Part B

North Strathfield metro station

10

10.0 North Strathfield metro station

This chapter provides a description of North Strathfield metro station and its precinct during operation and construction of this proposal. This chapter also provides an assessment of potential impacts during operation and construction that relate to North Strathfield and identifies mitigation measures to address these impacts.

10.1 Overview

North Strathfield metro station would be located immediately adjacent to the existing North Strathfield Station and would provide direct interchange with the T9 Northern Line.

The metro station would be located parallel and to the west of Queen Street, bounded to the north by Pomeroy Street, to the east by Queen Street, and to the south by the existing North Strathfield Station entry.

North Strathfield metro station would provide customers travelling on the busy T9 Northern Line with an attractive interchange option to access key centres, as well providing as access to new centres.

The area surrounding North Strathfield is characterised by single storey detached residential properties and low-rise residential apartments, townhouse buildings and a mix of schools and commercial uses. The North Strathfield local centre is located nearby on the opposite side of Queen Street, with retail and offices at street level and some residences above.

10.1.1 Operation

The vision for North Strathfield metro station and its surrounds is for a high amenity living precinct, well connected to Sydney's key employment and leisure destinations.

North Strathfield metro station would provide a direct interchange between Sydney Metro and Sydney Trains services. Entrances located off Queen Street would provide customers with access to the Sydney Trains and Sydney Metro platforms.

A new pedestrian footbridge would also be provided (to the north of the existing station building) to provide an interchange connection between Sydney Metro and Sydney Trains services and connect to a new station entry from the west via Pomeroy Street. The existing footbridge that connects Queen Street, the Sydney Trains station platforms, and the public footpath access to the west of the station (between Pomeroy Street and Hamilton Street East), would also provide a connection to the metro station. The existing footbridge may also require upgrades/replacement including the potential widening of the footbridge to provide improved interchange capacity (to be further investigated subject to detailed design and further stakeholder consultation).

North Strathfield metro station would support the local centre at North Strathfield, providing activation through enhanced access and connections. The station would also support several of the priorities and initiatives outlined by the City of Canada Bay Council.

When operational, North Strathfield metro station would provide legible, safe and intuitive station access to the east and west of the existing rail corridor, including connectivity to the Bakehouse Quarter and to Powells Creek open space. It would deliver new public domain enhancements to Queen Street and support the development of the proposed local centre.

A number of changes would be made to the local transport network to facilitate integration of the metro station, including a new low-speed environment on Queen Street to prioritise pedestrians, new kiss and ride and bus zones, and upgrades to a number of surrounding intersections.

During operation, there is generally expected to be a noticeable improvement to the character and visual amenity of the area due to the new metro station, and the associated accessibility and placemaking outcomes. However, from some viewpoints there may be a reduction in visual amenity due to the scale of the metro infrastructure and changes to the existing North Strathfield Station. The design of the station would be consistent with the principles and outcomes presented in the Design Guidelines developed for Sydney Metro West, including place-specific design principles that respond to contextual factors (refer to Appendix E).

The accessibility and placemaking improvements would also result in social benefits associated with increased access to jobs, education and services and improved amenity, and some opportunities for local businesses such as increased passing trade and improved accessibility.

Key potential impacts anticipated during operation of North Strathfield metro station include:

- the majority of intersections around North Strathfield metro station would operate at satisfactory levels, although there would be some minor increased delays at the Pomeroy Street / Queen Street / Beronga Street intersection due to proposed modifications to accommodate pedestrian and bus movements
- the presence of new metro station infrastructure and interchange facilities with the existing station would change the setting of the local heritage listed station. This impact is anticipated to be minor and would be managed through the Design Guidelines and design quality processes so that the new built elements are sympathetic to the heritage significance of the existing station.

Potential impacts associated with other environmental matters such as operational noise and vibration, Aboriginal heritage, groundwater, flooding, social and business impacts would comply with the relevant criteria and/or be minor to negligible.

10.1.2 Construction

Major civil construction including station excavation and tunnelling work at North Strathfield was assessed and approved under a previous Sydney Metro West planning application and does not form part of this proposal. This proposal includes the construction activities required to complete North Strathfield metro station, and associated precinct work required for the operation of Sydney Metro West.

Construction of North Strathfield metro station would require the continued use of two construction sites on the eastern side of the existing rail corridor established as part of the of the work carried out under the previous Sydney Metro West planning application. Additional areas within the existing rail corridor would also be required to support construction of this proposal. The work for this proposal is expected to have a total duration of about four years.

Construction transport impacts would generally be a continuation of those from the work carried out under the previous Sydney Metro West planning application, including the closure of the footpath and removal of parking along the western side of Queen Street. In addition, parking along the eastern side of Queen Street would also be removed to maintain two-way traffic flow along this road. Opportunities to mitigate on-street parking impacts would be explored in consultation with the City of Canada Bay Council during construction planning. Access to the pedestrian footbridge on the southern end of the existing North Strathfield Station would be maintained during construction. Nearby intersections would generally perform at the same level of service with or without construction traffic or operate with spare capacity with the addition of construction traffic.

Construction work required within the rail corridor at and around North Strathfield Station would primarily be carried out during scheduled Sydney Trains rail possessions. Rail replacement bus services, which operate during rail possessions, would be provided.

There would be potential temporary noise and vibration impacts associated with worst-case scenario aboveground construction activities. During the daytime, noise impacts are predicted to be ‘low’ to ‘moderate’ when work would be carried out outside the station, particularly when noise-intensive equipment such as concrete saws is being used. During the night-time, outdoor work during rail possessions is predicted to result in ‘low’ to 'moderate’ noise impacts at the nearest residential receivers. These impacts would occur over isolated weekend periods. High sleep disturbance impacts are predicted at one residential receiver with ‘moderate’ impacts predicted at several other nearby residential receivers during the rail possession work. There would be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur. The Sydney Metro Construction Noise and Vibration Standard (CNVS) would be implemented to manage temporary impacts and further investigation of minimising sleep disturbance would be completed as detailed construction planning information becomes available.

Construction activities occurring within and around the existing local heritage listed North Strathfield Station would result in moderate temporary impacts to the setting of the item. The presence of construction work and disruptions to the local area are also expected to result in moderate impacts to landscape character and visual amenity, medium social impacts and slight negative impacts to local businesses.

Some minor additional vegetation clearing would be required, mainly within the existing rail corridor. This vegetation is comprised of planted street trees and naturally propagated native and exotic species, and there would be minimal biodiversity impacts.

Potential impacts associated with other environmental matters such as Aboriginal heritage, contamination, groundwater and flooding would be minor to negligible.

These impacts would be managed through the implementation of the Sydney Metro management frameworks and standard mitigation measures including the Construction Environmental Management Framework (CEMF), Overarching Community Communications Strategy (OCCS), Construction Traffic Management Framework (CTMF) and CNVS.

10.2 Station and precinct description

10.2.1 Design development

Development of the design has involved ongoing consultation with stakeholders and the Design Advisory Panel. This has included:

- feedback as part of submissions to and consultation associated with the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a)
- ongoing meetings and workshops held with Canada Bay Council since exhibition of the preceding approved *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a)
- ongoing meetings with Sydney Trains
- meetings and advice from the Design Advisory Panel.

Key features or changes to the design to avoid or minimise impacts, and respond to feedback from stakeholders and the Design Advisory Panel include:

- setbacks of the station buildings from Queen Street – responding to feedback from Canada Bay Council
- provision of public plaza space fronting Queen Street – responding to feedback from Canada Bay Council
- retention of a cross corridor pedestrian link across the corridor between Hamilton Street East and Wellbank Street, consistent with feedback from the Design Advisory Panel and Canada Bay Council
- a design that is sympathetic to the heritage significance of the existing North Strathfield Station – responding to feedback from the Design Advisory Panel.

10.2.2 Station design

The indicative layout and key design elements of North Strathfield metro station are shown in Figure 10-1, with a long-section and cross-section shown in Figure 10-2 and Figure 10-3, respectively. The design of the metro station is subject to further detailed design development.

The key features of North Strathfield metro station are provided in Table 10-1.

Table 10-1 Key features – North Strathfield metro station

Key features	Description
Proposed station entry	• entries on Queen Street • entry from Pomeroy Street via a pedestrian footbridge to the west of the proposed metro station • entry from Hamilton Street East via retained pedestrian footbridge to the west of the proposed metro station.
Customers	• residents within walking and cycling distance • visitors travelling to and from nearby residential and education areas • visitors to local entertainment, retail or dining attractions • customers transferring to and from other transport modes.
Primary station function	Origin and interchange.
Catchment	Residential, education and entertainment.
Transport interchange	• walk • cycle • suburban rail, and potentially intercity services • bus • point-to-point transport • kiss and ride.

North Strathfield metro station would consist of an underground station with an island platform in a north-south orientation.

A new pedestrian footbridge located off Queen Street would provide customers with access to the Sydney Trains and Sydney Metro platforms via entrances on Queen Street. Customers transferring between the Sydney Metro network and the Sydney Trains network would do so within the paid area of the footbridge. A public domain area would be located to the south of the proposed metro station.

A new pedestrian footbridge would also be provided (to the north of the existing station building) to provide an interchange connection between Sydney Metro and Sydney Trains and connect to a new station entry from the west. The existing footbridge that connects Queen Street, the Sydney Trains station platforms, and the public footpath access to the west of the station (between Pomeroy Street and Hamilton Street East), may require upgrades/replacement including the potential widening of the footbridge to provide improved interchange capacity (to be further investigated).

Escalators and/or stairs and lifts would provide access to the Sydney Trains and Sydney Metro platforms.

Areas for station services and utilities would be provided underground and within consolidated services buildings.

The aboveground station infrastructure (including new pedestrian footbridge, station services and space for non-station use) would rise about six to seven storeys above the street at the northern end of the station.

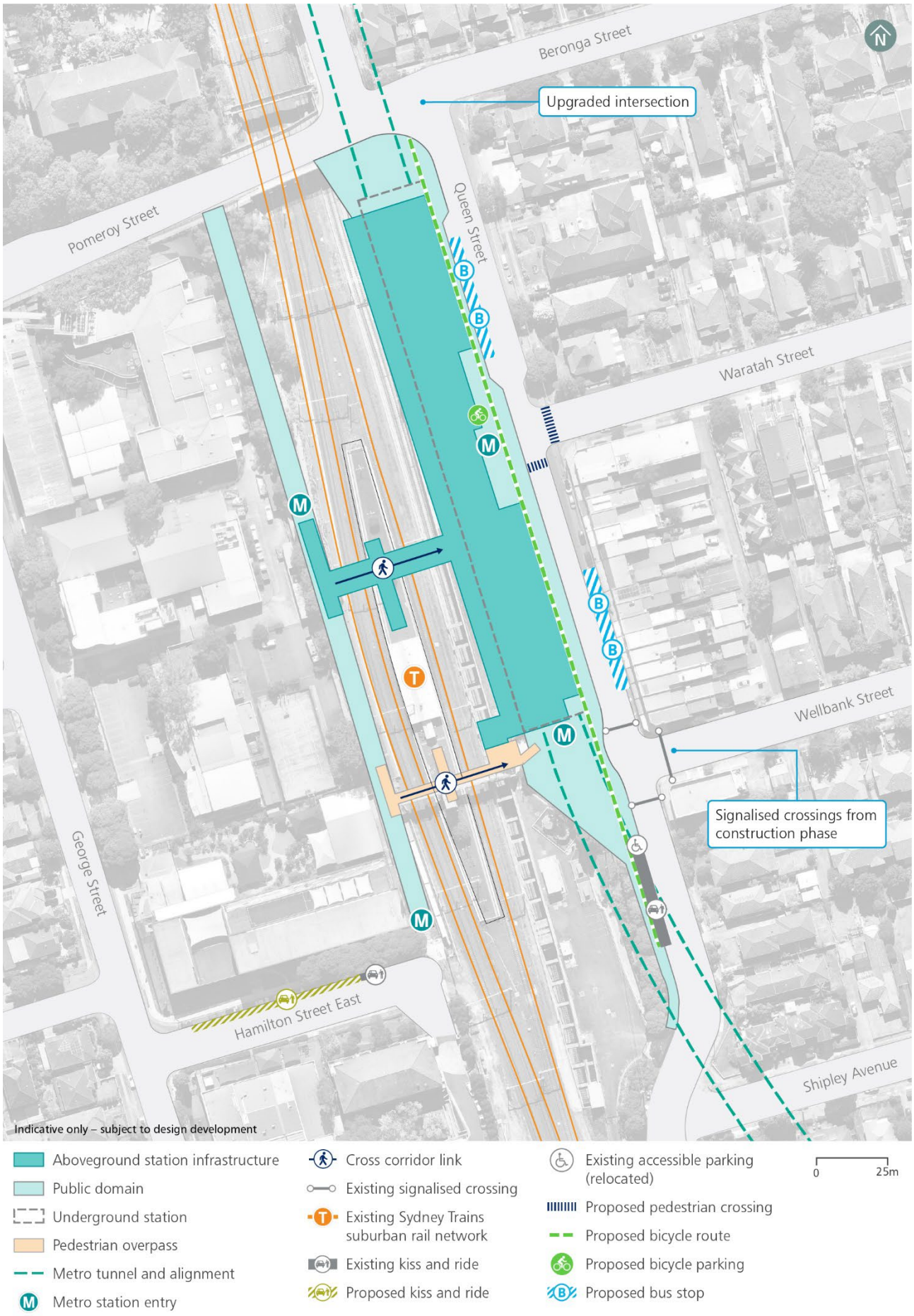

Figure 10-1 Indicative layout and key design elements – North Strathfield metro station

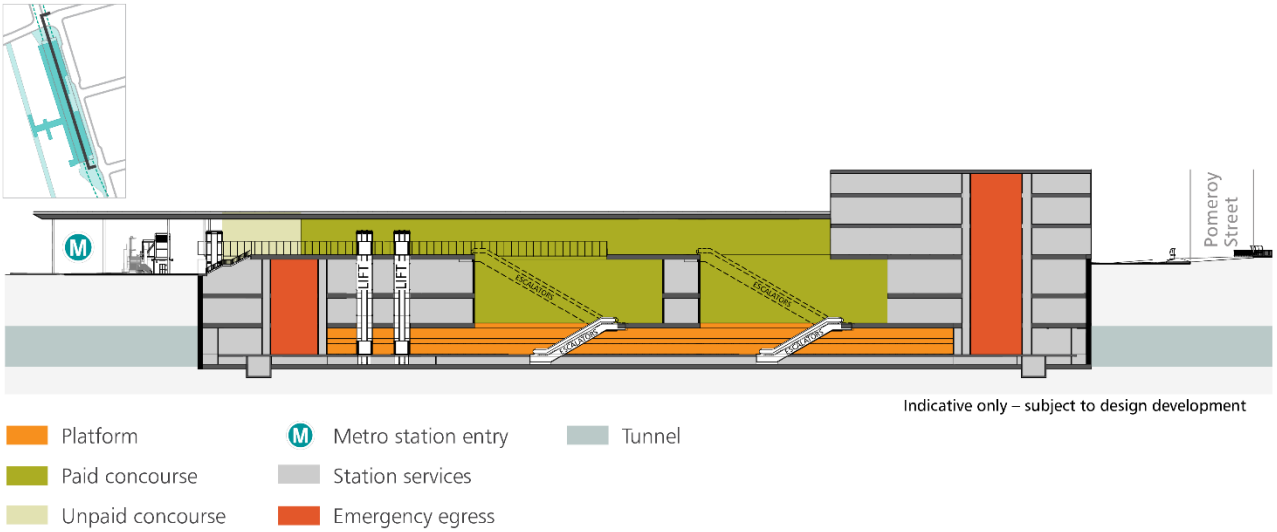

Figure 10-2 Indicative long-section - North Strathfield metro station

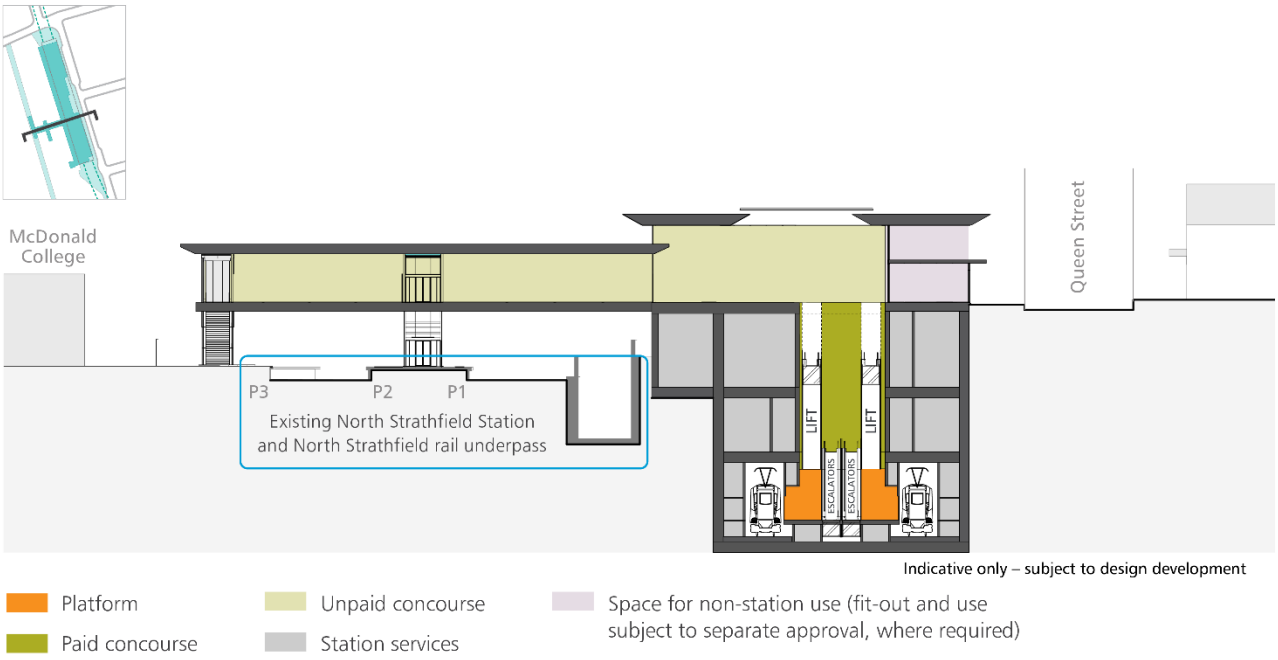

Figure 10-3 Indicative cross-section - North Strathfield metro station

10.2.3 Station precinct and interchange facilities

North Strathfield metro station would include a series of precinct and interchange elements, such as:

- bicycle parking
- a new pedestrian footbridge accessed via Pomeroy Street and Hamilton Street East (to the north of the existing station building) to provide for transfers with the Sydney Trains network within the paid area of the station and a new western entry to the station
- cross-corridor pedestrian connection between Queen Street, the Sydney Trains station platforms, and the public footpath access to the west of the station (between Pomeroy Street and Hamilton Street East) at opening of this proposal, with the potential to upgrade the existing aerial footbridge to enhance pedestrian flow and connectivity throughout the station precinct to be further investigated
- provision for local bus interchange on Queen Street
- dedicated kiss and ride located on Queen Street and Hamilton Street East

- new crossings and/or intersection treatment along Queen Street at the Beronga Street, Wellbank Street and Waratah Street intersections
- built elements along Queen Street, and provision of utilities and services to provide space for future non-station uses to around the height of the station footbridge (e.g. retail, commercial and/or community facilities). Fit-out and use of these spaces would be subject to separate approval, where required. Refer to Section 5.4.3 (Structures and spaces for non-station uses) of this Environmental Impact Statement for further detail.

10.2.4 Provisioning for over and/or adjacent station development

Over and/or adjacent station development is not proposed at North Strathfield metro station.

10.3 Placemaking

The vision for North Strathfield metro station and its surrounds is for:

A high amenity living precinct, well connected to Sydney's key employment and leisure destinations.

10.3.1 Integration with strategic planning

The *Eastern City District Plan* (Greater Sydney Commission, 2018b) identifies North Strathfield as a local centre within an urban renewal area. To capitalise on this plan, a number of plans and strategies have been developed, which have informed the development of North Strathfield metro station and would guide the future design.

This proposal has considered the objectives of *Better Placed* (Government Architect NSW, 2017) as outlined in Section 5.2 (Placemaking and design) of this Environmental Impact Statement. An overview of how this proposal meets the relevant transport and connectivity outcomes of the *Healthy Built Environment Checklist* (NSW Government, 2020a) is also provided in Appendix I (Healthy Built Environment Checklist).

City of Canada Bay Local Strategic Planning Statement

The relationship of Sydney Metro West to the *City of Canada Bay Local Strategic Planning Statement* (City of Canada Bay Council, 2020) is discussed in Section 7.10.4 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a).

The Local Strategic Planning Statement highlights that a metro station at North Strathfield would support urban renewal in the area west of the existing rail corridor, development of a local centre focused on Queen Street, and investigation into housing diversity in the area east of the station.

A new metro station would support the development of the local centre at North Strathfield, providing activation through enhanced access and connections. The benefits of metro are recognised, with Council reviewing and updating strategic bicycle plans so that routes and links provide safe and legible connections.

The station would be able to support several of the priorities and initiatives outlined by Council. North Strathfield metro station would provide a major investment in transport infrastructure and realise the development of a new transport interchange at North Strathfield, improving transfer opportunities between metro, trains and buses. A metro station at North Strathfield would also support the objectives, priorities and actions of the Local Strategic Planning Statement by providing an activated public domain to Queen Street, servicing increased housing diversity and urban renewal in the area and encouraging active transport use.

Parramatta Road Corridor Urban Transformation Strategy

The *Parramatta Road Corridor Urban Transformation Strategy* (NSW Government, 2016) provides the long-term vision and framework to support coordinated employment and housing growth in the Parramatta Road Corridor. North Strathfield is identified within the Homebush Precinct. The vision of the Homebush Precinct is to transform the area into an 'active and varied hub, blending higher density housing and a mix of different uses, supported by a network of green links and open spaces with walking access to four train stations.'

Sydney Metro West would support this vision, with the metro station increasing public transport accessibility and development opportunities in the area.

Sydney Green Grid

Powells Creek and Mason Park have been identified as a Green Grid project opportunity. Powells Creek and Mason Park form an important open space corridor linking the urban centres of Concord West, North Strathfield, Homebush and Strathfield to Parramatta Road, Bicentennial Park and the Parramatta River foreshore. The Parramatta Road Urban Renewal Corridor is also identified as a project opportunity, with the potential to improve access to open space along the corridor as renewal occurs. Sydney Metro would support improved access to these open spaces by providing upgraded entries to the west of the station and enhanced easy connections across the existing rail corridor.

10.3.2 Place and design principles

Place and design principles for North Strathfield metro station were identified in Section 7.10.4 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a). The principles build on the five Sydney Metro-wide design objectives and have considered relevant local council strategies and *Better Placed* design objectives (refer to Section 5.2 (Placemaking and design) of this Environmental Impact Statement). Table 10-2 outlines how these principles have been achieved in the North Strathfield metro station design.

Table 10-2 Design responses to North Strathfield metro station place and design principles

Place and design principle	Design response
Facilitate direct interchange between Sydney Metro and Sydney Trains services on the T9 Northern Line and easy connections with other modes	• the metro station is located immediately adjacent to the existing Sydney Trains station and is relatively shallow to minimise customer transfer time between the metro and Sydney Trains services • a new pedestrian footbridge between the metro platforms and the Sydney Trains platforms would provide direct, accessible interchange • direct connection would be provided to new bus stops on Queen Street near the station entry • improved connections across the existing rail corridor with the integration of the existing station access at the southern end into the metro entry.
Ensure legible, safe and intuitive station access to the east and west of the existing rail corridor	• two new station entries would be located on Queen Street, to facilitate access from the east with: - one opposite the intersection with Waratah Street and close to the new bus stops - a second entrance at the southern end of the station opposite Wellbank Street, connecting with the unpaid cross corridor pedestrian connection to Hamilton Street East • the existing station entries to the west (from Hamilton Street East and Pomeroy Street) would be upgraded and directly connected to the new aerial footbridge providing improved access to Sydney Trains and Sydney Metro platforms.
Support an active public domain area focused on Queen Street	• the metro station would be set back from Queen Street to provide space for a high amenity public domain, including street trees, new street lighting, shelters (at bus stops) and new pavements • provision of a pedestrian friendly low-speed environment on Queen Street near the station entries • pedestrian safety and access improvements would include: - new signalised pedestrian crossings at the Queen Street / Wellbank Street intersection - new pedestrian crossings at the Queen Street / Waratah Street intersection - an upgrade intersection and pedestrian crossings at the Beronga Street / Pomeroy Street / Queen Street intersection.

Place and design principle	Design response
Enable an easy connection across the existing rail corridor and to key destinations including the Bakehouse Quarter and the Powells Creek open space corridor	• easy connection across the corridor would be maintained by the southern accessible connection linking Wellbank Street in the east to Hamilton Street East in the west • broader connectivity is reinforced to the Bakehouse Quarter, and Powells Creek open space (identified as part of the Sydney Green Grid network).
Integrate the historic value of the North Strathfield Station into the design of the metro station, and its surrounding station precinct	• the design would aim to retain or interpret key heritage significance fabric of the existing North Strathfield Station where possible • the design of the station buildings would respond to the local heritage character of the precinct.

The key urban design strategies to support the implementation of the place and design principles are illustrated in Figure 10-4, Figure 10-5 and Figure 10-6.

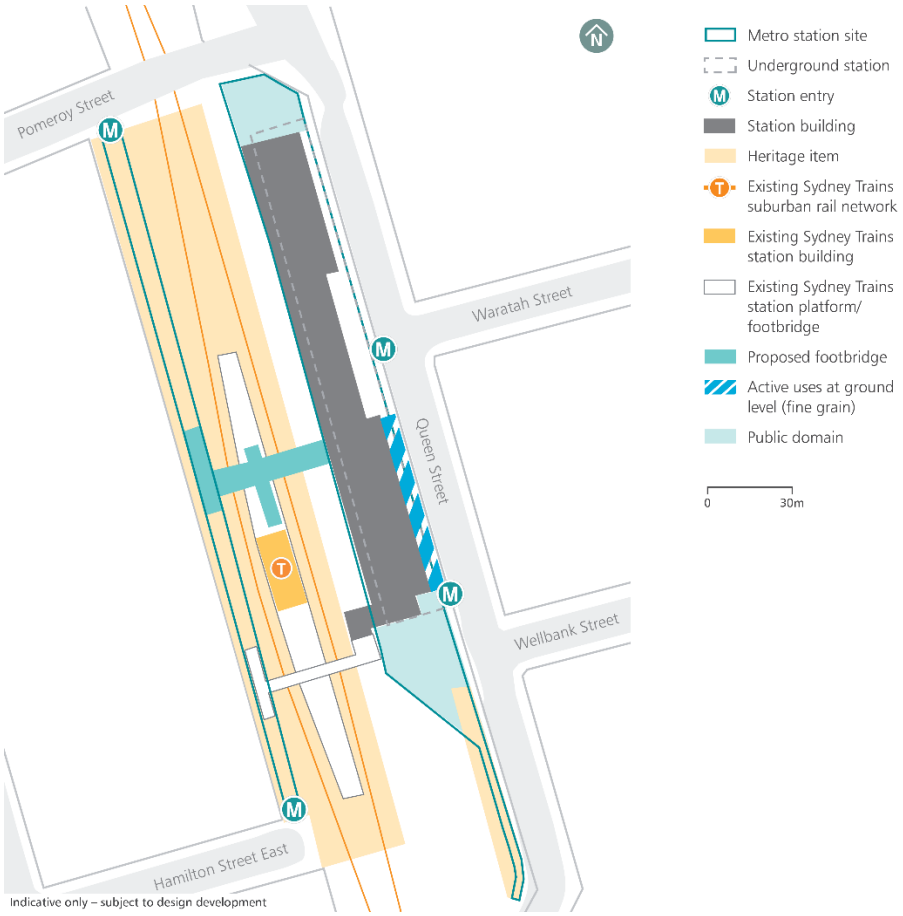

Figure 10-4 Land use and function urban design strategies - North Strathfield metro station

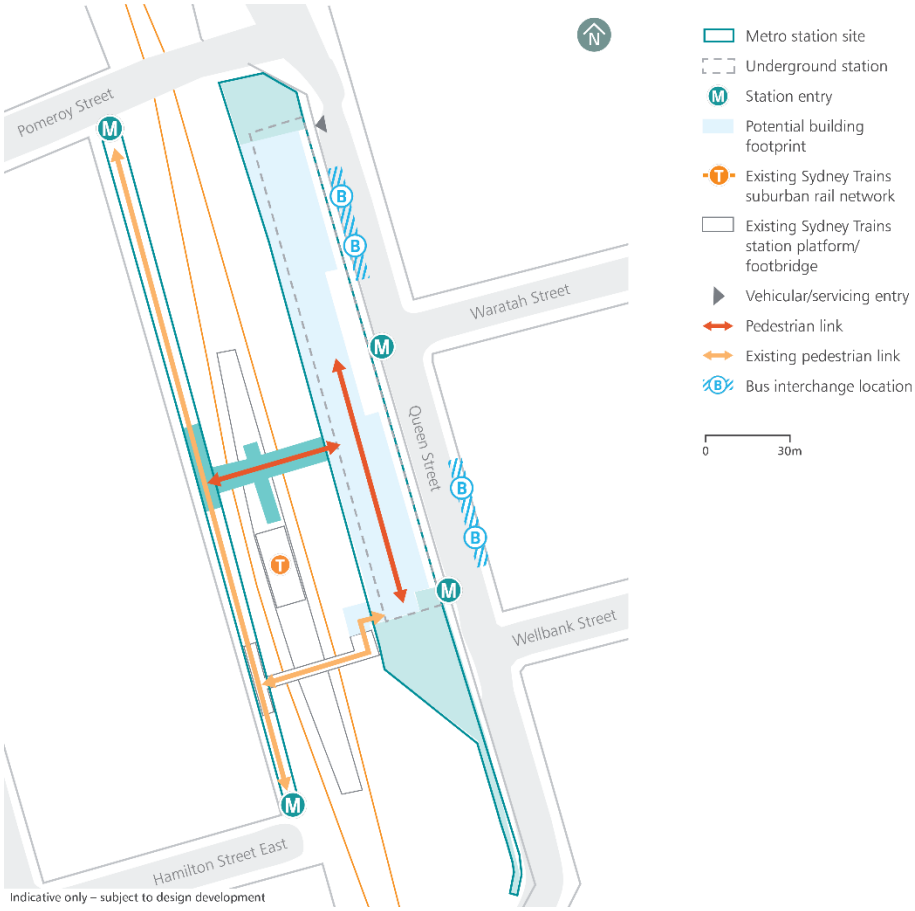

Figure 10-5 Access and connectivity urban design strategies - North Strathfield metro station

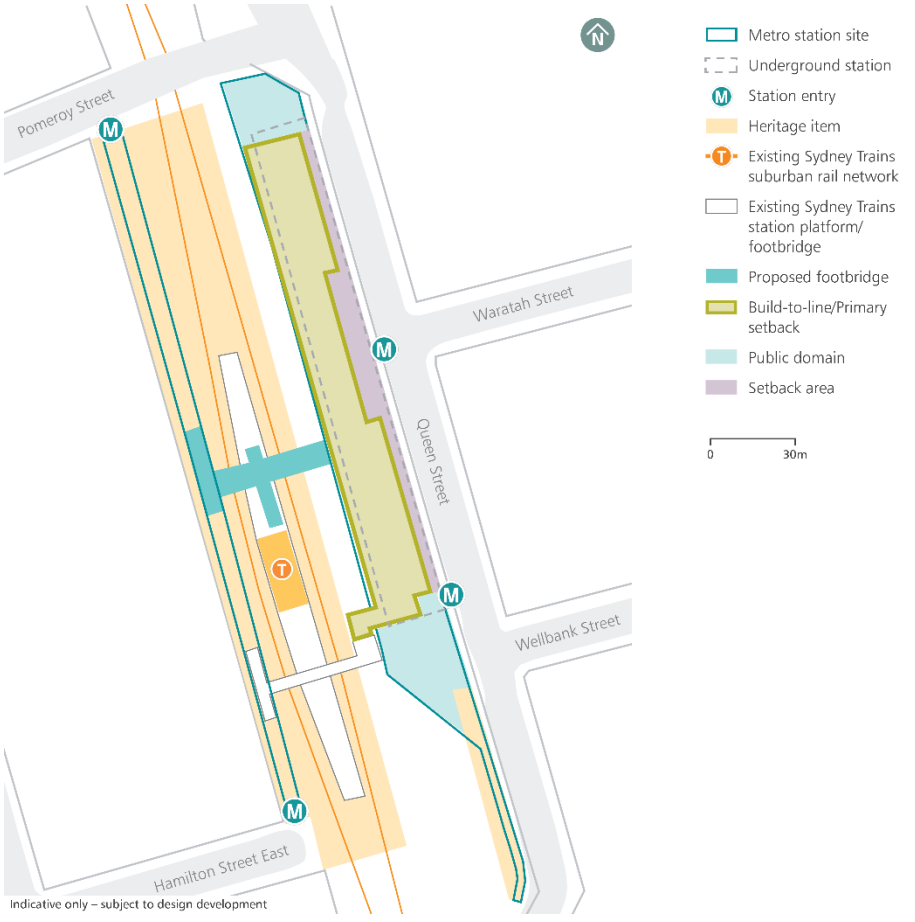

Figure 10-6 Built form urban design strategies - North Strathfield metro station

The North Strathfield metro station design includes the following key movement and place features:

- a new low-speed traffic environment on Queen Street near the station entries to prioritise pedestrians
- improved pedestrian safety and amenity around the station entry precinct with the addition of new signalised crossings at the Queen Street / Wellbank Street intersection and as part of an upgraded Queen Street / Beronga Street / Pomeroy Street intersection
- new pedestrian crossing points opposite the station entry on Queen Street and Waratah Street
- provision of a safe environment for cyclists along Queen Street and bicycle parking facilities at the station to encourage active transport participation
- ability for a continued movement corridor along Queen Street (including for buses) within the traffic calmed environment
- new street enhancements including street tree planting, furniture and fixings, and pavements to enhance the local centre on Queen Street.

10.3.3 Transport interchange, access and connectivity

Integration with other transport modes, including active transport, is fundamental to improving access to the public spaces and local community facilities surrounding or delivered as part of the North Strathfield metro station design. The station is strategically located to provide interchange and relief to the T9 Northern Line. The station would also provide improved access to destinations on the Sydney Metro West corridor to the local community of North Strathfield. The station would deliver new public domain enhancements to Queen Street and support the development of the proposed local centre.

Examples of how the North Strathfield metro station design integrates with other transport modes and improves access for customers and the community include:

- direct, easy and accessible transfer via the new aerial footbridge between Sydney Metro and Sydney Trains platforms
- improved pedestrian access and safety through a low-speed environment and dedicated crossing facilities along Queen Street at Wellbank, Waratah and Pomeroy Streets
- provision of cycling paths along Queen Street and bicycle parking near the station entry
- upgraded station western entries from Hamilton Street East and Pomeroy Street
- maintenance of and connection to the existing accessible unpaid pedestrian access across the rail corridor connecting Wellbank Street in the east to Hamilton Street East in the west. Sydney Metro are continuing to investigate upgrades to the footbridge with the potential for a new pedestrian footbridge to provide enhanced customer transfer capacity while maintaining connection across the rail corridor
- direct access to new bus stops on Queen Street immediately outside the station entry
- provision of new and extended kiss and ride zone on Queen Street and Hamilton Street East.

10.4 Construction description

This section provides a description of the construction activities required to complete North Strathfield metro station, and associated precinct work required for the operation of Sydney Metro West.

Major civil construction including station excavation and tunnelling work at North Strathfield was assessed and approved under *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and does not form part of this proposal.

10.4.1 Overview

Construction of North Strathfield metro station would require the continued use of two construction sites on the eastern side of the rail corridor established as part of the previous Sydney Metro West planning application. Additional areas are also required to support construction of this proposal. The majority of the North Strathfield metro station construction sites would have been levelled and excavated as a result of activities associated with the work carried out under the previous Sydney Metro West planning application prior to the commencement of this proposal. Additional minor excavation would also be required for this proposal to allow for station services on the western side of the proposed metro station (adjacent to the North Strathfield rail underpass structure).

The North Strathfield metro station construction sites for this proposal would comprise:

- the approved construction sites that was established in *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a)
- additional footprint within the rail corridor to support within-corridor construction activities. Construction activities within the existing rail corridor would be undertaken between Rhodes Station to the north and Strathfield Station to the south. The location of these areas within the rail corridor may change during the construction period, depending on specific activities being carried out.

The location and indicative layout of the North Strathfield metro station construction sites are shown in Figure 10-7. Some activities would occur outside this construction sites, such as construction activities within the rail corridor, delivery of construction equipment, and station precinct and interchange work.

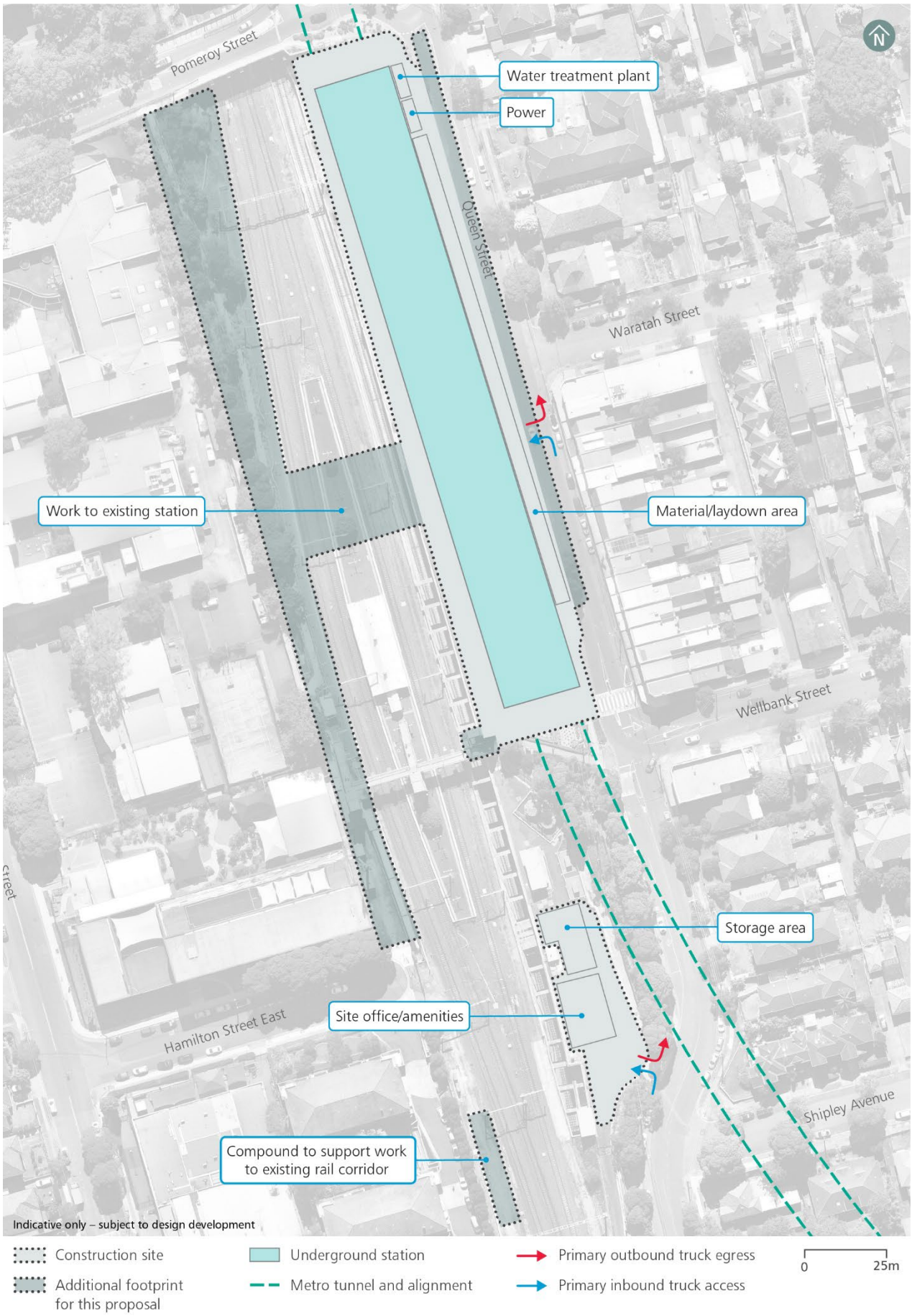

Figure 10-7 Indicative construction sites layout – North Strathfield metro station

10.4.2 Construction work

Key construction work at the North Strathfield metro station construction sites would include:

- enabling and site establishment work, including installation or retention of protection around heritage structures for North Strathfield Station
- relocation of utilities, including:
  - fibre optic cable relocation works within the rail corridor between Rhodes Station to the north and Strathfield Station to the south
  - signals and communication routes at Platform 3
  - overhead wiring structures
- access to and use of the existing rail corridor between Rhodes Station to the north and Strathfield Station to the south, to support work within the rail corridor
- construction and fit-out of a new aerial footbridge (to the north of the existing footbridge) to enable integration of this proposal with the existing Sydney Trains suburban network and to provide access to the existing station and North Strathfield metro station from the west of the rail corridor. This would include modifications such as localised widening to Platform 3
- construction of the station and structures for non-station use
- station fit-out, including tie-in work to the area at the existing aerial footbridge on the eastern side of the rail corridor
- construction of station precinct and interchange facilities
- finishing work, testing and commissioning.

The existing aerial footbridge that connects Queen Street, the Sydney Trains station platforms, and the public footpath access to the west of the station (between Pomeroy Street and Hamilton Street East), may require upgrade/replacement including the potential widening of the footbridge to provide improved interchange capacity (to be further investigated).

The indicative construction program for North Strathfield metro station is shown in Figure 10-8.

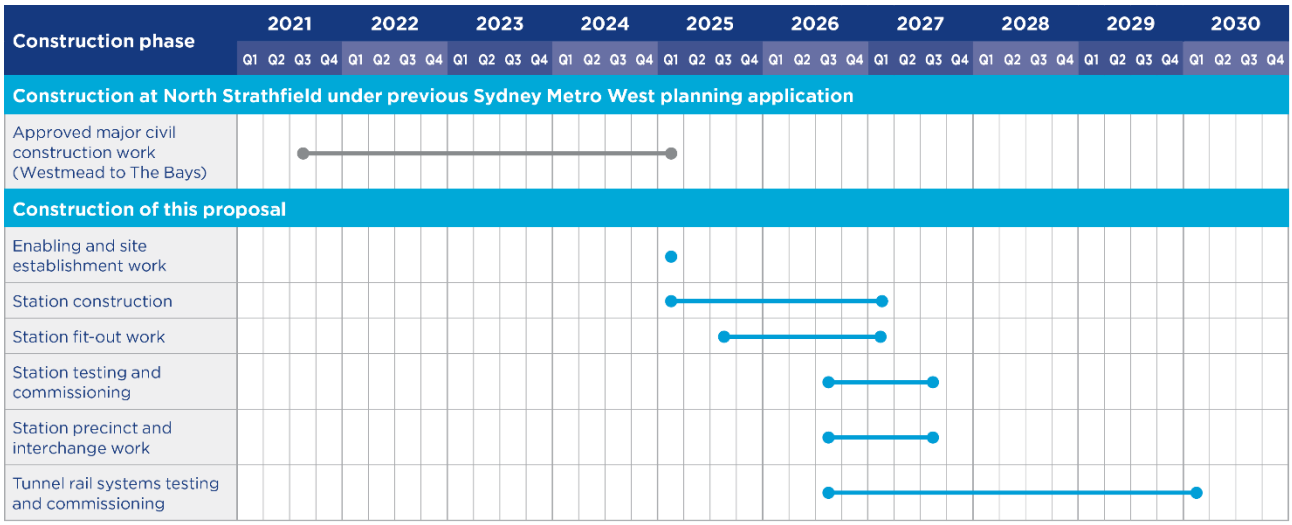

Figure 10-8 Indicative construction program – North Strathfield metro station

Other construction elements specific to North Strathfield metro station are shown in Table 10-3. Indicative construction hours, plant and equipment and workforce for North Strathfield metro station construction sites are provided in Section 6.5 (Other construction elements) of this Environmental Impact Statement. Key elements specific to North Strathfield metro station as described in the table below, are also depicted on Figure 10-7.

Table 10-3 Other construction elements – North Strathfield metro station

Construction element	Description
Construction traffic access and egress	Continued access and egress arrangements established by the work carried out under the previous Sydney Metro West planning application that would likely be maintained during construction include: • access to the construction sites east of the rail corridor via Queen Street. Heavy vehicles would pull up alongside the northern construction site for equipment and material loading and unloading, rather than enter the site.
	Additional and/or new access and egress arrangements likely to be required for construction of this proposal include: • egress from the northern construction site, east of the existing rail corridor by turning left along Queen Street • access to and egress from the existing rail corridor via existing access gates, primarily those located on Queen Street and Hamilton Street East. Other existing gates located between Strathfield Station and Rhodes Station may be used on occasion during rail possession work to support utility relocations.
Peak daily traffic movements	• about 320 daily heavy vehicle movements • about 360 daily light vehicle movements. Note: Movement refers to a one-way movement. A vehicle entering and then leaving a construction site represents two movements.
Transport network modifications	Continued temporary transport network modifications established by the work carried out under the previous Sydney Metro West planning application that would be maintained for the duration of construction include: • temporary removal of around 20 on-street parking spaces on the western side of Queen Street between Wellbank Street and Pomeroy Street. These spaces would also be permanently removed for operation of the station • relocation of the kiss and ride spaces on the western side of Queen Street between Wellbank Street and Pomeroy Street • temporary relocation of the existing school bus stops on the western and eastern sides of Queen Street (north of Wellbank Street) • new traffic signals at the Queen Street / Wellbank Street intersection (this would be a permanent feature present during operation of this proposal).
	Additional transport network modifications that would be introduced during construction of this proposal include the temporary removal of around 20 car parking spaces on the eastern sides of Queen Street between Wellbank Street and Pomeroy Street for the duration of construction. Queen Street will be maintained as one traffic lane in each direction. These spaces would also be permanently removed for operation of the station.

10.5 Transport

Further details of the operational and construction transport assessment, including the approach and methodology, is provided in Technical Paper 1 (Operational Transport) and Technical Paper 2 (Construction transport).

Potential impacts (including benefits) at a regional level or where impacts are common across precincts are assessed in Chapter 18 (Proposal-wide) of this Environmental Impact Statement. This includes strategic transport benefits during operation, and potential impacts in relation to road user safety, construction worker parking, emergency vehicles and road condition during construction.

10.5.1 Baseline environment

The baseline transport environment described for North Strathfield metro station includes the existing transport environment, as well as adjustments made by the work carried out under the previous Sydney Metro West planning application.

Active transport network

Key pedestrian facilities surrounding North Strathfield metro station include:

- footpaths on both sides of most streets in the vicinity of North Strathfield metro station, except on Queen Street south of Pomeroy Street where the footpath on the western side will be removed during the work carried out under the previous Sydney Metro West planning approval
- an accessible pedestrian bridge access across the rail line accessible from Queen Street in the east and Hamilton Street East or Pomeroy Street in the west.

As part of the work carried out under the previous Sydney Metro West planning application, the western footpath of Queen Street south of Pomeroy Street will be temporarily removed and new signalised pedestrian crossings will be provided at the Queen Street / Wellbank Street intersection.

The cycle network surrounding North Strathfield metro station includes:

- on-road and off-road cycle routes along Underwood Road, Bridge Road, Pomeroy Street, The Crescent, Concord Road, Patterson Street and Gipps Street
- shared paths near Powells Creek that form part of the Cooks River cycleway
- bicycle racks on both sides of the station and bicycle lockers on Queen Street.

Public transport network

A summary of the public transport services around North Strathfield metro station is provided in Table 10-4.

Table 10-4 Public transport services – North Strathfield metro station

Mode	Description
Rail	• T9 Northern Line on the Sydney Trains network via the existing North Strathfield Station.
Bus	• 6 bus routes to the east and west of the rail line • on-demand bus services • 21 school bus routes. During the work carried out under the previous Sydney Metro West planning application, the school bus stops on Queen Street north of Wellbank Street would be temporarily relocated to a nearby location.

Parking, loading, servicing and pick-up arrangements

The parking environment around North Strathfield metro station includes:

- time-restricted and unrestricted on-street parking on Queen Street, Beronga Street, Waratah Street, Wellbank Street and Shipley Avenue
- weekday peak-period clearways on Concord Road, with on-street parking available on the eastern side only outside of these periods.

As part of the work carried out under the previous Sydney Metro West planning application, the following parking changes will be in place:

- removal of about 24 on-street parking spaces on the western side of Queen Street between Wellbank Street and Pomeroy Street
- temporary relocation of the kiss and ride bay on the western side of Queen Street north of Wellbank Street to a nearby location
- relocation of a mail zone on the eastern side of Queen Street near Wellbank Street.

Traffic volumes and patterns

Approximate peak-hour midblock volumes on key access roads surrounding North Strathfield metro station are shown in Table 10-5. The key access roads carry traffic volumes generally commensurate with their function.

Table 10-5 Existing peak hour traffic volumes (mid-block) by direction (2021) – North Strathfield metro station

Road	Direction	AM peak hour volume (vehicles per hour)	PM peak hour volume (vehicles per hour)
Parramatta Road west of Concord Road	Eastbound	1,210	1,490
	Westbound	1,250	1,320
Wellbank Street east of Queen Street	Eastbound	350	390
	Westbound	350	400
Pomeroy Street west of Queen Street	Eastbound	800	900
	Westbound	950	860
Underwood Road north of Pomeroy Street	Northbound	970	870
	Southbound	970	1,150
Concord Road north of Parramatta Road	Northbound	960	780
	Southbound	1,170	1,330
Concord Road south of Wellbank Street	Northbound	1,020	980
	Southbound	1,180	1,090
Queen Street north of Wellbank Street	Northbound	410	450
	Southbound	440	490

Intersection performance

Modelled intersection performance during the AM and PM peak hours for key intersections in the vicinity of North Strathfield metro station is shown in Table 10-6. Continued road network changes implemented during the work carried out under the previous Sydney Metro West planning application, including new traffic signals at the Queen Street / Wellbank Street intersection, have been considered in the modelling.

Modelled intersection performance indicates that the following intersections currently perform at level of service E or F:

- Queen Street / Beronga Street / Pomeroy Street during the AM peak hour, which is due to its configuration as a roundabout where the worst movement is reported. This corresponds to the Queen Street northbound movement
- Pomeroy Street / Ismay Avenue during the AM and PM peak hours, which is due to its configuration as a roundabout where the worst movement is reported. This corresponds to the Pomeroy Street westbound movement during the AM peak hour and the Ismay Avenue northbound movement during the PM peak hour
- Pomeroy Street / Underwood Road during the evening peak hour, which is due to high traffic volumes travelling through the intersection, the presence of kerbside parking lanes and split signal phasing on the Pomeroy Street approaches that reduce the capacity and efficiency of the intersection.

Table 10-6 Modelled peak hour baseline intersection performance (2021) – North Strathfield metro station

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approaches (metres)	
Concord Road / Wellbank Street (signalised)					
AM peak	2,436	19	B	NB	55
				EB	40
				SB	95
				WB	75

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approaches (metres)	
PM peak	2,635	30	C	NB	80
				EB	45
				SB	190
				WB	70
Queen Street / Wellbank Street (priority controlled)					
AM peak	1,039	15	B	NB	<5
				EB	-
				SB	5
				WB	10
PM peak	1,086	16	B	NB	5
				EB	-
				SB	5
				WB	10
Queen Street / Beronga Street / Pomeroy Street (roundabout)					
AM peak	2,027	81	F	NB	200
				EB	35
				SB	15
				WB	70
PM peak	1,985	13	A	NB	50
				EB	980
				SB	10
				WB	25
Pomeroy Street / George Street (signalised)					
AM peak	2,608	51	D	NB	90
				EB	410
				SB	95
				WB	95
PM peak	2,466	50	D	NB	70
				EB	345
				SB	75
				WB	120
Pomeroy Street / Ismay Avenue (roundabout)					
AM peak	2,186	>100	F	NB	50
				EB	110
				SB	-
				WB	>500
PM peak	1,945	>100	F	NB	>500
				EB	40
				SB	-
				WB	260

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approaches (metres)	
Pomeroy Street / Underwood Road (signalised)					
AM peak	2,636	46	D	NB	170
				EB	10
				SB	325
				WB	130
PM peak	2,602	71	F	NB	105
				EB	10
				SB	470
				WB	130
Homebush Bay Drive / Underwood Road / Australia Avenue (roundabout)					
AM peak	4,549	20	B	NB	50
				EB	15
				SB	30
				WB	35
PM peak	4,979	42	C	NB	125
				EB	15
				SB	35
				WB	50

Freight transport

Freight trains operate through North Strathfield via the North Strathfield rail underpass.

10.5.2 Operational impact assessment

This section outlines the transport interchange provisions proposed at North Strathfield metro station as shown in Figure 10-1.

The transport interchange provisions have been designed to maximise the seamless travel experience for all customer groups transferring between this proposal and other transport modes. Stations have been designed for ease of interchange from the different modes, including pedestrian and cycle facilities and to minimise disruptions to public transport users and the surrounding road network.

This section also discusses the potential impact of the transport interchange provisions on the transport network during operation.

Passenger demand

Station passenger demand forecast for the 2036 AM peak hour (8am to 9am) indicates about 4,000 customers accessing North Strathfield metro station, 900 customers egressing North Strathfield metro station and nearly 5,000 customers using the station to transfer between Sydney Trains and Sydney Metro services during the AM peak hour. This indicates this station would be used as an interchange but also as a point of origin.

The 2036 modal breakdown of access and egress during the AM peak hour is presented in Table 10-7.

The key observations from this analysis indicate that the majority of access and egress trips would be by walking, with some transfers to bus. Access and egress direction is more common to the west; however, the east also represents a substantial walking catchment.

Table 10-7 2036 forecast mode of access and egress – North Strathfield metro station

Mode	Walk	Cycle	Bus	Kiss and ride	Park and ride
Access	57%	1%	22%	9%	11%
Egress	83%	1%	16%	0%	0%

Integration with other transport modes

A description of how North Strathfield metro station would integrate with existing transport modes during operation is provided in Table 10-8. Appropriate signage and wayfinding would be provided within the precinct to provide easy customer transfer and access to the station.

Table 10-8 Network integration – North Strathfield metro station

Network	Description
Pedestrian network	Two eastern station entries are proposed at North Strathfield metro station via Queen Street – an entry directly opposite Waratah Street and an entry further south opposite Wellbank Street. The existing station entries from the west (from Pomeroy Street and Hamilton Street East) would also be upgraded. New pedestrian facilities proposed to be provided as part of the station and precinct include: • a new aerial pedestrian footbridge connecting the metro station to the existing North Strathfield Station • footpath widening and introduction of a low-speed environment on Queen Street in front of the station entries to prioritise pedestrians • an upgraded walkway from Pomeroy Street to the station entry • new pedestrian crossings at the following locations: - signalised crossings at the Queen Street / Wellbank Street intersection through retention of the construction phase signals (delivered as part of the work carried out under the previous Sydney Metro West planning application) - zebra crossings at the Queen Street / Waratah Street intersection to prioritise pedestrian movements • an upgrade of the Pomeroy Street / Beronga Street / Queen Street intersection including pedestrian crossings. Existing pedestrian facilities that would also assist with providing access to the station include the existing pedestrian link over the railway corridor, providing a key east-west connection and accessible access to the station. 2036 pedestrian modelling indicates that the footpaths surrounding North Strathfield metro station would operate satisfactorily at level of service A in both the AM and PM peak periods.
Cycle network	New cycling facilities proposed to be provided as part of the station and precinct include: • a cycleway along Queen Street to facilitate cycle access to the station • bicycle parking facilities near the station entrances on Queen Street and Hamilton Street East to facilitate easy transfers.
Public transport network	Public transport integration at North Strathfield metro station would include: • direct interchange between Sydney Trains and Sydney Metro services via the new aerial pedestrian footbridge • new kerbside bus stops along Queen Street near the station entries • customers would be able to transfer between the new bus stops and the North Strathfield metro station entries using footpaths and new crossing points across Queen Street. Sydney Metro are continuing to investigate the potential for a new pedestrian footbridge to provide additional customer interchange capacity, and a revised cross-corridor unpaid connection.

Network	Description
Road network	Road network changes that would be implemented as part of the station precinct include: • retention of the construction phase traffic signals at the Queen Street / Wellbank Street intersection • an upgraded Pomeroy Street / Beronga Street / Queen Street intersection. The nature of this intersection upgrade would be determined in consultation with relevant stakeholders, including City of Canada Bay Council and Transport for NSW • zebra crossings on the Queen Street / Waratah Street intersection • introduction of a low-speed environment on Queen Street in front of the station entries • extension of the existing kiss and ride facility on Hamilton Street East • retention of the existing kiss and ride facility on Queen Street • Sydney Metro would investigate opportunities for an additional kiss and ride zone on Waratah Street. Based on the low forecast volumes of customers expected to access the station by car, these trips would not impact road network and intersection performance. Kiss and ride spaces, including accessible spaces, would be provided as described above for these customers. No park-and-ride provisions are proposed and therefore these users would need to utilise the existing parking facilities available. Parking strategies to address potential parking impacts in residential streets in the vicinity of the station would be developed in consultation with the City of Canada Bay Council.

Road network performance

Intersection performance results for the '2036 without proposal' and '2036 with proposal' scenarios during the AM and PM peak hours for key intersections in the vicinity of North Strathfield metro station are shown in Figure 10-9.

Intersections are forecast to operate satisfactorily at level of service C or better during the weekday AM and PM peak periods, with and without this proposal. Some minor increased delays are forecast at the Pomeroy Street / Queen Street/ Beronga Street intersection.

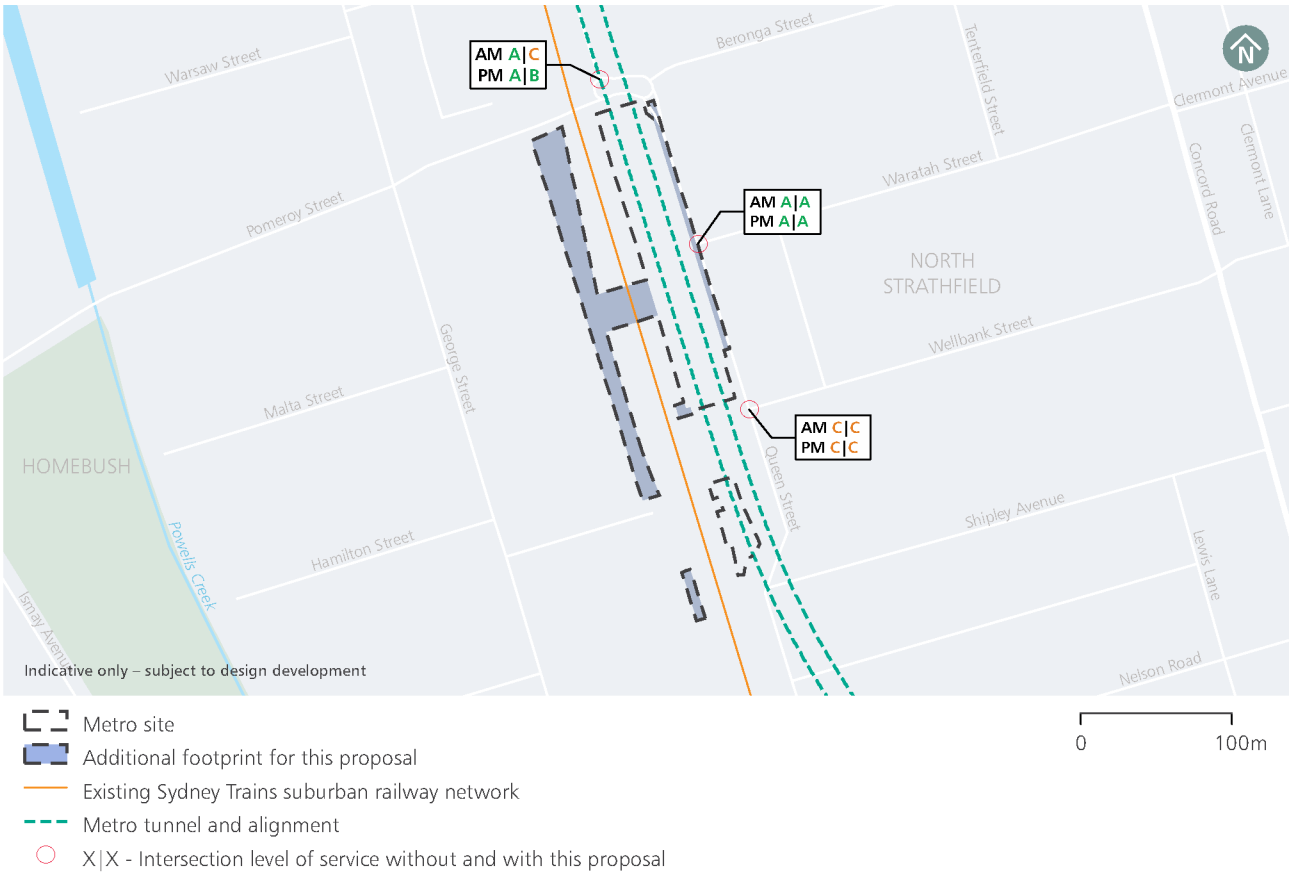

Figure 10-9 Operational intersection performance – North Strathfield metro station (2036)

Parking and property access

A number of parking spaces would be removed around North Strathfield metro station as part of this proposal including around:

- 24 parking spaces on the western side of Queen Street between Pomeroy Street and Wellbank Street (also temporarily removed as part of the work carried out under the previous Sydney Metro West planning application) to accommodate bus stops and proposed network changes
- 17 parking spaces on the eastern side of Queen Street between Beronga Street and Wellbank Street to accommodate bus stops and proposed network changes (also removed for construction of this proposal)
- four parking spaces on the Waratah Street approach would be converted to kiss and ride spaces during peak periods
- two parking spaces on Hamilton Street East would be converted to kiss and ride spaces (with the possibility for short-stay parking outside peak periods)
- 12 parking spaces on the approaches to the upgraded intersections to provide safe operation and efficient use for all road users. A number of these spaces will have been temporarily removed to facilitate the work carried out under the previous Sydney Metro West planning application.

Access to all nearby properties would be maintained during operation of this proposal.

Freight transport

Operation of North Strathfield metro station would not impact on rail freight operations at the existing North Strathfield rail underpass.

10.5.3 Construction impact assessment

Construction haul routes

The primary construction haul routes for North Strathfield metro station are shown in Figure 10-10. Construction site access and egress locations as well as the number of daily traffic movements anticipated at North Strathfield metro station construction sites are outlined in Section 10.4. Occasional access and egress would also be required for existing rail corridor access gates particularly access gates from Hamilton Street East and Queen Street near Shipley Avenue, although other access points between Strathfield and Rhodes Stations may also be used. These access gates would be used infrequently associated with works during rail possessions.

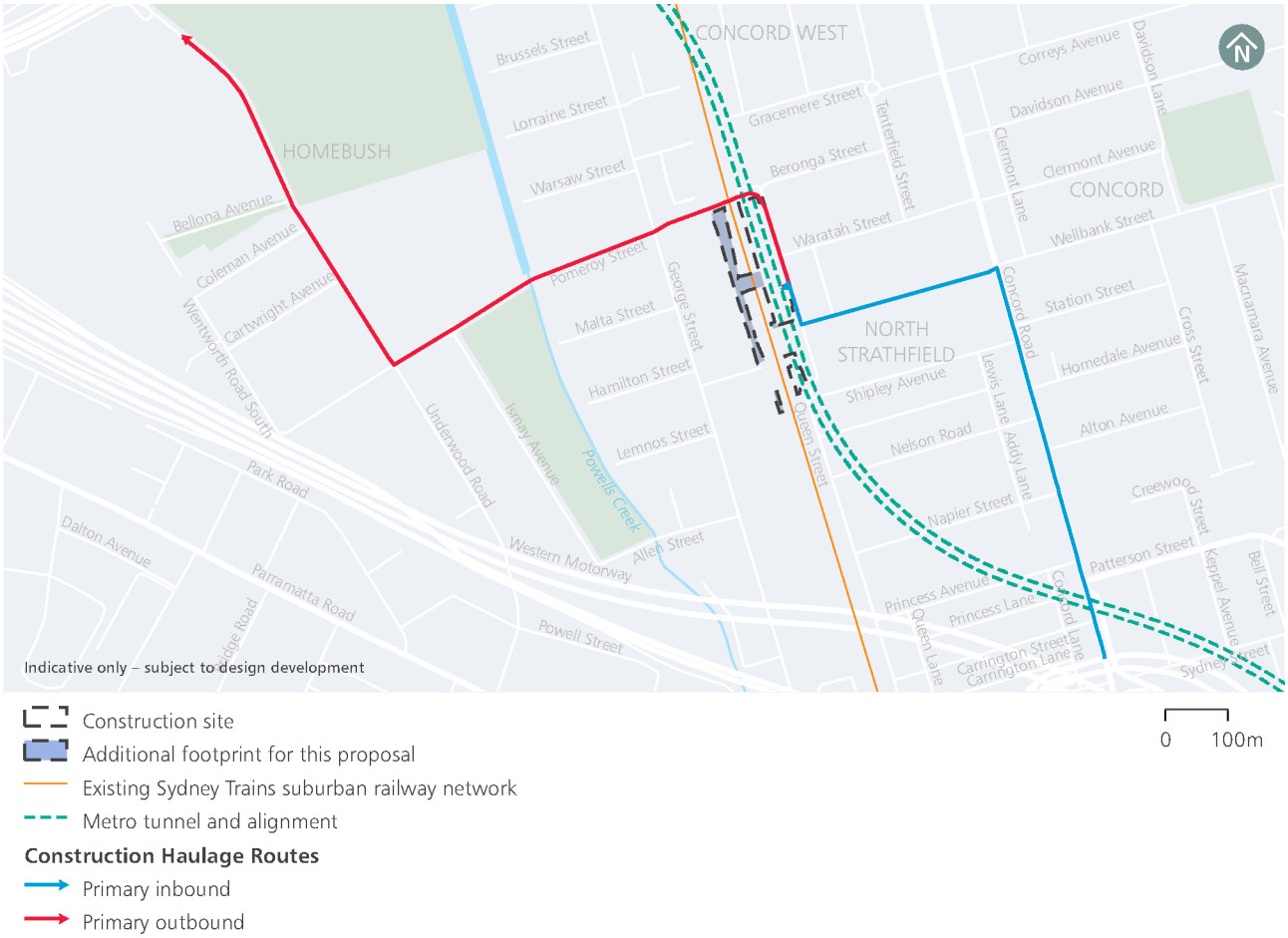

Figure 10-10 Primary construction haul routes – North Strathfield metro station

Active transport network

Access to the pedestrian footbridge on the southern end of the existing North Strathfield Station would be maintained during construction. This access would be temporarily reconfigured to maintain connectivity to and from the station and minimise disruption to pedestrian movements.

The footpath on the western side of Queen Street between Wellbank Street and Pomeroy Street will be closed as part of the work carried out under the previous Sydney Metro West planning application. This arrangement would continue for the duration of construction of this proposal. Construction for new bus stops and pedestrian facilities may require short-term closures (for around a few months) of sections of footpaths, which may result in some minor additional travel times for pedestrians. Appropriate diversions would be established to safely guide pedestrians around work zones.

Pomeroy Street and Underwood Road would be used by construction vehicles travelling to and from the construction sites, which are designated on-road cycle links. Construction vehicles would also travel adjacent to shared paths along Concord Road and Pomeroy Street. Impacts to cyclists on these roads would be minor given that cyclists would be interacting with a low number of additional heavy vehicles. To address potential conflicts, mitigation measures outlined in the CTMF would be implemented during construction.

Public transport network

Construction work required within the rail corridor at and around North Strathfield Station would primarily be carried out during scheduled rail possessions. Rail replacement bus services, which operate during the rail possessions, would be provided.

Sydney Trains would be consulted with during detailed construction planning of the proposal, with works coordinated with scheduled Sydney Trains rail possessions where possible, to minimise impacts on the operation of the rail network, and to provide advanced notification to customers of the proposed works and information on alternative travel options. In addition, there may be a need for works to be carried out outside of scheduled Sydney Trains rail possessions.

Roads forming part of the North Strathfield metro station construction haul route also used by buses include Concord Road and Underwood Road. Impacts on buses would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network.

The school bus stops on Queen Street north of Wellbank Street that will be relocated as part of the work carried out under the previous Sydney Metro West planning application would continue to operate in their relocated position for the duration of construction of this proposal.

Parking and property access

About 24 car parking spaces will be removed and the kiss and ride zone relocated from the western side of Queen Street between Wellbank Street and Pomeroy Street as part of the work carried out under the previous Sydney Metro West planning application. This arrangement would continue during construction of this proposal. These parking spaces would also be permanently removed for operation of the station.

In addition, about 17 spaces located on the eastern side of Queen Street between Wellbank Street and Pomeroy Street would also be removed during construction of this proposal, to provide sufficient construction space and maintain two traffic lanes (one in each direction) on Queen Street. These parking spaces would also be permanently removed for operation of the station.

Potential impacts of the short-term removal (for around few months) of some on-street parking spaces on the western side of Queen Street south of Wellbank Street and on the northern side of Hamilton Street East for the new kiss and ride bays would be minor given the short duration.

Where existing parking is removed to facilitate construction activities, a parking management plan would be developed in accordance with the requirements of the CTMF. This would include consultation with the City of Canada Bay Council relevant local council to investigate opportunities to provide alternative parking facilities.

Property access would be maintained during construction of this proposal.

Road network performance

Intersection performance results for the ‘2026 without proposal’ (without construction vehicles) and ‘2026 with proposal’ (with construction vehicles) scenarios are shown in Figure 10-11.

During the AM peak hour (7:45am to 8:45am) and PM peak hour (4:45pm to 5:45pm), it is anticipated that North Strathfield metro station construction sites would generate a total of 58 light vehicle movements and 38 heavy vehicle movements during the peak construction activity.

These vehicle movement forecasts were assumed for the intersection performance modelling. Peak hours were selected to represent the times when background traffic demand is at its greatest.

Modelled intersection performance during construction indicates that the Queen Street / Wellbank Street intersection would decrease from level of service B to C during the PM peak hour. This intersection would still operate with spare capacity with the addition of construction traffic.

All other intersections would perform at the same level of service with or without construction traffic.

Figure 10-11 Construction sites intersection performance – North Strathfield metro station (2026)

Freight transport

Possession of the freight line at North Strathfield may also be required during construction. Australian Rail Track Corporation and Sydney Trains would be consulted prior to any possession works, with works coordinated to minimise impacts to the operation of the freight rail network.

10.5.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

The approach to transport and traffic management during the construction phase, including the process for the development of all construction traffic management plans is outlined in the CTMF provided in Appendix G.

The CTMF provides the overall strategy and approach for construction traffic management for Sydney Metro West, and an outline of the traffic management requirements, mitigation measures and processes that would be common to each of the proposed construction sites. It establishes the traffic management processes and acceptable criteria to be considered and followed in managing roads and footpaths adjacent to construction sites.

Mitigation measures that are specific to address the operation and construction of North Strathfield metro station are listed in Table 10-9.

Table 10-9 Transport mitigation measures – North Strathfield metro station

Ref	Impact / issue	Mitigation measure	Timing
Transport			
EIS-TT6	Pomeroy Street/ Queen Street/ Beronga Street intersection upgrade	The upgrade of the Pomeroy Street / Queen Street / Beronga Street intersection would be determined in consultation with City of Canada Bay Council and Transport for NSW.	Operation
EIS-TT14	Impacts to rail services	Where works are required within the rail corridor, Sydney Trains and Australian Rail Track Corporation would be consulted to minimise potential disruptions to rail services. Works would be carried out during scheduled Sydney Trains rail possessions where possible, and customers would receive advanced notification of proposed works and information on alternative travel options.	Construction
EIS-TT19	Pedestrian access at the existing North Strathfield Station	Access would be maintained to the pedestrian footbridge at the existing North Strathfield Station. Any adjustments to the footbridge would be carried out in consultation with Transport for NSW.	Construction

10.6 Noise and vibration

Further details on the operational and construction noise and vibration assessment, including the approach and methodology, are provided in Technical Paper 3 (Operational noise and vibration) and Technical Paper 4 (Construction noise and vibration).

10.6.1 Baseline environment

Existing noise levels around North Strathfield metro station are controlled by traffic noise from the surrounding road network and rail movements along the existing rail line. On the eastern side of the existing rail line is a small number of local community shops on Queen Street, surrounded by a residential area. On the western side is The McDonald College and adjoining Our Lady of the Assumption Catholic Primary School, the Papilio Early Learning Centre, with residential receivers further to the west, north and south.

The area surrounding North Strathfield metro station is generally suburban and includes residential, commercial and educational receivers. This precinct has been divided into two noise catchment areas (NCAs) for the construction noise assessment – NCA10 and NCA11. The site and NCAs are shown in Figure 10-12.

Figure 10-12 Location of sensitive receivers near North Strathfield metro station and NCAs

Unattended noise monitoring was carried out at sensitive receiver locations near North Strathfield metro station between March and July 2019 as part of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a). This data represents the noise environment prior to the commencement of the work carried out under the previous Sydney Metro West planning application and was used to inform this assessment.

The results of the unattended noise monitoring are summarised in Table 10-10 and indicate that background noise levels generally reflect the residential and commercial nature of the area.

Short-term attended noise monitoring was also carried out at North Strathfield metro station between March and July 2019. The results were generally found to be consistent with the unattended noise monitoring. Detailed observations from the attended monitoring are provided in Technical Paper 4 (Construction noise and vibration).

Table 10-10 Summary of unattended noise monitoring – North Strathfield metro station

Location ID	Noise logger location	Noise level (dBA)[1,2]					
		Background noise (RBL)			Average noise level (L_{Aeq})		
		Day	Evening	Night	Day	Evening	Night
B.10	17 George Street, North Strathfield	47	47	44	60	60	55
B.11	131 Queen Street, North Strathfield	51	47	39	61	60	55

Notes:

1. The RBL and L_{Aeq} noise levels have been determined with reference to the procedures in the Noise Policy for Industry (NSW Environment Protection Authority, 2017)
2. Daytime is 7am to 6pm, evening is 6pm to 10pm, and night-time is 10pm to 7am

10.6.2 Operational impact assessment

The operational noise associated with North Strathfield metro station has been assessed for the nearest and most noise-affected residential and educational sensitive receivers for each source type, as presented in Table 10-11.

The results indicate that the predicted noise levels would be compliant with the applicable noise criteria. Noise attenuation has been incorporated into the design to determine the predicted noise levels and includes consideration of the use of large fan attenuators, vent orientation, acoustic louvres and appropriate plant selection. These measures would be further developed throughout the detailed design phase so that compliance with the environmental noise criteria is achieved.

At North Strathfield metro station the sleep disturbance noise criteria is L_{AFmax} 54 dB(A). The L_{AFmax} predicted noise levels associated with the draught relief shaft at the nearest sensitive receiver is 53 dB(A). Given compliance with the applicable noise criteria is achieved, further consideration of attenuation is not required.

There would be no sources of vibration as part of operation of the station that would impact nearby receivers. Potential operational vibration impacts from trains operating in the tunnels are addressed in Chapter 16 (Tunnels) of this Environmental Impact Statement.

Table 10-11 Operational noise levels – North Strathfield metro station

Period / source	Criteria[1], dB(A)	Predicted noise level ($L_{Aeq,15min}$)
Queen Street – residential		
Daytime	56	43
Evening	48	43
Night-time	43	37
Emergency mode	48	43
Draught relief noise impacts	65 L_{Amax}	53
The McDonald College, George Street – education		
Daytime	40	39
Evening	40	39
Night-time	40	37
Emergency mode	45	45

Notes:

1. Criteria differs between operational noise source type (refer Technical Paper 3 (Operational noise and vibration))

10.6.3 Construction impact assessment

The construction scenarios and anticipated working hours at the North Strathfield metro station construction sites are shown in Table 10-12. The estimated duration of each activity is also provided, noting that most activities would be intermittent and would not occur on a continual basis during every day of the activity.

The proposed work is anticipated to have a total duration of about four and a half years. Refer to Figure 10-8 for the indicative construction program at North Strathfield metro station.

The majority of piling and brownfield work (work within the existing rail corridor) would be completed during about 17 individual short-term rail possessions.

Temporary construction noise and vibration impacts would be managed through the implementation of standard and additional mitigation measures in accordance with the Sydney Metro CNVS.

Table 10-12 Construction activities and working hours – North Strathfield metro station

Scenario	Activity		Indicative duration (months)	Hours of work[1]			
				Std. day	Out of hours works		
					Day OOH	Evening	Night
Station construction							
Site establishment and public domain work	Typical	Deliveries and general work	18	✓	✓	-	-
	Peak	Construction / decommissioning of facilities and hoarding		✓	✓	-	-
Piling	Typical	Supporting work	2	✓	✓	✓	✓
	Peak	Bored piling with support plant		✓	✓	✓	✓
Station / facility construction	Typical	Internal construction and fit-out	30	✓	✓	✓	✓
	Peak 1	Installation of framing and structure		✓	✓	✓	-
	Peak 2	Concrete work		✓	✓	✓	-
Excavation	Typical	Mucking out	4	✓	✓	-	-
	Peak	Through soft soil/rock		✓	✓	-	-
Brownfield / other off-site work							
Piling	Typical	Supporting work	Rail possession[2]	✓	✓	✓	✓
	Peak	Bored piling with support plant		✓	✓	✓	✓
Brownfield work	Typical	Deliveries and supporting work	Rail possession[2]	✓	✓	✓	✓
	Peak	Installation of framing and structure		✓	✓	✓	✓

Notes:
1. OOH = out-of-hours
2. Work would be completed over a total of about 17 weekend rail possessions

Airborne construction noise

The predicted airborne NML exceedances from the North Strathfield metro station construction sites are summarised in Table 10-13 for all residential receivers and in Table 10-14 for commercial and other sensitive receivers. The predictions are representative of the highest noise levels that would be experienced when the works are nearest to the sensitive receiver.

The number of receivers predicted to experience exceedances of the NMLs are summarised in bands of 10 dB and are separated into day, evening and night-time periods, as appropriate.

During the daytime, the highest construction noise impacts are predicted during station / facility construction, when noise-intensive equipment such as a concrete saw would be in use. The highest impact work is expected to last for around 30 months; however, concrete saws would only be used intermittently as required when concrete slabs are poured.

During the night-time, the highest construction noise impacts are predicted during piling and brownfield work (work within the existing rail corridor) when noise intensive equipment such as grinders would be in use. This work would, however, be relatively short and is expected to be undertaken during around 17 two-day rail possessions.

Table 10-13 Overview of NML exceedances (residential receivers) during construction – North Strathfield metro station

Scenario	Activity	Indicative duration (months)	Number of receivers exceeding NML														
			Standard hours daytime			Out of hours											
						Daytime out of hours			Evening			Night time			Sleep disturbance		
			1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB
Station construction																	
Site establishment and public domain work	Typical	18	12	-	-	25	-	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Peak		27	2	-	53	17	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Piling	Typical	2	4	-	-	14	-	-	n/a	n/a	n/a	n/a	n/a	-	n/a	-	-
	Peak		14	-	-	65	4	-	n/a	n/a	n/a	n/a	n/a	-	n/a	n/a	-
Station / facility construction	Typical	30	-	-	-	4	-	-	10	-	-	37	5	-	9	-	-
	Peak 1		6	-	-	23	-	-	31	3	-	n/a	n/a	n/a	n/a	n/a	n/a
	Peak 2		103	8	-	289	29	1	394	40	5	n/a	n/a	n/a	n/a	n/a	n/a
Excavation	Typical	4	6	-	-	23	1	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Peak		20	-	-	73	4	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Brownfield / other off-site work																	
Piling	Typical	Rail possession	-	-	-	-	-	-	5	-	-	49	1	-	8	-	-
	Peak		-	-	-	15	-	-	30	-	-	184	12	-	49	1	-
Brownfield work	Typical	Rail possession	3	-	-	1	3	-	5	3	-	44	4	-	36	8	1
	Peak		-	-	-	6	-	-	16	-	-	112	7	-	40	8	1

Table 10-14 Overview of NML exceedances (other sensitive receivers) during construction – North Strathfield metro station

Scenario	Activity	Indicative duration (months)	Number of receivers exceeding NML											
			Commercial			Café/bar			Child care			Educational		
			1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB	1 10 dB	10 20 dB	>20 dB
Station construction														
Site establishment and public domain work	Typical	18	-	-	-	-	-	-	1	-	-	5	-	-
	Peak		16	-	-	1	-	-	-	1	-	6	-	-
Piling	Typical	2	-	-	-	-	-	-	-	-	-	6	-	-
	Peak		6	-	-	1	-	-	2	-	-	5	1	-
Station / facility construction	Typical	30	-	-	-	-	-	-	-	-	-	1	-	-
	Peak 1		-	-	-	-	-	-	-	-	-	6	-	-
	Peak 2		15	1	-	1	-	-	1	1	-	-	6	-
Excavation	Typical	4	-	-	-	-	-	-	-	-	-	6	-	-
	Peak		3	-	-	-	-	-	2	-	-	5	1	-
Brownfield / other off-site work														
Piling	Typical	Rail possession[1]	-	-	-	-	-	-	-	-	-	4	1	-
	Peak		1	-	-	-	-	-	-	-	-	4	2	-
Brownfield work	Typical	Rail possession[1]	1	-	-	-	-	1	-	-	-	3	1	-
	Peak		1	-	-	-	-	-	-	-	-	4	2	-

Notes:

1. Work would be completed during short-term rail possessions. A total of around 17 two day rail possessions would likely be required at this site

The findings of the worst-case construction noise impact assessment at the North Strathfield metro station construction sites during the daytime indicate:

- the nearest residential receivers would be relatively close to the construction sites and impacts are predicted to be ‘low’ to ‘moderate’ when work would be carried out outside the station, particularly when noise-intensive equipment, such as concrete saws, is being used as part of station / facility construction work. Concrete saws are expected to only be infrequently throughout the 30-month construction period
- impacts during ‘typical’ work that does not require noise-intensive equipment or is inside the station are predicted to substantially reduce, with noise levels generally predicted to comply with the noise management levels or result in only ‘low’ impacts
- the ‘peak’ scenarios would generate more noise and result in more exceedances than the ‘typical’ scenarios, which would result from the ‘peak’ scenarios using noise intensive (or noisier) equipment
- the nearest commercial and ‘other sensitive’ receivers are predicted to be impacted during some of the noisier outdoor work activities. Some of this work would, however, be complete at weekends during rail possessions when ‘other sensitive’ receivers such as childcare centres and educational facilities are unlikely to be in use. The highest impacts at these receivers are predicted when concrete saws are being used as part of station / facility construction. ‘Moderate’ worst-case impacts are predicted at:
    - Lighthouse Childcare, McDonald College and Our Lady of the Assumption Catholic Primary School
    - an adjacent commercial building

The findings of the worst-case construction noise impact assessment at North Strathfield metro station construction sites during the night-time indicate:

- outdoor work during rail possessions is predicted to result in ‘low’ to 'moderate’ impacts at the nearest residential receivers during work when equipment such as grinders are being used. A total of 17 rail possessions are expected to be required and would generally occur over isolated weekend periods. The impacts are generally reduced to ‘low’ when noise intensive equipment is not in being used during these activities, and fewer receivers are predicted to be impacted
- ‘low’ impacts are generally predicted during internal station / facility construction work. A small number of the nearest receivers are predicted to have ‘moderate’ impacts during the noisiest activities.

Based on current construction planning access points for tunnel fit-out and rail systems work would likely be via the Parramatta metro station, Clyde stabling and maintenance facility (including Rosehill services facility), Burwood North Station and The Bays Station construction sites. However, depending on construction staging, other construction sites would be used to access the tunnels to carry out tunnel fit-out and rail systems work. If North Strathfield metro station is used to support rail systems fit-out work, this would likely result in the following potential impacts:

- moderate exceedances of the noise management level at the nearest residential receivers during the daytime which could be reduced to negligible with the use of an acoustic shed (or other acoustic measures)
- high exceedances of the noise management level at the nearest residential receivers during the night-time which could be reduced to low with the use of an acoustic shed (or other acoustic measures)
- low exceedances of the noise management level at the nearest commercial receivers which could be reduced to negligible with the use of an acoustic shed (or other acoustic measures).

The impacts presented above are based on all equipment working simultaneously in each assessed scenario. There would be periods when construction noise levels are much lower than the worst-case levels predicted and there would be times when no equipment is in use and no impacts occur.

Highly affected residential receivers

Two residential receivers are expected to be highly noise affected during peak station / facility construction in the daytime and evening when concrete saws are being used outside. These receivers are located on Queen Street between Beronga Street and Waratah Street.

Sleep disturbance

A sleep disturbance screening assessment has been completed for the construction work and is summarised in Table 10-13.

'High' sleep disturbance impacts are predicted at one residential receiver with 'moderate' impacts predicted at several other nearby residential receivers during rail possessions. These impacts mainly result from heavy vehicles accessing the rail possession site via Queen Street and Hamilton Street.

'Low' impacts are predicted at a small number of receivers during station / facility construction fit-out.

The number of potential sleep disturbances would depend on several factors, including the number of heavy vehicles accessing the site during the night-time and the way in which vehicles are operated. The number of heavy vehicles at this construction sites during the night-time is expected to be around four trucks per hour. The requirement for night-time rail possessions would be relatively minimal and the rail possessions would generally only occur over isolated weekend periods.

During detailed construction planning, sleep disturbance would continue to be investigated to identify opportunities to minimise sleep disturbance impacts.

Vibration impacts

Construction work for this proposal at North Strathfield metro station would not involve major sources of vibration generating equipment. As such, potential vibration impacts are anticipated to be negligible and would be managed through the Sydney Metro CNVS.

Ground-borne noise

Ground-borne noise impacts would only arise where ground-borne noise levels are higher than the corresponding airborne noise levels. This can occur where work is underground or where surface work is shielded by noise barriers or other structures. For all scenarios at the North Strathfield metro station construction sites, airborne noise is anticipated to be higher than ground-borne noise levels and, as such, a ground-borne noise assessment is not required.

Construction traffic noise

Construction-related traffic has the potential to temporarily increase road traffic noise levels at receivers that are adjacent to the construction sites and haul routes. The forecast construction traffic volumes outlined in Section 10.5.3 have been used to determine where potentially noticeable increases in road traffic noise (i.e. a greater than 2 dB increase above the existing noise level) is likely. No roads around the North Strathfield metro station construction sites are anticipated to have a greater than 2 dB increase.

Utilities

The majority of utility adjustments would be carried out as part of the work carried out under the previous Sydney Metro West planning application; however, there may be some minor utility adjustments required as part of this proposal, including work along the existing rail corridor at North Strathfield for routing station or rail services.

An assessment of the potential noise levels from utility work has been carried out to determine predicted noise levels at various offset distances from typical items of equipment. The results show that where the closest receivers are around 10 to 15 metres from the proposed utility work, worst-case noise levels of between 80 to 90 dBA for short periods are possible during noisy phases of the work.

During the night-time, worst-case residential NML exceedances of greater than 30 dB above the NML are possible if noise intensive equipment is used during the night-time. Utility work would be temporary, and the duration of impacts would be limited with the majority of this work occurring during scheduled rail possessions.

10.6.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

The approach to noise and vibration management during the construction phase, including the process for the development of all construction noise and vibration statements is outlined in the CNVS (Appendix H).

The CNVS provides the overall strategy and approach for construction noise and vibration management for Sydney Metro West, and an outline of the noise and vibration management requirements and processes that would be common to each of the proposed construction sites.

In addition, the Sydney Metro CEMF (Appendix F) outlines the construction noise and vibration mitigation measures to minimise impacts as relevant to this proposal as a whole.

The CNVS and CEMF are discussed further in Chapter 20 (Synthesis) of this Environmental Impact Statement.

10.7 Non-Aboriginal heritage

Further details on the non-Aboriginal heritage assessment, including the approach and methodology, are provided in Technical Paper 5 (Non-Aboriginal heritage).

10.7.1 Baseline environment

Existing setting

The North Strathfield metro station site is located adjacent to the existing North Strathfield Station. The existing environment comprises an open setting located between early 20th century commercial and residential structures of mixed single to three storey developments to the east and the existing rail corridor to the west. The North Strathfield rail underpass, a freight line track is located west of the site below ground level, beneath the existing track surface. The North Strathfield Station Upgrade works completed under the Transport Access Program in late 2019 included the provision of new lifts, a footbridge connection, upgrade of platform surfaces and station buildings, landscaping and plantings (including removal of garden beds) and ancillary works. The North Strathfield metro station study area and existing heritage items within the study area are shown in Figure 10-13.

Site history

The North Strathfield metro station study area previously formed land grants to free settlers, known as Liberty Plains. The construction of the Main North Line through the study area by 1887 resulted in the consolidation of settlement and development patterns in the area, however a station was not opened until 1918, which rapidly accelerated subdivision and development of the surrounding area. Industrial development to the west and south of the study area, including the Arnott's biscuit factory, was established in the early 20th century. By 1943, North Strathfield had developed into an expansive suburban area comprising small residential allotments.

Figure 10-13 Heritage items within the study area – North Strathfield metro station

10.7.2 Impact assessment

Built heritage impact assessment

Table 10-15 summarises the impacts of construction and operation of this proposal on built heritage items within the study area at North Strathfield metro station.

Potential impacts to build heritage items in the North Strathfield metro station study area would range from negligible to moderate. Management of potential impacts is outlined in Section 10.7.3. A draft Heritage Interpretation Strategy has been prepared for this proposal (Appendix K). Where heritage items, including significant archaeology are impacted by this proposal, they would be considered for inclusion in the Heritage Interpretation Strategy or place specific interpretation plans prepared as part of this proposal.

Table 10-15 Impacts on significance of built heritage items – North Strathfield metro station

Item, listing and significance	Potential impact	Magnitude
Street Trees (adjacent to North Strathfield Railway Station) Canada Bay LEP Item No. I397 Local	**Direct impact** Construction of the metro station and interchange facilities would be located outside the heritage curtilage of the item and as such, would not result in any adverse direct (physical) impacts. Public domain work would be located on the western side of Queen Street and would be located within the heritage curtilage of this item. This work would preserve the trees that are present and would be restricted to modifications to the existing footpaths and street kerbs.	**Negligible**
	Settlement and vibration The street trees are not anticipated to physically affected by vibration levels from the surrounding construction works, which are predicted to be below the cosmetic damage screening criteria.	**Neutral**
	Temporary indirect (visual) impact Temporary structures and hoarding located within the construction sites would not obstruct or overshadow views towards the item. The construction of this proposal would not involve modifications to the streetscape in the vicinity of the significant trees.	**Negligible**
	Permanent indirect (visual) impact The extension of the kiss and ride parking on Queen Street would be located within the current roadway and in an area where existing short-term and accessible parking exists. This would not alter the visual setting of the streetscape and would not impact the significance of the heritage item.	**Negligible**
North Strathfield Railway Station Group (including ornamental garden fronting Queen Street) Transport Asset Holding Entity s170 (4801029) Local	**Direct impact** Work to construct the proposed footbridge would involve excavation into the platform but would not involve excavation or removal of the existing brick platform coping, which is graded of high heritage value to the significance of the existing station overall. Areas of piling installation would be installed through sub-platform fill material and would not impact significant heritage fabric. Works would not involve any modification to the existing brick platform coping or station platform building, both elements of high heritage value to the significance of the station overall. Under this proposal, the remaining (southern) portion of the North Strathfield Station heritage gardens would be removed. The gardens are significant for the item due to their preserved layout demonstrative of early 20th century landscaping; however, the symmetry and form of the garden will have already been impacted by the work carried out under the previous Sydney Metro West planning application. The removal of the remainder of the garden would complete the removal of this former entry garden.	**Minor**

Item, listing and significance	Potential impact	Magnitude
	Although the fan garden is significant, and this proposal would complete its removal, given other high heritage value elements are being retained (existing brick platform coping and station platform building) overall the direct impact to this item as a result of this proposal is considered minor.	
	Settlement and vibration Vibration levels from the surrounding construction work are predicted to be below the cosmetic damage screening criteria. Potential direct impacts associated with vibration are not anticipated.	**Neutral**
	Temporary indirect (visual) impact During construction, temporary hoarding and construction equipment within the construction sites at the heritage item, as well as protective hoarding, would largely obscure the station platform building. Plant and equipment would result in temporary overshadowing of the structure.	**Moderate**
	Permanent indirect (visual) impact The footbridge would remove view lines toward the significant station building and platform coping from Pomeroy Street but would reinstate this view line closer to the structure along the alignment of the new footbridge. The Queen Street entrance to the metro station would be about two to three storeys in elevation and would be situated about 30 metres north-east of the existing station platform building. While this structure would obscure current view lines from Queen Street toward the platform station building, this area is currently not publicly accessible and the proposed route for transfers from metro to existing rail would provide a larger viewing area to the east of the existing railway corridor to see the existing station platform building side-on. The setting of the existing station building would be altered; however, clear sight lines towards the significant heritage details of the station building would remain. The removal of the remaining southern portion of the North Strathfield Station heritage gardens along Queen Street would impact the visual setting of the item along this vantage point, resulting in the complete removal of a significant element within the heritage curtilage. However, the proposed public domain and landscaping within this area would reduce the overall visual impacts associated with the removal of the fan gardens.	**Moderate**

Archaeological impact assessment

This section considers the potential archaeological impacts at North Strathfield metro station within areas of additional footprint for this proposal (shown on Figure 10-13). The area within the approved North Strathfield metro station construction sites have been previously assessed in Chapter 12 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a).

Additional footprint areas that form part of this proposal are consistent with the historical and archaeological assessment previously prepared, as these areas are almost wholly located within the rail corridor (where no archaeological remains have been predicted) or at North Strathfield Station (where archaeological remains are not anticipated prior to 1918).

Overall, significant archaeological remains are not predicted within the additional areas of the North Strathfield metro station construction sites. As such, construction activities that would result in further ground disturbance as part of this proposal would not result in any impacts to significant archaeological remains. Ground disturbing works at the North Strathfield metro station sites would adhere to Sydney Metro's Unexpected Heritage Finds Procedure. Further detail on the management of potential impacts is outlined in Section 10.7.3.

10.7.3 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, Non-Aboriginal heritage would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes heritage management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

10.8 Aboriginal heritage

The approach and methodology for the Aboriginal heritage assessment are provided in Chapter 4 (Methodology) of this Environmental Impact Statement. The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

10.8.1 Baseline environment

The work carried out under the previous Sydney Metro West planning application assessed the potential impacts of the establishment of the North Strathfield metro station construction sites.

This section summarises the existing environment presented in the *Sydney Metro West Environmental Impact Statement – Westmead to the Bays and Sydney CBD* (Sydney Metro, 2020a), including providing existing context for the additional footprint area required for construction of this proposal at North Strathfield.

Landscape and archaeological context

The North Strathfield metro station construction sites are within the Cumberland Lowlands physiographic region of the Cumberland Plain, consisting of a raised artificial embankment and cleared landing area created during construction of the North Strathfield underpass (refer to Technical Paper 4 of the *Sydney Metro West Environmental Impact Statement - Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a)). Powells Creek is the closest permanent watercourse, approximately 400 metres to the west. Reference to the 1:100,000 Geological Map Sheet for Sydney (Map 9130) indicates that the surface geology is dominated by Wianamatta Group units, comprising Ashfield Shale, Minchinbury Sandstone and Bringelly Shale, overlying the Mittagong Formation and the Hawkesbury Sandstone. Raw materials include shale (claystone and siltstone), carbonaceous claystone, laminite and fine to medium-grained lithic sandstone.

Review of historical reference materials indicates that the North Strathfield metro station construction sites have been heavily impacted by the development of North Strathfield railway station and associated infrastructure, and buildings, roads, commercial and residential development. The archaeological implication is the potential disturbance or destruction of pre-existing Aboriginal sites and archaeological deposits.

Previous Aboriginal cultural heritage assessments

The following summarises key investigations undertaken in the local environs that are relevant to this proposal:

- Niche Environment and Heritage Pty Ltd (2011) undertook an archaeological survey of the Australian Catholic University, Strathfield Campus located approximately 2.5 kilometres south of the North Strathfield construction sites. The assessment confirmed a high degree of disturbance across the project's study area. No Aboriginal sites or areas of Potential Archaeological Deposit were identified. Registered Aboriginal Parties involved in the project did not identify any specific cultural value associated with the site. The assessment concluded that the project's study area was located in a continuous urban environment with limited recorded Aboriginal objects and therefore had little to contribute to regional cultural heritage landscape values
- Artefact Heritage Pty Ltd (2020) undertook archaeological survey of the area as part of the *Sydney Metro West Environmental Impact Statement - Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a). The survey identified that the North Strathfield metro station construction sites were located in a low sensitivity landform (that is, a crest) away from major permanent water sources. On the basis of its previous disturbance and distanced from permanent water, the area was assessed as having a low archaeological potential.

Recorded Aboriginal sites

The *Sydney Metro West Environmental Impact Statement – Westmead to the Bays and Sydney CBD* (Sydney Metro, 2020a) did not identify any previously recorded Aboriginal sites. No surface sites were identified during the survey and subsurface archaeological potential was assessed as low.

An updated search of the AHIMS database was undertaken on 21 August 2021 (Search ID 609566), including the additional footprint for this proposal. There were no additional entries identified within 100 metres of the North Strathfield metro station construction sites in the search results.

Aboriginal community consultation and cultural values

Consultation undertaken with Registered Aboriginal Parties for the previous Sydney Metro West planning application did not identify any site-specific cultural values at the North Strathfield metro station construction sites. Registered Aboriginal Party field representatives did note that the area is part of a wider cultural landscape of high cultural significance to the local Aboriginal community. In particular, major water sources including Powells Creek were likely to be of particular cultural significance.

Ongoing consultation with Aboriginal heritage knowledge holders is underway as part of design development for this proposal, including for the purposes of better understanding cultural values and addressing the Connecting with Country framework.

Field investigation results

The *Sydney Metro West Environmental Impact Statement – Westmead to the Bays and Sydney CBD* (Sydney Metro, 2020a) included a survey of the North Strathfield metro station construction sites undertaken with participation from Registered Aboriginal Party representatives from the Metropolitan Local Aboriginal Land Council. A field investigation was undertaken on 11 January 2022 for the additional footprint required for this proposal at North Strathfield metro construction site with participation from a Registered Aboriginal Party representative from the Metropolitan Local Aboriginal Land Council. No site-specific cultural values were identified during the field investigation, however the representative noted that the general North Strathfield metro station area is located along sandstone ridgelines commonly associated with historic travel routes for Aboriginal peoples from inland areas towards the Parramatta River environs.

10.8.2 Operational impact assessment

Direct impacts

No identified Aboriginal sites, objects and/or site-specific cultural heritage values would be directly impacted during operation of this proposal at North Strathfield metro station.

Indirect impacts

No identified Aboriginal sites, objects and/or site-specific cultural heritage values would be indirectly impacted during operation of this proposal at North Strathfield metro station.

During development of Sydney Metro West, consultation was undertaken with knowledge holders to inform the project development as part of the Connecting with Country Pilot program. This consultation will continue during further development of the project. In accordance with Concept Condition of Approval CB4 and CB5, a draft Heritage Interpretation Strategy has been prepared for this proposal (Appendix K) which details how Aboriginal heritage values would be interpreted and reflected within the design of this proposal.

Further details regarding Sydney Metro's approach to Connecting with Country, and heritage and archaeology design guidelines are provided in the station and precinct design guidelines in Appendix E.

10.8.3 Construction impact assessment

Direct impacts

There were no recorded Aboriginal sites, objects or site-specific cultural values identified within the North Strathfield metro station construction sites, including within the additional footprint for this proposal. Therefore, there would be no direct impacts on identified Aboriginal heritage sites, objects or site-specific cultural values during construction of this proposal.

Indirect impacts

No identified Aboriginal sites, objects and/or values would be indirectly impacted during construction of this proposal at the North Strathfield metro station construction sites.

10.8.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, Aboriginal heritage would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

10.9 Landscape and visual amenity

Further details on the landscape and visual amenity assessment, including the approach and methodology, are provided in Technical Paper 6 (Landscape and visual amenity).

10.9.1 Baseline environment

The North Strathfield metro station construction sites are adjacent to the existing North Strathfield Station on Queen Street, generally between Pomeroy Street to the north, Queen Street to the east, the North Strathfield Station to the west and Hamilton Street East to the south.

As part of the work carried out under the previous Sydney Metro West planning application, all buildings and vegetation within the approved construction sites will have been removed. Trees along Queen Street adjacent to the northern construction site will have also been removed, opening up views to the site from the residential areas to the east of the rail corridor. All vegetation and pathways within the northern half of the North Strathfield Station heritage gardens will have been removed.

The approved construction sites will be enclosed by hoardings and pedestrian paths would be diverted around the sites where required. The approved northern construction site will extend into Queen Street, removing one lane of car parking, the road verge and pathway along the western side of Queen Street, from around Wellbank Street to Pomeroy Street.

The North Strathfield local centre is located on Queen Street, which is aligned generally north to south, and parallel to the existing North Strathfield Station and rail corridor. The local centre includes a block of early twentieth century two-storey commercial terrace buildings, with retail and offices at street level and some residences above.

A train underpass (the North Strathfield rail underpass) parallels the station. A construction site and maintenance area were established to construct this underpass and will be used as a construction support site for the work carried out under the previous Sydney Metro West planning application. This area of the site is partly screened by the street trees along the western verge of Queen Street.

The existing station is surrounded by single storey detached residential properties and low-rise residential apartment and townhouse buildings to the east, and a mix of schools and other commercial uses to the west. To the north of the existing station, the Pomeroy Street overbridge provides east-west connectivity across the rail line and elevated views over the station. To the south, the commercial core of North Strathfield is located between the rail corridor and George Street, including the 'Bakehouse Quarter', located in the historic former Arnott's complex.

Section 10.3 provides further discussion of the intended future character local strategic plans relevant to North Strathfield. A detailed review of local planning guidance relevant to landscape and visual context is provided in Technical Paper 6 (Landscape and visual amenity).

Landscapes and public realm areas

The landscapes and public realm areas with potentially impacted by this proposal, and the landscape sensitivity level for these areas, are outlined in Table 10-16.

Table 10-16 Landscapes and public realm areas – North Strathfield metro station

Location	Baseline environment	Landscape sensitivity level
The existing North Strathfield Station	The existing North Strathfield Station is locally heritage listed and on the Transport Asset Holding Entity section 170 (s170) heritage and conservation register. The station has an island platform with a single storey Victorian-style red brick platform building (c.1918). The station is in a cutting below the level of Queen Street and is not prominent in views from the surrounding area. There is a steel and concrete footbridge and lifts, which have recently been constructed to the south of the platform building, providing lift and stair access to the station platform.	Local

Location	Baseline environment	Landscape sensitivity level
	The station is entered via the heritage gardens at Queen Street, and via a north-south aligned footpath in the west that connects Pomeroy Street in the north with Hamilton Street East in the south.	
North Strathfield Station s170 listed heritage gardens	This small ornamental garden is included in the Transport Asset Holding Entity section 170 heritage listing for the North Strathfield Station. It provides a visual feature that marks the entry to the existing station. These gardens provide pedestrian access from Queen Street to the existing station. All vegetation and pathways within the northern half of the gardens would have been removed as a part of the work carried out under the previous Sydney Metro West planning application. As part of the previous work, there will be hoarding established along the construction site boundaries and pedestrian paths will be diverted around the construction sites through the remaining areas of the gardens.	Local
Queen Street streetscape	Queen Street forms the main street for the North Strathfield local centre. There are footpaths on both sides of Queen Street and a centrally located pedestrian crossing near the station entrance. Street trees and continuous awnings to the front of the local centre provide shade and comfort for pedestrians. A bicycle locker area is located adjacent to the station heritage gardens, supporting cycle access to the station. The street includes an avenue of mature Brushbox trees, to the south of the station, which have a local heritage listing and contribute to a leafy streetscape character enhancing the amenity of the surrounding residential area. Legibility is enhanced by the grid pattern of the surrounding residential streets that channel views towards Queen Street and the existing station.	Local
Hamilton Street East	Hamilton Street East is a cul-de-sac street located to the south of the station, extending between George Street and the rail corridor. It includes on-street parking with footpaths on both sides and mature trees within adjacent private properties. The street is bordered by educational facilities and medium-rise apartment buildings. There is access to the station from Hamilton Street East, via a shared-use footpath, and maintenance access to the rail corridor. A kiss and ride zone and bicycle parking are located at the eastern end of the street.	Local

Representative viewpoints

Representative viewpoints that have been selected to inform the daytime visual impact assessment are shown in Figure 10-14. These viewpoints are of local sensitivity.

While the impact rating for all of these six viewpoints are provided, the following three have been selected as the most representative for this station to be discussed in this section. These take into account the degree of sensitivity and potential operational and construction elements that would be visible:

- **viewpoint 1: view south along Queen Street and Beronga Street** – presents the interface of this proposal with surrounding residences
- **viewpoint 3: view north-west from the corner of Queen and Wellbank Streets** – presents the scale and relationship of this proposal with commercial areas and the heritage-listed gardens
- **viewpoint 5: view north-east from North Strathfield Station footbridge** – includes the heritage setting of the existing North Strathfield Station platform building and the commercial area in the background of the view.

These viewpoints are assessed in further detail in this chapter. A detailed assessment of all viewpoints is provided in Technical Paper 6 (Landscape and visual amenity).

Figure 10-14 Representative viewpoints – North Strathfield metro station

Night-time visual sensitivity

The setting of the North Strathfield metro station construction sites is an area of medium district brightness (A3), which is of low sensitivity. While the residential areas would include some lighting from properties and local streets, the lighting levels increase at the North Strathfield commercial area on Queen Street. The existing North Strathfield Station, schools and a mix of other commercial uses to the west of the station also add to the brightly lit night sky. There would be some security light remaining from the work carried out under the previous Sydney Metro West planning application.

10.9.2 Operational impact assessment

Operation of this proposal at North Strathfield metro station would comprise underground and surface elements. The key elements of this proposal that would be visible are described in Section 10.2 (Station and precinct description).

Landscape impact

Landscape impacts anticipated as a result of the operation of this proposal are summarised in Table 10-17. Management of potential impacts is discussed in Section 10.9.4.

During operation, upgrades to the existing station and adjacent public realm areas along Queen Street would considerably improve the landscape quality and functioning of this precinct.

There would be a new station entry facing Queen Street, opposite the commercial properties in the local centre of North Strathfield. The prominence of the new station entry would improve legibility within the precinct, with the metro station having improved visibility from residential areas to the east, particularly in views along Wellbank Street.

The new footbridge (to the north of the existing station building) would improve accessibility of the existing station, allowing for easy transfers between transport modes. Unpaid areas of the footbridge would also provide improved east-west permeability of the precinct. The metro station would be set within a new public domain area, which would extend north to the western verge of Queen Street.

The remaining northern portion of the existing North Strathfield Station Transport Asset Holding Entity s170 listed heritage fan gardens would be replaced with a public domain area, impacting upon the character and sense of place provided by these gardens.

There would be minor beneficial landscape impacts in surrounding streets, including the Queen Street streetscape and Hamilton Street East, due to improvements in public domain and improvements in the accessibility and legibility of the precinct.

While the character and purpose of Queen Street would be transformed by this proposal, there would be an improved public domain. Queen Street in the vicinity of the station would be reduced in width, and bus stops, and cycle facilities established. The north-western side of Queen Street would be restored with new public domain areas shaded by street trees. There would be a new station entry and some activation facing Queen Street.

The impacted areas of Hamilton Street East would be reinstated and there would be extended kiss and ride facilities and improvements to the station interchange facilities, and accessibility and legibility of the precinct.

Table 10-17 Landscape impacts during operation – North Strathfield metro station

Location	Landscape sensitivity level	Magnitude of change	Impact rating
The existing North Strathfield Station	Local	Considerable improvement	Moderate beneficial
North Strathfield Station s170 listed heritage gardens	Local	Considerable reduction	Moderate adverse
Queen Street streetscape	Local	Noticeable improvement	Minor beneficial
Hamilton Street East	Local	Noticeable improvement	Minor beneficial

Daytime visual amenity impact

Visual amenity impacts anticipated as a result of the operation of this proposal are summarised in Table 10-18. Generally, the introduction of new structures and public domain areas would result in both adverse and beneficial potential visual impacts. Management of potential impacts is discussed in Section 10.9.4. An artist's impression of North Strathfield metro station during operation is shown in Figure 10-15. Potential station finishes would be identified as part of further design development and would be consistent with the principles and outcomes presented in the Design Guidelines (Appendix E).

Table 10-18 Daytime visual impacts during operation – North Strathfield metro station

Location	Sensitivity rating	Magnitude of change	Impact rating
Viewpoint 1: view south along Queen Street and Beronga Street	Local	Considerable reduction	Moderate adverse
Viewpoint 2: view west along Waratah Street	Local	Noticeable reduction	Minor adverse
Viewpoint 3: view north-west from the corner of Queen and Wellbank streets	Local	Noticeable improvement	Minor beneficial
Viewpoint 4: view north-west from Queen Street	Local	No perceived change	Negligible
Viewpoint 5: view north-east from North Strathfield Station footbridge	Local	Noticeable reduction	Minor adverse
Viewpoint 6: View south from North Strathfield Station platform	Local	Noticeable reduction	Minor adverse

As noted in Section 10.9.1, the most representative viewpoints have been described in detail in this section. Potential impacts from these viewpoints would include the following:

- **viewpoint 1: view south along Queen Street and Beronga Street** – this view would experience a moderate adverse visual impact during operation. The aboveground station infrastructure, including the station services building would be located in the middle ground of view, extending along the rail corridor, to the west of Queen Street. This would be a new contemporary structure, with mainly services facilities facing Pomeroy and the northern end of Queen Street. While there would be improvements to the streetscape, and high-quality architecture and public domain established, the scale and character of this built form would contrast with the character of the residential properties in this view. The building would be set back from the corner of Queen and Pomeroy streets, rising about six to seven storeys at the northern end of the buildings, and there would be an area of public domain established on this corner. The location of services to the north of Queen Street and provision of public domain on the corner, in the middle ground of this view, would contribute to reducing this contrast. Further south along Queen Street, a new metro station entrance would be visible, including spaces for future non-station use (e.g. retail, commercial and/or community facilities) and upgraded public domain along the street. A new bus interchange would also be seen along Queen Street, in front of the station
- **viewpoint 3: view north-west from the corner of Queen and Wellbank Streets** – this view would experience a minor beneficial impact during operation, due to the compatibility of the new built form with the existing streetscape. A new public plaza would be seen at this view (replacing the heritage listed garden), which would alter the character of the streetscape and entry to the existing station, being of a larger and more urban scale than the existing small-scale gardens. The metro station building would extend north along Queen Street, introducing a contemporary structure in the centre of this view. This building would rise above the height of the buildings opposite, within the North Strathfield local centre. The station building would contrast in scale and form to the character of these terrace buildings, creating a more urban character to this view
- **viewpoint 5: view north-east from North Strathfield Station footbridge** – this view would experience a minor adverse impact during operation, as the metro station would increase the built form visible and alter the setting of the heritage character buildings. A footbridge extending over the rail corridor would be a new focal point in the middle ground of view, including escalator and lift access to the existing train station platforms. The structure would be contemporary in style and contrast in scale and character to the heritage platform buildings. To the east (right of view), a new metro station and adjacent station services building would be seen. This would limit views to Queen Street and surrounding vegetation in the residential area of North Strathfield.

The existing views and photomontages of this proposal during operation at viewpoints 1 and 5 are provided in Figure 10-16 to Figure 10-19.

Indicative only – subject to design development

Figure 10-15 Artist's impression of North Strathfield metro station during operation

Figure 10-16 Existing view from viewpoint 1 (view south along Queen Street and Beronga Street) – North Strathfield metro station. Extent of previous vegetation removal as part of the work carried out under the previous Sydney Metro West planning application is shown in orange

Indicative only – subject to design development

Figure 10-17 Photomontage from viewpoint 1 (view south along Queen Street and Beronga Street) – North Strathfield metro station

Figure 10-18 Existing view from viewpoint 5 (view north-east from North Strathfield Station footbridge) – North Strathfield metro station. Extent of previous vegetation removal as part the work carried out under the previous Sydney Metro West planning application is shown in orange. Additional footprint for this proposal is shown in purple

Indicative only – subject to design development

Figure 10-19 Photomontage from viewpoint 5 (view north-east from North Strathfield Station footbridge) – North Strathfield metro station

Night-time visual amenity impact

The anticipated night-time visual impacts during operation are summarised in Table 10-19.

The new metro station and public domain areas would be brightly lit to provide for customer safety, including lighting within the station, at station entries and plaza lighting along Queen Street. While the rail corridor cutting would contain some lighting from the metro station, there would also be additional lighting within the existing station with the new footbridge to the north of the platforms being brightly lit and elevated above the rail cutting. While all lighting would be designed to minimise light spill and skyglow, the openness of the station architecture and level of lighting required to ensure safety would increase the overall brightness of this area and would be visible from residential and commercial properties that overlook the station.

Table 10-19 Night-time visual amenity impacts during operation – North Strathfield metro station

Location	Sensitivity rating	Magnitude of change	Impact rating
North Strathfield metro station	A3: Medium level brightness	Noticeable reduction	Minor adverse

10.9.3 Construction impact assessment

The North Strathfield metro station construction sites for this proposal would include the construction sites for the work carried out under the previous Sydney Metro West planning application, as well as additional footprint shown on Figure 10-7. The main additional elements that would be visible would include construction of a new footbridge, construction of station services, work to the existing North Strathfield Station, and construction support sites within the existing rail corridor. The proposed works, construction site features, equipment and vehicle access routes that would be visible are described in Chapter 6 (Proposal description – construction) of this Environmental Impact Statement and Section 10.4.

Landscape impact

Landscape impacts anticipated as a result of the construction of this proposal are summarised in Table 10-20. Management of potential impacts is discussed in Section 10.9.4.

The northern construction site established under the previous Sydney Metro West planning application would continue to be used and would be expanded to the west to support the construction of a new footbridge over the existing rail line. At the existing North Strathfield Station, the existing footbridge to the south of the station would remain open, maintaining the accessibility of the station during this work. The existing footbridge that connects Queen Street, the Sydney Trains station platforms, and the public footpath access to the west of the station (between Pomeroy Street and Hamilton Street East), may require upgrades/replacement including the potential widening of the footbridge to provide improved interchange capacity (to be further investigated). The legibility of, and wayfinding around, the station would be reduced by the scale of the construction activity.

The southern part of the heritage gardens would be maintained for the initial stages of construction, maintaining the setting to the existing station and local centre. The presence of construction activity would, however, continue to reduce the amenity of the gardens. The pathways would be restricted in places and diverted around the construction site. However, a direct connection between the station and Queen Street through the gardens would be maintained. As construction progresses, the remaining ornamental garden beds and footpaths would be removed.

Construction vehicles would be seen accessing the site from both Queen Street and Pomeroy Street. The site would be enclosed by hoarding and there would be major construction works to install the station infrastructure, including large-scale machinery and construction vehicles.

During construction, Hamilton Street East would be used to access a compound area within the rail corridor. The existing footpaths, driveways, bicycle parking and pedestrian access to the station would be maintained. However, the on-street parking spaces along the northern side of the street would be closed and works to extend the existing kiss and ride zone may temporarily restrict access and movement along the street.

Table 10-20 Landscape impacts during construction – North Strathfield metro station

Location	Landscape sensitivity level	Magnitude of change	Impact rating
The existing North Strathfield Station	Local	Considerable reduction	Moderate adverse
North Strathfield Station s170 listed heritage gardens	Local	Considerable reduction	Moderate adverse
Queen Street streetscape	Local	Considerable reduction	Moderate adverse
Hamilton Street East	Local	Noticeable reduction	Minor adverse

Daytime visual amenity impact

Visual amenity impacts anticipated as a result of the construction of this proposal are summarised in Table 10-21. Viewpoints would generally experience moderate to minor adverse temporary visual impacts during construction due to the continued presence of construction sites and the scale of the works that would rise above the existing streetscape. Management of potential impacts is discussed in Section 10.9.4.

Table 10-21 Daytime visual impacts during construction – North Strathfield metro station

Location	Sensitivity rating	Magnitude of change	Impact rating
Viewpoint 1: view south along Queen Street and Beronga Street	Local	Considerable reduction	Moderate adverse
Viewpoint 2: view west along Waratah Street	Local	Considerable reduction	Moderate adverse
Viewpoint 3: view north-west from the corner of Queen and Wellbank streets	Local	Considerable reduction	Moderate adverse
Viewpoint 4: view north-west from Queen Street	Local	Noticeable reduction	Minor adverse

Location	Sensitivity rating	Magnitude of change	Impact rating
Viewpoint 5: view north-east from North Strathfield Station footbridge	Local	Considerable reduction	Moderate adverse
Viewpoint 6: view south from North Strathfield Station platform	Local	Considerable reduction	Moderate adverse

As noted in Section 10.9.1, the most representative viewpoints have been discussed in detail in this section. Potential temporary impacts for the duration of construction from these viewpoints would include the following:

- **viewpoint 1: view south along Queen Street and Beronga Street** – there would be a moderate adverse temporary impact for this view during construction of this proposal, as works to construct a new station and services building at the northern end of the northern construction site would be visible in the middle ground of this view, rising several stories above Queen Street. There would be a continued presence of the northern construction site along the western side of Queen Street and expanding into a parking lane. Construction vehicles would also be visible travelling along Queen Street and accessing the site via gates on Queen Street. There would be hoarding around the perimeter of the site and large plant and equipment visible rising above the site
- **viewpoint 3: view north-west from the corner of Queen and Wellbank Streets** – there would be a moderate adverse temporary impact for this view during construction due to the scale and extent of construction activity. This would include the use of large equipment and plant and the construction of a new station entrance structure that would rise several stories above the streetscape, higher than the existing commercial buildings opposite the site. The construction work would extend south, removing the remainder of the station heritage gardens and some trees visible at this view
- **viewpoint 5: view north-east from North Strathfield Station footbridge** – there would be a moderate adverse temporary impact at this view during construction, as work would enclose this view. This footbridge would remain open during construction and hoarding would continue to be seen along parts of the northern construction site boundary. As part of this proposal, the approved northern construction site would be extended to the west, and across the northern part of the station (centre of view), including work on the western and island platforms and extending over the rail corridor. This would include the use of large-scale equipment and plant to construct a new footbridge, including escalators and lifts. This work would rise above the skyline, obstructing the vegetated backdrop to this view.

To manage these potential impacts, management and mitigation measures are provided in Section 10.9.4 and Chapter 20 (Synthesis) of this Environmental Impact Statement. These sections include measures to locate elements of construction sites to minimise visual impact, where feasible and reasonable.

Night-time visual amenity impact

The anticipated night-time visual impacts as a result of the construction of this proposal are summarised in Table 10-22.

Night work would be required at this location during station construction and during rail possessions. This would include brightly lit task lighting, lighting at key areas of the construction sites and additional headlights from heavy vehicles accessing the site. The rail corridor cutting would contain some of this lighting and all lighting would be designed to minimise light spill and skyglow. However, this lighting would increase the lighting levels around the station and within the construction sites, seen from adjacent residences and commercial properties on Pomeroy and Queen Streets, and The McDonald College.

Table 10-22 Night-time visual amenity impacts during construction – North Strathfield metro station

Location	Sensitivity rating	Magnitude of change	Impact rating
North Strathfield metro station	A3: Medium level brightness	Considerable reduction	Moderate adverse

10.9.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, landscape and visual amenity impacts would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes landscape and visual amenity management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

The design of this proposal would also be consistent with the principles and outcomes presented in the Design Guidelines (refer to Appendix E).

Mitigation measures that are specific to the operation and construction of North Strathfield metro station to address potential impacts are listed in Table 10-23.

Table 10-23 Landscape and visual amenity mitigation measures – North Strathfield metro station

Ref	Impact/issue	Mitigation measure	Timing
Landscape and visual amenity			
EIS-LV8	Landscape impacts	Opportunities to provide gardens within the areas adjoining the heritage listed areas of the station, or in the vicinity, would be investigated as part of design development to reflect the local values of the community and reinforce the sense of place for the North Strathfield local centre.	Operation

10.10 Soils, contamination and groundwater

Further details on the contamination assessment, including the approach and methodology, are provided in Technical Paper 7 (Contamination). The approach and methodology for the soils and groundwater assessments are provided in Chapter 4 (Methodology) of this Environmental Impact Statement and Appendix D (Detailed assessment methodologies). The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

10.10.1 Baseline environment

The baseline environment as relevant to soils, contamination and groundwater is discussed in the following sections.

Prior to the commencement of this proposal, buildings and other infrastructure located on the majority of the land required for the North Strathfield metro station construction sites will be demolished, and bulk excavation work for the station will have occurred as part of the work carried out under the previous Sydney Metro West planning application. Minor areas of additional footprint are also required to support construction of this proposal within the rail corridor.

Soils

The existing soils environment is described in detail in Chapter 19 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and is summarised in the following sections, including in relation to the additional areas of land required for construction of this proposal.

Soil and geology types

The geological units expected to be encountered at the North Strathfield metro station construction sites include Quaternary deposits (zero to two metres below ground level), Ashfield Shale and Mittagong Formation (two to 34 metres below ground level) and Hawkesbury Sandstone (greater than 34 metres below ground level).The *Soil Landscapes of Sydney 1:100,000 Sheet* (Chapman et al., 2009) and *Penrith 1:100,000 Sheet* (Bannerman et al., 2010) identify Blacktown (strongly acidic and hard setting soils) soil units in the vicinity of North Strathfield metro station.

Soil salinity

The NSW Natural Resources Atlas sourcing information from the *Salinity Hazard Map of NSW* (DIPNR, 2018) does not indicate a soil salinity hazard at this site and immediately surrounding the construction sites.

Acid sulfate soils

Potential acid sulfate soils risk maps obtained from the former Office of Environment and Heritage (now part of NSW Department of Planning and Environment) were reviewed to assess the probability of potential acid sulfate soils being present in proximity to North Strathfield metro station. No potential acid sulfate soils were identified within the construction sites and immediate vicinity. However, areas around Powells Creek located around 300 metres to the west of the North Strathfield metro station construction sites are identified as 'disturbed terrain' (see Figure 10-21), which are often located on reclaimed land or land subject to dredging or mining, with the potential presence of acid sulfate soils. These areas are associated with fill and/or alluvium that extends from harbour shores up local drainage lines. Investigations would be undertaken prior to the work being carried out under the previous Sydney Metro West planning application to further assess the presence of acid sulfate soils.

Contamination

Areas of environmental interest (AEI) identified in Chapter 20 of *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) at North Strathfield metro station construction sites are described (as relevant to this proposal) as follows:

- AEI 35 – Historical railway activities (within the additional footprint for this proposal) – moderate risk of surface soil contamination from residual heavy metals, hydrocarbons, pesticides and asbestos from historical and current railway use
- AEI 36 – Embalming chemicals (Funeral Home) (to the east of the construction sites) – moderate risk of groundwater contamination from hydrocarbons and solvents
- AEI 37 – Dry cleaning (to the east of the construction sites) – moderate risk of groundwater contamination from residual volatile organic compounds from dry cleaning activities
- AEI 38 – Hazardous building materials/demolition wastes (within the construction sites) – low risk of surface soil contamination from heavy metals, hydrocarbons, pesticides and asbestos
- AEI 38(a) - Hazardous building materials/demolition wastes (within additional footprint for this proposal) – moderate risk of surface soil contamination from heavy metals, hydrocarbons, pesticides and asbestos)
- AEI 39 – Historical commercial and industrial land use in surrounding locality (outside of construction sites) – moderate risk of groundwater contamination from heavy metals, hydrocarbons, pesticides, and asbestos being present at depth within construction sites due to migration from the off-site source
- AEI 40 – Potential firefighting activities (Switch Yard at Underwood Road, North Strathfield) (to the west of the construction sites) – low risk of groundwater contamination and vapour from per- and poly-fluoroalkyl substances (PFAS).

AEIs rated as moderate risk or above following the completion of the work carried out under the previous Sydney Metro West planning application are shown on Figure 10-20.

Minor surface soil disturbance may be required in the additional footprint for this proposal (within the rail corridor). The risk of shallow soil contamination or encountering previously dumped construction waste within the construction site boundary for the work carried out under the previous Sydney Metro West planning application is expected to be low as it would have been removed or managed prior to construction of this proposal. There is a moderate risk of surface soil contamination within the additional footprint for this proposal.

Off-site groundwater contamination sources would not be remediated during the work carried out under the previous Sydney Metro West planning application; therefore, residual groundwater contamination could remain. The ingress of contaminated groundwater to subsurface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required for this proposal to determine the need for any additional groundwater remediation.

The conceptual site model and risk ranking for the areas of environmental interest at North Strathfield metro station are detailed in Appendix C of Technical Paper 7 (Contamination).

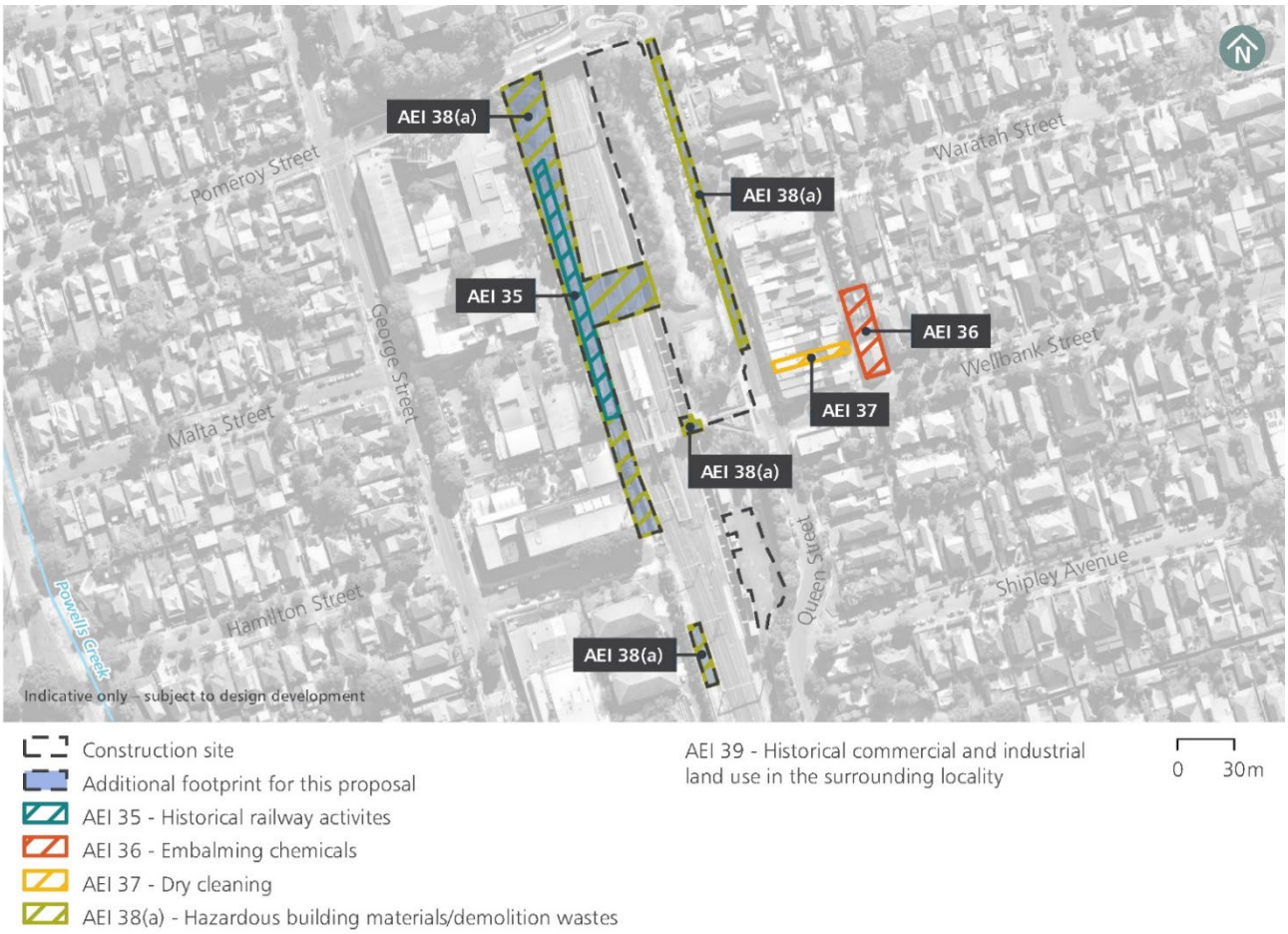

Figure 10-20 Areas of environmental interest (moderate risk or above) – North Strathfield metro station

Groundwater

The previous Sydney Metro West planning application includes the excavation of an untanked station box (excavation that allows groundwater to flow into the structure) for North Strathfield metro station.

The baseline groundwater environment for this proposal is described further in Table 10-24, and shown in Figure 10-21.

Table 10-24 Groundwater baseline environment – North Strathfield metro station

Aspect	Description
Groundwater levels and flow	The predicted groundwater drawdown within the immediate station area from work carried out under the previous Sydney Metro West planning application will bring the groundwater level to about 17 metres below ground level (Sydney Metro, 2020a) (see Figure 10-21 for the groundwater drawdown extent). This is assumed as the groundwater level at the commencement of construction for this proposal. The predicted groundwater inflows to the North Strathfield metro station box (untanked) of up to about 0.4 litres per second is expected to continue at the commencement of construction work for this proposal. As a result, localised groundwater flow is expected to be towards the untanked station box.
Groundwater quality	The baseline groundwater quality may be impacted by a change in the groundwater flow direction, towards the untanked station box (which is likely to induce groundwater seepage). Potential contaminants of concern include heavy metals, hydrocarbons, solvents (namely formaldehyde), chlorinated hydrocarbons, and volatile organic compounds (see the contamination baseline environment discussion above). As such, the baseline groundwater quality for this proposal is expected to be consistent with that defined for the work carried out under the previous Sydney Metro West planning application.

Aspect	Description
	Groundwater level drawdown in the vicinity of saltwater bodies has the potential to cause saltwater to intrude into fresh groundwater systems. There is potential that the saline waters of Powells Creek (located around 300 metres east of the construction sites) could be drawn into the groundwater adjacent to the creek. The potential impacts to sensitive receptors are discussed in Section 5.8.8 of Technical Paper 7 (Hydrogeology) of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and form the baseline environment for this proposal.
Groundwater users	Seven registered bores reported to be used for monitoring purposes are expected to have a reduced groundwater level at the commencement of construction of this proposal (as a result of the work carried out under the previous Sydney Metro West planning application). No registered water supply bores were identified within the groundwater drawdown extent and therefore are not likely to be impacted. As such, potential impacts to groundwater bores as a result of this proposal are not expected and have not been discussed further.
Groundwater dependent ecosystems	Figure 10-21 shows a groundwater dependent ecosystem identified within the predicted groundwater drawdown extent from the previous Sydney Metro West planning application). (Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion) located around 650 metres to the north-east of the construction sites. There is a low potential for up to about four metres of groundwater drawdown to impact this groundwater dependent ecosystem as a result of the work carried out under the previous Sydney Metro West planning application).
Surface water and groundwater interaction	The interaction between surface water and groundwater in proximity to North Strathfield metro station is considered limited due to the altered nature of the area. The primary interactions include: • surface water acting as recharge to underlying groundwater units, where hydraulic gradients and modified environments (e.g. concrete-lined waterways/channels) permit • groundwater discharging to surface water as baseflow, especially in areas of low elevation (where hydraulic gradients and modified environments allow) • induced flow of surface water into groundwater due to the predicted groundwater drawdown resultant from work carried out under the previous Sydney Metro West planning application) • the surrounding area is highly urbanised with predominantly impervious surfaces across the catchments prior to the commencement of work for this proposal, which reduces possible surface water infiltration into soils and underlying groundwater. The surrounding area highly urbanised with predominantly impervious surfaces across the catchments prior to the commencement of work for this proposal, which reduces possible surface water infiltration into soils and underlying groundwater. There is potential that the that groundwater level drawdown could result in reduced groundwater base flow towards Powells Creek and the wetlands at Mason Park, Powells Creek Reserve, and Bicentennial Park (see Figure 10-21 at the commencement of construction for this proposal. The potential impacts to these surface water features are discussed in Section 5.8.8 of Technical Paper 7 (Hydrogeology) of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and form the baseline environment for this proposal.

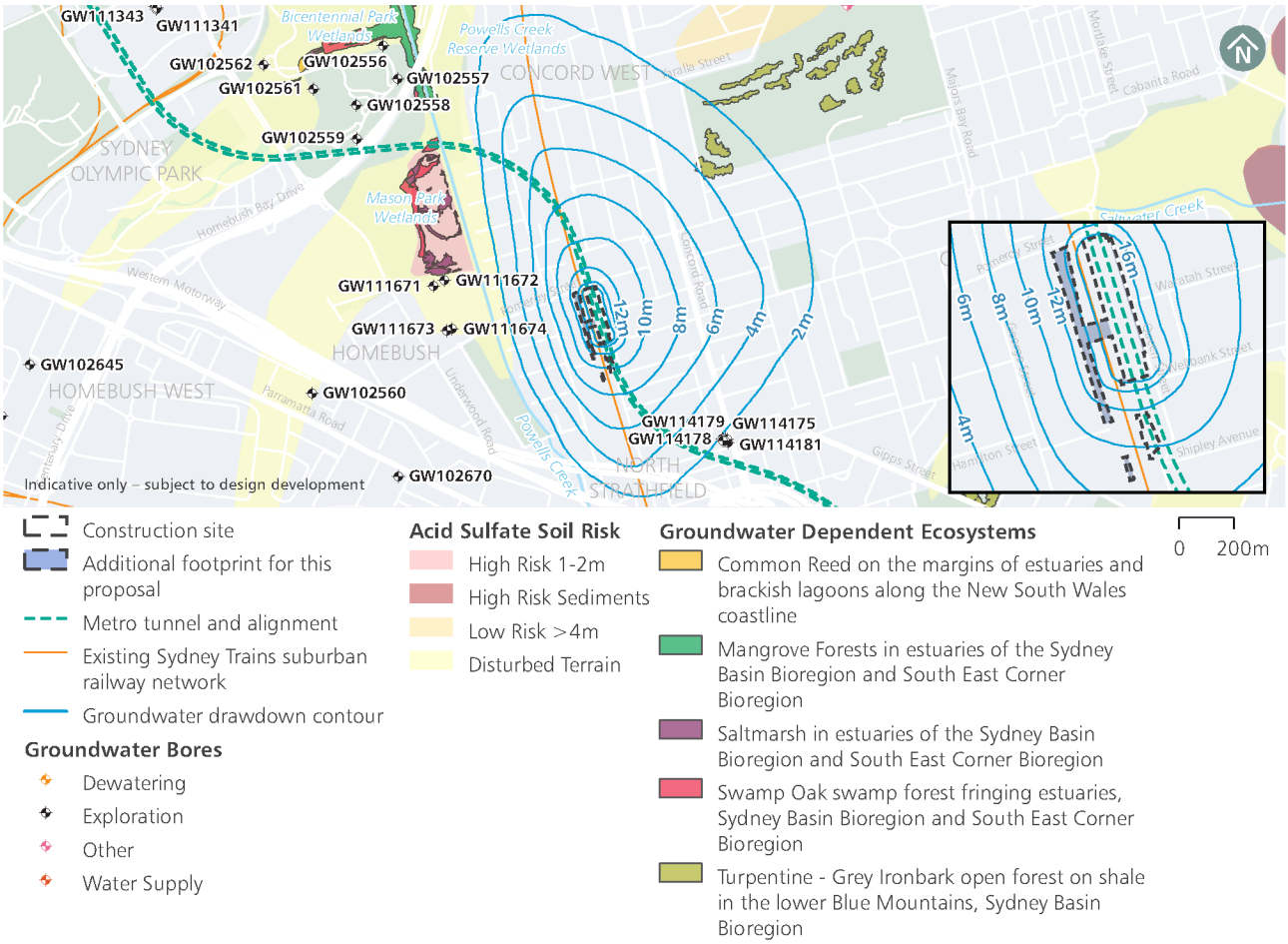

Figure 10-21 Groundwater baseline environment – North Strathfield metro station

10.10.2 Operational impact assessment

Soils

The operation of North Strathfield metro station is not expected to have any further impact on soils, including from saline soils, as there would be no excavation after completion of construction. Acid sulfate soil investigations would be undertaken under the previous Sydney Metro West planning application within the zone of groundwater drawdown to assess potential impacts and decide whether an Acid Sulfate Soils Management Plan (ASSMP) is required for operation of this proposal.

Contamination

Soil and/or groundwater contamination, if present, is expected to be investigated and remediated to the extent possible during the work carried out under the previous Sydney Metro West planning application or this proposal in accordance with the relevant mitigation measures and conditions of approval. Groundwater would be continued to be extracted from the untanked underground metro station during operation and potentially require treatment prior to discharge. All groundwater extracted from de-watering of the station box would be captured, pumped to the operational water treatment plant at the Clyde stabling and maintenance facility and treated prior to discharge in accordance with the water quality requirements outlined in Section 18.9 (Hydrology and water quality) of this Environmental Impact Statement.

Operation of North Strathfield metro station would require limited use and storage of chemicals, oils or fuels. There are no significant sources of contamination or impacts anticipated from the operation of North Strathfield metro station or the public domain. Management measures associated with the use and storage of chemicals during operation would be implemented (refer to Chapter 20 (Synthesis) of this Environmental Impact Statement).

Groundwater

Potential impacts to groundwater during operation at North Strathfield metro station are described further in Table 10-25.

Table 10-25 Potential impacts to groundwater during operation – North Strathfield metro station

Potential impact	Discussion
Groundwater recharge	The surface area of impervious surfaces at North Strathfield metro station is not expected to increase due to the operational elements for this proposal, as the construction site prior to commencement of work for this proposal would comprise predominately paved (impervious) surfaces.
Groundwater levels, inflows, and flow patterns	Groundwater inflows to the station box would continue throughout operation at roughly the modelled inflow rates identified as part of the baseline environment (refer to Table 10-24). This inflow rate is deemed to be a conservative representation of long-term inflow rates for the operation of this proposal. The potential groundwater impacts of this proposal are not expected to further exacerbate the groundwater levels, inflows, and groundwater flow regime for the work carried out under the previous Sydney Metro West planning application. Further groundwater modelling to confirm potential impacts and flow patterns would be carried out for the work carried out under the previous Sydney Metro West planning application. in accordance with condition of approval D122. This groundwater modelling report would be further reviewed and updated to incorporate the scope of this proposal.
Groundwater quality	Groundwater quality and the volume of potentially impacted groundwater to be managed during operation of this proposal is expected to remain consistent with the baseline conditions. The station box would be untanked during operation, requiring ongoing de-watering which would result in groundwater drawdown. Operation of North Strathfield metro station is not expected to result in adverse impacts from saltwater intrusion. Any long-term groundwater inflows would be collected, treated at the operational water quality treatment plant at the Clyde stabling and maintenance facility, and discharged in accordance with the water quality requirements outlined in Section 18.9 (Hydrology and water quality) of this Environmental Impact Statement.
Groundwater dependent ecosystems	Additional impacts on identified groundwater dependent ecosystems (terrestrial vegetation) in proximity of North Strathfield metro station are not anticipated to occur during the operation of this proposal. As per mitigation measure B3 for the previous Sydney Metro West planning application, additional investigations and assessment would be completed to confirm the potential for impacts to groundwater dependent ecosystems due to groundwater drawdown, and to identify any required mitigation through design. This would be reviewed and updated as required for this proposal (refer to mitigation measure EIS-GW3 in Section 10.6.4).
Surface water – groundwater interaction	The baseline conditions for surface water features in proximity to the North Strathfield metro station are expected to continue during the operational phase of this proposal and therefore there is potential for groundwater drawdown to impact on recharge to surface water features. Mitigation measures GW2 and GW3 of the previous Sydney Metro West planning application. identified that further investigations during design development may confirm the existing baseflow contribution by groundwater resources to Powells Creek and the wetlands at Mason Park, Powells Creek Reserve, and Bicentennial Park, and the likelihood and significance of potential impacts of predicted groundwater drawdown on baseflow. Further investigations may confirm a substantial reduction in baseflow, and further review of opportunities to reduce the potential for baseflow loss may be required as part of the previous Sydney Metro West planning application. A review of further investigations and potential treatments implemented as part of the work carried out under the previous Sydney Metro West planning application. would be undertaken to identify whether further measures may be needed to manage potential impacts on recharge to surface water features as part of this proposal.

Potential impact	Discussion
Policy compliance	The minimal harm criteria in the NSW Aquifer Interference Policy (NSW Department of Primary Industries, 2012) and Water Sharing Plan rules (NSW Department of Industry, 2011) adopted for the previous Sydney Metro West planning application. would be complied with during the operation of this proposal, noting that impacts from the alteration of groundwater levels and flow regime are likely to be less during operation of this proposal.

10.10.3 Construction impact assessment

Soils

There may be potential temporary minor soil erosion from the exposure of soil to water runoff and wind during minor excavation works required for this proposal. This would be adequately managed with the implementation of standard erosion and sediment controls, which would be established through the CEMF.

Disturbance of saline soils at North Strathfield metro station construction sites is not expected to occur as saline soils have not been mapped within or near the site.

There is potential for acid sulfate soils within the predicted groundwater drawdown extent during construction. The exposure of acid sulfate soils during construction could result in the release of acid sulfates, which could pollute downstream watercourses. Further investigation of acid sulfate soils would be undertaken for the work carried out under the previous Sydney Metro West planning application. This would be reviewed for this proposal during design development to identify the potential need for further measures to manage acid sulfate soils for this proposal if present.

Contamination

Existing contamination

Based on the assessment all AEI were all ranked as moderate risk for this proposal except for AEI 40 which is ranked as low risk. Soil contamination within the existing construction site is likely to be remediated prior to the commencement of construction for this proposal and any residual contamination is likely to be minor and isolated. There are areas outside the construction sites for the previous Sydney Metro West planning application that would require shallow and localised soil disturbance during this proposal within AEI 35 and AEI 38(a). The additional area is shown Figure 10-20. This soil disturbance could result in the direct contact, inhalation, or ingestion of heavy metals, hydrocarbons, pesticides and asbestos, as well as off-site contamination, if not managed appropriately. If contamination is encountered, it would be managed in accordance with mitigation measures C1 to C5.

Groundwater dewatering would continue during construction of this proposal, as the station would be untanked. As the groundwater contamination sources are off-site sources, the risk of contamination remains moderate for AEI 36 through to AEI 40. In accordance with condition of approval (D122) for the previous Sydney Metro West planning application, a Groundwater Modelling Report will be developed to assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report, including where required for groundwater contamination, would be reviewed, and as applicable adopted during construction of this proposal.

New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be implemented (refer to Chapter 20 (Synthesis) of this Environmental Impact Statement).

Groundwater

Potential impacts to groundwater during construction at North Strathfield metro station are outlined in Table 10-26.

Table 10-26 Potential impacts to groundwater during construction – North Strathfield metro station

Potential impact	Discussion
Groundwater recharge	Almost all of the surface area within the construction sites is expected to be comprised of impervious surfaces at the commencement of this proposal following completion of the work carried out under the previous Sydney Metro West planning application. and therefore, the net impact on regional groundwater recharge due to the construction works for this proposal is considered negligible.
Groundwater levels, inflows, and flow patterns	Groundwater inflows to the station box would continue throughout construction of this proposal at roughly the modelled inflow rates identified as part of the baseline environment (refer to Table 10-24). The potential impacts from construction of this proposal are expected to be consistent with the baseline groundwater levels, inflows, and flow regime from the work carried out under the previous Sydney Metro West planning application. Potential groundwater impacts of this proposal would be managed through the implementation of mitigation measures outlined in the CEMF and Chapter 20 (Synthesis) of this Environmental Impact Statement. This would include the development of a Groundwater Construction Monitoring Program that would be consistent with the requirements of the Concept condition of approval C17. Further groundwater modelling to confirm the impacts and flow patterns would be undertaken for the work carried out under the previous Sydney Metro West planning application. This would be further reviewed and updated as required for this proposal (refer to the mitigation measures in Chapter 20 (Synthesis) of this Environmental Impact Statement).
Groundwater quality	Groundwater quality and the volume of potentially impacted groundwater to be managed during construction of this proposal is expected to remain consistent with the baseline conditions. Groundwater inflows would be collected, treated and discharged in accordance with the water quality requirements outlined in Section 18.9 (Hydrology and water quality) of this Environmental Impact Statement. Further groundwater monitoring to confirm groundwater quality and groundwater modelling to confirm potential groundwater flow patterns would be carried out for the previous Sydney Metro West planning application This would be further reviewed and updated as required for this proposal (refer to the mitigation measures in Chapter 20 (Synthesis) of this Environmental Impact Statement).
Groundwater dependent ecosystems	Potential impacts on identified groundwater dependent ecosystems (terrestrial vegetation) in proximity of North Strathfield metro station, if realised through the construction of this proposal, are expected to continue during construction of this proposal. Mitigation measure B3 of the previous Sydney Metro West planning application identified that further investigations and assessment during design development may confirm the likelihood and significance of potential impacts to groundwater dependent ecosystems due to groundwater drawdown. Where further investigations confirm a substantial reduction in baseflow, further review of opportunities to reduce groundwater drawdown would occur (for example, this may include additional grouting at the station). Refer to mitigation measure EIS-GW3 in Section 10.10.4 for further detail.
Surface water – groundwater interaction	The baseline conditions for surface water features, in proximity to the station are expected to continue during construction of this proposal. That is, the potential for groundwater drawdown to impact on recharge to surface water features remains consistent during construction of this proposal. Further investigations during design development for the previous Sydney Metro West planning application confirmed the existing baseflow contribution by groundwater resources to Powells Creek and the wetlands at Mason Park, Powells Creek Reserve, and Bicentennial Park. It also confirmed the likelihood and significance of potential impacts of predicted drawdown on baseflow would be reviewed and updated for this proposal.

Potential impact	Discussion
	Where further investigations confirm a substantial reduction in baseflow, measures would be implemented to reduce the potential for baseflow loss. The mitigation measures identified for the previous Sydney Metro West planning application would be maintained into and throughout construction of this proposal.
Policy compliance	The minimal harm criteria in the NSW Aquifer Interference Policy (NSW Department of Primary Industries, 2012) and Water Sharing Plan rules (NSW Department of Industry, 2011) adopted for the previous Sydney Metro West planning application are expected to be carried through and complied with into construction of this proposal.
Ground movement	During the previous Sydney Metro West planning application, the specific risk to most buildings and structures due to ground movement would be negligible, with superficial damage to buildings unlikely (Sydney Metro, 2020a). The potential for further ground movement (and therefore potential impacts to buildings and structures) as a result of construction of this proposal is unlikely due to the excavation of the station box being carried out during the work carried out under the previous Sydney Metro West planning application. As such, the extent of ground movement is considered to be negligible as a result of construction of this proposal.

10.10.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, soils, contamination and groundwater would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes soil, contamination and groundwater management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

Mitigation measures that are specific to the operation and construction of North Strathfield metro station to address potential impacts are listed in Table 10-27.

Table 10-27 Soils, contamination and groundwater mitigation measures – North Strathfield metro station

Ref	Impact/issue	Mitigation measure	Timing
Soils, contamination and groundwater			
EIS-GW3	Groundwater dependent ecosystems	Additional investigations and assessment completed as part of the previous Sydney Metro West planning application (mitigation measure B3) would be reviewed and adopted or updated for this proposal, to confirm the potential for impacts to groundwater dependent ecosystems due to groundwater drawdown, and to identify any required mitigation through design.	Construction

10.11 Flooding

Further details on the flooding assessment, including the approach and methodology, are provided in Technical Paper 8 (Hydrology, flooding and water quality). The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

10.11.1 Baseline environment

North Strathfield metro station is located on the downstream slope of an area with several small overland flow paths draining the residential area to the east of the site. The overland flow that discharges towards the existing station is captured and conveyed to an open drain on the upstream, eastern side of the existing rail line, which flows to the south and ultimately into Powells Creek. The site ranges from around 14 to 20 metres Australian Height Datum (AHD).

Overland flows from Waratah Street contribute to flooding of a depth of around 0.1 metres in Queen Street, which is mostly contained in the kerb and gutter drainage at the intersection of Queen Street and Waratah Street in the one and five per cent Annual Exceedance Probability (AEP) (with climate change) events. At the same location in the Probable Maximum Flood (PMF) event, the depth of flooding is 0.3 metres which is also mostly contained within the gutter.

To the west of Wellbank Street, ponding on Queen Street of up to 0.3 metres is likely during the one per cent AEP flood event. Ponding depth is up to one metre in the PMF event and encroaches the station building footprint and discharges over the flood protection wall and into the existing rail corridor. There is major overland flooding potential across the northern portion of the site of up to one metre during the PMF event (high hazard areas).

Flooding is predominantly low hazard in the five per cent AEP, one per cent AEP and one per cent AEP (with climate change) events within the construction site and adjacent streets, including the area of additional footprint along Queen Street. Access and evacuation to the site is available in the one per cent AEP (with climate change) flood event, with the surrounding streets being low hazard, and with only small, localised areas with high hazard occurring in the street kerb drainage and the open drain running parallel with Queen Street.

High hazard flooding areas would occur on the surrounding streets and in the rail corridor during the PMF. This is mostly due to expected floodwaters in the North Strathfield Rail Underpass, as well as discharge from Wellbank Street onto Queen Street. Access and evacuation in the PMF event would be available from the northern part of the site via adjacent streets; however, evacuation towards the south would be hazardous for pedestrians and vehicles.

The site and immediate surrounds are not located in a floodway or flood storage areas. There are no mainstream flooding or coastal inundation risks relevant to the site and immediate surrounds.

Modelling suggests that several private properties would currently experience inundation during flood events. This includes seven properties in Beronga Street and three properties in Queen Street (south of Wellbank Street) during the one per cent AEP (with climate change) event. This increases to nine and four properties respectively during the PMF event.

The station box at North Strathfield metro station will have been excavated as part of the work carried out under the previous Sydney Metro West planning application.

The previous Sydney Metro West planning application identified that impacts to existing flooding behaviour at the North Strathfield metro station construction site would include:

- potential inundation of the construction site from existing flow paths on Queen Street and ingress of floodwaters into station excavation during the PMF event (although the station excavation would be protected from these events)
- potential flooding impacts to Queen Street, including ponding, from the obstruction of existing flow paths through the construction site. Flow paths may be obstructed by construction site hoardings.

10.11.2 Operational impact assessment

The flood protection levels for North Strathfield metro station are driven by the one per cent AEP (with climate change) flood event (plus 0.3 metres of freeboard), which is 21.94 metres AHD at Waratah Street (at Queen Street) and 18.94 metres AHD at Wellbank Street (at Queen Street). The existing surface levels at the station entries are about 21.8 metres AHD and 19.05 metres AHD respectively. Therefore, the design level of the station is at or above the flood level, which indicates the station is unlikely to be affected by flooding during this flood event.

Operational flood impact criteria established for this proposal are described in Section 3.1.4 of Technical Paper 8 (Hydrology, flooding and water quality). An assessment of potential flooding impacts at North Strathfield metro station is provided in Table 10-28 and shown in Figure 10-22. The operational flooding assessment considers the flooding extent for the one per cent AEP (with climate change) and PMF events. The five per cent AEP (with climate change) is also considered in Technical Paper 8 (Hydrology, flooding and water quality). Figures showing the modelling for a range of flooding events are provided in Appendix B and C of Technical Paper 8 (Hydrology, flooding and water quality).

Potential impacts during operation of this proposal at North Strathfield metro station are generally expected to be minor in all flooding events. Mitigation measures to manage potential impacts are outlined in Section 10.11.4.

Table 10-28 Potential flooding impacts for the modelled one per cent AEP and PMF flood events – North Strathfield metro station

Potential impact	Description
Change in peak flooding levels	• during the one per cent AEP (with climate change) event the following potential impacts are predicted: - potential increases in water level within the kerb drainage at the Beronga Street / Queen Street intersection. This increase would cause minor increases of up to 0.1 metres within private properties. All of these properties are currently flood affected, with the exception of one new property - reduced flood levels as a result of a lowered road surface on Queen Street along the eastern side of the station - localised minor increases in flood level near the station entrance, however, this would not affect private property or traffic movements on Queen Street - the area of public domain proposed to the south of the metro station may block a small portion of flow that previously discharged through the gardens adjacent to Wellbank Street. This would result in increases in flood level on Queen Street and Wellbank Street of up to around 0.2 metres and private property impacts of up to 0.1 metres. The detailed design for this proposal would seek to minimise potential impacts, including to properties, through consistency with relevant impact flooding criteria and consideration of best practice guidelines • during the PMF event, hydraulic impacts on Queen Street near Beronga Street and Waratah Street would generally be consistent with those predicted for the one per cent AEP (with climate change) event. The potential loss of flood storage at the south of the station would result in increases in flood level of up to around 0.1 metres affecting a large area of the road and four private properties in the vicinity of Queen and Wellbank streets (refer to Appendix B of Technical Paper 8 (Hydrology, flooding and water quality).
Change in flood extent	• potential minor increases in flood extent, including in areas adjacent to and south of the metro station along Queen Street, as well as some increases along the Waratah Street, Wellbank Street and Pomeroy Street for all events up to the PMF. The detailed design for this proposal would seek to minimise potential impacts, including to properties, through consistency with relevant impact flooding criteria and consideration of best practice guidelines up to and including the one per cent AEP event.
Compatibility with the flood hazard of the land	• flood risk and potential impacts from this proposal are considered manageable and therefore are considered compatible with the flood hazard of the site. Further design refinement would aim to contain flows within the minor and major urban drainage system • during the one per cent AEP event, elevated high flood hazard areas at the intersection of Wellbank and Queen Street which could affect access and evacuation routes • during the PMF event, potential increases in high flood hazard extent are predicted along sections of Queen Street. Mitigation measures (refer to Section 10.11.4) would be implemented with the aim of containing flows within the roadway.
Change in duration of inundation	• change in duration of inundation would be negligible in all flood events.
Potential property impacts	• there is potential for several private properties (five in Beronga Street and three in Queen Street) to experience increased inundation during flood events as a result of the proposal. These properties would currently experience flooding impacts and the increased impact from this proposal would be no greater than the baseline condition

Potential impact	Description
	• further design refinement would be carried out during detailed design so that no additional private properties would be affected by flooding up to and including the one per cent AEP due to permanent infrastructure delivered as part of this proposal. Further detail on the criteria is included in Technical Paper 8 (Hydrology, flooding and water quality).
Consistency with floodplain risk management	• there is no applicable floodplain risk and stormwater management plan for this area. The northern construction site is not within the *Canada Bay Local Environmental Plan 2013* flood planning area. The southern construction site is not within the *Burwood Local Environmental Plan 2012* flood planning area. The *Parramatta Road Corridor Flood Risk Assessment* was undertaken for the City of Canada Bay Council (WMA Water, 2020). The mapping shows flooding consistent with the modelling undertaken as part of this assessment, with the sites being flood free and minor street flooding adjacent to the sites.
Potential impacts to critical infrastructure and emergency management arrangements for flooding	• no potential flooding impacts to the major road or rail transport routes identified in the *South West Regional Emergency Management Plan* (South West Metropolitan Regional Emergency Management Committee, 2017) would occur as a result of this proposal.
Potential social and economic costs from flooding impacts	• given the generally low flood affectation at North Strathfield metro station and the expected low impact on flood behaviour on surrounding properties and infrastructure as a result of this proposal (with the implementation of mitigation measures), the potential social and economic costs from flooding impacts are considered low.

Figure 10-22 Potential change in flood levels (one per cent AEP event) – North Strathfield metro station

10.11.3 Construction impact assessment

The duration of construction at the North Strathfield metro station construction site would be about four to five years (see Figure 10-8). In general, the potential construction phase flood risks would be a continuation of the potential flooding risks associated with the previous Sydney Metro West planning application, including:

- direct intense rainfall onto the site may cause nuisance flooding and drainage issues
- continued potential interruption of overland flow paths from temporary construction site infrastructure and modifications to landforms
- the potential interruption or diversion of existing flood routes away from the location of bunding or spoil within construction sites, resulting in a reduction of flood storage and an increased flood risk to adjacent sites
- disruption of street kerb and gutter at construction site vehicle entry locations, including driveways which may result in localised ponding
- potential blocking of drainage networks through increased sedimentation of surface water.

In the PMF event, the northern and southern construction sites are expected to experience localised areas of high flood hazard. Access to and evacuation from the site in this event would be available from the northern station construction site with adjacent streets having lower hazard particularly at the northern end. Queen Street in the vicinity of Wellbank Street would be expected to experience discharge resulting in high hazard which would not be safe for pedestrians or vehicles. Potential risk to construction areas which are not protected from flood inundation along with danger to people and vehicles accessing or working within the construction site would be managed as part of construction planning and would consider relevant measures outlined in the Construction Environmental Management Framework.

The CEMF (Appendix F) requires the preparation of a Soil and Water Management Plan that would include consideration of surface water and flooding measures and progressive erosion and sediment control plans to manage potential impacts.

This proposal also requires additional footprint areas in the rail corridor and along Queen Street. The additional area along Queen Street has the potential to experience inundation of construction works from the existing flow paths along Queen Street, or interruption of the overland flow paths resulting in increased flood risk to adjacent areas. Work in the existing rail corridor would only be undertaken periodically during rail possessions with no long-term storage of infrastructure or equipment. As such, potential impacts from these works would be low and limited to the immediate area. There are high flood hazard areas at the intersection of Wellbank and Queen Street which could affect access to and departure from the construction site.

Localised changes to overland flows would be limited in their scale to the immediate vicinity of the construction works, and due to the temporary nature of the impacts are considered minor. The overall risk of flooding impacts during construction from this proposal is considered low and the magnitude of impacts negligible.

Compatibility of construction sites with flood conditions

The previous Sydney Metro West planning application identified that the North Strathfield metro station construction site is considered to be compatible with flood conditions due to generally low hazard in the five per cent AEP and one per cent AEP flood events (both with climate change). Potential risk to construction areas which are not protected from flood inundation would be managed as part of construction planning and would consider relevant measures outlined in the Construction Environmental Management Framework.

Consistency with floodplain risk management plans

There is no applicable floodplain risk and stormwater management plan for the site. The site is not within the *Canada Bay Local Environmental Plan 2013* flood planning area. The area is not subject to major overland or riverine flooding.

Potential impacts to emergency management arrangements for flooding

No major road or rail transport routes identified in the *South West Metropolitan Regional Plan* area would be impacted by flood flows in the vicinity of the site.

Potential social and economic costs from flooding impacts

Similar to the operations phase, potential social and economic costs from flooding impacts at North Strathfield metro station construction site as a result of this proposal are considered low given the generally low flood hazard at North Strathfield metro station construction site during the five per cent AEP and one per cent AEP events (both with climate change), and therefore the expected low impact on flood behaviour on surrounding properties and infrastructure. The CEMF (Appendix F) requires the preparation of a Soil and Water Management Plan that would include consideration of surface water and flooding measures and progressive erosion and sediment control plans to manage potential impacts.

10.11.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

Potential flood risks during construction of this proposal would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes flooding management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

10.12 Social impacts

Further details on the social impact assessment, including the approach and methodology, are provided in Technical Paper 9 (Social impacts). A discussion of potential broader proposal-wide and regional social impacts (both benefits and disbenefits) are provided in Chapter 18 (Proposal-wide) of this Environmental Impact Statement.

10.12.1 Baseline environment

The characteristics of the communities within the social locality is described as the social baseline. The social baseline has been analysed by considering the human, social, economic, physical, and natural capital present around North Strathfield metro station.

Statistical analysis of the social baseline has been carried out by considering the primary geographical areas of interest as defined by the Australian Bureau of Statistics (ABS). These areas of interest have been termed as:

- **the proximal area:** Statistical Area level 1 (SA1s) have been chosen as the closest approximation of each of the localities along the corridor
- **suburb:** Statistical Area level 2 (SA2s) have been chosen to prepare community profiles for this proposal corridor
- **region:** the Greater Sydney area has been chosen to assist with the assessment of the broader social impacts. It has also been used for comparative purposes.

A summary of each type of community capital as it related to North Strathfield metro station is discussed in Table 10-29. This summary considers the proximal area of analysis only. A discussion of potential broader corridor-wide and regional social impacts (both benefits and disbenefits) is provided in Chapter 18 (Proposal-wide) of this Environmental Impact Statement.

Table 10-29 Community capitals summary – North Strathfield metro station

Capital	Summary
Human	The North Strathfield locality had a relatively high share of residents aged 35 to 64 years and 65 to 84 years when compared to the nearby localities. Its population make up closely resembles the Greater Sydney average, with 23 per cent of the population under the age of 19 (25 per cent Greater Sydney), 64 per cent between the ages of 20 and 64 (61 per cent Greater Sydney) and 12 per cent over the age of 65 (14 per cent Greater Sydney). The North Strathfield locality had one of the highest percentage of residents attending an educational facility. In 2016, 28.4 per cent of all residents of the North Strathfield locality were attending either preschool, infants/primary and secondary school, university, TAFE or other educational facilities. Of the residents attending an educational facility, there was a fairly even balance of residents attending infants/primary and secondary school, university or other tertiary institutions.

Capital	Summary
Social	In 2016, the North Strathfield locality had the highest proportion of family households across the corridor (74 per cent), with the majority being couple families with children (41.3 per cent). Around half of households reported speaking only English at home, which is comparable to the 53.4 per cent of residents born in Australia. 18 per cent of the population in the North Strathfield locality volunteered through an organisation or group, one of the highest across all localities. Volunteer rates demonstrate a level of community cohesion and strength, and commitment to making a different to the lives of people. The North Strathfield locality had relatively high levels of stability of residence compared to other localities, with 51.8 per cent of residents living in the same address as five years ago.
Economic	Overall, households were relatively more advantaged compared to other localities, particularly those localities directly to the west with almost 40 per cent of households earning above $2,500 per week. A high proportion of households were either owned outright (34.7 per cent) or owned with a mortgage (30.4 per cent), which is comparable to Greater Sydney (64.5 per cent owned outright or with a mortgage). It also had the highest portion of mortgage repayments in the lowest quartile (21.8 per cent paying between $0 to $1184 per month). Of those renting, 75 per cent were paying in the highest quartile (paying greater than $443 per week), potentially driven by the high occupancy rates across the locality (94.3 per cent). Unemployment levels in North Strathfield were relatively low when compared to the whole corridor (5.3 per cent compared to 6.8 per cent) and lower that Greater Sydney (6 per cent). Unemployment levels are calculated based on those of eligible age (between the ages of 16 and 65), who are not engaged in secondary education and who are able to work. Of those that were employed, the dominant industry was professional, scientific and technical services (11.6 per cent) and health care and social assistance (11.5 per cent).
Physical	In 2016, over half of dwellings in the North Strathfield locality were separate houses at 55.3 per cent, the highest of all the localities. The average household size within the locality was the second highest overall at 2.9 persons per household. Residents in the North Strathfield locality tended to be highly car dependent, with 45.5 per cent travelling to work via car as a driver, while 27.8 per cent travelled via train or bus.
Natural	The natural heritage of Bicentennial Park, which is part of nearby Sydney Olympic Park and features an important wetland ecosystem and parklands.

10.12.2 Operational impact assessment

Social impacts would be experienced at different geographies or spatial extents. A large proportion of operational social impacts associated with North Strathfield metro station would be felt at a regional and a suburb level; however, some would be experienced at a proximal level. This section focuses on the operational impacts at the proximal level, while a region- and suburb-based analysis, including potential beneficial social impacts, is provided in Chapter 18 (Proposal-wide) of this Environmental Impact Statement.

An assessment of the potential social impacts, both positive (benefits) and negative (disbenefits), of the operation of North Strathfield metro station is outlined in Table 10-30. These potential impacts are unmitigated and would be appropriately managed through the implementation of the mitigation measures outlined in Section 10.12.4 and through the performance outcomes detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. Sydney Metro would also develop a Community Benefit Plan to guide the development of community benefit initiatives (by Principal Contractors).

A residual impact rating has been assigned to each pre-mitigated impact in Table 10-30 to quantify the impacts after mitigation measures have been applied.

Table 10-30 Summary of operational social impacts - North Strathfield metro station

Pre mitigation impact	Social impact category	Impact type	Residual impact rating
Increased access to jobs, businesses, education, services, and social facilities improving social cohesion and social health for the whole community, including vulnerable persons.	Health and wellbeing Way of life Accessibility Livelihoods	Positive	High
Social amenity and placemaking benefits, including improvements to the aesthetic value of the area by creating attractive and active public spaces that reflect the existing or desired future scale and character of local areas.	Surroundings	Positive	High
Change to community character due to permanent changes to local visual character, including change to the ornamental heritage garden fronting Queen Street associated with the existing North Strathfield Railway Station	Community	Negative	Medium
Potential decline in social amenity and ability to experience surroundings in the way the community have done in the past to due to ongoing operational noise for residents in Queen Street.	Way of life	Negative	Low
Potential decline in how people experience their living environments due to light spill at night, specifically for properties located along the east-west aligned residential streets near the new station, including Waratah Street and Wellbank Street. The operation of North Strathfield metro station would see an increase in the night-time lighting levels. Technical Paper 6 (Landscape and visual amenity) found that while all lighting would be designed to minimise light spill and skyglow, the openness of the station architecture and level of lighting required to provide for the safety for customers at night would increase the light levels around the station and introduce additional lighting to Queen Street. There is a potential that some stakeholders on nearby streets would experience a negative social impact at night due to light spill.	Way of life Livelihoods	Negative	Low

The assessment indicates that the longer term and ongoing social impacts of this proposal would primarily be related to increased access to jobs and services, as well as social amenity and placemaking. There would be some residual negative social impacts with respect to nearby residents' way of life; however, these would be managed to an acceptable level through the mitigation measures as identified in in Chapter 20 (Synthesis) of this Environmental Impact Statement.

10.12.3 Construction impact assessment

Construction activities would predominantly be carried out within the same construction sites required for the work carried out under the previous Sydney Metro West planning application, with additional land required from within the existing rail corridor and surrounding roads for the purposes of construction work. Anticipated construction impacts are expected to be similar and would be a continuation of those from the work carried out under the previous Sydney Metro West planning application. During this proposal, local amenity impacts such as noise, vibration, and air quality would reduce compared to the work carried out under the previous Sydney Metro West planning application due to the nature of the construction activities for this proposal.

An assessment of the potential social impacts of constructing this proposal at North Strathfield metro station are outlined in Table 10-31. These potential impacts would be appropriately managed through the implementation of the mitigation measures outlined in Section 10.12.4 and through the performance outcomes detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. Sydney Metro would also develop a Community Benefit Plan to guide the development of community benefit initiatives (by Principal Contractors).

A residual impact rating has been assigned to each pre-mitigated impact to quantify the impacts after these mitigation measures have been applied.

Table 10-31 Summary of construction social impacts – North Strathfield metro station

Pre mitigation impact	Social impact category	Impact type	Residual impact rating
Continued temporary changes to the way of life for people living, working, or accessing services near the construction sites due to reconfiguration of stairs and vertical transport connections from the existing station. Temporary changes to bus stops, parking, footpaths and pedestrian crossings. Culturally and linguistically diverse households and older residents may be disproportionately impacted if communication materials are not accessible in their language.	Accessibility Way of Life	Negative	Medium
Continued changes to community character and connection to place due to ongoing construction activity and an increased construction interface with customers on the existing platform and Queen Street, including additional hoarding and changes to streetscape.	Community	Negative	Low
Potential wellbeing impacts associated with ongoing construction activity for vulnerable people including those people sensitive to noise and vibration, needing assistance with mobility or communication, or experiencing mental ill health. Psychosocial impacts as a result of inherent changes to the social fabric or the local area.	Health and wellbeing	Negative	Medium
Continued reduction in amenity in local area due to the expansion of the existing construction sites and associated noise, air quality and vibration impacts.	Surroundings Way of life	Negative	Medium

The assessment indicates that the social impacts of this proposal would effectively represent a continuation of the impacts identified for the previous Sydney Metro West planning application, though generally at a lower level of intensity and extent. Key negative impacts would be largely related to community, culture, surroundings and way of life, and would be temporary and short term in nature. These impacts would be managed to an acceptable level through proven mitigation measures as identified in Chapter 20 (Synthesis) of this Environmental Impact Statement.

10.12.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, social impacts would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes social impact management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.

The OCCS (Appendix C) also specifies that a Community Communication Strategy would be prepared and implemented during construction which would define the location specific measures to be implemented to minimise impacts on people during construction.

Design refinements that have occurred to avoid or minimise social impacts, and to respond to stakeholder feedback are provided in Technical Paper 9 (Social impacts). Monitoring commitments during the operation and construction of this proposal, including adaptive management measures, are provided in Technical Paper 9 (Social impacts).

Mitigation measures that are specific to the operation and construction of North Strathfield metro station to address potential impacts are listed in Table 10-32.

Table 10-32 Social impacts mitigation measures - North Strathfield metro station

Ref	Impact/issue	Mitigation measure	Timing
Social impacts			
EIS-S2	Potential impacts on school infrastructure	Ongoing engagement would be undertaken with NSW Department of Education to continue to investigate feasible and reasonable mitigation measures related to construction traffic, pedestrian safety, construction noise and vibration, and air quality.	Construction

10.13 Local business impacts

The approach and methodology for the local business assessment are provided in Chapter 4 (Methodology) of this Environmental Impact Statement. The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

10.13.1 Baseline environment

The North Strathfield metro station construction sites will be established as part of the work carried out under the previous Sydney Metro West planning application. Chapter 16 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) included a description of the existing environment as it relates to this business impact assessment, based on ABS Census 2016 data.

This proposal would also require some additional footprint within the rail corridor to support within-corridor construction activities, as well as for precinct works adjacent to the rail corridor. As updated census data is not yet available, the existing environment remains consistent as described by Chapter 16 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a).

To verify this a desktop gap analysis was carried out with respect to any new data available and the specific scope of this proposal. The baseline environment is summarised in the sections below and more detail is provided in Chapter 16 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020).

Local business profile

The North Strathfield station local business study area is largely consistent with that considered in Chapter 16 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a). Due to the additional footprint areas being adjacent to the North Strathfield metro station construction sites for this proposal, the 400-metre zone for consideration of local businesses has been expanded accordingly (refer to Figure 10-23).

Figure 10-23 Local business impacts study area – North Strathfield metro station

The study area contains a diverse mix of employment uses including industry and building use. Local business in the vicinity of North Strathfield metro station fall into the four following key areas:

- west of the existing station – comprised of educational and recreational facilities
- east of the existing station – a local retail precinct including a café, hairdresser, dry cleaner, computer repair shop etc.
- the Bakehouse Quarter, southwest of the existing station – a mixed use area including offices, retail, cafes and restaurants, and entertainment venues
- Concord Road to the east – a larger local shopping precinct including supermarkets, pharmacy, newsagent, bakery, takeaways, and restaurants.

Table 10-33 identifies the types of existing businesses within the local business impacts study area.

Table 10-33 Businesses within the local business impacts study area – North Strathfield metro station

Impact area	Types of businesses	Approximate number of businesses
Within 100 metres of the site	Commercial, retail, education, cafes and restaurants	20 to 30
Between 100 and 400 metres of the site	Commercial, retail, education, cafes and restaurants	60 to 90

Employment

At the 2016 census about 5,500 people were employed within the ‘destination zones’ relevant to the North Strathfield metro station local business impacts study area. Destination zones are the spatial unit used to code ‘place of work’ by the Australian Bureau of Statistics.

The eastern side of the study area is characterised by small businesses associated with food and beverage, retail and local commercial services, while land to the west is occupied by the McDonald College and surrounding educational facilities, which are situated directly adjacent to the existing North Strathfield Station. The wider area is mainly residential, with the employment figures reflecting this mix of uses focused on local population serving businesses.

Employment within the local business impacts study area is fairly evenly distributed across sectors, with the two largest sectors being household services and goods distribution. Together these sectors made up over 60 per cent of all jobs at the 2016 census.

Retail trade and other services represented the two largest employing industries in the study area, followed by manufacturing, construction and transport, postal and warehouse services.

These prominent industries reflect the role of North Strathfield as a predominantly residential area supported by a local centre and small businesses that serve the surrounding community.

Travel patterns

Australian Bureau of Statistics 2016 Census data indicates that most local workers were reliant on a car (as driver) as their main method of travel to work (71.9 per cent). This is likely to be a product of the highly connected nature of the area, being well connected to the Western Motorway. Train travel was used by 15.7 per cent of workers, likely using the existing North Strathfield Station located within the local business impacts study area.

Since the 2016 Census, it is likely that the share of workers working from home in the local business impacts study area has increased, with this trend likely to be accelerated in a post-COVID-19 environment.

10.13.2 Operational impact assessment

A qualitative based assessment of the potential indirect operational impacts to local businesses at North Strathfield metro station is provided in Table 10-34. There are no direct impacts anticipated for local businesses during operation. Potential opportunities for local businesses during operation are also provided in Table 10-34.

North Strathfield metro station would provide additional interchange capability and reduce crowding on existing rail services. This would provide greater access to employment and education opportunities for local workers, customers and communities. The broader North Strathfield Station precinct is proposed to be a high amenity living precinct, well connected to Sydney's key employment and leisure destinations. It would also attract visitors to local entertainment, retail or dining attractions.

Table 10-34 Local business impacts during operation – North Strathfield metro station

Potential impact operation	Risk assessment	
	Likelihood	Significance
Potential opportunities		
Increased passing trade for businesses Some businesses (such as retail and cafés) located around North Strathfield metro station may benefit from an increase in passing trade from customers accessing the station.	Likely	Moderate positive
Improved accessibility Some businesses may experience increased accessibility (both those reliant on passing trade and destination businesses, for example those that are visited by appointment) bringing in new customers who previously could not easily access the area.	Likely	Moderate positive
Improved amenity Improved amenity (such as visual amenity and urban design) around North Strathfield metro station would make the area a more attractive place. This could contribute to improved customer experiences (for a range of business types) throughout the area and increased foot traffic for those businesses reliant on passing trade.	Likely	Moderate positive

Potential impact operation	Risk assessment	
	Likelihood	Significance
Potential indirect impacts		
Impacts on accessibility Some businesses may experience reduced accessibility due to altered traffic (such as the altered intersections) and parking conditions. Changed traffic arrangements could collectively restrict and hinder servicing, delivery and customer access opportunities, resulting in time and vehicle related costs. In addition to the car parking spaces removed part of the work carried out under the previous Sydney Metro West planning application, additional car parking spaces would be removed to facilitate new kiss and ride spaces as well as other key operational aspects of this proposal.	Unlikely	Slight negative

10.13.3 Construction impact assessment

A qualitative based assessment of the potential indirect construction impacts to local businesses at North Strathfield metro station is provided in Table 10-35. There are no anticipated direct impacts to local businesses during construction. Opportunities for local businesses during construction have also been outlined in Table 10-35.

Potential construction impacts would be a continuation of those from the work carried out under the previous Sydney Metro West planning application. During this proposal, local amenity impacts such as noise, vibration, and air quality would reduce compared to the preceding major civil construction work between Westmead and The Bays due to the nature of this proposal's activities.

Table 10-35 Local business impacts during construction – North Strathfield metro station

Potential impact construction	Risk assessment	
	Likelihood	Significance
Potential opportunities		
Continuation of passing trade from construction workforce Businesses along Queen Street may continue to benefit from an increase in the number of customers from construction workers on site, including retail and cafes, in comparison to pre-construction numbers.	Possible	Slight positive
Potential indirect impacts		
Continuation of temporary traffic congestion Significant traffic and travel time impacts are not predicted around key business areas within the local business impacts study area during the previous Sydney Metro West planning application, which is expected to continue during this proposal. Modelled intersection performance with construction traffic indicates that the intersection on Pomeroy Street and George Street would see a slight deterioration in level of service during evening peak hour (from level of service E to F).	Likely	Slight negative
Continued parking impacts Some businesses surrounding the construction sites may have experienced impacts associated with temporary loss of parking during the work carried out under the previous Sydney Metro West planning application. These impacts may continue during construction of this proposal. Additional transport network modification that would also be introduced during construction of this proposal includes the temporary removal of around 17 car parking spaces on the eastern side of Queen Street between Wellbank Street and Pomeroy Street.	Likely	Slight negative

Potential impact construction	Risk assessment	
	Likelihood	Significance
There may also be some short-term closures (for around a few months) of some on-street parking spaces on the western side of Queen Street and on the northern side of Hamilton Street East to establish the new kiss and ride zones. These spaces are in addition to the parking spaces that would be removed as part of the work carried out under the previous Sydney Metro West planning application. This may lead to an increased impact of businesses fronting Queen Street in this location. Spare capacity on nearby streets would be used to accommodate as many as possible of the on-street parking spaces impacted during construction. Some of these spaces are likely to be currently used by customers of businesses on Queen Street.		
Continued impacts to accessibility During construction of this proposal, there will be temporary closures of footpaths such as on the western side of Queen Street between Pomeroy Street and Wellbank Street, and at the Queen Street and Waratah Street intersection. These temporary access adjustments could deter customers from businesses on Queen Street that rely on passing trade due to inconvenient pedestrian diversions but given that the closure will be on western side (the opposite side of the road from businesses), this would be a rare occurrence.	Rare	Slight negative
Temporary loss of power and utilities Unplanned power and utility interruptions could result in business impacts during interruptions. Given most utility works would be completed as part of the work carried out under the previous Sydney Metro West planning application, any substantial impact from unplanned power and utility interruptions is very unlikely.	Almost unprecedented	Slight negative
Continuation of temporarily reduced local amenity Some businesses surrounding the construction sites may have experienced impacts associated with reduced local amenity and visibility during the work carried out under the previous Sydney Metro West planning application. These impacts may continue during construction of this proposal. Potential noise, vibration and visual impacts from construction works may continue to temporarily result in reduced local amenity for example for some businesses along Queen Street and to the west along George Street. Businesses closest to the construction sites would be the most affected, particularly businesses such as cafes that are more reliant on a pleasant local urban amenity and visibility.	Likely	Slight negative
Continuation of safety and security impacts There is potential for businesses to experience a temporary reduction in patronage due to perceptions related to safety and security when travelling through the local business study area. Safety and security could relate to the perception of potentially becoming a victim of crime. These perceived impacts are likely to be limited to retail and cafes and restaurants located near the North Strathfield metro station construction sites that would normally continue trading into the evening. This is because safety and security impacts tend to become more prevalent outside of daylight hours when any reduction in visibility decreases surveillance and the ability to see and navigate hazards.	Rare	Slight negative

10.13.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, local business impacts would be managed in accordance with Sydney Metro's CEMF (Appendix F).

The OCCS (Appendix C) also specifies that a Community Communication Strategy would be prepared and implemented during construction and include requirements related to small business engagement. The Community Communication Strategy would define the location specific measures to be implemented to minimise impacts on individual businesses during construction, taking into account the commercial character of the locality, its general trading profile (daily and annually), and information gained from the business profiling.

10.14 Biodiversity

The approach and methodology for the biodiversity assessment are provided in Chapter 4 (Methodology) of this Environmental Impact Statement. The legislative context for the assessment is provided in Appendix B (Legislative and policy context).

10.14.1 Baseline environment

Site context

The area immediately surrounding the proposed location of North Strathfield metro station is highly urbanised, with a history of clearing and development over the past 200 years. This includes the previous use of the area for agriculture, with subsequent redevelopment for residential and commercial land uses. The area is relatively flat, with a landform generally draining towards Parramatta River.

The nearest area of native vegetation is the Mason Park Wetland approximately 440 metres to the north-west.

Vegetation characteristics

Vegetation in the area surrounding the proposed location of North Strathfield metro station is limited to landscape and ornamental plantings only. No remnant native vegetation is present. Vegetation within these areas are native and exotic landscape plantings in isolated garden beds, or street trees.

Vegetation within the North Strathfield metro station construction sites will be removed by the work carried out under the previous Sydney Metro West planning application, with the exception of additional footprint at the north-west side of the station and three planted landscaping trees on the platform of the existing station (refer to Figure 10-24).

The additional footprint for this proposal north-west side of the existing station is comprised of planted street trees and naturally propagated native and exotic species. Canopy species in this location include Lemon scented gum (*Corymbia citriodora),* Grey gum (*Eucalyptus punctata),* Sweet pittosporum *(Pittosporum undulatum)*, Camphor laurel (*Cinnamomum camphora*), Chinese hackberry (*Celtis sinensis*), Brush box (*Lophostemon confertus*), Swamp Oak (*Casuarina glauca)*, Silver wattle (*Acacia dealbata*), Queensland silver wattle (*Acacia podalyriifolia)* and Hickory wattle (*Acacia falcata*). The understorey is dominated by planted shrubs, groundcovers and grasses, particularly Coastal or Native Rosemary (*Westringia fruticose*), Basket grass (*Lomandra longifolia*), Lily turf (*Liriope muscari*) and Native sarsaparilla (*Hardenbergia violacea*).

Vegetation on the existing station platform is comprised of two Evergreen Ash (*Fraxinus excelsior*) and one Orange Jessamine (*Murraya paniculata*), all of which have been planted as part of the existing station landscaping and none of which are native vegetation.

The vegetation present in this location is not considered to comprise any coherent plant community type, being landscape plantings.

Figure 10-24 Vegetation – North Strathfield metro station

Threatened ecological communities

There are no threatened ecological communities present within the additional footprint for this proposal at the North Strathfield metro station construction sites.

Groundwater dependent ecosystems

There are no groundwater dependent ecosystems present within the North Strathfield metro station construction sites, including the additional footprint for this proposal.

As identified in Section 10.10.1, a groundwater dependent ecosystem (Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion) is located around 650 metres to the north-east of the North Strathfield metro station construction sites.

Threatened flora species

There are no threatened flora species present within the North Strathfield metro station construction sites, including the additional footprint for this proposal.

Threatened fauna species

The North Strathfield metro station construction sites will be cleared by the work carried out under the previous Sydney Metro West planning application. As such, the commencement of work associated with this proposal no roosting habitat would be present for microbats.

All additional footprint areas associated with this proposal were assessed for threatened fauna habitat, including microbat habitat within structures proposed to be removed. No habitat or any individuals were identified during the inspection undertaken for this assessment. As such, no potential impacts to microbats are anticipated and impacts have not been assessed further.

Migratory species

There is no habitat associated with migratory species present within the North Strathfield metro station construction sites, including the additional footprint for this proposal.

Aquatic ecology

There is no aquatic habitat present within the North Strathfield metro station construction sites, including the additional footprint for this proposal.

10.14.2 Operational impact assessment

Direct impacts

Direct impacts related to the operation of North Strathfield metro station would be limited to the disruption of fauna due to noise, light and human activity. As the majority of activity would be underground at this location, impacts would only include those associated with surface activities such as people moving in and out of the station, additional street-level lighting and the increased movement of private vehicles, buses and taxis. In the context of the urban locality including substantial residential and retail development, as well as movements associated with the existing station, these impacts would be minor.

Indirect impacts

Indirect impacts associated with the operation of North Strathfield metro station would be limited to the management of stormwater runoff and its impacts to local waterways. This may include changes in the quantity and quality of stormwater runoff leaving North Strathfield metro station, resulting in subsequent impacts to nearby aquatic systems such as Powells Creek (located about 400 metres to the west). Biodiversity impacts associated with such changes include temporary or permanent inundation of wetland habitat, changes in water chemistry affecting sensitive breeding habitat (e.g. pH changes affecting amphibian breeding and foraging habitat) and changes in turbidity affecting the overall health and productivity of aquatic plants and animals.

This proposal is located within an area that is already highly urbanised and the existing stormwater systems are likely to already be contributing to the impacts described above. Despite this, this proposal would seek to manage operational stormwater effectively and manage the quantity and quality of water leaving North Strathfield metro station (refer to Chapter 18 (Proposal-wide) of this Environmental Impact Statement).

Potential impacts to groundwater dependent ecosystems are discussed in Section 10.10.

10.14.3 Construction impact assessment

Direct impacts

As outlined in Section 10.14.1, the additional footprint areas that would be impacted by this proposal do not represent a coherent plant community type. No threatened flora is present within this location and the habitat value of this area for threatened fauna is considered to be very low.

Construction of North Strathfield metro station would also result in disruption to fauna due to noise, light and human activity. In the context of the highly urbanised local context, including a mixed commercial and residential area, the impact of this direct disturbance is not anticipated to be significant.

Indirect impacts

Potential changes to the quantity and quality of stormwater runoff leaving the North Strathfield metro station construction sites, sediment-laden runoff and spills could result in indirect adverse impacts to nearby aquatic systems such as the Parramatta River. Biodiversity impacts associated with this would include temporary or permanent inundation of wetland habitat, changes in water chemistry affecting breeding habitat (e.g. pH changes affecting amphibian breeding and foraging habitat) and changes in turbidity affecting the overall health and productivity of aquatic plants and animals.

The mobilisation of sediment and contaminants from the North Strathfield metro station construction sites would be managed through the implementation of mitigation measures outlined in Appendix F (Construction Environmental Management Framework). Potential water quality and quantity impacts would be managed through the measures included in Chapter 18 (Proposal-wide) of this Environmental Impact Statement. As such the potential for indirect downstream biodiversity impacts is expected to be low.

Potential impacts to groundwater dependent ecosystems are discussed in Section 10.10.3.

10.14.4 Management and mitigation measures

Environmental management for this proposal would be undertaken through the environmental management approach as detailed in Chapter 20 (Synthesis) of this Environmental Impact Statement. This includes operational mitigation measures (where relevant) and performance outcomes for the operation and construction of this proposal.

During construction of this proposal, biodiversity would be managed in accordance with Sydney Metro's CEMF (Appendix F). The CEMF includes biodiversity management objectives and mitigation measures to minimise impacts as relevant to this proposal as a whole.