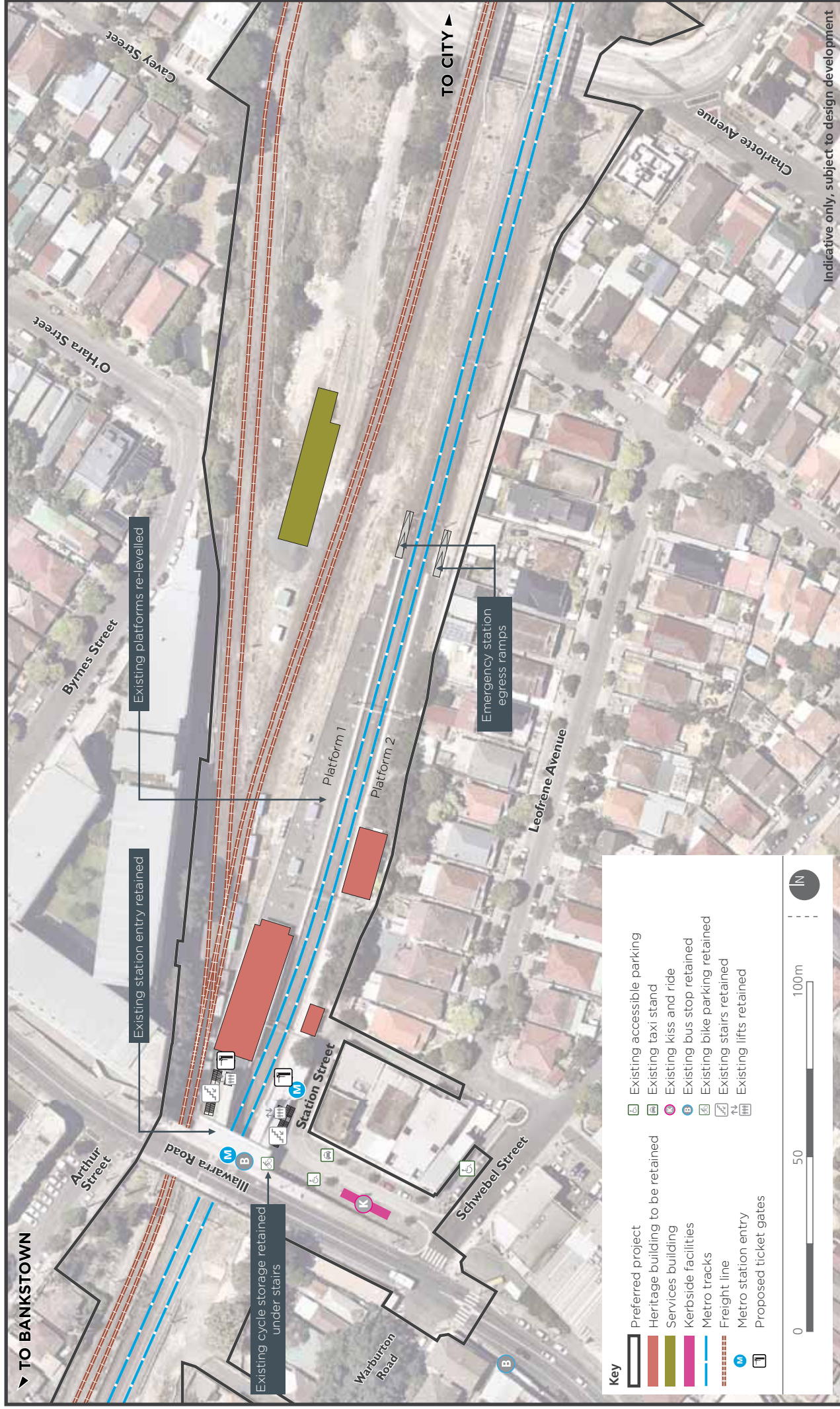
Marrickville Station

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. Station entrances are located on Illawarra Road and in Station Street.

Marrickville Station was recently upgraded as part of Transport for NSW's Transport Access Program. The key works proposed as part of the preferred project are shown on Figure 1.2 and summarised in Table 1.1. An artist's impression is provided in Figure 1.3.

Table 1.1 Marrickville Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance from Illawarra Road would be retained. The existing lifts would also be retained.• The existing at-grade entry from Station Street to platform 2 would be retained.• The existing heritage listed platforms would be re-levelled.• The existing station buildings, including the recently completed elevated concourse and associated canopy, would be retained.• The existing heritage station buildings on platforms 1 and 2 would be retained and repurposed.• The former booking office on platform 2 would be retained.
Station area
<ul style="list-style-type: none">• All bus stops would be retained in their current locations, including the southbound bus stop on Illawarra Road which was recently relocated as part of the upgrades to the station.• The existing kiss and ride facility on the western side of Station Street would be retained.• The existing accessible parking space on Station Street would be retained.• The existing taxi zone on Station Street would be retained.• The existing bike storage/parking facility below the station stairs would be retained.• The existing cycle route along the southern side of the rail corridor would be rerouted along Schwebel Street, Leofrene Avenue, and Riverdale Avenue.



Marrickville Station - indicative layout of key design elements

FIGURE 1.2



Marrickville Station - artist's impression

FIGURE 1.3

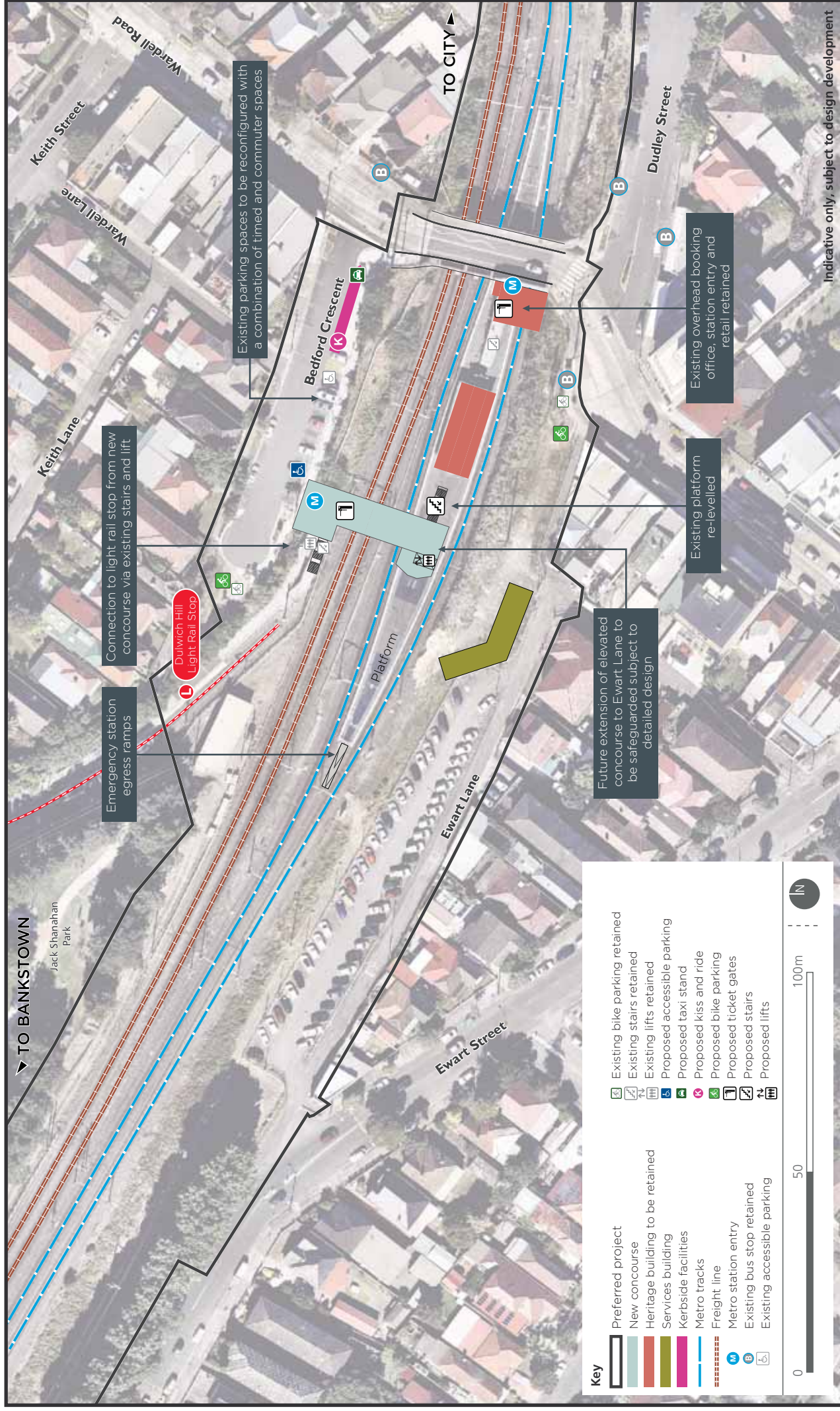
Dulwich Hill Station

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 preferred project are shown in Figure 1.4 and summarised in Table 1.2. An artist's impression is provided in Figure 1.5.

Table 1.2 Dulwich Hill Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance would be retained and upgraded.• A new elevated station concourse would be provided with new stairs and a lift, and would connect the station platform to the Dulwich Hill light rail stop. The concourse would be accessed from a new station entrance at Bedford Crescent (northern side). The future extension of the new elevated concourse to Ewart Lane has been safeguarded.• The existing heritage listed platforms would be re-levelled.• The existing heritage listed overhead booking office and station building on the platform would be retained and repurposed.• The existing retail within the overhead booking office would be retained.
Station area
<ul style="list-style-type: none">• The existing bus stops located on Dudley Street and Wardell Road would be retained.• Existing pedestrian pathways surrounding the station would be upgraded, including from Ewart Lane to Wardell Road and from Keith Lane to Bedford Crescent.• New kiss and ride and taxi facilities would be provided on the southern side of Bedford Crescent at its eastern end.• The two existing accessible parking spaces on the southern side of the Bedford Crescent would be retained and one new accessible parking space would be provided.• Existing bike parking on Wardell Road to the south of the station would be retained.• New bike parking facilities would be provided on Wardell Road to the south of the station.• The existing bike parking spaces on Bedford Crescent would be retained and additional spaces provided.



Dulwich Hill Station - indicative layout of key design elements

FIGURE 1.4



Dulwich Hill Station - artist's impression

FIGURE 1.5

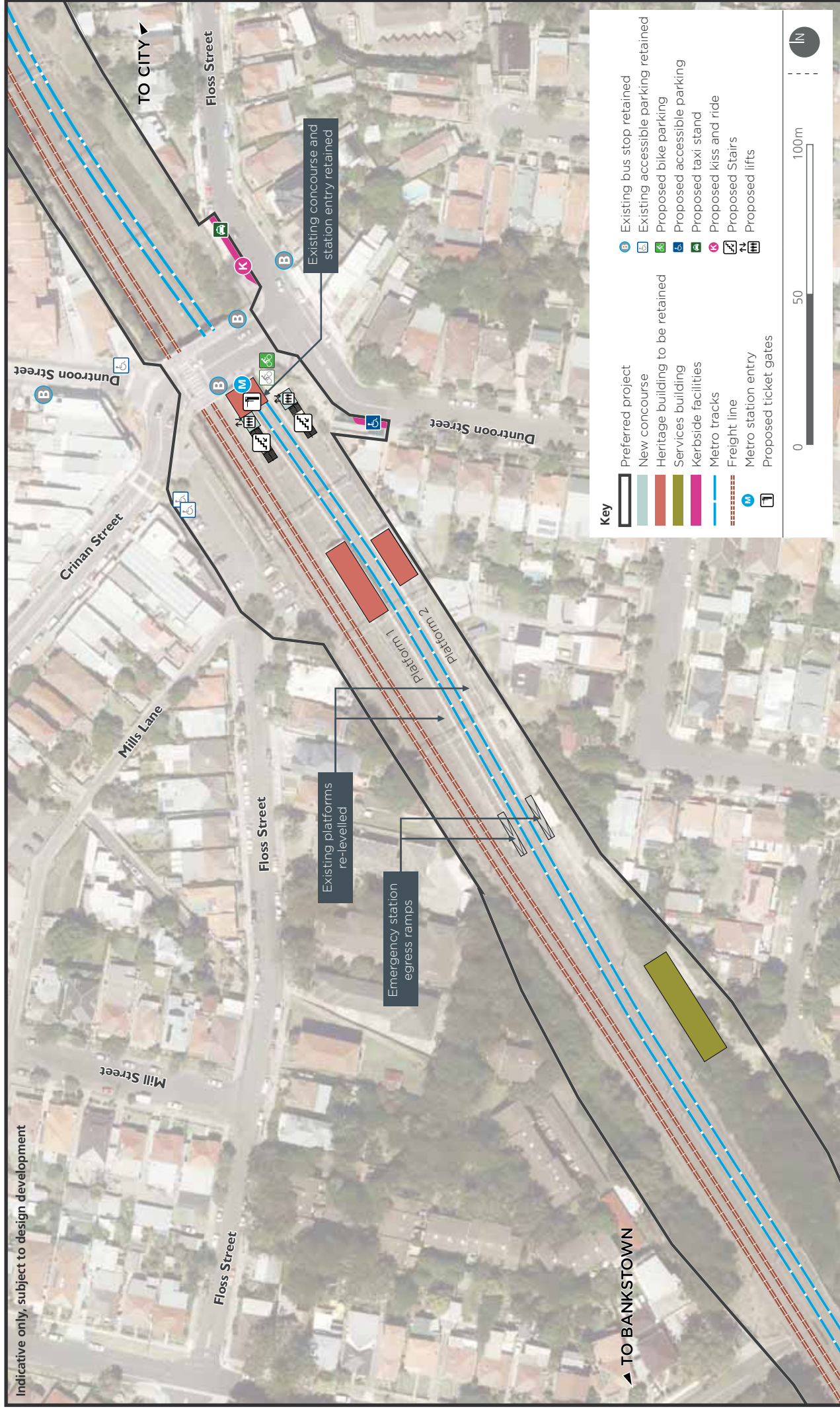
Hurlstone Park Station

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

The key works proposed as part of the preferred project are shown in Figure 1.6 and summarised in Table 1.3. An artist's impression is provided in Figure 1.7.

Table 1.3 Hurlstone Park Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance would be retained and upgraded.• Two new lifts would be provided.• The existing stairs would be removed and replaced.• The existing heritage listed platforms would be re-levelled.• The existing heritage listed overhead booking office and heritage buildings on platforms 1 and 2 would be retained and repurposed.
Station area
<ul style="list-style-type: none">• The existing bus stops on the overbridge would be retained.• New kerbside facilities would be located on Floss Street, on the eastern side of the overbridge adjacent to the station.• The existing accessible parking spaces on Floss Street and Duntroon Street on the northern side of the rail corridor would be retained.• New accessible parking would be provided on Duntroon Street on the southern side of the rail corridor.• The existing bike parking on Crinan Street outside the station entrance would be retained and additional bike parking provided.



Hurlstone Park Station - indicative layout of key design elements

FIGURE 1.6



Hurlstone Park Station - artist's impression

FIGURE 1.7

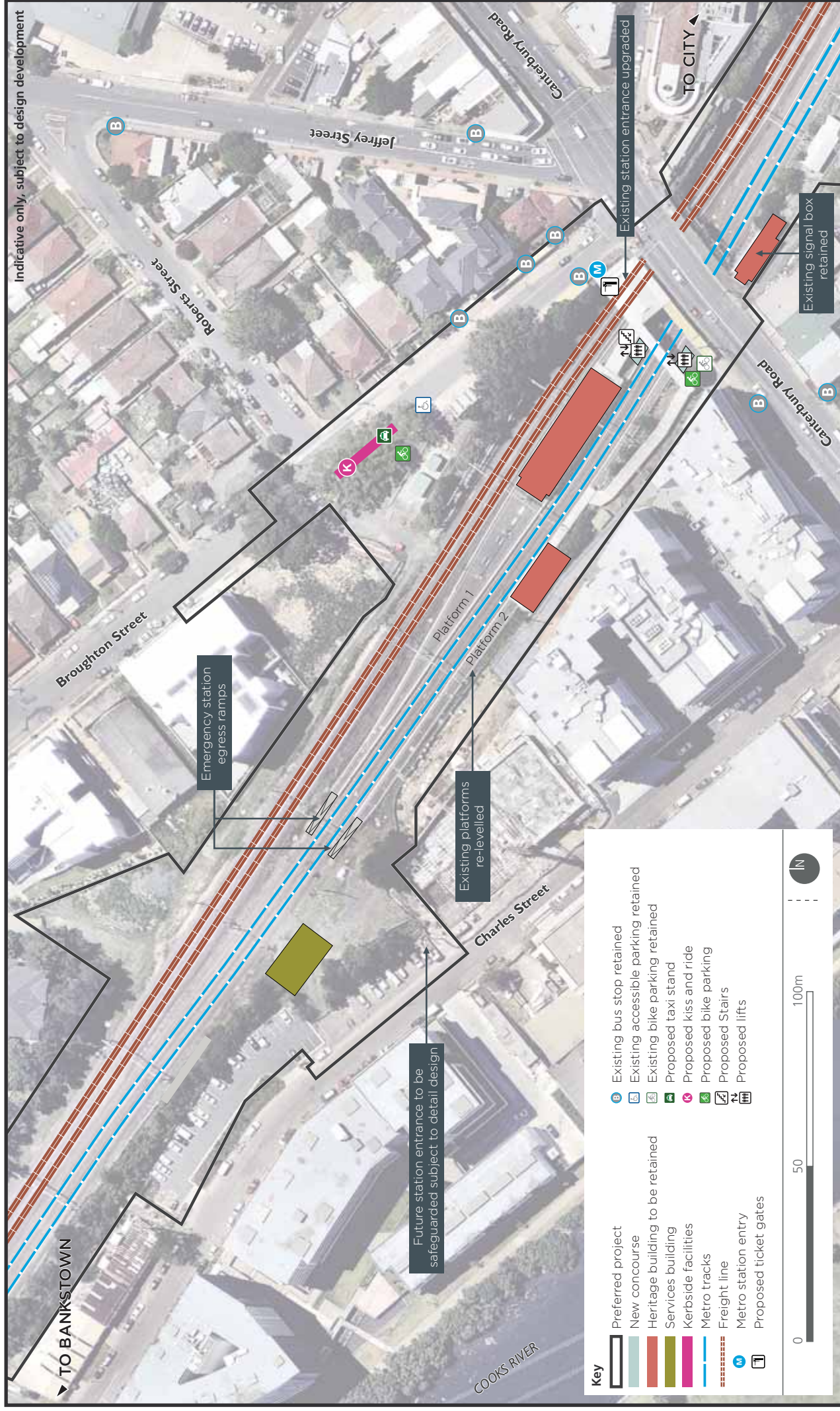
Canterbury Station

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 preferred project are shown in Figure 1.8 and summarised in Table 1.4.

Table 1.4 Canterbury Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance would be retained and upgraded.• The design provides for a potential future station entrance on Charles Street, to enable access to platform 2.• The existing heritage listed platforms would be re-levelled.• The existing stairs from platform 1 to the footbridge would be replaced with new stairs.• Two new lifts to the platforms would be provided.• The existing heritage listed footbridge and overhead booking office would be retained.• The existing heritage listed buildings on platforms 1 and 2 would be retained and repurposed.• The existing heritage listed signal box on the south-eastern side of the Canterbury Road overbridge would be retained.
Station area
<ul style="list-style-type: none">• The existing bus stops on Broughton Street and Canterbury Road would be retained and the bus shelters on Broughton Street would be refurbished.• Existing pedestrian pathways surrounding the station would be upgraded.• New kerbside facilities would be provided on Broughton Street.• The existing accessible parking space on Broughton Street would be retained.• The existing bike parking on Canterbury Road would be retained and additional bike parking provided.• New bike parking would be provided on Broughton Street, directly south of the proposed kerbside facilities.



Canterbury Station - indicative layout of key design elements

FIGURE 1.8

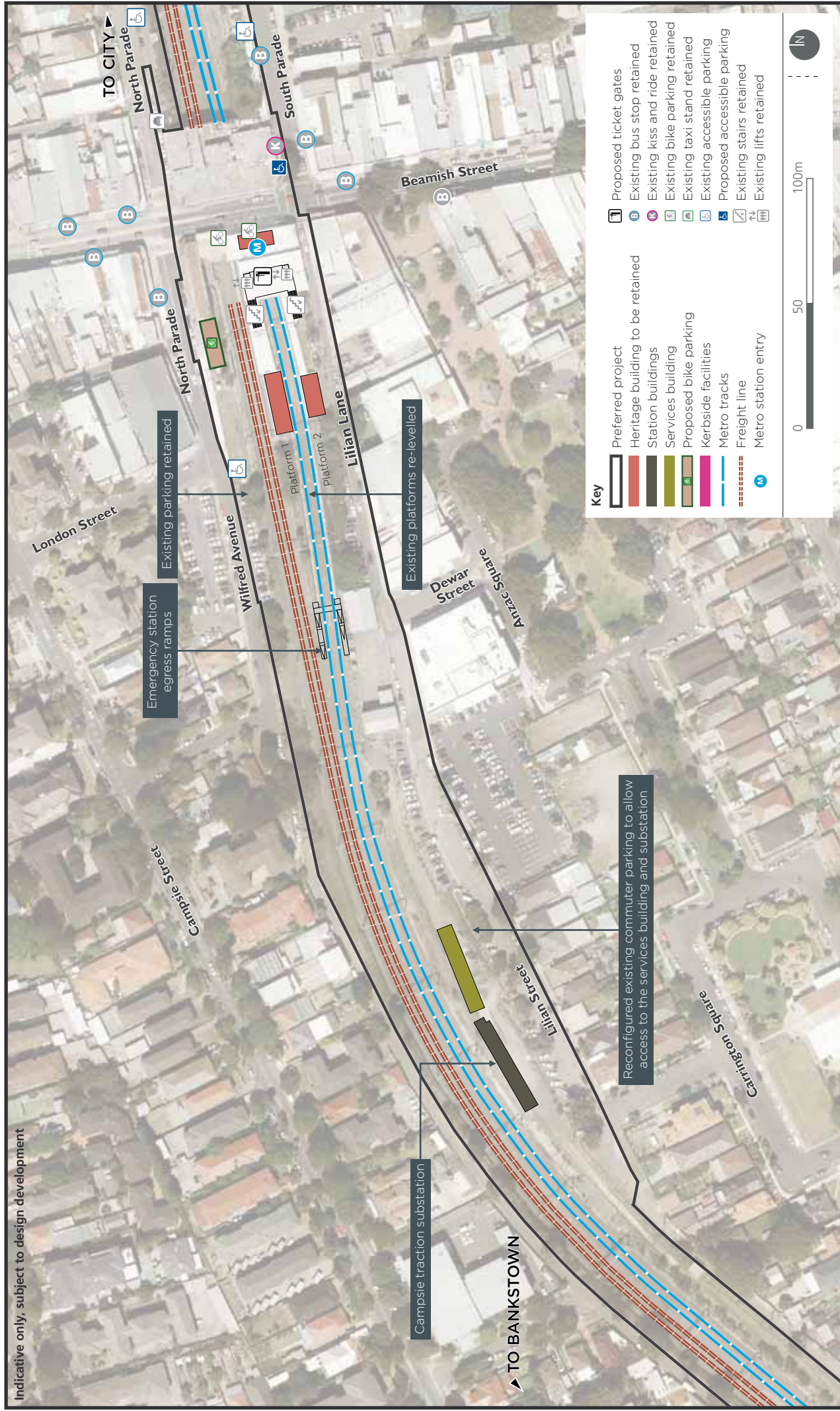
Campsie Station

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 preferred project are shown in Figure 1.9 and summarised in Table 1.5.

Table 1.5 Campsie Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance at Beamish Street would be retained and upgraded.• The existing heritage listed platforms would be re-levelled.• The existing heritage listed buildings on platforms 1 and 2 would be retained and repurposed.
Station area
<ul style="list-style-type: none">• The existing bus stops located in the vicinity of the station would be retained.• The existing kiss and ride facility on South Parade would be retained and a new accessible park provided at this location.• The existing taxi stand on North Parade would be retained.• The existing accessible parking on North Parade, Wilfred Avenue, and South Parade would be retained.• The existing bike parking on Beamish Street outside the station would be retained.• New bike parking facilities would be provided on North Parade.



Campsie Station - indicative layout of key design elements

FIGURE 1.9

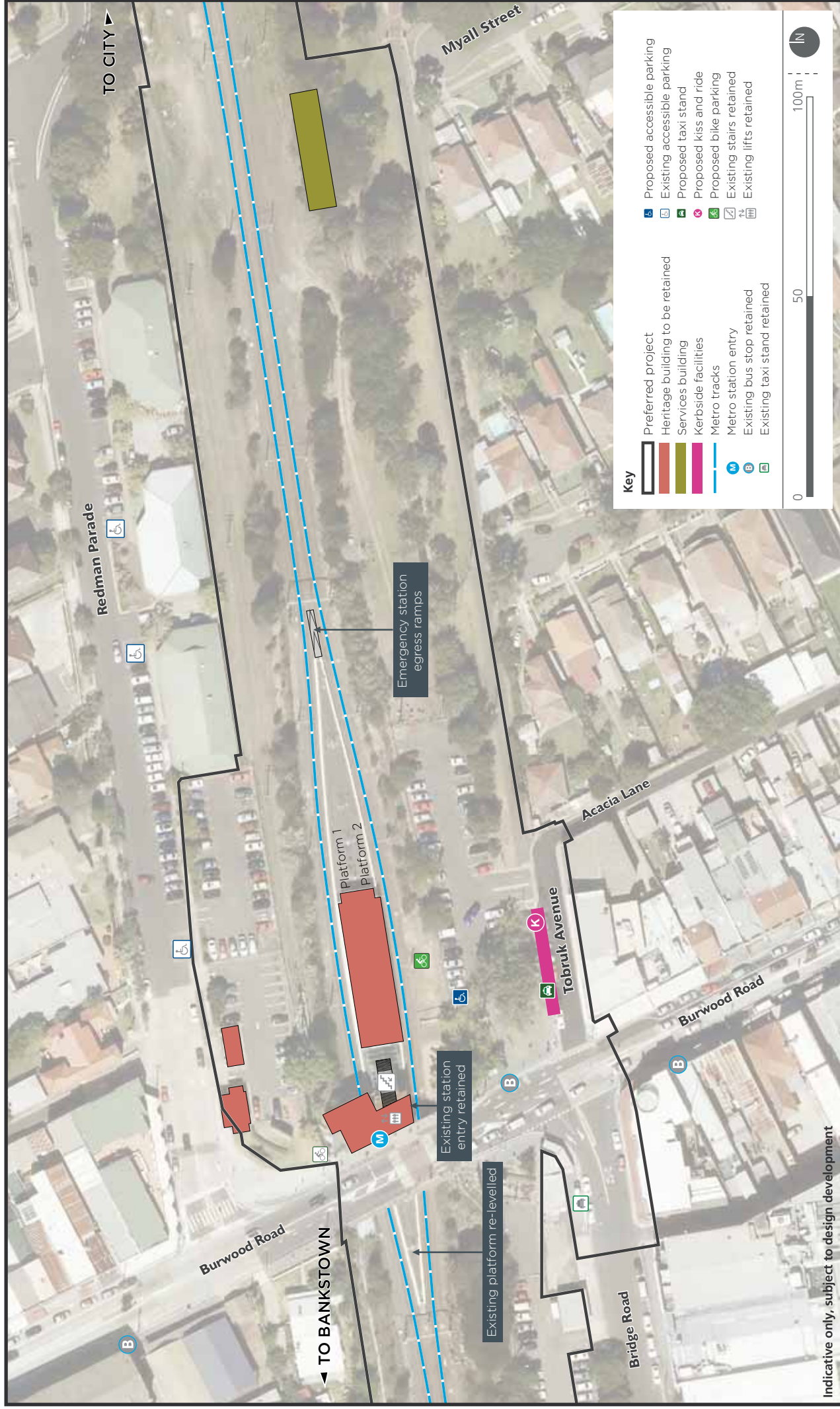
Belmore Station

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 preferred project are shown in Figure 1.10 and summarised in Table 1.6.

Table 1.6 Belmore Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance would be retained and upgraded.• The existing heritage listed platforms would be re-levelled.• The existing heritage listed platform building and overhead booking office would be retained and repurposed.• The existing heritage buildings located within the car park to the north of the station would be retained.
Station area
<ul style="list-style-type: none">• The existing bus stops in the vicinity of the station would be retained.• New taxi and kiss and ride facilities, would be provided on Tobruk Avenue.• New accessible parking spaces would be provided in the Tobruk Avenue car park.• The existing accessible parking along Redman Parade would be retained.• New bike parking would be provided within the Tobruk Avenue car park.• The existing bike parking on Burwood Road to the north of the station entrance would be retained.



Belmore Station - indicative layout of key design elements

FIGURE 1.10

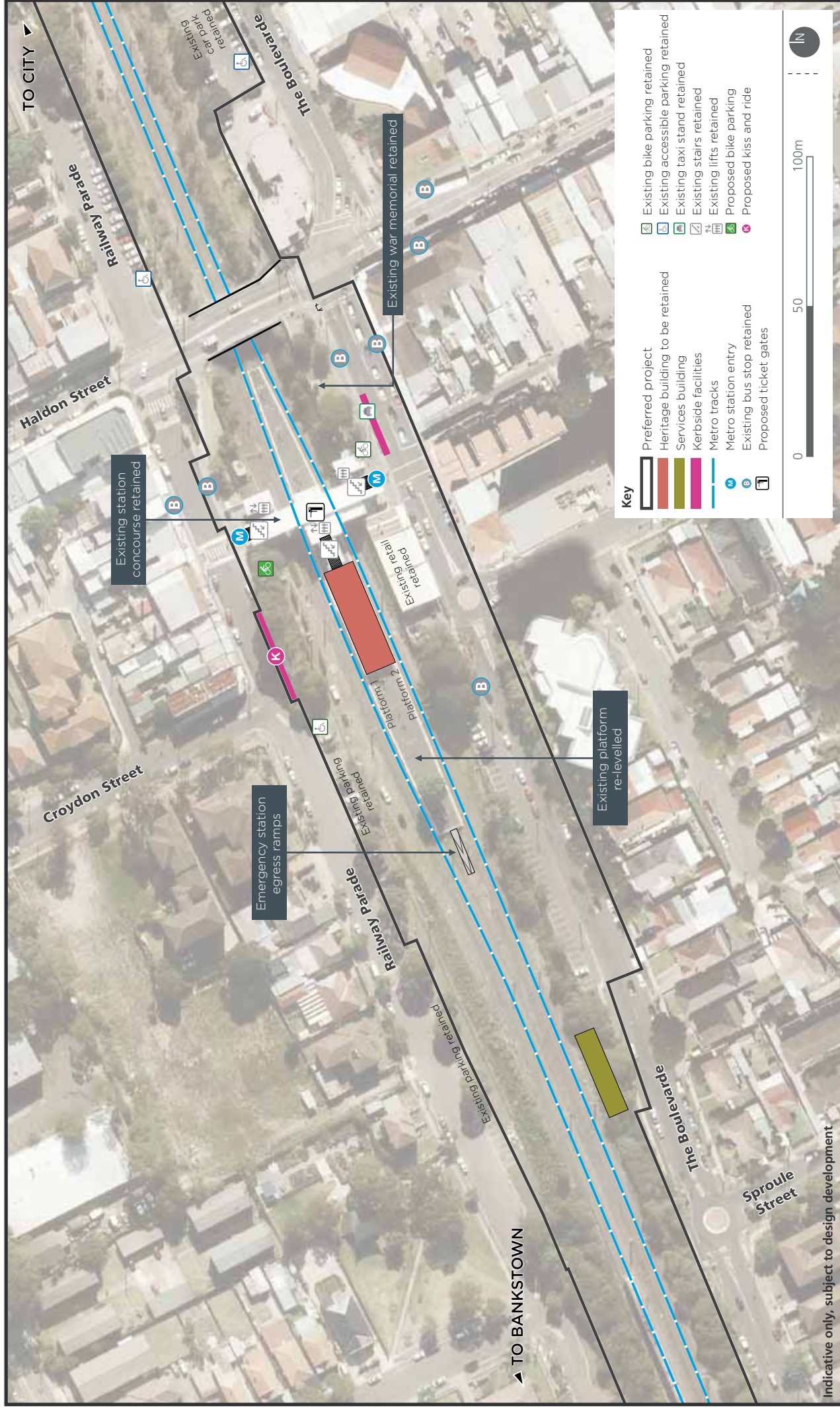
Lakemba Station

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 preferred project are shown in Figure 1.11 and summarised in Table 1.7.

Table 1.7 Lakemba Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance would be retained.• The existing heritage listed platforms would be re-levelled.• The existing heritage station building on the platform would be retained and repurposed.
Station area
<ul style="list-style-type: none">• The existing bus stops located on The Boulevarde, Railway Parade, and Haldon Street (south) would be retained.• The existing bike parking on the northern side of The Boulevarde would be retained.• New bike parking would be provided on the southern side of Railway Parade.• New kiss and ride kerbside facilities would be provided on Railway Parade (west of new station entrance) and new taxi kerbside facilities would be provided on The Boulevarde (east of the new station entrance).• The existing accessible parking on Railway Parade and The Boulevarde would be retained.



Indicative only, subject to design development

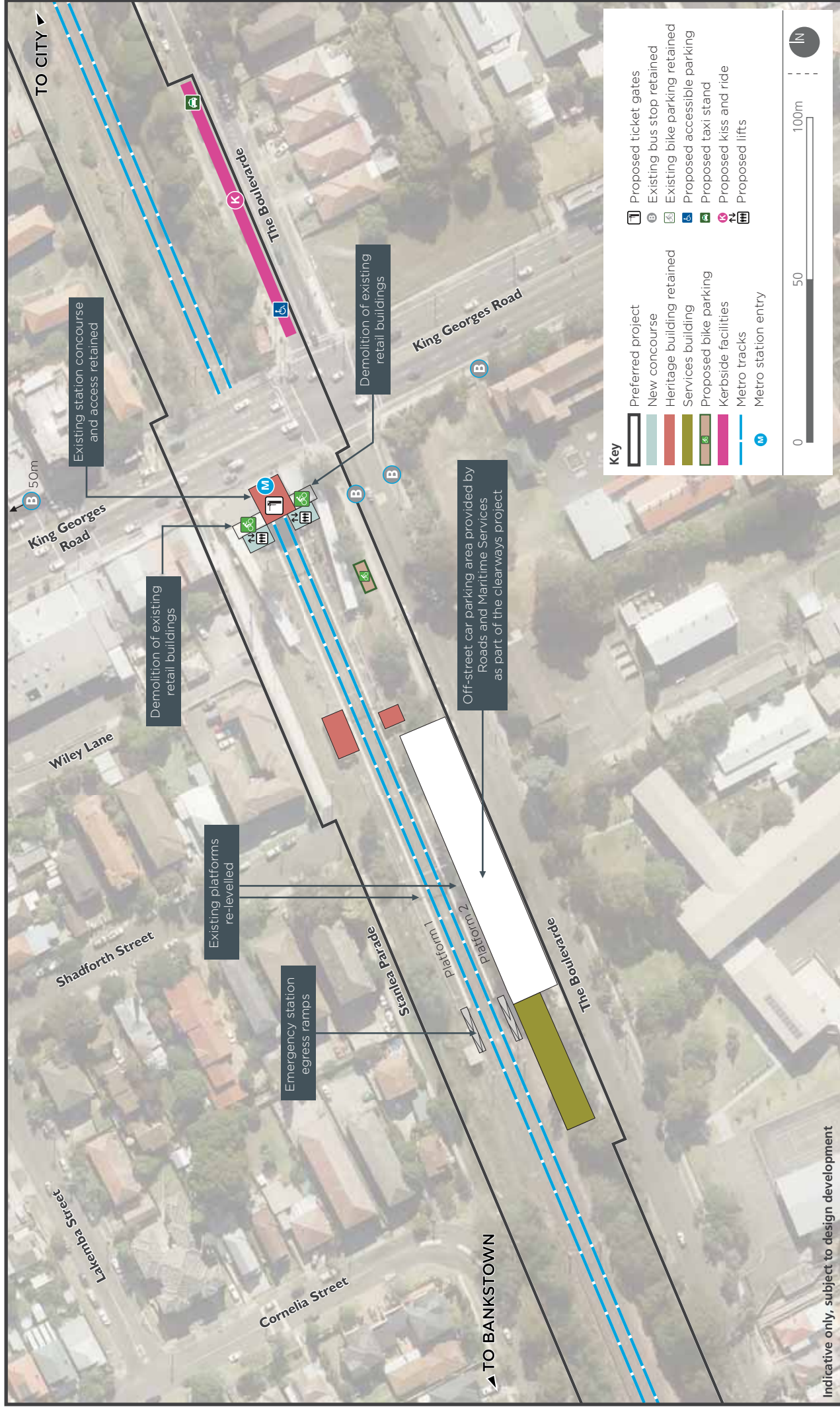
Wiley Park Station

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 preferred project are shown in Figure 1.12 and summarised in Table 1.8. An artist's impression is provided in Figure 1.13.

Table 1.8 Wiley Park Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance would be retained and upgraded.• The existing retail shop and a disused premises at the station entrance would be demolished.• Two new lifts would be provided.• The existing heritage listed platform would be re-levelled.• The existing heritage listed overhead booking office, concourse and platform buildings would be retained and repurposed.
Station area
<ul style="list-style-type: none">• The existing bus stops would be retained.• Existing pedestrian pathways surrounding the station would be upgraded.• New bike parking would be provided on The Boulevarde and at the station entrance.• New kerbside facilities and accessible parking would be provided on The Boulevarde, east of King Georges Road.



Wiley Park Station - indicative layout of key design elements

FIGURE 1.12



Wiley Park Station - artist's impression

FIGURE 1.13

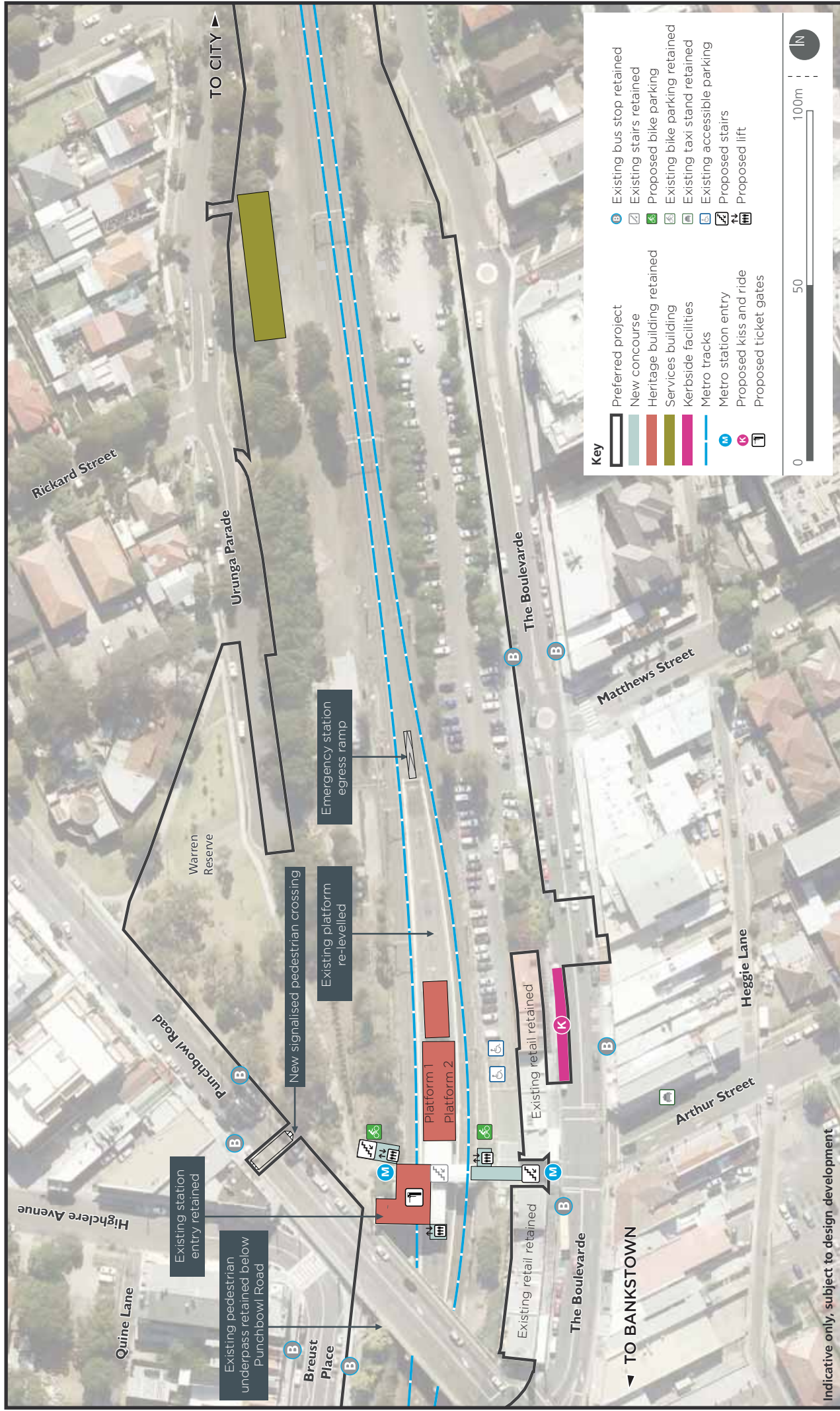
Punchbowl Station

Punchbowl Station is located to the east of the Punchbowl Road overbridge. The station area is bounded by commercial land uses and a car park fronting The Boulevard to the south, Warren Reserve and Urunga Parade to the north, and Punchbowl Road to the west. The station entrances are located on Punchbowl Road (via Warren Reserve) to the north, and The Boulevard to the south.

The key works proposed as part of the preferred project are shown in Figure 1.14 and summarised in Table 1.9.

Table 1.9 Punchbowl Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing station entrance would be retained and upgraded.• Three new lifts and two new stairs would be provided.• The existing concourse footbridge would be extended to accommodate new lifts and stairs.• The existing stairs to both entrances would be replaced.• The existing heritage listed platform would be re-levelled.• The existing heritage listed station buildings and overhead booking office would be retained.
Station area
<ul style="list-style-type: none">• The existing bus stops on Punchbowl Road and The Boulevard would be retained.• New bike parking would be provided at the northern and southern station entrances.• Kerbside facilities would be provided on The Boulevard.• The existing accessible parking adjacent to the southern station entrance would be retained.• A new pedestrian crossing would be provided on Punchbowl Road north-east of Bruest Place.• The existing pedestrian underpass below Punchbowl Road would be retained and upgraded.



Punchbowl Station - indicative layout of key design elements

FIGURE 1.14

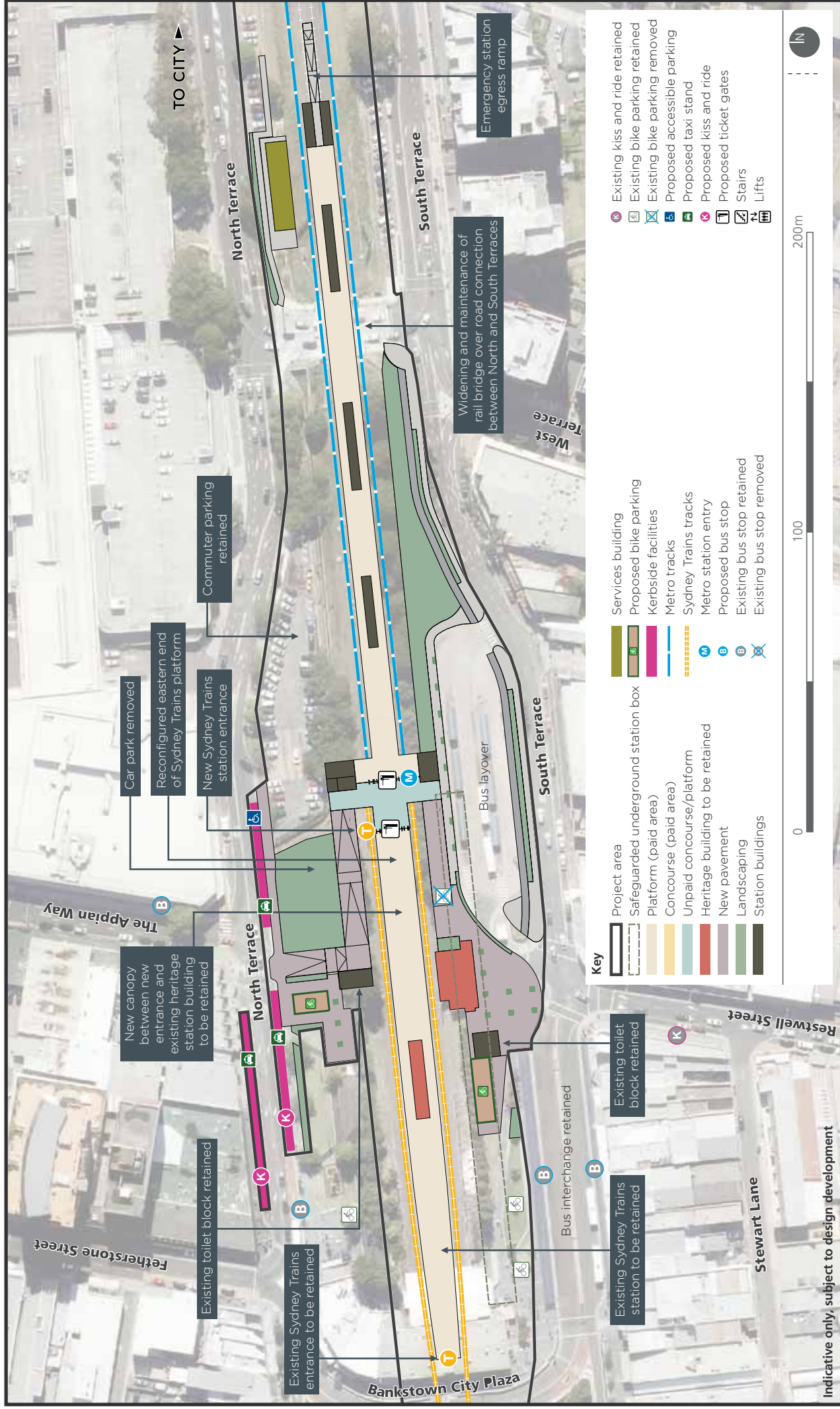
Bankstown Station

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. 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 preferred project are as per those proposed as part of the exhibited project and are shown in Figure 1.15 and summarised in Table 1.10. Figure 1.15 also shows how the design safeguards for a potential future underground station.

Table 1.10 Bankstown Station key design elements

Description
Station works
<ul style="list-style-type: none">• The existing Sydney Trains station entrance at Bankstown City Plaza would be retained.• A new at-grade corridor crossing would be provided at the eastern end of the existing Sydney Trains platform and would provide access to both Sydney Trains and new Sydney Metro platforms.• New station plazas would be constructed at station entrances on both sides of the rail corridor.• 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.• 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
<ul style="list-style-type: none">• The bus layover area on South Terrace would be retained with minor adjustments to accommodate the new station entrance.• The bus interchange area on South Terrace, near the existing station entrance, would be retained.• The existing bus stop on the northern side of station on North Terrace would be retained.• 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.• 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.• Removal of existing car park located adjacent to the Appian Way off North Terrace, resulting in the loss of 10 off-street spaces.



Bankstown Station - indicative layout of key design elements

FIGURE 1.15

1.1.2 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 1.1.1:

- 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 to ensure that the gap 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 1.1.1. Final locations would be confirmed during detailed design.

Track and rail system facility works

Track works

The preferred project would use the existing Sydney Trains tracks. 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.

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.

Track works would also include connecting to the metro tracks being provided west of Sydenham Station as part of the Chatswood to Sydenham project.

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 crossover on the eastern side of Campsie Station
- replacement of the existing track crossover to the east of Bankstown Station with a new Sydney Metro turnback
- a reconfigured rail junction and turnback to the west of Bankstown Station for Sydney Trains services.

The turnback 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 preferred 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 between 180 and 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 overhead wiring along the line to meet Sydney Metro operational requirements and Sydney Trains 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.

With the exception of the utility protection and relocation works described in Section 2.10, these works would take place within the rail corridor.

1.1.3 Works to convert stations and the rail line to Sydney Metro operations – other works

Upgrading bridges along the rail corridor

Works are required to 16 road overbridges and six underbridges located within the project area (refer Table 1.11). The type of works required would vary, and would be confirmed during detailed design.

Generally, the bridge upgrade works would consist of providing enhanced protection to existing bridge piers, installation of anti-throw screens, vertical protection screens, vehicle collision barriers and general maintenance work.

The locations of the bridges proposed to be upgraded are shown in Figure 1.1.

Table 1.11 Overbridges and underbridges where works are proposed

Bridge	
Overbridge	Burwood Road overbridge, Belmore
Illawarra Road overbridge, Marrickville	Moreton Street overbridge, Belmore
Livingstone Road overbridge, Marrickville	Haldon Street overbridge, Lakemba
Albermarle Street overbridge, Dulwich Hill	King Georges Road overbridge, Wiley Park
Wardell Road overbridge, Dulwich Hill	Stacey Street overbridge, Bankstown
Crinan Street overbridge, Hurlstone Park	Underbridge
Church/Hutton Street footbridge, Canterbury	Meeks Road underbridge, Marrickville
Melford Street overbridge, Canterbury	Victoria Road underbridge, Marrickville
Canterbury Road overbridge, Canterbury	Ness Avenue/Terrace Road underbridge, Dulwich Hill
Beamish Street overbridge, Campsie	Cooks River/Charles Street underbridge, Canterbury
Duke Street footbridge, Campsie	Wairoa Street underbridge, Campsie
Loch Street overbridge, Campsie	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 1.1. 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
- Westfield Street.

The indicative alignment is shown on Figure 1.1.

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 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 preferred 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 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.

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 preferred project would include maintenance of existing track drainage to ensure that stormwater is efficiently conveyed within and across the corridor to the surrounding stormwater drainage system.

1.2 Property requirements

The preferred 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 preferred project has avoided the need to permanently acquire land and properties. Construction of the preferred project would require the temporary leasing of land and may require the need to cease commercial leases on NSW Government owned land. Leasing requirements and impacts are described below.

1.2.1 Cessation of commercial leases on NSW Government owned land

To undertake the proposed station upgrade works, the preferred project would require access to land, which is currently subject to one existing commercial lease at Wiley Park Station, on land owned by the NSW Government (RailCorp).

The preferred project would require the cessation of the lease at this station.

All the impacted leases would be ceased in accordance with lease agreements held with the NSW Government.

1.2.2 Temporary lease of property

Some areas of land would need to be temporarily leased or occupied for construction compounds and other work sites during construction of the preferred project (refer to Section 2.8 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. In addition, some areas of land may need to be temporarily leased or occupied to provide infrastructure to support the implementation of the temporary transport plans. Following further design development, consultation would be undertaken with the relevant landowner to arrange leasing of the required piece of land.

1.2.3 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.

1.3 Operation of the preferred project

Operation of the preferred project would be as per that described in the exhibited project.

The preferred project would operate in conjunction with Sydney Metro Northwest (which extends from Tallawong to Chatswood stations), and the Sydney Metro City & Southwest Chatswood to Sydenham project (which extends 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.

1.3.1 Timing

Sydney Metro Northwest will be operational 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 Tallawong Station to Sydenham Station prior to the final conversion of the T3 Bankstown Line to metro operations.

1.3.2 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.

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.

1.3.3 Hours of operation

The first metro service to depart Tallawong 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 Tallawong 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.

1.3.4 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.

1.3.5 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 1.16.



Figure 1.16 Indicative Sydney Metro train interior

1.3.6 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.

1.3.7 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 (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 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.

1.3.8 Emergency and incident management

The operational management plan for the project would include procedures for incident and emergency management.

2. Preferred project description – construction

This section provides a description of the indicative construction methodology for the preferred 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 section 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.

2.1 Overview

2.1.1 Key construction stages

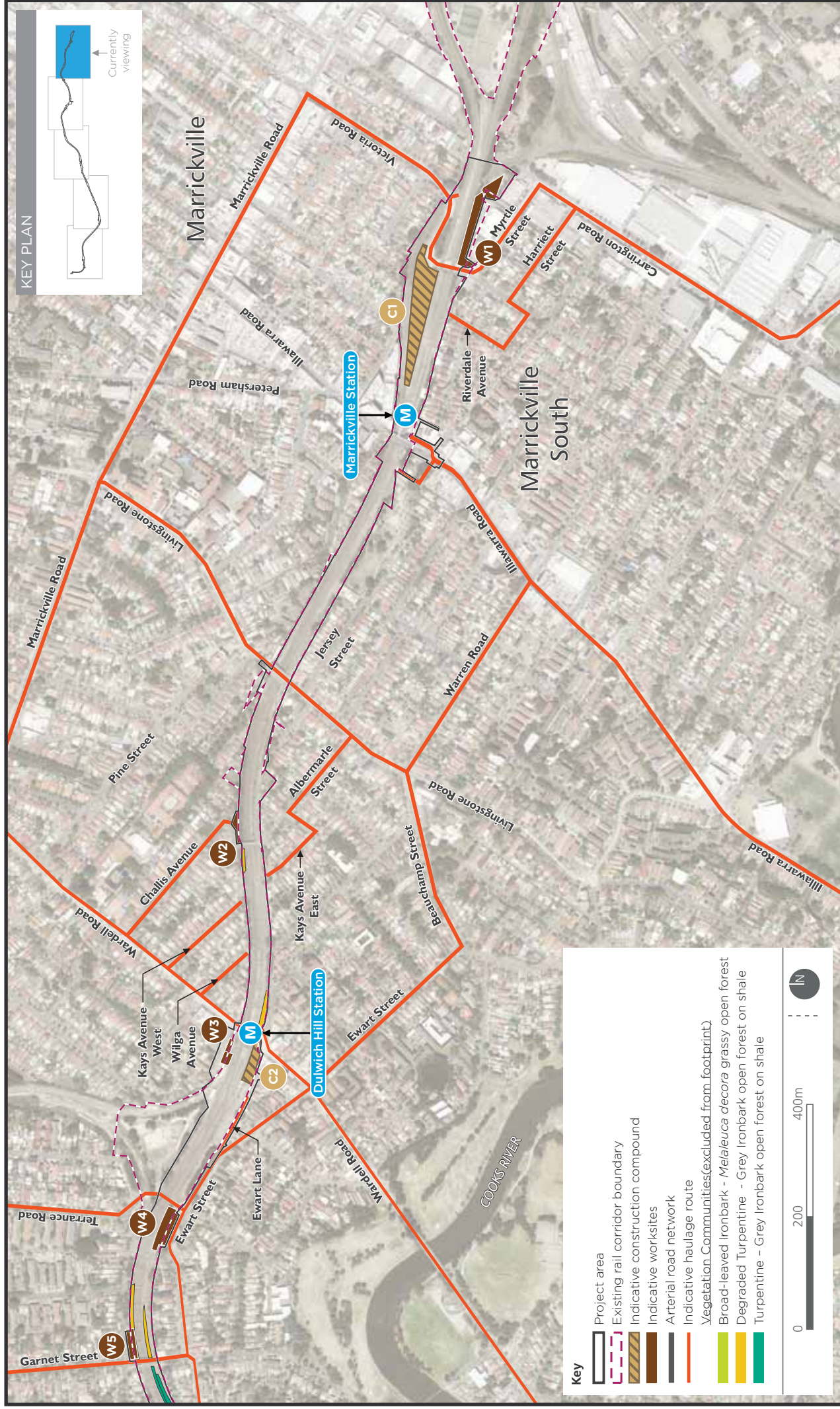
Construction of the preferred project would broadly involve the following key stages:

- enabling works (described in Section 2.2)
- main construction works, including track and station works (described in Sections 2.3 to 2.5)
- finishing works (described in Section 2.6.1)
- testing and commissioning (described in Section 2.6.2), including final conversion to Sydney Metro systems.

The construction methodology presented in this section 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.

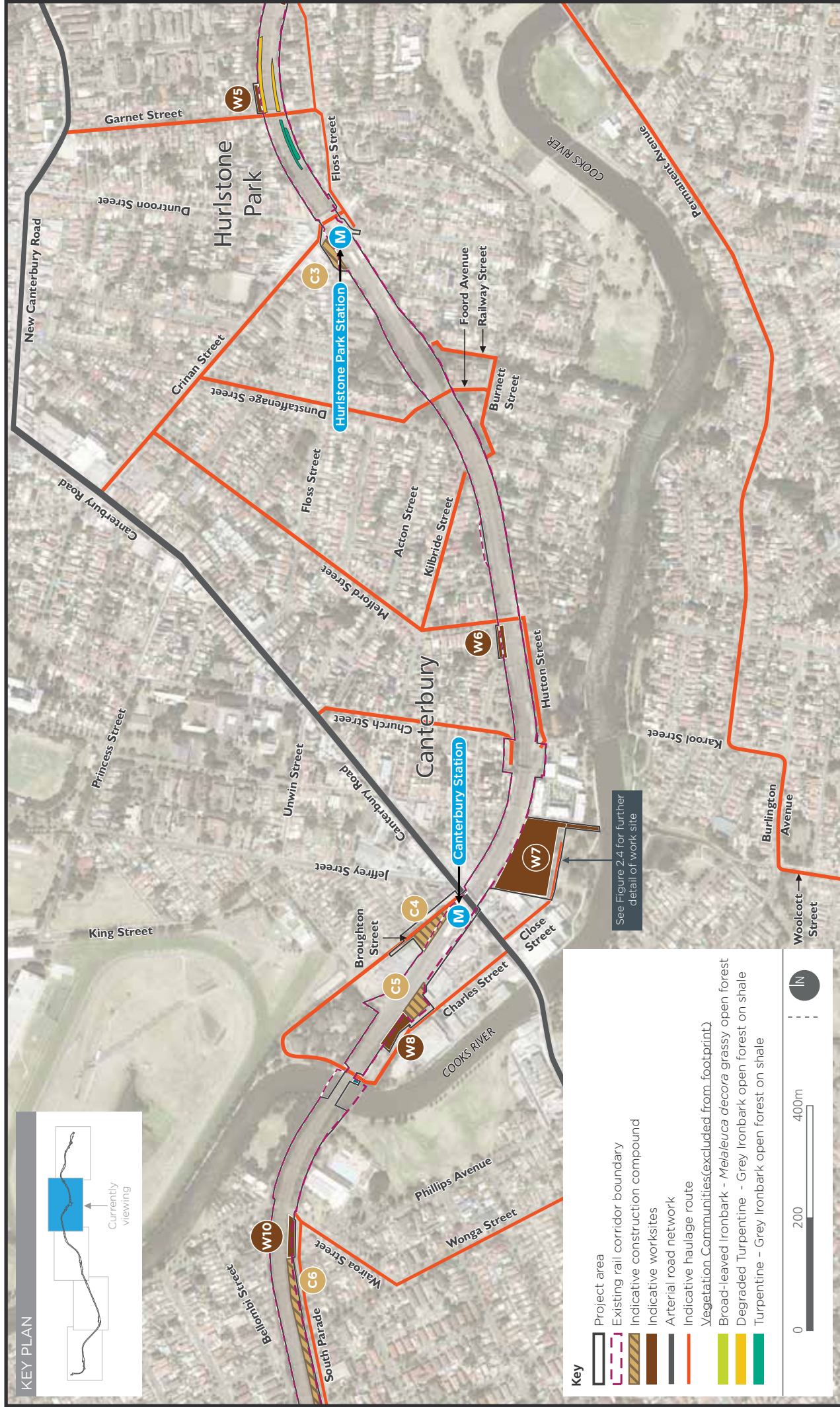
Key construction areas, including the proposed construction compounds, work sites, and haul routes proposed for use during construction, are shown in Figure 2.1.

Construction of the preferred project would commence in 2018/2019 once all necessary approvals are obtained and the metro service to Bankstown would commence operation in 2024.



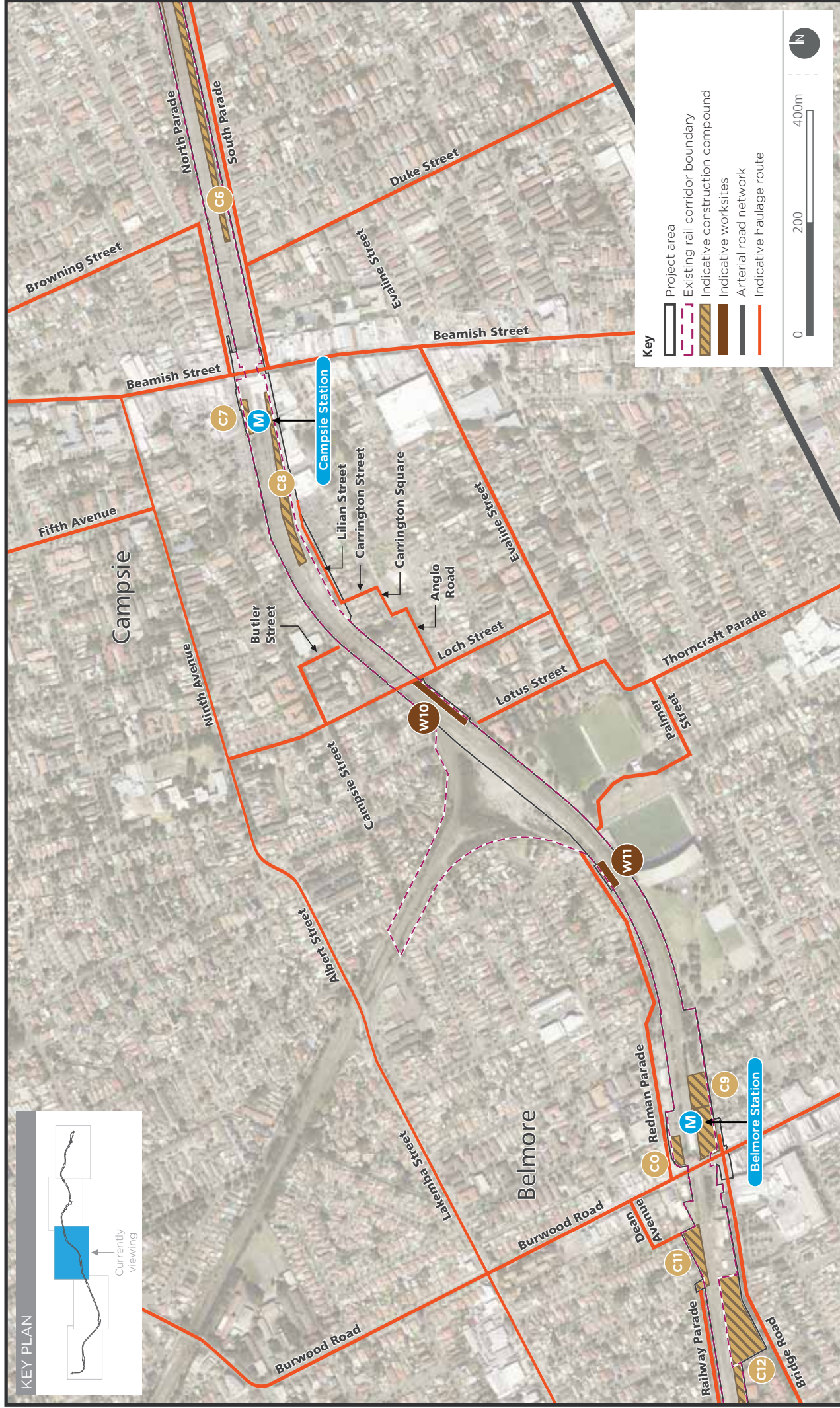
Preferred project area - construction activities - map 1

FIGURE 2.1



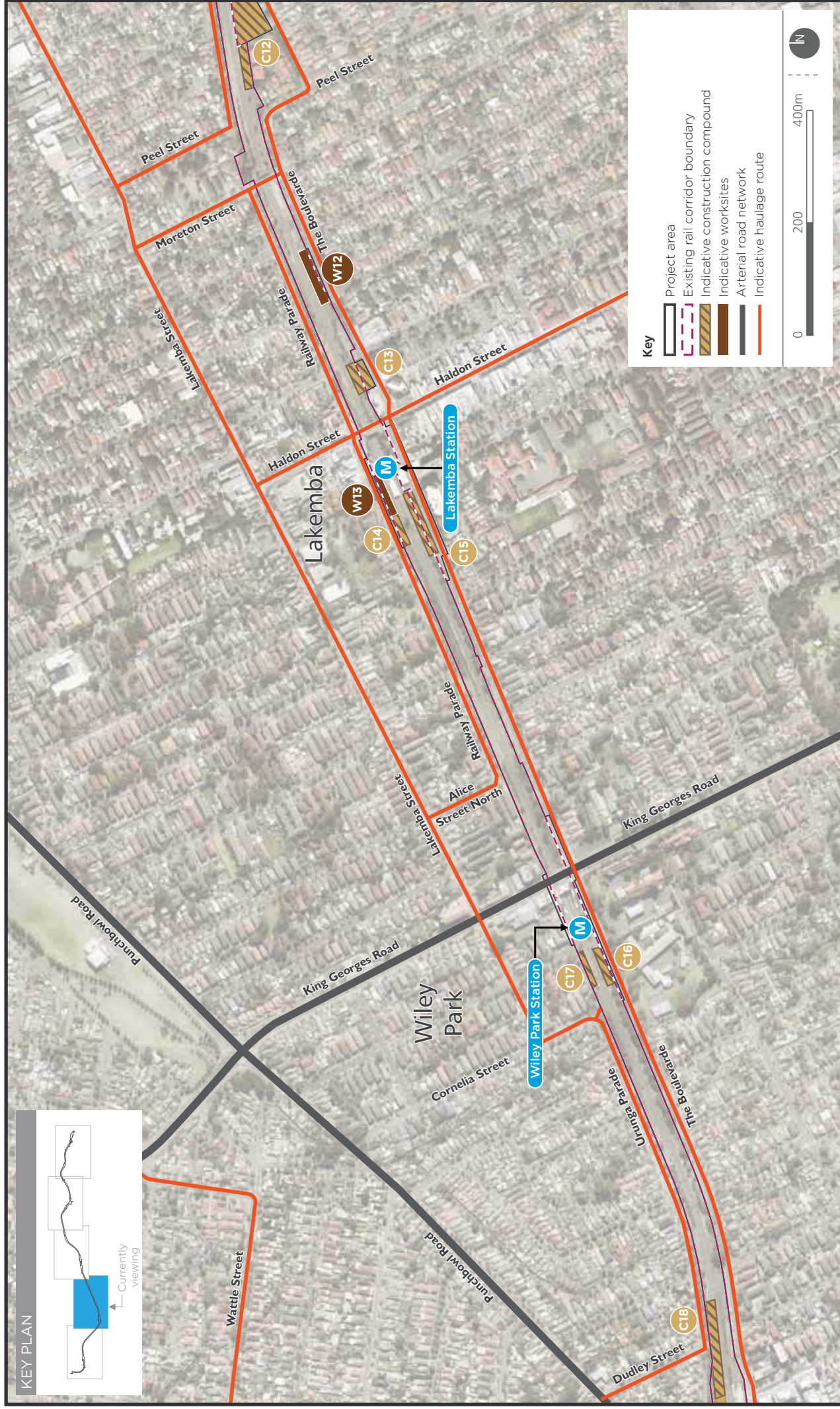
Preferred project area - construction activities - map 2

FIGURE 2.1



Preferred project area - construction activities - map 3

FIGURE 2.1



Preferred project area - construction activities - map 4

FIGURE 2.1

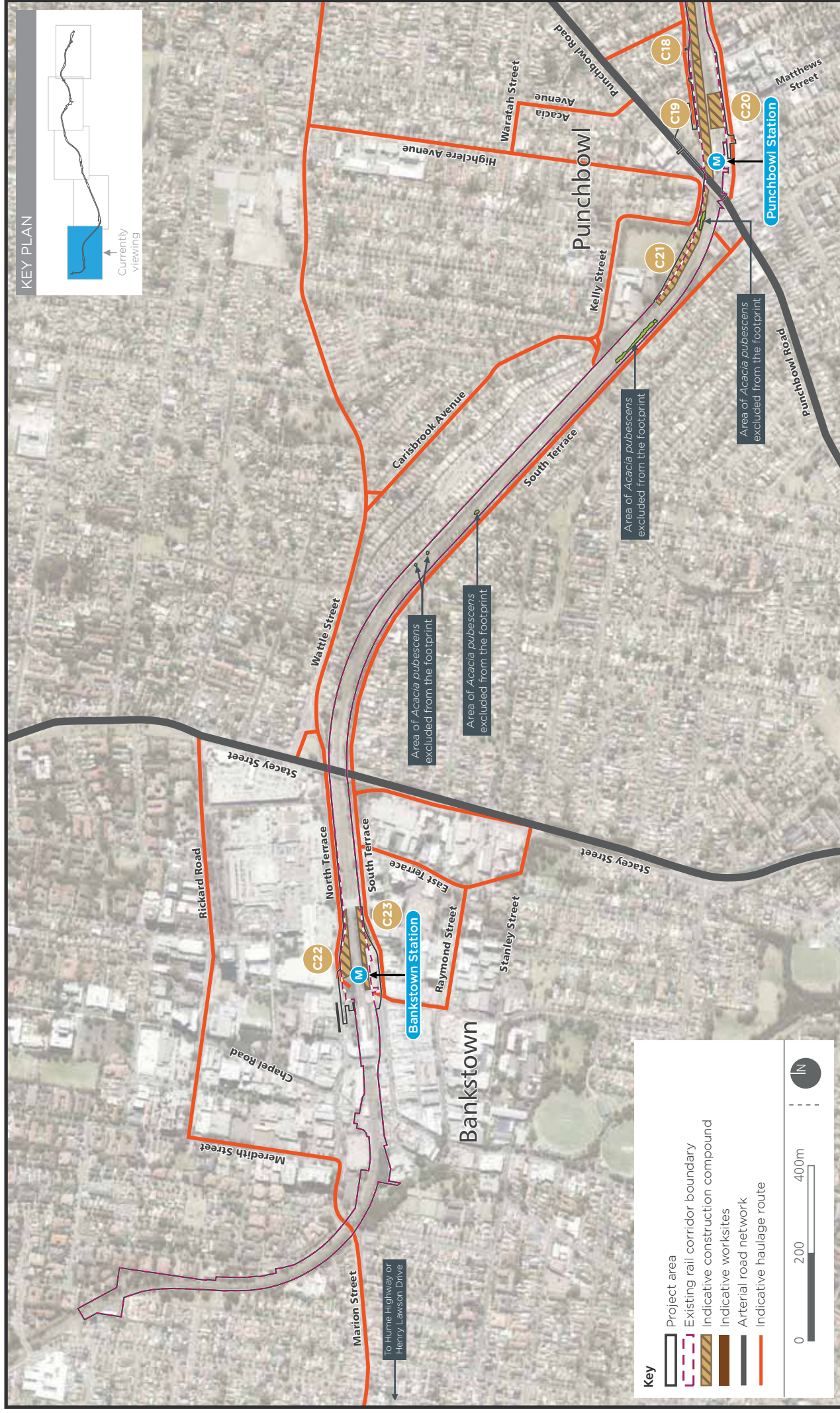


FIGURE 2.1

2.1.2 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 section has been developed with consideration given to the environmental constraints and issues identified during the early stages of the design and environmental assessment process.

Construction environmental management

The *Sydney Metro City & Southwest Construction Environmental Management Framework* (Sydney Metro, 2017a) (the 'Construction Environmental Management Framework') defines 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.

The *Sydney Metro City & Southwest Construction Noise and Vibration Strategy* (Sydney Metro, 2017b) (the 'Construction Noise and Vibration Strategy') defines 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 *Interim Construction Noise Guideline*, to provide a consistent approach to management and mitigation across all Sydney Metro projects.

2.2 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. It is noted that some enabling works may require additional approvals prior to being implemented. However, these works are described chronologically here to aid comprehension.

2.2.1 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 2.2.2)
- 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.

2.2.2 Building removal works

A number of Sydney Trains buildings (e.g. section huts) located along the corridor would 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.

2.2.3 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, 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.

2.3 Station works

2.3.1 Outline methodology

Station works would be staged to suit operational requirements and the availability of possession periods.

The following general work activities would be undertaken for a typical station upgrade:

- Site establishment and enabling works:
 - establishment of site compound (erection of 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 and anti-throw screens
 - installation of lifts
 - installation of fixtures, lighting and CCTV cameras for areas affected by construction works.
- Station works:
 - reuse and refurbishment of station and services buildings (including mechanical/electrical/building fit-out)
 - platform works and re-levelling
 - station area works
 - provision of new kerbside and bike parking facilities
 - landscaping, painting and paving works.
- Finalisation:
 - landscaping and public domain works, including installation of 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.

2.3.2 Tree removal and management

The preferred project would involve trimming or removing trees in the vicinity of stations. 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 2.1 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 2.1 Number of trees at stations with the potential to be impacted

Station	Native trees	Exotic trees	Total trees
Marrickville	50	15	65
Dulwich Hill	11	2	13
Hurlstone Park	8	9	17
Canterbury	38	7	45
Campsie	28	6	34
Belmore	61	11	72
Lakemba	67	0	67
Wiley Park	22	41	63
Punchbowl	25	22	47
Bankstown	79	1	80

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 2.4.3).

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 preferred 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, in consultation 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 preferred project.

2.4 Corridor works

2.4.1 Track works

As described in Section 1.1.3, the preferred project would involve changes to the existing track at Campsie and Bankstown. There may, however, also be a requirement to upgrade or replace track or supporting infrastructure elsewhere along the rail corridor following further investigations to be undertaken as part of detailed design.

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
- maintenance of existing track drainage.

2.4.2 Bridge works

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.

Construction would typically involve:

- close bridge lanes and/or footpaths depending on requirements
- existing parapets being removed down to the existing bridge slab
- precast parapet sections being positioned with the use of cranes and fixed to the bridge deck, throw screens would be prefabricated prior to installation
- installation of bridge protection measures
- modifications and maintenance where required
- bridge lanes and/or footpaths reopened to traffic.

2.4.3 Other corridor works

The preferred project would require works along the length of the corridor as follows:

- installation of new communications services routes
- maintenance works to existing track drainage
- installation of fencing.

2.4.4 Removal of vegetation within the rail corridor

The biodiversity assessment for the preferred project was undertaken based on the assumption that all vegetation within the rail corridor would need to be removed to construct the preferred project, with the exception of:

- native vegetation that would require biodiversity offsets if removed (specifically areas of 'Turpentine - Grey Ironbark open forest on shale', 'Degraded Turpentine - Grey Ironbark open forest on shale' and 'Broad-leaved Ironbark – Grey Box' (shown on Figure 2.1)
- identified areas of the threatened species Downy Wattle located within the rail corridor between Punchbowl and Bankstown stations (shown in Figure 2.1).

Based on this assumption, about 16.3 hectares of vegetation (not including vegetation classed as exotic grassland) may need to be removed, including:

- up to 7.3 hectares of planted native vegetation
- up to nine hectares of exotic scrub and forest.

It is expected that large areas of the planted native vegetation and exotic scrub and forest would not require removal for the corridor works, however this is subject to the detailed design of the proposed works, including fencing and the communications services route.

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 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 2.3.2.

2.5 Associated infrastructure

2.5.1 Substations and station services buildings

Construction of substations and services buildings would generally involve:

- enabling works (as described in Section 2.2)
- 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 2.6.

2.5.2 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:

- along 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
- along Westfield Street (including the substation access road) between Mooney Avenue and the Canterbury Substation.

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.

2.6 Finishing, testing and commissioning

2.6.1 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 Section 1. 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 2.1.2.

2.6.2 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 2.7.2). Alternative transport arrangements for rail customers would be implemented during this period (refer to Section 2.11).

2.7 Construction program and timing

2.7.1 Program

An indicative construction program is provided in Figure 2.2.

Construction of the preferred project would commence once all necessary approvals are obtained (anticipated to be in 2018/2019). Upgraded stations would be progressively delivered from 2019 until 2022, with the main station upgrade works estimated to take about one year 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 would also occur during this period to improve the reliability of services.

Station works would potentially be staggered throughout the overall construction period so that not all station works would be undertaken at once. This would mean that most stations would be open to customers for the majority of the construction period. A typical construction program for station works is provided in Figure 2.3.

Sydney Trains services would continue to operate to each station throughout the construction period (excluding during possessions or any other closure periods).



Figure 2.2 Indicative construction program for the preferred project

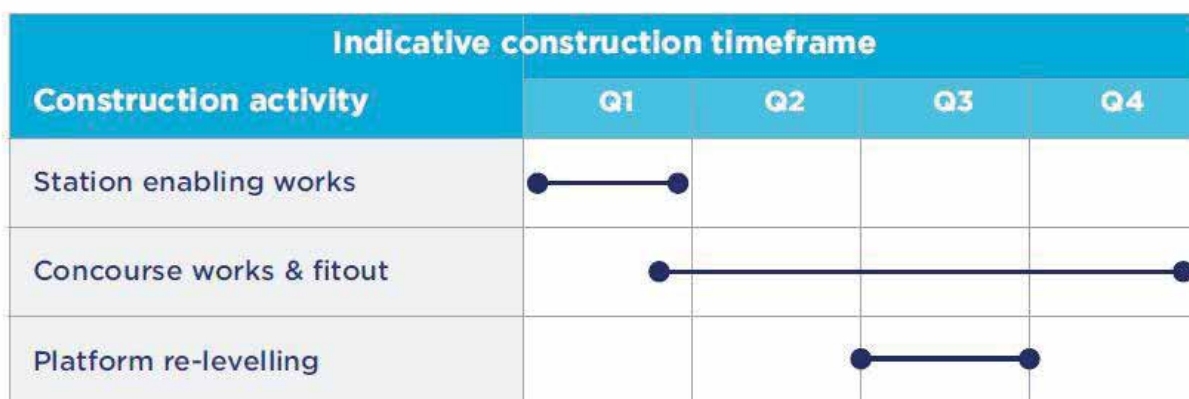


Figure 2.3 Indicative construction program for station works

2.7.2 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 may need to be undertaken during possession periods include:

- station works and activities on stations which cannot be undertaken during operation of the network
- track and corridor works
- bridge works.

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 2.11.

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 weekend 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 the preferred project works.

Additional weekend possessions

Up to an additional eight weekend possessions would be required each year to complete the preferred project works. Works to be undertaken during standard and additional weekend possessions would include installation of communications services routes, bridge works, fencing and station works that need to be undertaken from or interface with the rail track.

School holiday possessions

This would involve up to a two week possession of the T3 Bankstown Line (either in full or part) during the Christmas school holiday periods. Opportunities to minimise the number or duration of school holiday possessions would be further investigated during detailed design and following appointment of the construction contractor.

The assessment assumes the use of a full line possession during the Christmas school holiday periods. This would be in addition to the standard and additional weekend possessions outlined above. It is proposed to undertake possessions during the Christmas 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.

Night-time weekday possessions

Night-time weekday possessions would involve closure of the rail line once the evening peak train services have concluded and the line would be re-opened prior to morning train services commencing. Night-time weekday possessions would be required on an occasional basis to prepare the rail corridor ahead of weekend or school holiday possessions and maximise the activities that can be undertaken during these possessions. Other low noise generating activities, such as survey and investigations, may also be undertaken during this time.

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 2.6.2.

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.

2.7.3 Temporary station closures

Individual stations may also be closed for up to 2 months to complete the station works. Up to three stations may be closed at any one time. Temporary rail replacement buses would be provided during these periods in accordance with the alternative transport arrangements described in Section 2.11.

Prior to any closures, the community (including customers) would be notified about any proposed changes to access.

2.7.4 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 preferred project is approved.

During possession periods (described in Section 2.7.2), 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, including ballast tamping, would not be used during the night-time period (between 10pm and 7am), unless constraints exist such as:

- works requiring a weekend rail possession and where those works cannot be undertaken during daytime and evening periods, due to the limited duration of the rail possession; or
- works subject to requirements of the 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 2.1.2), 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 for the Environmental Impact Statement
- 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.

2.8 Construction compounds, work sites and access

The project area includes all areas required to construct the preferred 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.

For the purposes of the preferred project, 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, rollers, piling rig, water tankers, street sweepers 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 2.2 to 2.6.

2.8.1 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 2.1. A summary of each compound is provided in Table 2.2.

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 2.2 Construction compound locations

Map Ref	Location	Existing use	Duration of use ¹
C1	Victoria Road, Marrickville	Rail corridor	Short-term
C2	Ewart Lane, Dulwich Hill	Rail corridor, parking	Short-term
C3	Floss Street, Hurlstone Park	Roads reserve and rail corridor	Short-term
C4	Broughton Street, Canterbury	Rail corridor and rail uses	Short-term
C5	Charles Street, Canterbury	Rail corridor, parking	Short-term
C6	South Parade, Campsie	Rail corridor	Short-term
C7	North Parade/Wilfred Avenue, Campsie	Rail corridor, road reserve with parking	Short-term
C8	Lilian Street, Campsie	Rail corridor, parking	Short-term
C9	Tobruk Avenue, Belmore	Rail corridor, open space	Short-term
C10	Redman Parade, Belmore	Parking and rail corridor	Short-term
C11	Railway Parade, Belmore	Rail corridor, open space	Short-term
C12	Bridge Road, Belmore	Sydney Trains maintenance facility	Long-term
C13	The Boulevarde, Lakemba	Rail corridor, parking	Short-term
C14	Railway Parade, Lakemba	Rail corridor, parking	Short-term
C15	The Boulevarde, Lakemba	Rail corridor, parking	Short-term
C16	The Boulevarde, Wiley Park	Rail corridor, road verge	Short-term
C17	Urunga Parade, Wiley Park	Rail corridor, road verge	Short-term
C18	Urunga Parade, Punchbowl	Rail corridor	Short-term
C19	Urunga Parade, Punchbowl	Rail corridor, road reserve	Long-term
C20	The Boulevarde, Punchbowl	Parking and corridor	Short-term
C21	Bruest Place, Punchbowl	Rail corridor	Short-term
C22	South Terrace, Bankstown	Rail corridor	Short-term
C23	North Terrace, Bankstown	Rail corridor, road reserve	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. The duration of use of these sites would be minimised where possible.

2.8.2 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 would generally be located outside the rail corridor, are shown in Figure 2.1 and are listed in Table 2.3.

Table 2.3 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	Albermarle Street bridge	Roadway/ rail corridor	Bridge works	Short-term
W3	Dulwich Hill	Rail corridor and Council car park	Crane location for construction of station	Short-term
W4	Terrace Road bridge	Rail corridor and road verge	Bridge works	Short-term
W5	Garnet Street/The Parade, Dulwich Hill	Rail corridor and road verge/informal parking	Bridge works	Short-term
W6	Melford Street/Canberra Street, Hurlstone Park	Rail corridor and road reserve	Bridge works	Short-term
W7	Close Street, Canterbury	Former Canterbury Bowling and Community Club	Support for Canterbury Station works and corridor works including car parking	Long-term
W8	Charles Street, Canterbury	Rail corridor and car park	Station works	Short-term
W9	South Parade at Wairoa Street, Canterbury	Rail corridor and road verge	Bridge works	Short-term
W10	Lillian Lane, Campsie	Rail corridor and road verge	Bridge works	Short-term
W11	Redman Parade, Belmore	Rail corridor and road reserve	Bridge works	Short-term
W12	The Boulevarde	Rail corridor and road verge	Substation works	Short-term
W13	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. The duration of use of these sites would be minimised where possible.

Work site 7 is proposed on the former Canterbury Bowling and Community Club. As a result, further detail is provided in Figure 2.4 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.

2.8.3 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 2.1.2). 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 preferred project, described in Section 2.3.2.

2.8.4 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 1.2.2, leases would be entered into as required.



Figure 2.4 Indicative layout for work site 7

2.8.5 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 2.1.

2.8.6 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.

2.8.7 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 2.5.



Figure 2.5 Indicative hoarding to be used at compounds and work sites

2.8.8 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 2.6 at a regional scale, and in more detail on Figure 2.1. 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.

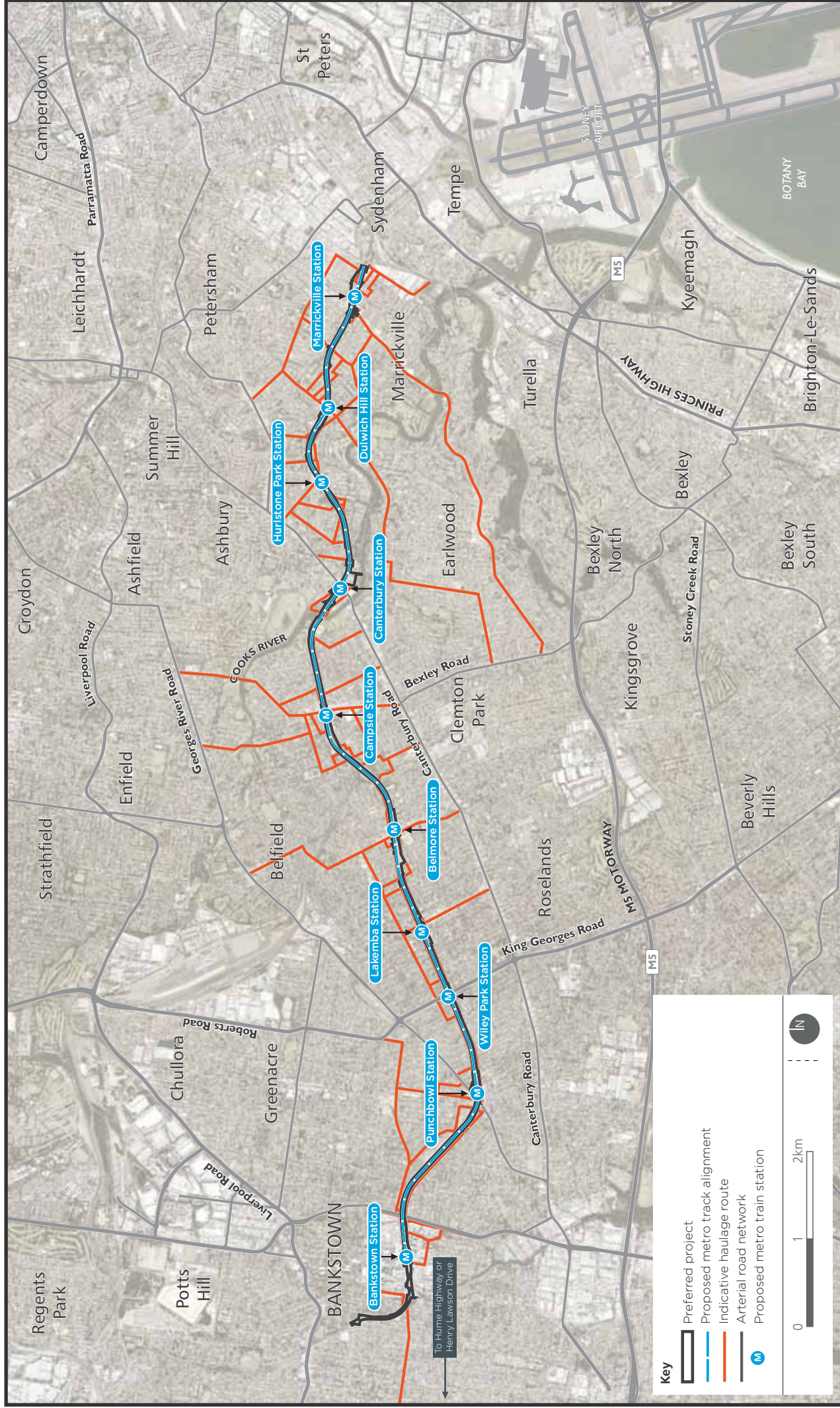
2.8.9 Construction traffic volumes

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 – up to 19 metres long (includes rigid and semi-trailer vehicles), greater than 4.5 tonnes.

Estimated traffic volumes are summarised in Table 2.4. 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.



Preliminary haulage routes

FIGURE 2.6

Table 2.4 Estimated construction traffic volumes during possession periods

Construction compound	Vehicles per hour - AM peak (7.30 - 8.30am) ¹		Vehicles per hour - PM peak (4.15 - 5.15pm) ¹		Heavy vehicles per hour outside recommended standard hours ¹	
	Heavy vehicles	Light vehicles	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	48	44	48	44	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.

2.9 Workforce and construction resources

2.9.1 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 2.5.

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 2.5 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

2.9.2 Materials and water usage

A variety of materials would be required to construct the preferred project. The major items and indicative quantities are listed in Table 2.6.

It is estimated that about 45,000 cubic metres of fill material would be required to construct the preferred project. It is expected that all, or the vast majority of, fill material could consist of spoil excavated from the project area.

Table 2.6 Indicative material and water usage estimates

Location	Concrete (m ³)	Steel (tonnes)	Water (litres)	Ballast (tonnes)
Marrickville Station	300 to 500	100	300,000	0
Dulwich Hill Station	300 to 500	100	300,000	0
Hurlstone Park Station	300 to 500	100	200,000	0
Canterbury Station	300 to 500	100	250,000	0
Campsie Station	300 to 500	100	400,000	0
Belmore Station	200	100	300,000	0
Lakemba Station	300 to 500	100	500,000	0
Wiley Park Station	300 to 500	100	200,000	0
Punchbowl Station	300 to 500	100	500,000	0
Bankstown Station	800	50	600,000	2,934
Corridor between Bankstown to Punchbowl	200	80	1,200,000	6,000

2.9.3 Construction plant and equipment

An indicative list of the plant and equipment expected to be used during construction is provided in Table 2.7. 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.

2.9.4 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 2.10.

Table 2.7 Indicative construction plant and equipment

Scenario	Back hoe	Ballast tamper	Bobcat	Cable trailer and truck	Cable winch	Compressor	Concrete pump	Concrete truck / agitator	Diamond saw	Excavator	Franna crane	Generator	Hand tools	Horizontal direction drill	Mobile crane (300 tonne)	Mobile crane (50 tonne)	Piling rig (bored)	Roller (non-vibratory)	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			✓	✓	✓						✓			✓					✓		

2.10 Utilities management

The potential impacts on key utilities, and the proposed approach to managing utilities during construction, are considered in this section.

2.10.1 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 preferred project.

The location of trunk utilities has been based on Dial Before You Dig searches; and a review of utility data, including as-built surveys, and agency and council records. Preliminary consultation has also been held with utility owners, including Sydney Water, Ausgrid, Telstra, TPG, and Qenos.

The following utility owners have assets which may require adjustment, protection, and/or relocation as part of the preferred 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 pipeline (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
 - aerial optic fibre and coaxial cables
 - underground copper wire
 - vacant cable conduits
- NBN:
 - network cables
- Optus:
 - underground optic fibre cables
 - aerial optic fibre and coaxial 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.

2.10.2 Potential impacts and management framework

The *Sydney Metro City & Southwest Sydenham to Bankstown Upgrade Utilities Management Framework* (Sydney Metro, 2017c) (the 'Utilities Management Framework') 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 preferred 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 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.

2.11 Alternative transport arrangements

2.11.1 Temporary Transport Strategy

The *Sydney Metro City & Southwest Sydenham to Bankstown Temporary Transport Strategy* (Sydney Metro, 2017d) (the 'Temporary Transport Strategy') 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 preferred 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 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.

2.11.2 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.

The temporary transport plans may include consideration of the following, depending on the type and duration of rail possession:

- increasing rail service frequencies on the T2 Inner West Line (between Lidcombe and the CBD) and the T8 Airport and South 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 Inner West Line and the T8 Airport and 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
 - 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 preferred project would include a review of the temporary transport plan for the Sydney Metro Epping to Chatswood conversion, 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, and specified in the plan. This would include identifying any temporary leases required to support the implementation of the temporary transport management plans.

A number of different approaches are available for providing temporary bus services. Each approach may form a component of the temporary transport plans. These components, shown in Figure 2.7, include:

- buses that stop at all stations along the corridor (required for all possession types)
- buses that only stop at a limited number of stations before continuing an express service to the end of journey location (required for all possession types)
- buses that move passengers to another rail line such as the T2 Inner West Line, the T8 Airport and South Line and the T1 North Shore, Northern & Western Line (to be considered for the Christmas school holiday and final possessions)
- 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 (to be considered for the Christmas school holiday and final possessions).

During temporary closures of stations, buses would move passengers to the nearest open station.

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 the Temporary Transport Strategy.

2.11.3 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 and 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 T8 Airport and 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.

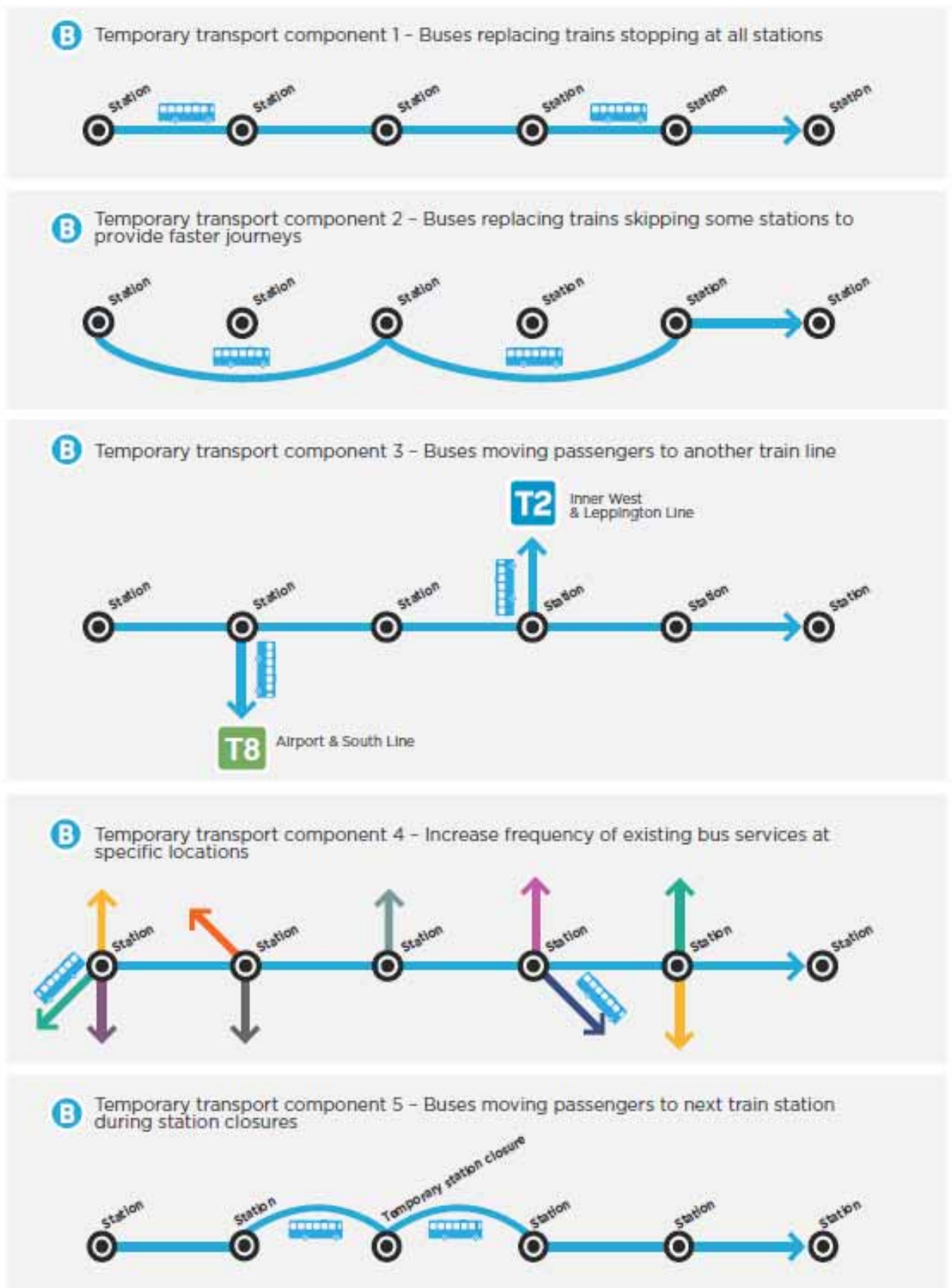


Figure 2.7 Temporary transport management plan components

SYDENHAM TO BANKSTOWN

SUBMISSIONS AND PREFERRED INFRASTRUCTURE REPORT

> Appendix B – Preferred project description