Transport for NSW

Narwee Station Upgrade

Review of Environmental Factors

April 2016

Narwee Station Upgrade Review of Environmental Factors

Transport Access Program
Ref – 4966434

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Abbreviations

Term	Meaning
AHIMS	Aboriginal Heritage Information Management System
ASA	Asset Standards Authority (refer to Definitions)
ASS	Acid Sulfate Soils
CCTV	Closed Circuit TV
CEMP	Construction Environmental Management Plan
CLM Act	*Contaminated Land Management Act 1997* (NSW)
CNVMP	Construction Noise and Vibration Management Plan
CPTED	Crime Prevention Through Environmental Design
DBH	Diameter Breast Height
DBYD	Dial Before You Dig
DDA	*Disability Discrimination Act 1992* (Cwlth)
DSAPT	*Disability Standards for Accessible Public Transport (2002)*
ECM	Environmental Controls Map
EMS	Environmental Management System
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EPL	Environment Protection Licence
ESD	Ecologically Sustainable Development (refer to Definitions)
FM Act	*Fisheries Management Act 1994* (NSW)
Heritage Act	*Heritage Act 1977* (NSW)
ICNG	*Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2000).
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007* (NSW)
LEP	Local Environmental Plan
LGA	Local Government Area

Term	Meaning
LoS	Level of Service
MCA	Multi Criteria Assessment
NES	National Environmental Significance
Noxious Weeds Act	*Noxious Weeds Act 1993* (NSW)
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
OEH	NSW Office of the Environment and Heritage
PA system	Public Address system
PDP	Public Domain Plan
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
RailCorp	(former) Rail Corporation of NSW
RBL	Rating Background Level
REF	Review of Environmental Factors (this document)
Roads Act	*Roads Act 1993* (NSW)
Roads and Maritime	NSW Roads and Maritime Services (formerly Roads and Traffic Authority)
SEPP	State Environmental Planning Policy
SHR	State Heritage Register
SoHI	Statement of Heritage Impact
TCP	Traffic Control Plan
TfNSW	Transport for NSW
TGSI	Tactile Ground Surface Indicators (“tactiles”)
TMP	Traffic Management Plan
TPZ	Tree Protection Zone
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
UDP	Urban Design Plan
WARR Act	*Waste Avoidance and Resource Recovery Act 2001* (NSW)

Definitions

Term	Meaning
Average Recurrence Interval	The likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. For example, floods with a discharge as large as or larger than the 100-year ARI flood will occur on average once every 100-years.
Asset Standards Authority	The ASA is an independent body within TfNSW, responsible for engineering governance, assurance of design safety, and ensuring the integrity of transport and infrastructure assets. Design Authority functions formerly performed by RailCorp are now exercised by ASA.
Concept design	The concept design is the preliminary design presented in this REF, which would be refined by the Contractor (should the Proposal proceed) to a design suitable for construction (subject to TfNSW acceptance).
Design and Construct Contract	A method to deliver a project in which the design and construction services are contracted by a single entity known as the Contractor. The Contractor completes the project by refining the concept design presented in the REF and completing the detailed design so that it is suitable for construction (subject to TfNSW acceptance). The Contractor is therefore responsible for all work on the project, both design and construction.
Detailed design	Detailed design broadly refers to the process that the Contractor undertakes (should the Proposal proceed) to refine the concept design to a design suitable for construction (subject to TfNSW acceptance).
Disability Standards for Accessible Public Transport	The Commonwealth *Disability Standards for Accessible Public Transport 2002* ("Transport Standards") (as amended) are a set of legally enforceable standards, authorised under the Commonwealth *Disability Discrimination Act 1992* (DDA) for the purpose of removing discrimination 'as far as possible' against people with disabilities. The Transport Standards cover premises, infrastructure and conveyances, and apply to public transport operators and premises providers.
Ecologically Sustainable Development	As defined by clause 7(4) Schedule 2 of the EP&A Regulation. Development that uses, conserves and enhances the resources of the community so that ecological processes on which life depends are maintained, and the total quality of life, now and in the future, can be increased.
Feasible	A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.
Interchange	Transport interchange refers to the area/s where passengers transit between vehicles or between transport modes. It includes the pedestrian pathways and cycle facilities in and around an interchange.
Noise sensitive receiver	In addition to residential dwellings, noise sensitive receivers include, but are not limited to, hotels, entertainment venues, pre-schools and day care facilities, educational institutions (e.g. schools, TAFE colleges), health care facilities (e.g. nursing homes, hospitals), recording studios and places of worship/religious facilities (e.g. churches).

Term	Meaning
NSW Trains	From 1 July 2013, NSW Trains became the new rail provider of services for regional rail customers.
Opal card	The integrated ticketing smartcard being introduced by TfNSW.
Out of hours works	Defined as works *outside* standard construction hours (i.e. outside of 7am to 6pm Monday to Friday, 8am to 1pm Saturday and no work on Sundays/public holidays).
Pedestrian underpass	The existing pedestrian underpass provides access to Narwee Station from Hannans Road to the north and Hurst Place to the south.
Platform Building	The existing 1931 Platform Building is located on the western end of the platform and currently contains a male and female toilet, a women's waiting room and a communications room.
Proponent	A person or body proposing to carry out an activity under Part 5 of the EP&A Act - in this instance, TfNSW.
Rail possession	Possession is the term used by railway building/maintenance contractors to indicate that they have taken possession of the track (usually a block of track) for a specified period, so that no trains operate for a specified time. This is necessary to ensure the safety of workers and rail users.
Reasonable	Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.
Sensitive receivers	Land uses which are sensitive to potential noise, air and visual impacts, such as residential dwellings, schools and hospitals.
Sydney Trains	From 1 July 2013, Sydney Trains replaced CityRail as the provider of metropolitan train services for Sydney.
Tactiles	Tactile tiles or Tactile Ground Surface Indicators (TGSIs) are textured ground surface indicators to assist pedestrians who are blind or visually impaired. They are found on many footpaths, stairs and train station platforms.
The Proposal	The construction and operation of the Narwee Station Upgrade.
Ticket Office	The existing Ticket Office is located on the eastern end of the platform and contains a booking office and staff amenities. It was constructed in 1984 and is would be demolished as part of the Proposal.
Vegetation Offset Guide	The TfNSW guide that applies where there is vegetation clearing proposed, and where the impact of the proposed clearing is not deemed 'significant' for the purposes of section 111 of the EP&A Act. The Guide provides for planting of a minimum of eight trees for each large tree with a diameter at breast height (DBH) of more than 60 cm, four trees where the DBH is 15-60 cm, or two trees where DBH is less than 15 cm.

Executive summary

Overview

Transport for NSW (TfNSW) is the government agency responsible for the delivery of major transport infrastructure projects in NSW and is the proponent for the Narwee Station Upgrade (the Proposal).

The Proposal is part of the Transport Access Program which is a NSW Government initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure.

This Review of Environmental Factors (REF) has been prepared to assess the environmental impacts associated with the construction and operation of the Proposal under the provisions of Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Description of the Proposal

The Proposal would provide safe and equitable access to the station platform and the surrounding pedestrian network; and would also improve customer facilities and amenity. The improvements would in turn assist in supporting the growth in public transport use and would provide an improved customer experience for existing and future users of the station.

The key features of the Proposal are summarised as follows:

- extension of the island platform at the eastern end to provide new stairs, a lift and waiting area
- installation of new canopies for weather protection above the new lift, stairs and waiting area providing cover up to the existing Platform Building
- refurbishment of the Platform Building with a new family accessible toilet, a Customer Information Window and staff facilities to replace existing facilities in the Ticket Office (to be demolished)
- improvements to bicycle facilities including new shelters and additional bicycle racks
- provision of a new kiss and ride area, new kerb ramps and bus zone works (including new shelter) on Hannans Road
- upgrade of the two existing accessible parking spaces in the commuter car park off Hannans Road to ensure compliance with relevant standards
- provision of an accessible parking space, upgrade of the taxi rank and kiss and ride area, and installation of Tactile Ground Surface Indicators (TGSI's) at the raised pedestrian crossing on Hurst Place and Fisher Place
- ancillary works including localised platform regrading (as necessary), improvements to lighting and seating, improvement of station communication systems (including CCTV cameras), wayfinding signage, services diversion and/or relocation, station power supply upgrade, minor road/drainage works, fencing and landscaping.

Subject to approval, construction is expected to commence in 2016 and take around 18 months to complete. A detailed description of the Proposal is provided in Chapter 3 of this REF.

Need for the Proposal

Improving transport customer experience is the focus of the NSW Government transport initiatives. Transport interchanges, train stations and commuter car parks are important gateways to the transport system and as such play a critical role in shaping the customer experience and perception of public transport.

The upgrades are designed to drive a stronger customer experience outcome, to deliver improved travel to and between modes, encourage greater public transport use and better integrate interchanges with the role and function of town centres. The Proposal would also assist in responding to forecasted growth in the region and as such would support growth in commercial and residential development.

The Proposal fulfils the Transport Access Program objectives by proposing to provide:

- a station that is accessible to those with a disability, the ageing, parents/carers with prams and customers with luggage
- improved customer experience (weather protection, better interchange facilities and visual appearance)
- minimises pedestrian conflict and crowding points
- improved integration with surrounding precinct
- improved customer safety
- improved wayfinding in and around the station
- minimise impacts to heritage features
- improved customer amenity.

The Proposal is also consistent with planning strategies in NSW, including *NSW 2021 – Making NSW Number One* (Department of Premier and Cabinet, 2011) and the *NSW Long Term Transport Master Plan* (TfNSW, 2012a).

The Proposal would also ensure that Narwee Station would meet legislative requirements under the *Disability Standards for Accessible Public Transport 2002* (DSAPT).

Design options considered

Options for improving the access to, and amenity of, Narwee Station were developed following a succession of workshops with TfNSW, relevant stakeholders (including Sydney Trains) and the project design team.

Three concept design options were developed to address accessibility and customer experience needs and other design principles. There were improvements which were common to all options (including a new family accessible toilet, upgraded footpaths and access to station and interchange facilities, new platform canopies, new bicycle racks and platform regrading), with the key differences focused on alternate arrangements for an accessible path of travel to the platform. These options are summarised below:

- Option 1 would provide a new pedestrian bridge west of the existing pedestrian underpass to provide an accessible access to the platform. Upon completion of the pedestrian bridge, the stairs from the pedestrian underpass would be removed and the pedestrian underpass would remain as a link access across the railway. The Ticket Office would be demolished to allow the pedestrian bridge installation. All station facilities would be relocated into the Platform Building which would be refurbished.

  The pedestrian bridge would require relocation of the station entrances around 33 metres west of the current locations which would make Fisher Place the new

southern entrance point (rather than Hurst Place). The associated interchange facilities would also be relocated to Fisher Place.

- Option 2 would provide a new staircase and adjoining lift utilising the existing pedestrian underpass for access to the platform. The staircase and lift would be located to the west of the pedestrian underpass (adjacent to each other) similar to the existing configuration. The existing staircase would be filled and the Ticket Office demolished to create additional circulation space on the platform. All station facilities would be relocated into the Platform Building which would be refurbished. Interchange facilities to the south of the station would be retained in Hurst Place.
- Option 3 is similar to Option 2 and would provide a new staircase and adjoining lift utilising the existing pedestrian underpass for access to the platform. The staircase and lift would however be located on either side of the pedestrian underpass (stairs to the west and lift to the east). The platform would be extended to the east to accommodate the new lift location, creating an accessible path of travel to the station facilities. The existing staircase would be filled and the Ticket Office demolished to create additional circulation space on the platform. All station facilities would be relocated into the Platform Building which would be refurbished. Interchange facilities to the south of the station would be retained in Hurst Place.

Options 2 and 3 were selected as the preferred options over Option 1 as access would be provided via the existing pedestrian underpass allowing for the existing pedestrian desire lines to be retained, reduced visual impacts and improved security from a Crime Prevention Through Environmental Design (CPTED) perspective (e.g. maintaining the passive surveillance of the pedestrian underpass).

Option 3 was then selected over Option 2 as it would provide more circulation space on the platform and the lift would be less visually intrusive than Option 2.

Statutory considerations

The EP&A Act provides for the environmental impact assessment of development in NSW. Part 5 of the EP&A Act generally specifies the environmental impact assessment requirements for activities undertaken by public authorities, such as TfNSW, which do not require development consent under the EP&A Act.

The *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP) is the primary environmental planning instrument relevant to the proposed development and is the key environmental planning instrument which determines that this Proposal is permissible without consent and therefore is to be assessed under Part 5 of the EP&A Act.

Clause 79 of the Infrastructure SEPP allows for the development of 'rail infrastructure facilities' by or on behalf of a public authority without consent on any land. Clause 78 defines 'rail infrastructure facilities' as including elements such as 'railway stations, station platforms and areas in a station complex that customers use to get access to the platforms', 'public amenities for customers' and 'associated public transport facilities for railway stations'.

As TfNSW is a public authority and the proposed activity falls within the definition of rail infrastructure facilities under the Infrastructure SEPP, the Proposal is permissible without consent. Consequently the environmental impacts of the Proposal have been assessed by TfNSW under Part 5 of the EP&A Act.

This REF has been prepared to assess the construction and operational environmental impacts of the Proposal. The REF has been prepared in accordance with clause 228 of the *Environment Planning and Assessment Regulation 2000* (the EP&A Regulation).

In accordance with section 111 of the EP&A Act, TfNSW (as the proponent and determining authority) must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

Chapter 6 of this REF presents the environmental impact assessment for Narwee Station Upgrade, in accordance with these requirements.

Community and stakeholder consultation

Under the Infrastructure SEPP, consultation is required with local councils or public authorities in certain circumstances, including where council-managed infrastructure is affected. Consultation has been undertaken with Canterbury City Council and Hurstville City Council during the development of design options and the preferred option. Consultation with these stakeholders would continue through the detailed design and construction of the Proposal.

TfNSW is also proposing to undertake the following consultation for the Proposal:

- direct notification to community stakeholders
- public display of the REF.

Community consultation activities for the Proposal would be undertaken during the public display period of this REF. The REF would be displayed for a period of approximately three weeks. Further information about these specific activities is included in Section 5.4 of this REF.

During this period, the REF would also be available for viewing at Canterbury and Hurstville council offices, local libraries and the TfNSW Community Information Centre at 388 George Street, Sydney. The REF would also be available to download from the TfNSW website[1] and a Project Infoline (1800 684 490) would be available for members of the public to make enquiries.

TfNSW would review and assess all feedback received during the public display period, prior to determining whether or not to proceed with the Proposal.

Should the Proposal proceed to construction, the community would be kept informed throughout the duration of the construction period. Figure 1 presents an overview of the consultation and planning process and the current status of the Proposal.

[1] http://www.transport.nsw.gov.au/projects-tap

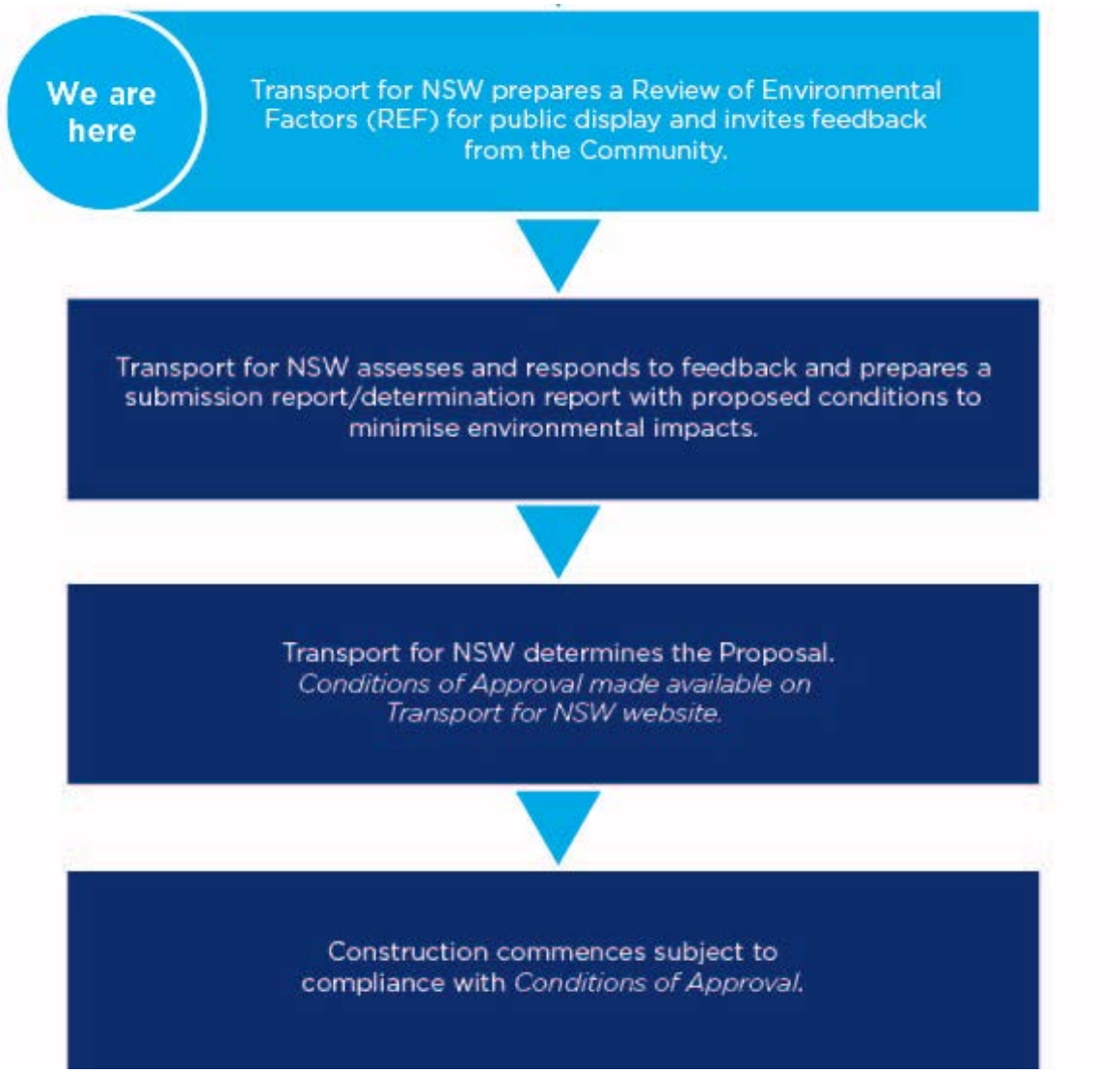


Figure 1 Planning approval and consultation process for the Proposal

Environmental impact assessment

This REF identifies the potential environmental benefits and impacts of the Proposal and outlines the mitigation measures to reduce the identified impacts.

The following key impacts have been identified should the Proposal proceed:

- temporary changes to vehicle and pedestrian movements to, from and around the station during construction
- temporary noise and vibration impacts during construction
- removal of two (2) untimed parking spaces on Hannans Road and one untimed parking space within the Hannans Road commuter car park to allow for new accessible parking and new kiss and ride area on the northern side of Hannans Road
- impacts to station heritage fabric through the loss of the existing stairs and partial demolition of the pedestrian underpass walls to integrate the new stairs and lift

- net loss of three toilets as a result of the Platform Building reconfiguration
- removal of trees and vegetation that would require planting offsets
- introduction of new elements such as the new lift and extended canopy into the visual environment.

Further information regarding these impacts is provided in Chapter 6 of the REF.

Conclusion

This REF has been prepared having regard to sections 111 and 112 of the EP&A Act, and clause 228 of the EP&A Regulation, to ensure that TfNSW takes into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the Proposal.

The detailed design of the Proposal would also be designed in accordance with the *NSW Sustainable Design Guidelines – Version 3.0* (TfNSW, 2013a) taking into account the principles of ecologically sustainable development (ESD).

Should the Proposal proceed, potential associated adverse impacts would be appropriately managed in accordance with the mitigation measures outlined in this REF and the Conditions of Approval imposed in the Determination Report. This would ensure the Proposal is delivered to maximise benefit to the community and minimise adverse impacts on the environment.

In considering the overall potential impacts and proposed mitigation measures outlined in this REF, the Proposal is unlikely to significantly affect the environment including critical habitat or threatened species, populations, ecological communities or their habitats.

1 Introduction

Transport for NSW (TfNSW) was established in 2011 as the lead agency for integrated delivery of public transport services across all modes of transport in NSW. TfNSW is the proponent for the Narwee Station Upgrade (the Proposal), to be delivered by the Infrastructure and Services Division.

1.1 Overview of the Proposal

1.1.1 The need for the Proposal

The NSW Government is committed to facilitating and encouraging use of public transport, such as trains, by upgrading stations to make them more accessible, and improving interchanges around stations with other modes of transport such as bicycles, buses and cars.

The Narwee Station and interchange area does not currently meet key requirements of the *Disability Standards for Accessible Public Transport 2002* (DSAPT) or the Commonwealth *Disability Discrimination Act 1992* (DDA).

Stairs currently provide the only means of access to the station platform from a pedestrian underpass and it is not accessible for people with reduced mobility, parents/carers with prams or customers with luggage.

Existing wayfinding signage to bus stops, taxi ranks and kiss and ride facilities surrounding the station is generally insufficient. In addition, there are safety issues associated with existing street crossings, lack of access from street kerbs in some locations and the absence of Tactile Ground Surface Indicators (TGSIs) at bus stops.

The Proposal would provide safe and equitable access to the station platform and the surrounding pedestrian network; and to also improve customer facilities and amenity. The improvements would in turn assist in supporting the growth in public transport use and would provide an improved customer experience for existing and future users of the station.

The expected increase in patronage has been taken into consideration during the design development. The 2014 barrier counts indicated a daily patronage of 4,040 trips which is expected to increase by around four per cent during this time to 4,200 by 2036. The Proposal has been designed to cater for a daily patronage of 4,830 (which is the 2036 daily patronage plus an increase of 15 per cent).

1.1.2 Key features of the Proposal

The key features of the Proposal are summarised as follows:

- extension of the island platform at the eastern end to provide new stairs, a lift and waiting area
- installation of new canopies for weather protection above the new lift, stairs and waiting area providing cover up to the existing Platform Building
- refurbishment of the Platform Building with a new family accessible toilet, a Customer Information Window and staff facilities to replace existing facilities in the Ticket Office (to be demolished)
- improvements to bicycle facilities including new shelters and additional bicycle racks
- provision of a new kiss and ride area, new kerb ramps and bus zone works (including new shelter) on Hannans Road

- upgrade of the two existing accessible parking spaces in the commuter car park off Hannans Road to ensure compliance with relevant standards
- provision of an accessible parking space, upgrade of the taxi rank and kiss and ride area, and installation of Tactile Ground Surface Indicators (TGSI's) at the raised pedestrian crossing on Hurst Place and Fisher Place
- ancillary works including localised platform regrading (as necessary), improvements to lighting and seating, improvement of station communication systems (including CCTV cameras), wayfinding signage, services diversion and/or relocation, station power supply upgrade, minor road/drainage works, fencing and landscaping.

Subject to approval, construction is expected to commence in 2016 and take around 18 months to complete. An alternative construction option is also being considered which may use an extended station closure for around six weeks to allow for an accelerated construction completion, which would reduce the overall program by up to six months. If the temporary station shutdown construction option is adopted, replacement shuttle buses would be provided between Narwee and its adjacent stations (Beverly Hills and Riverwood) at suitable intervals for the duration of the shutdown.

A detailed description of the Proposal is provided in Chapter 3 of this Review of Environmental Factors (REF).

1.2 Location of the Proposal

The Proposal would involve upgrade works to Narwee Station and surrounding streets, footpaths and the Hannans Road commuter car park.

The suburb of Narwee is located in the Canterbury City Local Government Area (LGA) and the Hurstville City LGA around 16 kilometres south-west of the Sydney Central Business District (CBD) in the suburb of Narwee. The suburb is predominantly residential, bisected by the railway in the south and the M5 Motorway to the north. The area surrounding the station is zoned as 'local centre' and consists of shops, small businesses and cafes/restaurants. The location of the Proposal in the regional context is shown on Figure 2.

Narwee Station is serviced by the T2 Airport, Inner West and South Line and is the 124th busiest station on the Sydney Trains network, with approximately 4,040[2] trips on an average weekday in 2014[3].

Narwee Station and the commuter car park off Hannans Road are located on land owned by RailCorp, and operated and maintained by Sydney Trains. The adjacent road/footpath network to the north and south of the station is owned by City of Canterbury Council (from here on referred to as Canterbury City Council). Canterbury City Council is also responsible for bus shelters, pedestrian crossings and landscaped garden beds within the area. The council boundary is located along the centreline of Broad Arrow Road to the south of the station. Hurstville City Council is responsible for the road/footpath, bus shelters, pedestrian crossings and landscaped garden beds within this area.

[2] One trip is equal to one journey through the station barriers (either in or out)
[3] NSW Bureau of Transport Statistics station barrier counts 2014

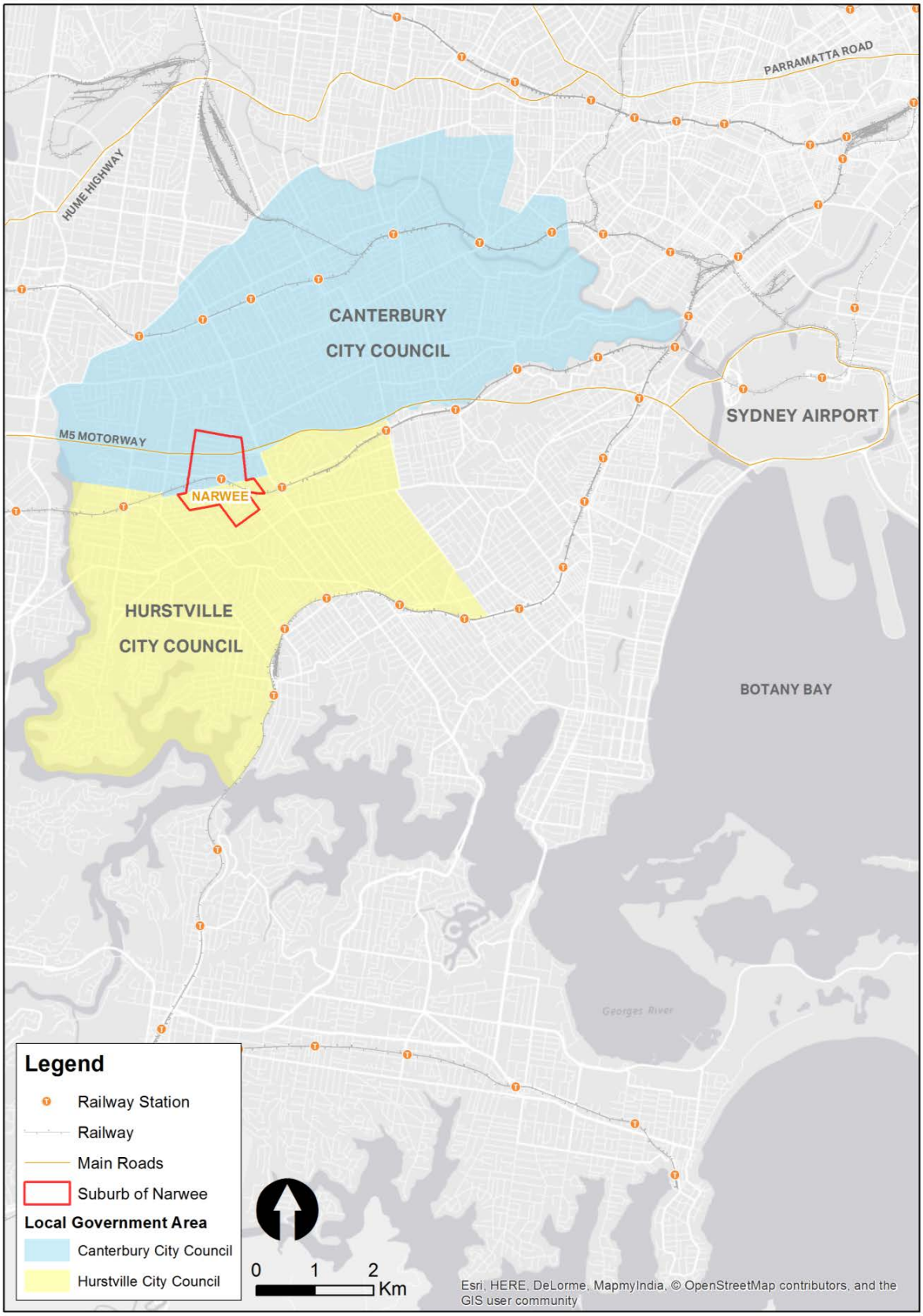


Figure 2 Regional context

1.3 Existing infrastructure and land uses

Narwee Station is a suburban customer station, with a catchment consisting of a mix of low, medium and high density residential housing zones and local centres which predominantly

serve the local communities. Figure 3 shows the key features in the area surrounding the station.

Small commercial shopping strips are located to the south of the station along Broad Arrow Road, Hurst Place and Fisher Place. Commercial development to the north is limited to the Narwee Hotel and a small arcade of shops at the southern end of Penshurst Road.

The station consists of two platforms on a single island with two tracks providing access to the platform, and two tracks which allow express trains to bypass Narwee Station. Platform 1 provides services to the City via Sydney Airport and Platform 2 provides services to Revesby and Macarthur. Both directions have around four services an hour during peak periods. Stairs provide the only means of access to the station platform from the pedestrian underpass.

The station consists of two main buildings on the platform level – a Platform Building and a Ticket Office. The Platform Building, located towards the western end of the platform, was constructed in 1931, and currently contains men's and ladies' toilets, store room, women's waiting room and communications room. The Ticket Office located on the eastern end was constructed in 1984 and contains the booking office and staff amenities.

The station is accessible from a pedestrian underpass beneath the railway, providing a link from Hannans Road on the northern side to Hurst Place to the south.

The pedestrian underpass is also used to provide an access path underneath the railway between the commercial/retail areas to the north and south of the station. There is an alternative pedestrian access beneath the railway along Broad Arrow Road, around 90 metres to the east of the station.

Existing transport interchange arrangements available at Narwee Station include:

- six unsheltered bicycle racks (with capacity for 12 bicycles) located near the Hannans Road station entrance, on the northern side of the station. There are currently no bicycle storage facilities present along the southern side of the station
- bus services operated by Punchbowl Bus Company along routes 940, 941, 944, with bus stops located on Hannans Road and on Broad Arrow Road. Night bus services along the N20 route also service Narwee Station providing late night departures
- a taxi zone (with a sheltered seat) on Hurst Place with capacity for one taxi around 50 metres to the south of the station entrance
- kiss and ride on Hurst Place with capacity for three vehicles during peak periods only
- a commuter car park adjacent to Hannans Road with a capacity for 72 untimed parking spaces, including two non-compliant accessible spaces. Additional untimed street parking is located Hannans Road and time restricted parking within the commercial area to the south of the station.

Educational and religious facilities in the vicinity of the Proposal include:

- Narwee Public School directly adjacent to the rail corridor to the south-west
- Beverly Hills Montessori Christian Preschool around 170 metres south
- Goodstart Early Learning Child Care Centre, Narwee around 180 metres south-west
- Salvation Army Narwee Corps (Church) around 230 metres to the north
- Narwee Preschool Kindergarten around 250 metres to the south-east.

King Georges Road is the nearest arterial road and is located around 750 metres to the east of the station with a local connection to the M5 Motorway.

Photographs of the existing station are provided in Figure 4 to Figure 7.

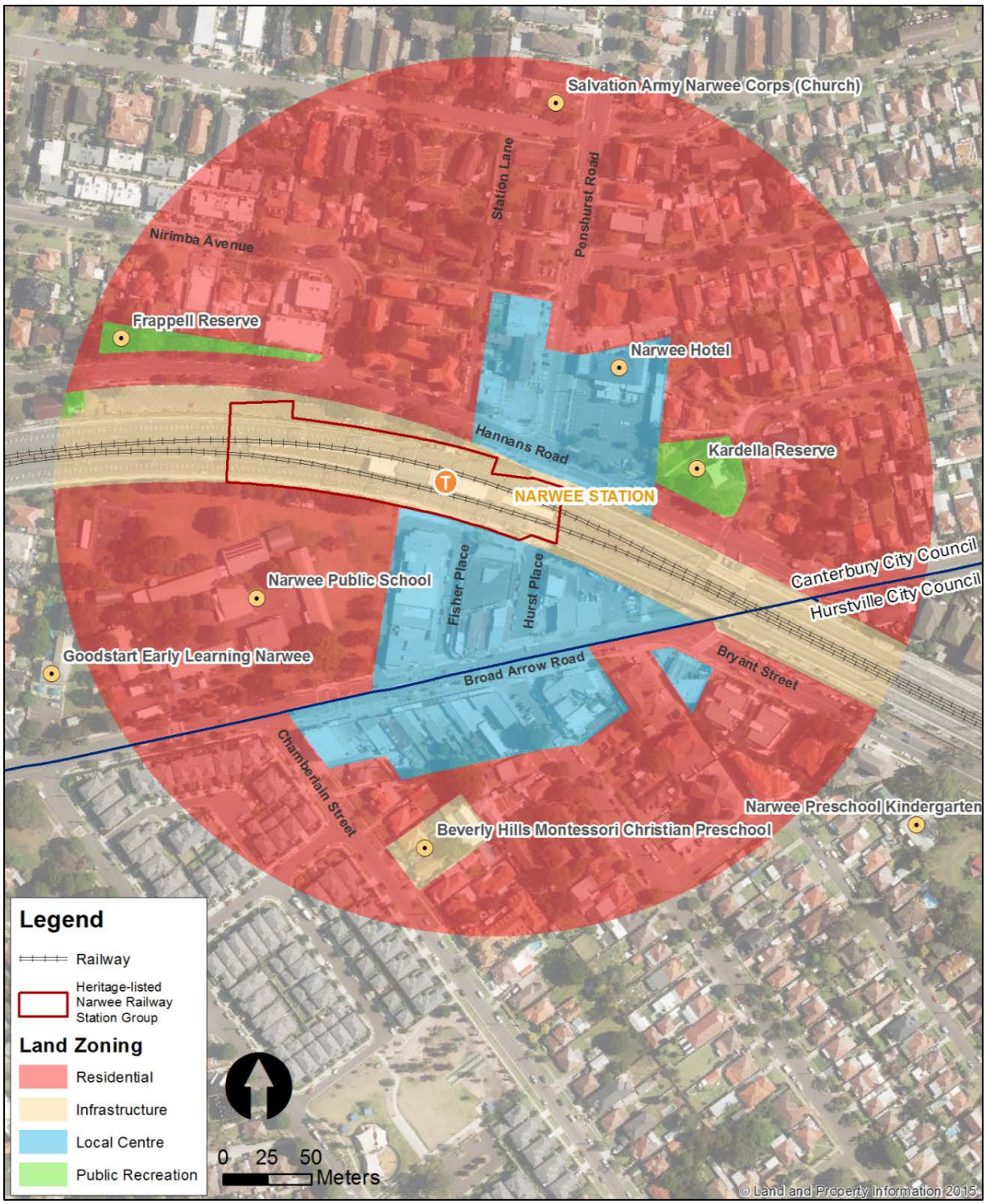


Figure 3 Site locality map

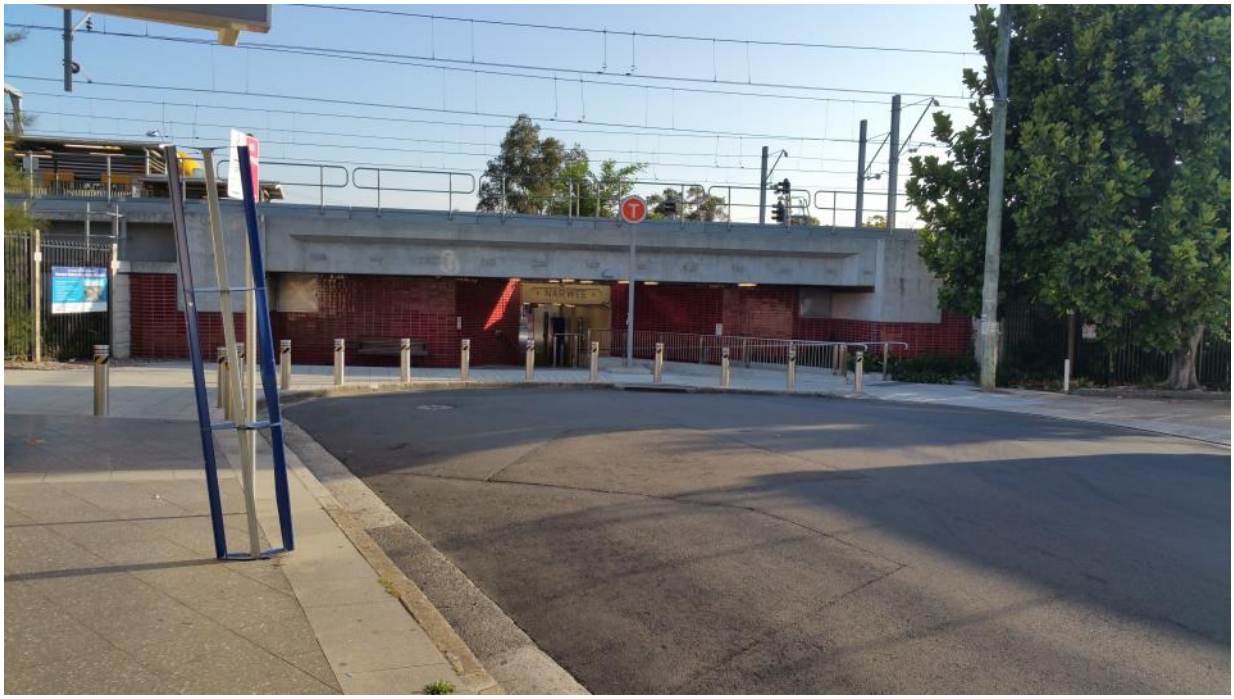


Figure 4 View towards Narwee Station from Hurst Place pedestrian underpass entrance

Figure 5 View towards Narwee Station from Hannans Road pedestrian underpass entrance

Figure 6 View towards the western Platform Building looking west

Figure 7 View towards top of existing stairs looking east

1.4 Purpose of this Review of Environmental Factors

This REF has been prepared by TfNSW to assess the potential impacts of the Narwee Station Upgrade. For the purposes of these works, TfNSW is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of this REF is to describe the Proposal, to assess the likely impacts of the Proposal having regard to the provisions of section 111 of the EP&A Act, and to identify mitigation measures to reduce the likely impacts of the Proposal. This REF has been prepared in accordance with clause 228 of the *Environment Planning and Assessment Regulation 2000* (the EP&A Regulation).

This assessment has also considered the relevant provisions of other relevant environmental legislation, including the *Threatened Species Conservation Act 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) and the *Roads Act 1993* (Roads Act).

Having regard to the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), this REF considers the potential for the Proposal to have a significant impact on matters of National Environmental Significance (NES) or Commonwealth land, and the need to make a referral to the Commonwealth Department of Environment for any necessary approvals under the EPBC Act. Refer to Chapter 4 for more information on statutory considerations.

2 Need for the Proposal

Chapter 2 discusses the need and objectives of the Proposal, having regard to the objectives of the Transport Access Program and the specific objectives of the Proposal. This chapter also provides a summary of the options that have been considered during development of the Proposal and why the preferred option has been chosen.

2.1 Strategic justification

2.1.1 Overview

Improving transport customer experience is the focus of the NSW Government's transport initiatives. Transport interchanges and train stations are the important gateways to the transport system and as such play a critical role in shaping the customer's experience and perception of public transport.

The Narwee Station Upgrade, the subject of this REF, forms part of the Transport Access Program. This program is designed to drive a stronger customer experience outcome to deliver seamless travel to and between modes, encourage greater public transport use and better integrate station interchanges with the role and function of town centres within the metropolitan area and developing urban centres in regional areas of NSW.

The Proposal is consistent with the NSW Government's commitment to deliver an efficient and effective transport system around Sydney and NSW as detailed in *NSW 2021 – A Plan to Make NSW Number One* (Department of Premier and Cabinet, 2011).

NSW 2021 is the NSW Government's ten year plan to guide budget and decision making in NSW. *NSW 2021* includes the following goals, targets and priority actions relevant to the Proposal:

- reduce travel times
- minimise public transport waiting times for customers
- improve co-ordination and integration between transport modes
- grow patronage on public transport
- improve public transport reliability
- improve customer experience with transport services.

The NSW Government has developed a *Long Term Transport Master Plan* (TfNSW, 2012a). This plan provides a comprehensive strategy for all modes of transport across NSW over the next 20 years, while also delivering on current commitments.

Data forecasts indicate that there would be significant growth in population and employment from 2006 up to 2036 in the area within the station catchment. The Proposal accommodates the forecast Sydney Trains patronage growth (to 2036, plus an additional 15 per cent) and changing travel patterns.

The *Disability Action Plan 2012-2017* (TfNSW, 2012b) was developed by TfNSW, in consultation with the Accessible Transport Advisory Committee, which is made up of representatives from peak disability and ageing organisations within NSW. The Plan discusses the challenges, the achievements to date, the considerable undertaking that is required to finish the job and provide a solid and practical foundation for future progress over the next five years. The Proposal has been developed in consideration of the objectives outlined in this Plan.

Public transport is viewed as critical to urban productivity, expanding employment opportunities by connecting people to jobs, reducing congestion, and supporting delivery of urban renewal. Further details of the application of NSW Government policies and strategies are discussed in Section 4.5 of this REF.

2.1.2 Objectives of the Transport Access Program

The Transport Access Program is a NSW Government initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure where it is needed most. The program aims to provide:

- stations that are accessible to those with disabilities, the ageing, parents/carers with prams and customers with luggage
- modern buildings and facilities for all modes that meet the needs of a growing population
- modern interchanges that support an integrated network and allow seamless transfers between all modes for all customers
- safety improvements including extra lighting, lift alarm, fences and security measures for car parks and interchanges, including stations, bus stops and wharves
- signage improvements so customers can more easily use public transport and transfer between modes at interchanges
- other improvements and maintenance such as painting, new fencing and roof replacements.

2.1.3 Objectives of the Proposal

The specific objectives of the Narwee Station Upgrade are to:

- provide a station that is accessible to those with a disability, the ageing, parents/carers with prams and customers with luggage
- improve customer experience and convenience (weather protection, better interchange facilities and visual appearance)
- minimise pedestrian conflict and crowding points
- improve integration with surrounding precinct
- improve customer safety
- improve wayfinding in and around the station
- minimise impacts to heritage features
- improve customer amenity.

2.2 Design development

Jacobs was engaged by TfNSW to develop the concept design for the Narwee Station Upgrade that would improve accessibility in and around the station, and meet key architectural, engineering and urban design objectives. The design development also accommodated the forecast Sydney Trains patronage growth (which is the estimated 2036 daily customer patronage plus an increase of 15 per cent).

The development of the concept design involved several key tasks, including an assessment of existing interchange performance and identification of key deficiencies and opportunities for improving accessibility and customer experience. The assessment identified the following deficiencies with the existing station:

- lack of an accessible path of travel to the station platform from the underpass
- restricted space between existing top of stairs, Ticket Office and ticket vending machine resulting in limited circulation space on the platform
- non-DDA compliant male and female toilets
- non-DDA compliant platform levels and cross falls
- insufficient bicycle facilities and wayfinding signage
- no formalised kiss and ride area to the north of the station
- the two accessible parking spaces within the Hannans Road commuter car park which are non-DDA compliant.

The assessment also identified opportunities for

- improved bus stop facilities
- provision of a shelter above the existing bicycle parking
- upgrades to lighting around Hurst Place and Fisher Place and installation of CCTV to improve safety.

2.3 Alternative options considered

Options for improving access to Narwee Station were developed following a succession of workshops with TfNSW, relevant stakeholders (including Sydney Trains) and the project design team.

Three concept design options were developed to address accessibility and customer experience needs and other design principles. A number of design elements were common to all options (including a new family accessible toilet, upgraded footpaths and access to station and interchange facilities, new platform canopies, new bicycle rack and platform regrading), with the key differences focused on alternate arrangements for an accessible path of travel to the platform. These are summarised below:

- Option 1 would provide a new pedestrian bridge west of the existing pedestrian underpass to provide an accessible access to the platform. Upon completion of the pedestrian bridge, the stairs from the pedestrian underpass would be removed and the pedestrian underpass would remain as a link access across the railway. The Ticket Office would be demolished to allow the pedestrian bridge installation. All station facilities would be relocated into the Platform Building which would be refurbished. The pedestrian bridge would require relocation of the station entrances around 33 metres west of the current locations which would make Fisher Place the new southern entrance point (rather than Hurst Place). The associated interchange facilities would also be relocated to Fisher Place.
- Option 2 would provide a new staircase and adjoining lift utilising the existing pedestrian underpass for access to the platform. The staircase and lift would be located to the west of the pedestrian underpass (adjacent to each other) similar to the existing configuration. The existing staircase and Ticket Office would be demolished to create additional circulation space on the platform. All station facilities would be relocated into the Platform Building which would be refurbished. Interchange facilities to the south of the station would be retained in Hurst Place.
- Option 3 is similar to Option 2 and would provide a new staircase and adjoining lift utilising the existing pedestrian underpass for access to the platform. The staircase and lift would however be located on either side of the pedestrian underpass (stairs to the west and lift to the east). The platform would be extended to the east to accommodate the new lift location, creating an accessible path of travel to the station

facilities. The existing staircase and Ticket Office would be demolished to create additional circulation space on the platform. All station facilities would be relocated into the Platform Building which would be refurbished. Interchange facilities to the south of the station would be retained in Hurst Place.

2.3.1 The 'do-nothing' option

Under a 'do-nothing' option, the existing non-compliant access to the platform would remain the same and there would be no changes to the way the station currently operates.

The NSW Government has identified the need for improving the accessibility of transport interchanges, train stations and commuter car parks across NSW as a priority under the Transport Access Program.

The 'do nothing' option was not considered a feasible alternative as it is inconsistent with NSW Government objectives and would not help encourage the use of public transport and would not meet the needs of the Narwee community.

2.3.2 Assessment of identified options

The design options were assessed using a Multi-Criteria Assessment (MCA) that included consideration of factors such as customer experience, accessibility, engineering constraints, modal integration and cost, to select a preferred option. The weighting of factors was determined during a MCA workshop with TfNSW, relevant stakeholders (including Sydney Trains) and the project design team.

2.4 Justification for the preferred option

The MCA assessment concluded that Options 2 and 3 were the preferred options over Option 1 as access would be provided via the existing pedestrian underpass, allowing for the existing pedestrian desire lines to be retained, reduced visual impacts and improved security from a Crime Prevention Through Environmental Design (CPTED) perspective (e.g. maintaining the passive surveillance of the pedestrian underpass)

Option 1 was considered to have a greater visual and heritage impact on the surrounding area due to the construction of a new pedestrian bridge. The pedestrian bridge would require relocation of the station entrances which would make Fisher Place the new southern entrance point (rather than Hurst Place) with the associated interchange facilities also relocated to Fisher Place. This option also reduces passive surveillance in the pedestrian underpass as it would be used less frequently than current levels.

Option 2 was similar to Option 3, however, it was not preferred from a customer experience perspective as it would provide limited circulation on the platform due to the location of the lift.

Of the two remaining options, Option 3 was selected over Option 2 for the following reasons:

- access would be provided via the existing pedestrian underpass allowing for the existing pedestrian desire lines to be retained
- the kiss and ride area and taxi rank would not need to be relocated to Fisher Place as proposed for Option 1, reducing the impact on the local traffic network
- it allowed for better circulation/manoeuvring space and reduced congestion points at lift landings than for Option 2
- the lift would be less visually intrusive than the lift location in Option 2 because it would be situated further from the Platform Building which is of heritage significance. A description of the Proposal (Option 3) is presented in Chapter 3.

3 Description of the Proposal

Chapter 3 describes the Proposal and summarises key design parameters, construction method, and associated infrastructure and activities. The description of the Proposal is based on the concept design and is subject to detailed design.

3.1 The Proposal

As described in Section 1.1, the Proposal involves an easy access upgrade of Narwee Station as part of the Transport Access Program which would improve accessibility and amenities for customers.

The Proposal would provide a number of improved features to provide an accessible station and improved interchange facilities. The Proposal would include the following key elements:

- extension of the island platform at the eastern end to provide new stairs, a lift and waiting area
- installation of new canopies for weather protection above the new lift, stairs and waiting area providing cover up to the existing Platform Building
- refurbishment of the Platform Building with a new family accessible toilet, a Customer Information Window and staff facilities to replace existing facilities in the Ticket Office (to be demolished)
- improvements to bicycle facilities including new shelters and additional bicycle racks
- provision of a new kiss and ride area, new kerb ramps and bus zone works (including new shelter) on Hannans Road
- upgrade of the two existing accessible parking spaces in the commuter car park off Hannans Road to ensure compliance with relevant standards
- provision of an accessible parking space, upgrade of the taxi rank and kiss and ride area, and installation of Tactile Ground Surface Indicators (TGSI's) at the raised pedestrian crossing on Hurst Place and Fisher Place
- ancillary works including localised platform regrading (as necessary), improvements to lighting and seating, improvement of station communication systems (including CCTV cameras), wayfinding signage, services diversion and/or relocation, station power supply upgrade, minor road/drainage works, fencing and landscaping.

The general layout of the Proposal and associated key elements are shown in Figure 8. An artist's impression of the Proposal is provided in Figure 9. Figure 10 shows the existing and proposed layout of the Platform Building which would be refurbished as part of the Proposal.

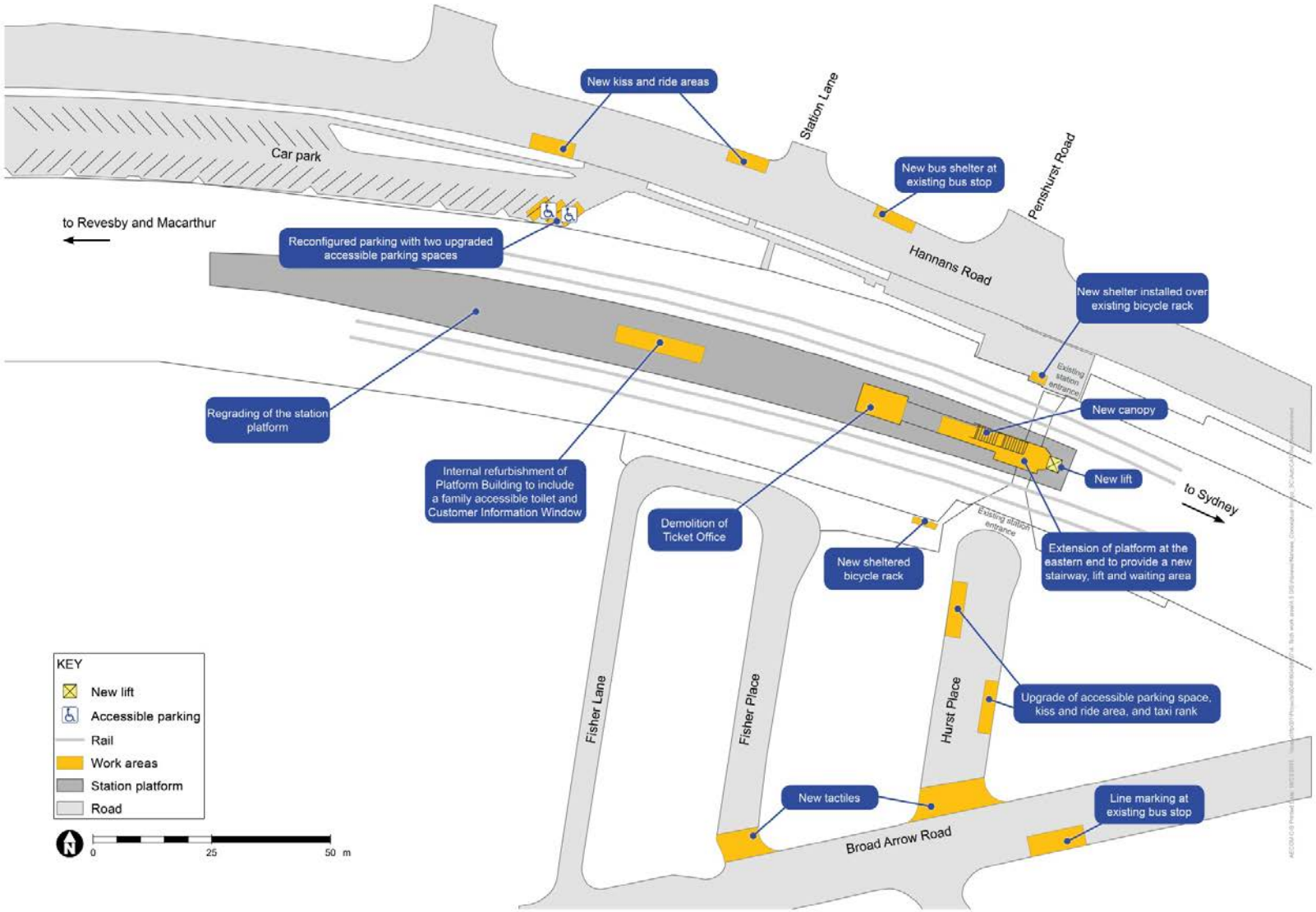
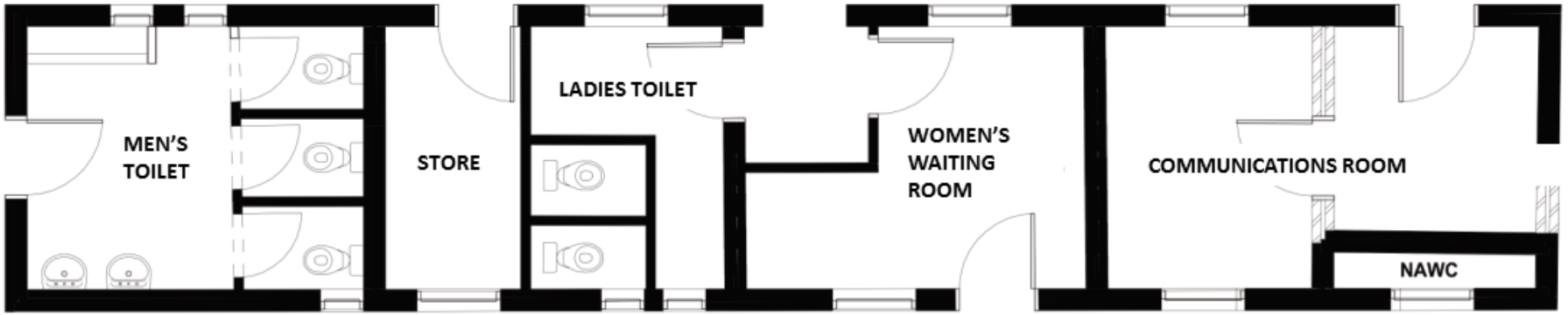


Figure 8 Key elements of the Proposal

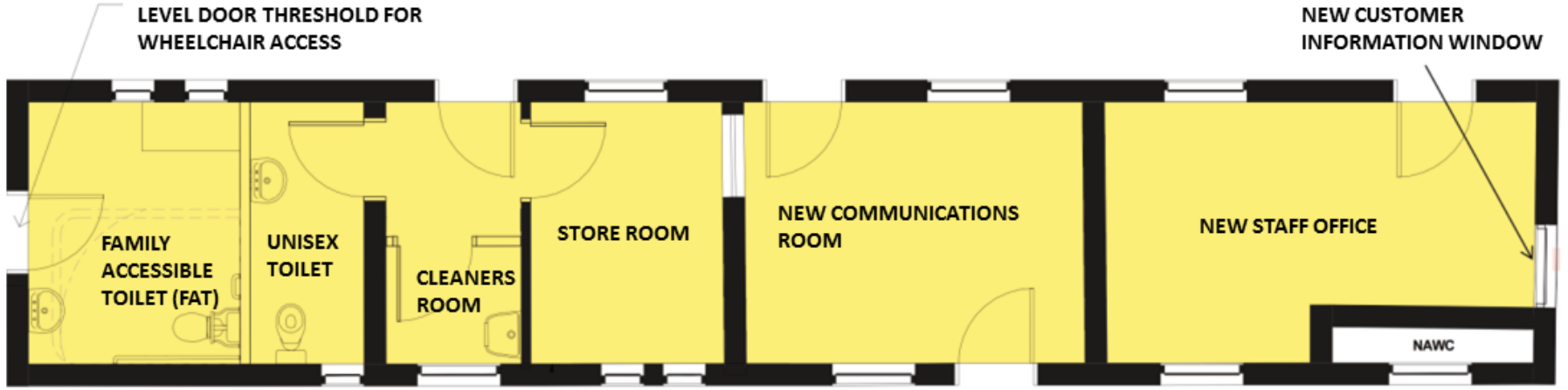
Indicative only, subject to detailed design

Figure 9 Artist's impression of the Proposal – view from Hannans Road looking south towards the station entrance

Indicative only, subject to detailed design – prepared by Jacobs



Existing Platform Building layout



Proposed Platform Building layout

Figure 10 Existing and proposed Platform Building layout

3.1.1 Scope of works

Details of the proposed works to take place at the station to improve accessibility and customer experience include:

Station upgrade

- demolition of existing Ticket Office to allow for construction of new facilities and improved circulation space
- extension of the island platform at the eastern end to provide a new stairway, lift and waiting area allowing for an accessible path of travel to the station
- partial demolition of the pedestrian underpass walls to integrate the new stairs and lift layout
- installation of new canopies for weather protection above the lift landing, stairs and waiting area up to the existing Platform Building (canopies would be designed to integrate with the existing heritage building)
- refurbishment of the heritage Platform Building including installation of a Customer Information Window and modifications to the room layout (including demolition of some internal partition walls) while minimising external modifications to maintain the original character of the building
- localised regrading of the existing platforms to provide compliant gradient (i.e. transverse slope) of maximum 1 in 40 (where required)
- other platform modifications including resurfacing, new TGSIs and relocation/replacement of boarding ramps, seats, bins, pay phone and vending machines
- services relocation and/or adjustments, including lighting and communications systems (e.g. CCTV), stormwater drainage, retaining walls, and overhead wiring
- station power supply upgrade works, which may include an upgrade to the existing transformer or the installation of a padmount substation and earthing/bonding provisions (specific power requirements to be determined during detailed design)
- adjustment to station ticketing facilities, including Opal card readers and ticket vending machines
- new/upgraded wayfinding signage and provision of statutory/regulatory signage
- landscaping works
- adjustments to boundary fencing
- temporary site compounds for storage of materials and equipment
- temporary works (where required) during construction in order to maintain existing pedestrian ‘level of service’, such as access provisions and construction of temporary pedestrian access bridge.

Interchange facilities

- construction of a shelter for the existing bicycle parking (with capacity for 12 bicycles) near the northern station entrance and installation of a new undercover bicycle rack (with capacity for eight bicycles) near the southern station entrance

- upgrade of the accessible parking space, three kiss and ride spaces and dedicated taxi rank (with capacity for one taxi) on Hurst Place (with no net loss of parking spaces)
- provision of two new kiss and ride spaces on either side of Hannans Road (i.e. two untimed parking spaces on the northern side would be converted to kiss and ride during peak periods and an area of restricted parking would be converted to kiss and ride during peak periods on the southern side)
- upgrade of the two accessible parking spaces in the Hannans Road commuter car park (with a net loss of one untimed parking space)
- bus zone works including construction of a new shelter for the existing bus stop on Hannans Road and remarking the lines of the existing bus bay on the eastern side of Broad Arrow Road
- ancillary road works (including drainage modifications, road resurfacing and TGSIs (where necessary), kerb realignment and a new kerb ramp on Hannans Road
- new wayfinding signage and provision of other signage, including statutory/regulatory signage.

Materials and finishes

Materials and finishes for the Proposal have been selected based on the criteria of durability, low maintenance and cost effectiveness, to accord with heritage requirements, to minimise visual impacts, and to be aesthetically pleasing.

Availability and constructability are also important criteria to ensure that materials are readily available and the structure can be built with ease and efficiently. Materials are also selected for their application based on their suitability for meeting design requirements.

Each of the upgraded or new facilities would be constructed from a range of different materials, with a different palette for each architectural element. Subject to detailed design, the Proposal would include the following:

- lift shaft – precast concrete within a metal frame, with an external glass and cladding finish
- platform stairs – concrete
- platform canopy – metal frame and corrugated metal roof sheeting to complement the existing Platform Building roof and canopies.

The design would be submitted to TfNSW's Urban Design and Sustainability Review Panel at various stages for comment before being accepted by TfNSW. An Urban Design Plan (UDP) and a Public Domain Plan (PDP) would also be prepared by the Contractor and submitted as part of the first design submission for endorsement by TfNSW.

3.1.2 Engineering constraints

There are a number of constraints which have influenced the design development of the Proposal.

Existing structures: the placement and integrity of existing structures would be considered during the development of the design. These structures included the pedestrian underpass, station entrances, stairs, Platform Building and Ticket Office.

Sydney Trains' requirements: modifications for existing structures and new structures within the rail corridor must be designed and constructed with consideration of train impact loads, structural clearances to the track, and safe working provisions.

Utilities: A Dial Before You Dig (DBYD) search has identified a number of utilities in the vicinity of the proposed works including:

- high pressure ethane gas pipeline along the north side of the station
- high and low voltage cables along the north side of the station
- telecommunication cables (underground)
- water supply and wastewater infrastructure
- rail utilities, including signalling cabling and overhead wiring.

Other considerations:

- Narwee Station is listed on RailCorp's Section 170 Heritage and Conservation Register (No. 4801924) and on the heritage schedule of the *Canterbury Local Environmental Plan 2012* (Item No. I151). In particular the Platform Building and Pedestrian Subway (pedestrian underpass) are of high significance and the platform (including brick edgings) is of moderate significance (refer to Section 6.5 for details of the significance assessment).
- the pedestrian underpass is at a low point and has the potential to be subject to flooding, however, this is considered unlikely due to the very small catchment area that contributes directly to the pedestrian underpass (less than 50 m^2) and the substantial existing drainage system in place both outside and inside the pedestrian underpass
- there is a limited area available for a construction compound and use of a large crane would be required to lift construction materials and equipment to the station from Hurst Place
- maintaining pedestrian access to the station and across the railway during construction (except during a possible station shutdown).

3.1.3 Design standards

The Proposal would be designed having regard to the following:

- *Disability Standards for Accessible Public Transport 2002* (issued under the Commonwealth Disability Discrimination Act 1992)
- Building Code of Australia
- relevant Australian Standards
- Asset Standards Authority standards
- Sydney Trains standards
- *NSW Sustainable Design Guidelines – Version 3.*0 (TfNSW, 2013a)
- *Guidelines for the Development of Public Transport Interchange Facilities* (Ministry of Transport, 2008)
- Crime Prevention Through Environmental Design (CPTED) principles
- other TfNSW policies and guidelines
- relevant council codes and standards.

3.1.4 Sustainability in design

The development of the concept design for the Proposal has been undertaken in accordance with the project targets identified in TfNSW's Environmental Management System (EMS) and the *NSW Sustainable Design Guidelines - Version 3.0* (TfNSW, 2013a) which groups sustainability into seven themes:

- energy and greenhouse gases
- climate resilience
- materials and waste
- biodiversity and heritage
- water
- pollution control
- community benefit.

Within each theme, potential initiatives are prioritised into two categories of requirements:

- **Compulsory** – the initiative is required to be implemented when applicable to the project as they refer to a corporate target, or are fundamental to the delivery of sustainable assets)
- **Discretionary** – the initiative has benefits to be implemented, however may not be the most appropriate.

A shortlist of initiatives has been developed by TfNSW specifically for Transport Access Program projects, which includes the Narwee Station Upgrade. These initiatives have been reviewed and incorporated into the concept design (unless otherwise justified). A summary of the key initiatives under consideration is provided in Appendix C. The checklist and the initiatives contained within would be reviewed again at the detailed design and construction phases, and submitted for approval by TfNSW.

3.2 Construction activities

3.2.1 Work methodology

Subject to approval, construction is expected to commence in 2016 and take around 18 months to complete. The construction methodology would be further developed during the detailed design of the Proposal by the nominated Contractor in consultation with TfNSW.

The proposed construction activities for the Proposal are identified in Table 1. This staging is indicative and is based on the current concept design and may change once the detailed design methodology is finalised. The staging is also dependent on the Contractor's preferred methodology, program and sequencing of work.

A temporary pedestrian access bridge may be required to maintain access to the station during construction. The temporary pedestrian access bridge would likely span from Hannans Road and connect to Fisher Place (rather than Hurst Place on the southern side of the station). The base of the structure would be required to have a clearance from the overhead wiring of at least 1.5 metres.

The details of the temporary pedestrian access bridge, if required, would be subject to further consideration during detailed design and construction planning once the need for and location of the bridge has been confirmed.

Table 1 Indicative construction staging for key activities

Stage	Activities
Site establishment and enabling works	• establishment of site compound (erect fencing, tree protection zones, site offices, amenities and plant/material storage areas) • establishment of temporary facilities as required (e.g. temporary pedestrian access bridge to station, temporary toilets) • removal of identified vegetation • services relocation
New lift and platform upgrade	• demolition of existing structures including the Ticket Office • platform modifications, platform extension, lift shaft including piling and foundations for lift shaft • construction of lift shaft, stairs, fencing and new canopies • installation of lift • installation of fixtures, lighting, signage and CCTV cameras for the station areas • platform resurfacing to bring gradient to between 1:40 and 1:100, new platform surface drainage and hearing protection loop installation • reconfiguration of the Platform Building to allow for communications/equipment room, staff facilities and toilets including a family accessible toilet • refreshment of Platform Building including painting works
Interchange works	• modifications and making good the existing pedestrian underpass including re-surfacing, lighting and painting • provision of a taxi zone, kiss and ride, bus stops, bicycle racks and accessible car parking spaces in the car park • installation of wayfinding signage and other statutory/regulatory signage • electrical and power supply upgrade works • replanting/landscaping, fencing adjustments and bollards
Testing and commissioning	• various activities to test and commission power supply, lifts, lighting, new/modifications to station services, ticketing systems, communication and security systems

An alternative construction option is being considered which would use an extended (six week) temporary station closure to allow for an accelerated construction completion which would reduce the overall program by up to six months.

If the temporary station shutdown option is adopted, replacement shuttle buses would be provided between Narwee and its adjacent stations (Beverly Hills and Riverwood) at suitable intervals for the duration of the shutdown. The benefits of this alternative construction option include:

- reduced construction period (by up to six months) which would allow the upgraded station to be opened to the community sooner
- reduced temporary visual and amenity impacts due to a reduced construction period
- remove the need for a temporary pedestrian access bridge
- reduce the safety risk to the customers from the construction/pedestrian interface
- improve construction staging efficiency with potential cost benefits.

3.2.2 Plant and equipment

The plant and equipment likely to be used during construction includes:

- trucks
- generator
- bobcat
- hand tools
- mulcher
- concrete pump
- piling rig
- concrete truck
- hydreama/hirail
- wacker packer
- nail gun
- chainsaw
- excavator
- mini-excavator
- coring machine
- demolition saw
- jack hammer
- grinder
- manitou
- scissor lift
- franna crane
- lighting tower
- mobile crane

3.2.3 Working hours

The majority of works required for the Proposal would be undertaken during standard (NSW) Environment Protection Authority (EPA) construction hours, which are as follows:

- 7.00 am to 6.00 pm Monday to Friday
- 8.00 am to 1.00 pm Saturdays
- no work on Sundays or public holidays.

Certain works may need to occur outside standard hours in some cases to minimise disruptions to customers, pedestrians, motorists and nearby sensitive receivers; and to ensure the safety of railway workers and operational assets. These out of hours works would include night works, and works during routine rail possessions (scheduled closures that occur regardless of the Proposal when part of the rail network is temporarily closed and trains are not operating).

It is estimated that at least six rail possessions (likely to be weekends) would be required to facilitate the following:

- establishment of temporary facilities (e.g. temporary pedestrian access to station, temporary toilets and construction hoardings)
- services relocation
- demolition of the existing stairs and Ticket Office
- platform extension, installation of the lift shaft foundations and piling
- partial demolition of the pedestrian underpass walls to allow for the installation of the lift and new stairs
- platform modifications
- construction of lift shaft, stairs, fencing and new canopy
- platform resurfacing and raising/regrading.

Out of hours works may also be scheduled outside rail possession periods, such as to allow for road works for safety reasons. Approval from TfNSW would be required for any out of hours work and the affected community would be notified as outlined in TfNSW's *Construction Noise Strategy* (TfNSW, 2012c) (refer to Section 6.3 for further details).

3.2.4 Earthworks

The Proposal would require minor earthworks for the following:

- excavation of the lift shaft through the station platform and into soils/fill and rock
- excavation for footings and foundations for the extension of the platform to the east
- other minor civil works including footings and foundations of the structures, drainage/stormwater works and trenching activities for service adjustments and relocations.

Excavated material would be reused onsite where practicable or disposed of in accordance with relevant legislative requirements.

3.2.5 Source and quantity of materials

The source and quantity of materials would be determined during the detailed design phase of the Proposal, and would consider the requirements of the *NSW Sustainable Design Guidelines – Version 3.0* (TfNSW, 2013a). Materials would be sourced from local suppliers where practicable. Reuse of existing and recycled materials would be undertaken where practicable.

3.2.6 Traffic access and vehicle movements

Traffic and transport impacts associated with the Proposal are assessed in Section 6.1 of this REF. The potential traffic and access impacts expected during the construction of the Proposal include:

- minor disruptions to pedestrian/cyclist movements in and around the station and the Hannans Road commuter car park
- removal of two untimed parking spaces on Hannans Road and one untimed parking space within the Hannans Road commuter car park to allow for upgraded accessible parking and new kiss and ride
- construction vehicle movements, access and parking arrangements may interrupt traffic flow and parking availability on Hurst Place, Hannans Road and Broad Arrow Road
- potential disruptions to bus and taxi arrangements.

If the alternative construction option (which utilises a temporary station closure) is adopted, replacement shuttle buses would be provided between Narwee and its adjacent stations (Beverly Hills and Riverwood) at suitable intervals for the duration of the shutdown. In the short-term this would be an inconvenience to customers, however, this temporary arrangement would reduce the overall construction program allowing the benefits of the Proposal to be available sooner.

A detailed construction methodology and associated management plans (such as a Construction Environmental Management Plan (CEMP)) would be developed during the design phase of the Proposal to manage impacts.

3.2.7 Ancillary facilities

Temporary construction compounds are required to accommodate a site office, amenities, laydown and storage area for materials. The following locations are being considered for use as construction compounds:

- a grassed area adjacent to Hannans Road and the existing commuter car park

- up to 20 spaces of the existing commuter car park
- an area adjacent to the rail corridor between Fisher Place and Hurst Place.

Temporary storage/laydown areas may also be required on the station platform.

The areas nominated for the compounds are on land owned by RailCorp (managed by Sydney Trains) and Canterbury City Council. Impacts associated with utilising these areas have been considered in the environmental impact assessment, including requirements for restoration and rehabilitation. Figure 11 shows the proposed works areas, indicative construction compound locations and the potential location for the temporary pedestrian access bridge (if required).

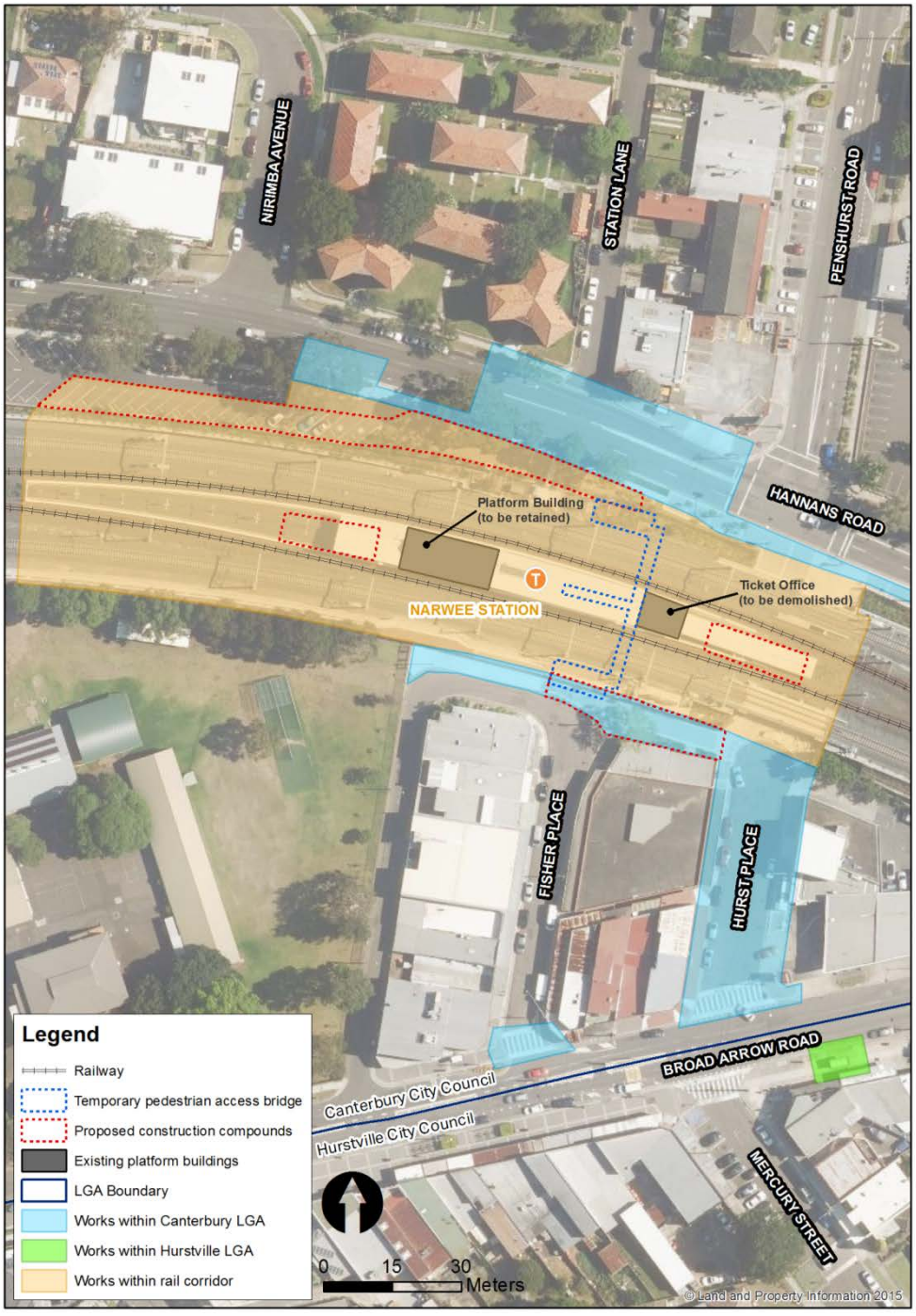


Figure 11 Proposed works areas

3.2.8 Public utility adjustments

The upgraded electrical supply required to accommodate the new infrastructure (e.g. the new lift) would also provide supply to the existing station lighting, communication rack equipment, general lighting, ticketing equipment, security and other general power requirements at the station.

Some drainage works would also be required to establish new drainage pipes on both sides of the station to connect to the existing stormwater pits (that are part of Canterbury City Council's stormwater system).

A range of other utilities are located on or adjacent to the Proposal site. Affected services would be relocated during site establishment. Services have been avoided where feasible. Services to the existing Ticket Office to be demolished would be cut off prior to demolition. Such relocation is unlikely to occur outside of the footprint of the works assessed in this REF. In the event that works would be required outside of this footprint, further assessment would be undertaken. The appropriate utility providers would be consulted during the detailed design phase.

3.3 Property acquisition

TfNSW does not propose to acquire any property as part of the Proposal.

3.4 Operation management and maintenance

The future operation and maintenance of the new station is subject to further discussions with Sydney Trains, TfNSW and Canterbury City Council. Structures constructed under this Proposal would be maintained by Sydney Trains. However it is expected that adjacent landscaped areas would continue to be maintained by Canterbury City Council.

4 Statutory considerations

Chapter 4 provides a summary of the statutory considerations relating to the Proposal including a consideration of NSW Government polices/strategies, NSW legislation (particularly the EP&A Act), environmental planning instruments, and Commonwealth legislation.

4.1 Commonwealth legislation

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

The (Commonwealth) EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places - defined in the EPBC Act as 'matters of National Environmental Significance (NES)'. The EPBC Act requires the assessment of whether the Proposal is likely to significantly impact on matters of NES or Commonwealth land. These matters are considered in full in Appendix A.

The Proposal would not impact on any matters of NES or on Commonwealth land. Therefore a referral to the Commonwealth Minister for the Environment is not required.

4.2 NSW legislation and regulations

4.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act establishes the system of environmental planning and assessment in NSW. This Proposal is subject to the environmental impact assessment and planning approval requirements of Part 5 of the EP&A Act. Part 5 of the EP&A Act specifies the environmental impact assessment requirements for activities undertaken by public authorities, such as TfNSW, which do not require development consent under Part 4 of the Act.

In accordance with section 111 of the EP&A Act, TfNSW, as the proponent and determining authority, must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the Proposal.

Clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) defines the factors which must be considered when determining if an activity assessed under Part 5 of the EP&A Act has a significant impact on the environment. Chapter 6 of the REF provides an environmental impact assessment of the Proposal in accordance with clause 228 and Appendix B specifically responds to the factors for consideration under clause 228.

4.2.2 Other NSW legislation and regulations

Table 2 provides a list of other relevant legislation applicable to the Proposal.

Table 2 Other legislation applicable to the Proposal

Applicable legislation	Considerations
Contaminated Land Management Act 1997 (CLM Act) (NSW)	Section 60 of the CLM Act imposes a duty on landowners to notify the Office of Environment and Heritage (OEH), and potentially investigate and remediate land if contamination is above EPA guideline levels. The site has not been declared under the CLM Act as being significantly contaminated (refer Section 6.8).
Crown Lands Act 1987 (NSW)	The Proposal does not involve works on Crown land.
Disability Discrimination Act 1992 (DDA Act) (Cwlth)	The Proposal would be designed having regard to the requirements of this Act.
Heritage Act 1977 (Heritage Act) (NSW)	• Sections 57 and 60 (approval) where items listed on the State Heritage Register are to be impacted • Sections 139 and 140 (permit) where relics are likely to be exposed • Section 170 where items listed on a government agency Heritage and Conservation Register are to be impacted. Narwee is listed on RailCorp's Section 170 Heritage and Conservation Register (No. 4801924) and as a heritage item on the *Canterbury Local Environmental Plan 2012* (Canterbury City Council 2012) (Item No. 151). A heritage assessment and archaeological review has been undertaken for the Proposal and is summarised in Section 6.5 and 6.4. The archaeological assessment concluded that there is a low risk of exposing historical archaeological relics during construction and that no archaeological approvals under the Heritage Act would be required. If unexpected archaeological items are discovered during the construction of the Proposal, all works would cease and appropriate advice sought. Formal notification is to be provided by the asset owner to the Heritage Council regarding the demolition of the Ticket Office at least 14 days prior to the demolition of the structure in accordance with section 170A(1)(c) of the Heritage Act.
National Parks and Wildlife Act 1974 (NPW Act) (NSW)	Sections 86, 87 and 90 of the NPW Act require consent from OEH for the destruction or damage of Indigenous objects. The Proposal is unlikely to disturb Indigenous objects (refer Section 6.4). However, if unexpected archaeological items or items of Indigenous heritage significance are discovered during the construction of the Proposal, all works would cease and appropriate advice sought.
Noxious Weeds Act 1993 (NSW)	One noxious weed was identified in the Proposal site (Lantana, *Ligustrum lucidum*). Appropriate management methods would be implemented during construction (refer Section 6.7).
Protection of the Environment Operations Act 1997 (PoEO Act) (NSW)	The Proposal does not involve a 'scheduled activity' under Schedule 1 of the PoEO Act. Accordingly, an Environment Protection Licence (EPL) is not required for the Proposal. However, in accordance with Part 5.7 of the PoEO Act, TfNSW would notify the EPA of pollution incidents that occur onsite. This would be managed in the CEMP to be prepared and implemented by the Contractor.

Applicable legislation	Considerations
Roads Act 1993 (Roads Act) (NSW)	Section 138 of the Roads Act requires consent from the relevant road authority for the carrying out of work in, on or over a public road. However, clause 5(1) in Schedule 2 of the Roads Act states that public authorities do not require consent for works on unclassified roads. The Proposal would involve works on Hannans Road, Fisher Place, Hurst Place and Broad Arrow Road which are local roads under the control of Canterbury and Hurstville City Councils. Consent under the Roads Act is not required, however Road Occupancy Licence/s would be obtained from council/s for road works and temporary road closures. Refer to Section 6.1 for more information.
Sydney Water Act 1994 (NSW)	The Proposal would not involve discharge of wastewater to the sewer.
Threatened Species Conservation Act 1995 (TSC Act) (NSW)	The site does not contain suitable habitat for listed threatened species or communities and is unlikely to have a significant impact on a threatened species or community (refer Section 6.7).
Waste Avoidance and Resource Recovery Act 2001 (WARR Act) (NSW)	TfNSW would carry out the Proposal having regard to the requirements of the WARR Act. A site-specific Waste Management Plan would be prepared.
Water Management Act 2000 (NSW)	The Proposal would not involve water use from a natural source (e.g. aquifer, river), water management works, drainage or flood works, controlled activities or aquifer interference.

4.3 State Environmental Planning Policies

4.3.1 State Environmental Planning Policy (Infrastructure) 2007

The Infrastructure SEPP is the key environmental planning instrument which determines the permissibility of the Proposal and which part of the EP&A Act an activity or development may be assessed.

Clause 79 of the Infrastructure SEPP allows for the development of 'rail infrastructure facilities' by or on behalf of a public authority without consent on any land (i.e. assessable under Part 5 of the EP&A Act). Clause 78 defines '*rail infrastructure facilities' as including elements such as 'railway stations, station platforms and areas in a station complex that commuters use to get access to the platforms', public amenities for commuters' and 'associated public transport facilities for railway stations'.*

Consequently, development consent is not required for the Proposal which is classified as a rail infrastructure facility, however the environmental impacts of the Proposal have been assessed under the provisions of Part 5 of the EP&A Act.

Part 2 of the Infrastructure SEPP contains provisions for public authorities to consult with local councils and other agencies prior to the commencement of certain types of development. Section 5.2 of this REF discusses the consultation undertaken under the requirements of the Infrastructure SEPP.

It is noted that the Infrastructure SEPP prevails over all other environmental planning instruments except where *State Environmental Planning Policy (Major Development) 2005*, *State Environmental Planning Policy No 14 – Coastal Wetlands* or *State Environmental*

Planning Policy No 26 – Littoral Rainforest applies. The Proposal does not require consideration under these SEPPs and therefore does not require further consideration of these SEPPs as part this REF.

4.3.2 State Environmental Planning Policy 55 – Remediation of Land

SEPP 55 provides a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. While consent for the Proposal is not required, the provisions of SEPP 55 have still been considered in the preparation of this REF.

Section 6.8 of this REF contains an assessment of the potential contamination impacts of the Proposal. It is unlikely that any large-scale remediation (Category 1) work would be required as part of the Proposal. The proposed land use does not differ to the existing use and is, therefore, unlikely to be affected by potential contaminants that might exist within the rail corridor.

4.4 Local environmental planning instrument and development controls

The Proposal is located within the Canterbury LGA. Minor works would also be required within the Hurstville LGA. The provisions of the Infrastructure SEPP mean that Local Environmental Plans (LEPs), prepared by councils for an LGA, do not apply. However, during the preparation of this REF, the provisions of the following LEPs were considered:

- *Canterbury Local Environmental Plan 2012*
- *Hurstville Local Environmental Plan 2012.*

4.4.1 Canterbury Local Environmental Plan 2012

The *Canterbury Local Environmental Plan 2012* (Canterbury LEP) is the governing plan for the Canterbury LGA, including Narwee. Table 3 summarises the relevant aspects of the Canterbury LEP applicable to the Proposal. Figure 12 shows the relevant section of the zoning map from the Canterbury LEP, with the indicative location of the Proposal.

Table 3 Relevant provisions of the Canterbury LEP

Provision description	Relevance to the Proposal
Clause 2.3 – Zone objectives and Land Use Table	Under the Canterbury LEP: • the rail corridor is zoned as SP2 Infrastructure – Railway • shops and businesses along Fisher Place, Hurst Place and the southern end of Penshurst Road are zoned B2 Local Centre • beyond the station, local streets are zoned R2 Low Density Resident, R3 Medium Density Residential and R4 High Density Residential. The Proposal is consistent with the objectives of the SP2 Infrastructure and B2 Local Centre zone.
Clause 5.9 – Preservation of trees or vegetation	Clause 5.9 of the Canterbury LEP is aimed at the preservation of trees and development consent is required for tree removal in most instances. However, by virtue of clause 5(3) and 79 of the Infrastructure SEPP, the clearing of vegetation for the Proposal is permissible without development consent and would be authorised under Part 5 of the EP&A Act. However consultation would be undertaken with Canterbury City Council, prior to tree removal. A discussion of potential impacts to vegetation is discussed in Section 6.7.
Clause 5.10 – Heritage conservation	The Canterbury LEP aims to conserve heritage significance of heritage items within the LGA. Narwee Station is listed as a heritage item on Schedule 5 of the LEP. A discussion of potential impacts to local heritage is outlined in Section 6.5.

4.4.2 Hurstville Local Environmental Plan 2012

The *Hurstville Local Environmental Plan 2012* (Hurstville LEP) is the governing plan for the Hurstville LGA, including Narwee. The minor bus re-lining works proposed within the Hurstville LGA are located on land zoned as B2 Local Centre. The Proposal is consistent with the objectives of this zone. Figure 12 shows the relevant section of the zoning map from the Hurstville LEP, with the indicative location of the Proposal.

Figure 12 Canterbury and Hurstville LEP zoning map

4.5 NSW Government policies and strategies

Table 4 provides an overview of other NSW Government policies and strategies relevant to the Proposal.

Table 4 NSW Government policies and strategies applicable to the Proposal

Policy/Strategy	Commitment	Comment
NSW 2021 – A Plan to Make NSW Number One (Department of Premier and Cabinet, 2011)	*NSW 2021 – A Plan to Make NSW Number One* is a ten-year plan developed in 2011 and outlines the high level strategic priorities and associated goals for government and its respective agencies. A key aspect in the transport strategy includes: • the return of quality transport and community services • building infrastructure that improves' people's lives and • strengthening our local environments. NSW 2021 includes the following goals, targets and priority actions relevant to the Proposal: • reduce travel times • minimise public transport waiting times for customers • improve coordination and integration between transport modes • grow patronage on public transport • improve public transport reliability • improve customer experience with transport services.	The Proposal is consistent with the NSW Government's commitment to: • grow patronage on public transport, and • improve customer experience with transport services. In particular the Proposal is consistent with Goal 7 – Reduce travel times, and Goal 20 – Build liveable centres. The Proposal contributes to Goal 14 – Increase opportunities for people with a disability, by improving transport access. The Proposal also supports active transport by contributing to the development of cycle facilities as part of an integrated local network.
Disability Action Plan 2012-2017 (TfNSW, 2012b)	The *Disability Action Plan 2012-2017* was developed by TfNSW in consultation with the Accessible Transport Advisory Committee, which is made up of up of representatives from peak disability and ageing organisations within NSW. The Disability Plan discusses the challenges, the achievements to date, the considerable undertaking that is required to finish the job, and provides a solid and practical foundation for future progress over the next five years.	The Proposal has been developed with consideration of the objectives outlined in this Plan and seeks to improve and provide equitable access to public transport facilities.
NSW Long Term Transport Master Plan (TfNSW, 2012a)	The *NSW Long Term Transport Master Plan* identifies a planned and co-ordinated set of actions to address transport challenges and will guide the NSW Government's transport funding priorities over the next 20 years. The Master Plan would meet a number of challenges to building an integrated transport system for Sydney and NSW, including: • customer-focused integrated transport planning • integrated modes to meet customer needs • getting Sydney Moving Again • sustaining Growth in Greater Sydney. The Master Plan links to NSW 2021, the Metropolitan Strategy for Sydney, the State Infrastructure Strategy, regional and sub-regional strategies, and national plans.	The Proposal implements the following key themes in the Master Plan: • improving customers' journey experience • making better use of existing assets • providing accessible transport to help address social exclusion.

Policy/Strategy	Commitment	Comment
Sydney's Walking Future - Connecting people and places (TfNSW, 2013b)	*Sydney's Walking Future* outlines the NSW government's efforts to: • promote walking for transport • connect people to places through safe walking networks around activity centres and public transport interchanges.	The Proposal would facilitate walking by removing physical barriers to accessible public transport.
Sydney's Cycling Future - Cycling for everyday transport (TfNSW, 2013c)	*Sydney's Cycling Future* outlines the NSW government's commitment to a safe and connected network of bicycle paths as an important part of Sydney's integrated transport system. The government wants to make bike riding a convenient and enjoyable option by improving access to towns and centres, and investing in bicycle facilities at transport hubs.	The Proposal supports the government's Bike and Ride Initiative that better integrates bicycle riding with other modes of transport, making it convenient to ride to transport hubs, park bicycles securely and transfer to public transport as part of longer transport journeys. The Proposal includes: • new shelter for the existing rack for 12 bicycles on Hannans Road • new sheltered bicycled parking for eight bicycles on Hurst Place. In total there would be capacity for 20 bicycles around the station once the Proposal is operational.
Rebuilding NSW – State Infrastructure Strategy 2014 (NSW Government, 2014)	*Rebuilding NSW* is a plan to deliver $20 billion in new productive infrastructure to sustain productivity growth in our major centres and regional communities. Rebuilding NSW will support overall population growth in Sydney and NSW. Public transport is viewed as critical to urban productivity, expanding employment opportunities by connecting people to jobs, reducing congestion, and supporting delivery of urban renewal.	The Proposal supports investment in rail infrastructure, and aligns with the reservation of $8.9 billion for urban public transport to support Sydney's population, that is expected to reach almost six million by 2031.
A Plan for Growing Sydney (Department of Planning and Environment, 2014)	*A Plan For Growing Sydney* superseded the draft *Metropolitan Strategy for Sydney 2036*. The Plan provides information on the strategies to accommodate an additional 664,000 homes and 689,000 jobs by 2031, which in part will be helped by a more integrated transport network. The Proposal is located in the South District. The Department of Planning and Environment is currently preparing new district plans to translate the objectives of the *Plan for Growing Sydney* into the newly defined districts.	The Proposal is consistent with the objectives of this Plan and would deliver improved and accessible footpath connections from the station to the surrounding area. The Proposal also takes into account potential future growth in the area.

Policy/Strategy	Commitment	Comment
Community Strategic Plan 2014 – 2023 (City of Canterbury Council, 2014)	The Canterbury City Council *Community Strategic Plan 2014 – 2023* is a plan for a sustainable Canterbury, balancing the environmental, social and economic needs of people here now with the needs of future generations. The Plan outlines the future outcomes of the city, that being, a pedestrian- and bike-friendly city with enough buses and trains that run on time.	The Proposal is consistent with the future outcomes of this Plan by addressing the need for a pedestrian and bike friendly city, enough buses and trains, and bus shelters or seats near public transport.

4.6 Ecologically sustainable development

TfNSW is committed to ensuring that its projects are implemented in a manner that is consistent with the principles of ecologically sustainable development (ESD). The principles of ESD are generally defined under the provisions of clause 7(4) of Schedule 2 to the EP&A Regulation as:

- the precautionary principle – If there are threats of serious or irreversible damage, a lack of full scientific uncertainty should not be used as a reason for postponing measures to prevent environmental degradation
- intergenerational equity – the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations
- conservation of biological diversity and ecological integrity – the diversity of genes, species, populations and their communities, as well as the ecosystems and habitats they belong to, should be maintained or improved to ensure their survival
- improved valuation, pricing and incentive mechanisms – environmental factors should be included in the valuation of assets and services.

The principles of ESD have been adopted by TfNSW throughout the development and assessment of the Narwee Station Upgrade. Section 3.1.4 summarises how ESD would be incorporated in the design development of the Proposal. Section 6.12.1 includes an assessment of the Proposal on climate change and sustainability, and Section 7.2 lists mitigation measures to ensure ESD principles are incorporated during the construction phase of the Proposal.

5 Community and stakeholder consultation

Chapter 5 discusses the consultation undertaken to date for the Proposal and the consultation proposed for the future. This chapter discusses the consultation strategy adopted for the Proposal and the results of consultation with the community, relevant government agencies and stakeholders.

5.1 Stakeholder consultation during concept design

As part of the development of the concept design options, TfNSW held a number of workshops with stakeholders including local councils and Sydney Trains.

A meeting was held with Hurstville and Canterbury City Councils on 10 November 2014, and subsequent separate meetings with each council on 16 November 2015 (Hurstville City Council) and 19 November 2015 (Canterbury City Council). The following matters were raised for consideration during the development of the preferred option:

- the lack of lift access at the station was a major community concern and was a priority for both councils
- impact to pedestrians while the pedestrian underpass area may be temporarily unavailable
- access across the railway during construction could be provided via an alternative pedestrian access point along Broad Arrow Road, however, Hurstville City Council had concerns with the safety of this access due to the narrow pathway
- both councils have a contract for advertising on bus shelters, which would need to be managed during temporary construction
- Canterbury City Council has recently undertaken some paving works along the footpaths in Hurst Place
- Hurstville City Council plans to re-surface Broad Arrow Road at some time in the future.

The preferred option incorporates many of these considerations including access improvements to and within the station. The Proposal would improve the amenity of the local area and complement other proposed upgrades within the locality.

5.2 Consultation requirements under the Infrastructure SEPP

Part 2, Division 1 of the Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Clauses 13, 14, 15 and 16 of the Infrastructure SEPP require that public authorities undertake consultation with councils and other agencies, when proposing to carry out development without consent.

Table 5 provides details of consultation requirements under the Infrastructure SEPP for the Proposal.

Table 5 Infrastructure SEPP consultation requirements

Clause	Clause particulars	Relevance to the Proposal
Clause 13 | Consultation with councils – development with impacts on council related infrastructure and services	Consultation is required where the Proposal would result in: • substantial impact on stormwater management services • generating traffic that would place a local road system under strain • involve connection to or impact on a council owned sewerage system • involve connection to and substantial use of council owned water supply • significantly disrupt pedestrian or vehicle movement • involve significant excavation to a road surface or footpath for which council has responsibility.	The Proposal includes works that would: • require connections to or impacts the stormwater system • disrupt pedestrian and vehicle movements • impact on road pavements under Council's care and control • impact on council-operated footpaths. Consultation with Canterbury and Hurstville City Councils would be undertaken concurrently with the REF display and would continue throughout the detailed design and construction phases.
Clause 14 | Consultation with councils – development with impacts on local heritage	Where railway station works: • substantially impact on local heritage item (if not also a State heritage item) • substantially impact on a heritage conservation area.	Narwee Station is listed as a local heritage site on the Canterbury LEP. Consultation with Canterbury City Council is required with regard to clause 14 of the Infrastructure SEPP. Refer to Section 6.5 for further information on potential heritage impacts.
Clause 15 | Consultation with councils – development with impacts on flood liable land	Where railway station works: • impact on land that is susceptible to flooding – reference would be made to *Floodplain Development Manual: the management of flood liable land.*	The Proposal is not located on land that is susceptible to flooding. Accordingly, consultation with both councils is not required in regard to this aspect. Refer to Section 6.9.
Clause 16 | Consultation with public authorities other than councils	For *specified development* which includes consultation with the OEH for development that is undertaken adjacent to land reserved under the *National Parks and Wildlife Act 1974*, and other agencies specified by the Infrastructure SEPP where relevant. Although not a specific Infrastructure SEPP requirement, other agencies TfNSW may consult with could include: • Roads and Maritime • Sydney Trains • OEH.	The Proposal is not located adjacent to land reserved under the *National Parks and Wildlife Act 1974*. Accordingly, consultation with the OEH on this matter is not required. The roads surrounding the development are owned and managed by the Canterbury and Hurstville City Councils and accordingly consultation with Roads and Maritime has not been undertaken. Relevant permits and/or approvals would be obtained from the relevant roads authority prior to / during construction as required.

5.3 Consultation strategy

A consultation strategy for the Proposal has been developed to encourage stakeholder and community involvement and foster interaction between stakeholders, the community and the project team. The consultation strategy that was developed, having regard to the requirements of the planning process ensures that stakeholders, customers and the community are informed of the Proposal and have the opportunity to provide input.

The objectives of the consultation strategy are to:

- provide accurate and timely information about the Proposal and REF process to relevant stakeholders
- raise awareness of the various components of the Proposal and the specialist environmental investigations
- ensure that the directly impacted community are aware of the REF and consulted where appropriate
- provide opportunities for stakeholders and the community to express their view about the Proposal
- understand and access valuable local knowledge from the community and stakeholders
- record the details and input from community engagement activities
- build positive relations with identified community stakeholders
- ensure a comprehensive and transparent approach.

5.4 Public display

The REF display strategy adopts a range of consultation mechanisms, including:

- public display of the REF at various locations
- distribution of a project update at the station, and to local community and rail customers, outlining the Proposal and inviting feedback on the REF
- advertisement of the REF public display in local newspapers with a link to the TfNSW website that includes a summary of the Proposal and information on how to provide feedback
- consultation with Canterbury and Hurstville Councils, Sydney Trains, NSW Trains and other non-community stakeholders.

Community consultation activities for the Proposal would be undertaken during the public display of this REF. The display period of the REF would be advertised in the week that the public display commences. The REF would be displayed for a period of around three weeks.

The REF would be placed on public display at the following locations:

- Riverwood Branch Library, Belmore Road, Riverwood
- Penshurst Branch Library, 630 Forest Road, Penshurst
- City of Canterbury Council Office, 137 Beamish St, Campsie
- Hurstville City Council Office, 24 MacMahon Street, Hurstville
- Transport for NSW Information Centre, Ground Floor, 388 George Street, Sydney (enter on King Street).

The REF would also be available on the TfNSW website[4]. Information on the Proposal would be available through the Project Infoline (1800 684 490) or by email[5].

During this time feedback is invited. Following consideration of feedback received during the public display period, TfNSW would determine whether to proceed with the Proposal and what conditions would be imposed on the project should it be determined to proceed.

5.5 Aboriginal community involvement

An Aboriginal Heritage Information Management System (AHIMS) search was undertaken for the area covered by the Proposal (the area around Narwee Station) plus a 50 metre radius, on 4 March 2016. The closest Aboriginal site was over one kilometre away and therefore would not be impacted by the Proposal.

The extensive landscape modification and high level of disturbance that has occurred across the Proposal site suggests that intact evidence of Aboriginal land use is unlikely to occur within the boundaries of the Proposal site. Similarly, the nature of the proposed works would suggest that there is no potential for Aboriginal archaeological remains to be impacted. Therefore it was not considered necessary to undertake specific Aboriginal consultation.

5.6 Ongoing consultation

At the conclusion of the public display period for this REF, TfNSW would acknowledge receipt of feedback from each respondent. The issues raised by the respondents would be considered by TfNSW before determining whether to proceed with the Proposal (refer to Figure 1).

Should TfNSW determine to proceed with the Proposal, the Determination Report would be made available on the TfNSW website and would summarise the key impacts identified in this REF, demonstrate how TfNSW considered issues raised during the public display period, and include a summary of mitigation measures proposed to minimise the impacts of the Proposal.

Should TfNSW determine to proceed with the Proposal, the project team would keep the community, councils and other key stakeholders informed of the process, identify further issues as they arise, and develop additional mitigation measures to minimise the impacts of the Proposal. The interaction with the community would be undertaken in accordance with a Community Liaison Plan to be developed prior to the commencement of construction.

[4] http://www.transport.nsw.gov.au/projects-tap
[5] projects@transport.nsw.gov.au

6 Environmental impact assessment

Chapter 6 of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the Proposal. For each potential impact, the existing environment is characterised and then an assessment is undertaken as to how the Proposal would impact on the existing environment.

This environmental impact assessment has been undertaken in accordance with clause 228 of the EP&A Regulation. A checklist of clause 228 factors and how they have been specifically addressed in this REF is included at Appendix B.

6.1 Traffic and transport

A Traffic, Transport and Access Impact Assessment was prepared by AECOM for the Proposal (AECOM, 2016a). The assessment included a desktop analysis and site inspection. Detailed traffic counts and modelling were not considered necessary as the Proposal is focused on the station area and is unlikely to have major impacts on the surrounding road network. The findings of the assessment are summarised in this section.

6.1.1 Existing environment

Narwee Station and access

Narwee Station is serviced by the T2 Airport, Inner West and South Line providing connections to the suburban train network. Narwee Station is the 124th busiest station on the Sydney Trains Network, with an average of around 4,040 trips per weekday (Bureau of Travel Statistics barrier counts, 2014).

The station consists of a single island platform with Platform 1 (on the northern side) providing services to the City via Sydney Airport and Platform 2 (on the southern side) providing services to Revesby and Macarthur. Both directions have around four services per hour during peak periods. In 2013, the station was expanded to four tracks as a result of the Kingsgrove to Revesby Quadruplication Project (part of the Rail Clearways Program).

The station can be accessed from a pedestrian underpass beneath the railway, providing a link from Hannans Road on the northern side to Hurst Place on the southern side. Stairs provide the only means of access to the station platform from the underpass. The underpass is also used as an access path across the railway lines.

Within the station area there are a number of existing facilities for customers including ticket machines, Opal card readers, female and male toilets (non-accessible) and canopies for weather protection over the existing stairs and Ticket Office to the Platform Building.

Road network and traffic

The road network in the vicinity of the Proposal site is shown in Figure 3 and includes Broad Arrow Road, Hurst Place, Hannans Road, Fisher Place and Penshurst Road. These five roads are managed by Canterbury City Council, with the exception of Broad Arrow Road which is also partly within Hurstville City Council boundary as the council border is located along the centre of the road

Broad Arrow Road is a regional collector road with one traffic lane and one parking lane. It provides an east-west connection between King Georges Road, Bonds Road and Romilly Street. The road intersects with Hurst Place and Fisher Place, both allowing pedestrian access to Narwee Station. The speed limit is 50 kilometres per hour, with the exception of a school zone (40 kilometres per hour) near Beverly Hills Girls High School and Narwee Public School.

Hurst Place is a local cul-de-sac with one traffic lane in each direction, providing access to Narwee Station, a service station, convenience store and other small retail stores. The road is accessible from Broad Arrow Road and provides timed parking, accessible parking, kiss and ride facilities and a taxi zone. The sign-posted speed limit is 50 kilometres per hour.

Hannans Road is a local collector road consisting of one traffic lane and one on-street parking lane in each direction, with an east-west alignment. The road provides connections to local streets between Belmore Road and Broad Arrow Road. North of Narwee Station, a signalised intersection at Hannans Road and Penshurst Road provides signalised pedestrian crossings. The sign-posted speed limit is 50 kilometres per hour, with the exception of a school zone (40 kilometres per hour) near Hannans Road Public School.

Fisher Place is a one-way local road which forms a circuit accessible from Broad Arrow Road. A footpath enables access to the Hurst Place station entrance to the east. The sign-posted speed limit is 50 kilometres per hour.

Penshurst Road is a local road with one traffic lane in each direction with a north-south alignment. The road provides a connection from Broad Arrow Road to Forest Road. The sign-posted speed limit is 50 kilometres per hour.

Parking

A number of car parking facilities are present around Narwee Station. The Hannans Road commuter car park provides 72 untimed car parking spaces including two accessible parking spaces (not DDA-compliant). Untimed on-street parking is also available along a majority of the surrounding local road network, north of the station including Hannans Road.

A limited number of timed (1P) on-street parking spaces are available to the south, along Broad Arrow Road, Hurst Place and Fisher Place. However, these spaces are located within a mixed use / commercial zone and consequently the spaces are not available exclusively to rail customers.

During the site inspection it was observed that the majority of the spaces available within the Hannans Road commuter car park were occupied. There were a number of untimed on-street parking spaces available on Hannans Road adjacent to the commuter car park.

Taxi waiting areas and kiss and ride facilities

A sign-posted taxi zone is located along Hurst Place near the intersection with Broad Arrow Road and provides capacity for one taxi. The zone is around 50 metres from the station entrance and provides a sheltered seating area. There is no accessible path of travel from the taxi zone to the station.

Narwee Station currently provides a formal signposted kiss and ride with capacity for three vehicles (during peak period only) near the Hurst Place entrance. Timed parking zones on Fisher Place are also used as informal kiss and ride areas. During the morning peak period, it has been observed that the no stopping zones on Hannans Road near the northern entrance are also used as informal kiss and ride areas.

Bus operations

Bus services operated by Punchbowl Bus Company travel along routes 940, 941, 944, with bus stops located on Hannans Road and on Broad Arrow Road. Night bus services along the N20 route also service Narwee Station providing late night departures / arrivals.

These bus routes currently stop within 100 metres of Narwee Station on Hannans Road, Penshurst Road and Broad Arrow Road, connecting residential areas to local transport interchanges, employment and retail areas. The existing bus shelter on Hannans Road does not have an accessible space and Tactile Ground Surface Indicators (TGSIs) are not provided for bus stops on Hannans Road to indicate boarding point.

Bus routes operate on low to moderate service frequencies (around one every 30 minutes on each route) during peak periods. The N20 NightRide operates around one every hour for five hours (12am to 5am).

Pedestrian facilities

Pedestrian access to Narwee Station is provided from Hurst Road and Hannans Road, via the underpass. Stairs provide the only means of access from the underpass to the station platform.

Footpaths are present along both sides of Hurst Place, Broad Arrow Road and Hannans Road as well as other roads surrounding the station. There is no accessible path of travel from the northern side of Hannans Road to the southern side near the Hannans Road commuter car park (no ramps available).

Pedestrian crossing facilities are provided on all approaches at the signalised intersection of Hannans Road/Penshurst Road, and on the southern and western approaches of the Broad Arrow Road/Hannans Road signalised intersection. Raised unsignalised zebra crossings are provided along Hurst Place, Fisher Place and Mercury Street along Broad Arrow Road. The raised pedestrian crossing facilities at the entrance to Hurst Place from Broad Arrow Road do not have TGSI.

A pedestrian count undertaken in October 2014 concluded that the majority of the morning peak period pedestrians entered and exited from the northern side (Hannans Road). Figure 13 presents the results of the pedestrian analysis, indicating the directional splits for pedestrians accessing and egressing the station.

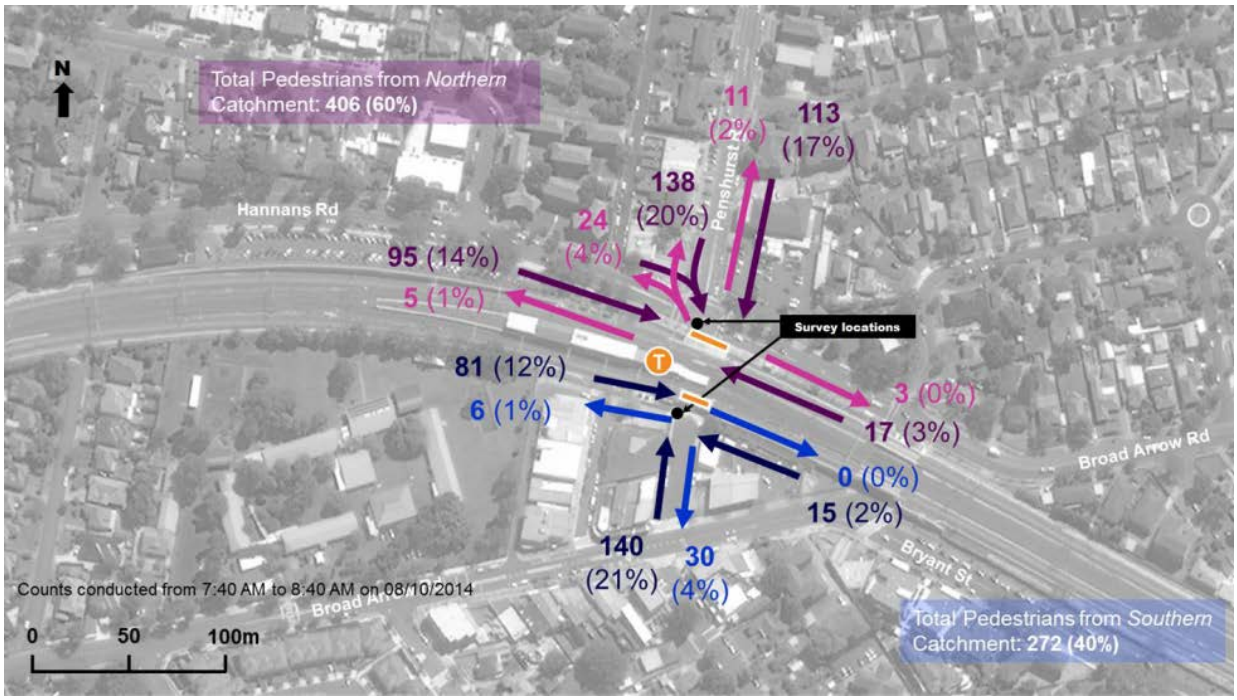


Figure 13 Pedestrian access analysis

Source: Narwee Station Precinct Accessibility Upgrade Concept Plan, Jacobs, 2015

Bicycle network and facilities

Dedicated on-road cycle connections are provided along Penshurst Road (in the north) and Hannans Road (in the west). However, these cycle lanes terminate prior to the station entrance, forming a gap in connectivity to the station. There are currently no formal cycle routes to the southern station entrance on Hurst Place.

An existing unsheltered bicycle rack with capacity for 12 bicycles is provided on the northern side of the station on Hannans Road. No bicycle parking is provided on the southern side of the station.

6.1.2 Potential impacts

Construction phase

Customer and public access impacts

Construction work is expected to have an impact on pedestrians and customers given the restricted space in which construction works are to be carried out. There may be changes to access to station platforms, interchange facilities and adjacent footpaths which could also result in longer walking distances and/or higher levels of congestion during peak periods.

Under one construction scenario, access to the station would be maintained during construction and any works to be undertaken in close proximity to existing footpaths would be managed and controlled at all times to ensure that there is no impact to public safety. Suitable detours would be provided as part of the traffic control measures. A temporary pedestrian access bridge would be constructed to maintain pedestrian access to Narwee Station and across the railway.

Alternatively, an extended (six week) temporary station closure to allow for an accelerated construction completion may be undertaken which would allow for a reduced construction program (by up to six months) thereby minimising overall construction related impacts to the local community. Access would remain across the railway via an alternative route along Broad Arrow Road however pedestrians would have a longer walking distance to cross the railway. Buses would replace trains during this period (refer to Section 3.2.1 for details of the bus replacement).

The details of these measures, if required, would be subject to further consideration during detailed design and construction planning in consultation with the relevant authorities. Notification would be provided to the community on alternative transport arrangements (including details of rail replacement buses, nearby stations and changes to pedestrian access).

Traffic impacts

Traffic generated by construction vehicles, including staff vehicles, is likely to be minimal given the nature of the proposed works and would fluctuate depending upon the construction staging. Around one to five heavy vehicles are anticipated per day on weekdays and up to 10 heavy vehicles during weekend possessions.

Minor temporary increases in traffic could be due to:

- delivery of construction materials and equipment
- spoil removal
- movement of construction personnel.

The vehicles generated on the road network as a result of the construction works are expected to generally consist of light vehicles from construction workers and heavy vehicle trips for delivery and removal of materials, plant and equipment.

Some works may result in temporary or partial lane closures and/or traffic diversions requiring a Road Occupancy License for the temporary road closure, if required. Roads potentially affected include Broad Arrow Road, Hurst Place, Fisher Place, Hannans Road and Penshurst Road. Road works would be undertaken progressively and in the minimum area and timeframe required to undertake the particular phase of work. Signage would be displayed around work areas to inform the public.

It may be necessary to undertake certain construction activities, such as concrete pours and delivery of oversized materials, outside standard construction hours so as to minimise traffic disruption.

Access for emergency vehicles would be maintained at the construction sites in accordance with emergency vehicle requirements.

Overall, if the proposed traffic management measures (detailed in Section 6.1.3) are implemented, the likely impact to traffic is expected to be manageable and would not have a major impact on the level of service of the surrounding road network.

Construction routes

The Proposal site is surrounded by local roads that serve residential dwellings and commercial premises, with many roads restricting access to vehicles over three tonne. The Proposal site is near the M5 Motorway (east-west) and King Georges Road (north-south), which are B-double routes that provide high clearances and sufficient road widths to accommodate larger vehicles.

The Broad Arrow Road Bridge under the rail line has a clearance of 3.9 metres, which would potentially restrict heavy vehicle movements from this direction. It is considered that Bryant Street and Penshurst Road would provide a more appropriate route for vehicles exceeding 3.9 metres in height. Figure 14 illustrates the likely access routes to each side of the station.

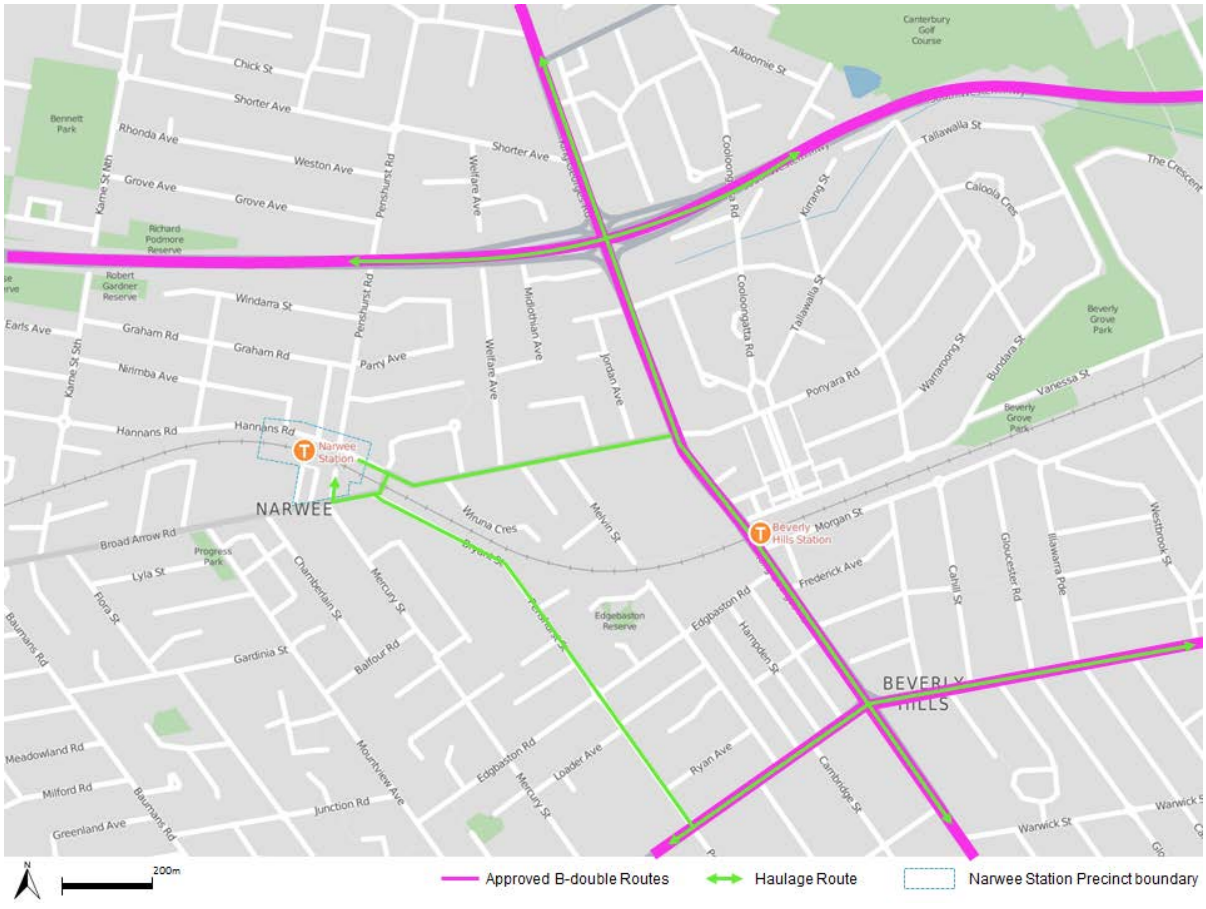


Figure 14 Potential construction vehicle routes – indicative only, subject to detailed design

Potential impacts on the local road network during haulage of materials would be minimised with the implementation of a construction Traffic Management Plan (TMP) and appropriate traffic controls as described in Section 6.1.3.

Parking

During construction, a work zone may be required along the southern side of Hannans Road and within the commuter car park (up to 20 spaces) which may cause part of Hannans Road commuter parking area to be temporarily unavailable. Hurst Place may also be partially closed for access during the temporary use of the crane (which would be required for construction activities (e.g. installation of the lift). This would temporarily reduce the availability of parking and increase the demand for on-street parking within the local network in the short term.

Parking provisions are not proposed for staff vehicles within or adjacent to the construction site, instead construction workers would be encouraged to car-pool or utilise public transport. However it is expected a portion of workers would travel via private vehicles and may temporarily result in a marginal increase in the demand for on-street parking within the surrounding local streets.

Untimed on-street parking spaces are located on Hannans Road near Narwee Station which provides additional availability for customers. The impact of increased on-street parking in the short term is not considered to be significant. A construction Traffic Management Plan (TMP) would be implemented to minimise potential parking impacts from construction traffic.

Taxi and kiss and ride facilities

Temporary relocation of the kiss and ride facilities and taxi stand on Hurst Place may be required during construction. Appropriate notification and signage would be provided to customers and taxi operators of the alternate transport arrangements should changes be required.

Bus facilities

Minor and temporary relocation of the bus stops on Hannans Road and Broad Arrow Road may be required during construction to allow the upgrades to the existing bus stops to be made. The level of service for the bus routes would not be significantly impacted. Appropriate signage to notify customers of the alternate transport arrangements would be provided should changes be required. The new bus stop locations would be established in consultation with bus operators.

Bicycle facilities

Construction work is expected to have a minor impact on the bicycle network. There would be a temporary reduction in bicycle parking during the works to install the bicycle shelter at the existing bicycle rack on Hannans Road. There may also be usage restrictions to this rack during construction as the proposed activities would be in close proximity to the existing bicycle facilities. Appropriate signs or traffic controllers (or similar) would be positioned to notify cyclists of the temporary arrangements. Potential impacts would be minimised with the implementation of management measures identified in Section 7.2.

Property access

Property access would be maintained during construction, where possible, to minimise the impact to local residents and businesses. However, during activities such as unloading of oversized materials, short term diversions to properties may be necessary. In such incidences, affected receivers would be notified in advance of the scheduled works.

Operational phase

The Proposal would provide equitable access for customers with reduced mobility and parents/carers with prams and customers with luggage to the station platforms, as well as new pedestrian crossings and new transport interchange facilities including kiss and ride areas and bicycle facilities.

The Proposal would result in positive impacts in terms of contributing towards making railway transport more accessible to the community. A summary of the operational traffic, transport and access impacts is provided below.

Customer and public access

The Proposal would provide the following improvements:

- a new stairway, lift and waiting area allowing for an accessible path of travel to the station from the underpass
- the provision of a lift to the station platforms, with accessible paths of travel from Hurst Place and Hannans Road which would accommodate mobility impaired persons accessing the station platforms (noting that mobility impaired access is not currently available at Narwee Station). These works would also provide improved access for the elderly and people with prams or luggage, etc.
- provision of an accessible parking space, a dedicated taxi rank and TGSI on Hurst Place and Fisher Place
- formalising interchange facilities on Hannans Road would provide a positive contribution towards the overall pedestrian and cycling environment.

The Proposal has been designed to cater for a daily patronage of 4,830 (which is the estimated 2036 daily patronage plus 15 per cent). During the development of the concept design, a pedestrian assessment was undertaken to determine if the Proposal would adequately cater for the projected increase in customers in terms of pedestrian flows.

To assess the pedestrian Level of Service (LoS), Fruin's Pedestrian Flow Rate criteria was adopted, which is the number of pedestrians that pass a point during a specific period of time for a given level of service, which is a qualitative measure of pedestrian comfort and crowding tolerance level. Fruin defined six levels of crowding for queuing areas, walkways and stairways which are expressed in terms of Levels of Service (LoS) and range from 'A' (best level) to 'F' (worst level).

It was concluded that the station would achieve LoS 'C' for all elements (excluding stairs) for 2036 plus 15 per cent under normal peak hour conditions. This is considered acceptable under the Building Code of Australia as the Proposal provides access via stairs with a width no less than the existing stairs. The Proposal is also considered acceptable from a fire access and egress perspective.

Other footpath improvements as part of the Proposal include new kerb ramps at Hannans Road near to the commuter car park and installation of TGSI's at bus stops and near ramps to improve accessibility and enhance safety.

Traffic

Given that the Proposal would provide an improved level of accessibility and amenity, the improved customer experience and upgraded facilities are likely to attract a higher patronage demand at the station. As a result, traffic activity is likely to marginally increase as a result of the Proposal. However, the potential traffic increase during operation is anticipated to have a negligible impact on the surrounding road network level of service.

Parking

The Proposal is not expected to significantly increase the level of car parking demand. However, it is noted that that the proposed improvements would reduce the amount of kerbside parking along Hannans Road and Hurst Place, as well as the loss of one untimed parking space within the Hannans Road commuter car park. Other anticipated impacts to parking spaces include:

- provision of an accessible parking space, three new kiss and ride spaces and a dedicated taxi rank (with capacity for one taxi) on Hurst Place would result in no net loss of parking spaces
- provision of two new kiss and ride spaces on either side of Hannans Road requires two untimed parking spaces and an area of restricted parking to be altered to kiss and ride during peak hours
- upgrade of two accessible parking spaces in the Hannans Road commuter car park would result in a net loss of one untimed parking space.

Overall, the positive impacts arising from improved accessibility and upgraded facilities at Narwee Station would outweigh the potential negative impacts of a slight reduction in the capacity of car parking spaces in the precinct. Parking is anticipated to be absorbed by other parking areas along local streets which are currently untimed.

Taxi and kiss and ride facilities

The Proposal includes the provision of four kiss and ride spaces west of the northern station entrance and maintaining the existing kiss and ride spaces on Hurst Place. The single space taxi zone at Hurst Place would also be maintained. These upgrades would address the informal kiss and ride activity, currently observed on roads near Narwee Station. The kiss and ride facilities would be located close to the station entrances, with appropriate pedestrian facility provisions, to ensure direct access is provided.

Bus facilities

The Proposal would not impact on the operation of buses in the vicinity of Narwee Station. Upgrades are proposed to the bus stops including the installation of a new shelter (with accessible space) at the existing stop on the northern side of Hannans Road and re-lining of the bus bay at Broad Arrow Road. The Proposal would improve the experience and accessibility for customers.

Bicycle facilities

The Proposal would not adversely impact on the local bicycle network. The Proposal includes the provision of a shelter for the existing bicycle parking (with capacity for 12 bicycles) near the northern station entrance and installation of a new undercover bicycle rack (with capacity for eight bicycles) near the southern station entrance.

The introduction of additional storage facilities in the vicinity of the station is likely to encourage active transport as a mode of access to the station precinct. Additionally, it is likely to minimise the likelihood of informal bicycle parking along fences and railings, in the absence of convenient formal storage facilities.

Property access

The Proposal is not expected to adversely impact on existing access to properties in the vicinity of the station. It is anticipated that the provision of a formalised kiss and ride facilities would reduce the number of people using existing property access points along Hannans Road to set-down/ pick-up and turn around.

6.1.3 Mitigation measures

A construction Traffic Management Plan (TMP) would be prepared by the Contractor in consultation with TfNSW and provided to Canterbury City Council, Hurstville City Council (and Road and Maritime Services as required). The construction TMP would be the primary management tool to manage potential traffic impacts associated with construction. The TMP, at a minimum, would include:

- procedures for preparing and implementing Traffic Control Plans (TCPs) for any detours (if required) or traffic controls to manage temporary road disruptions
- identification of final construction traffic access routes, site compound(s), contractor parking and loading zones
- nomination of access routes to and from the local road network and contractor parking
- scheduling of works/deliveries to avoid peak times and limiting of works in the road carriageway as much as practicable to limit parking losses and maintain customer access to the station
- measures to:
    - limit temporary parking losses
    - maintain services or other transport arrangements
    - maintain private property access unless otherwise agreed
- details of construction signage including signposts and variable message signs, traffic controllers and other community notifications.

Refer to Table 24 in Section 7.2 for a list of proposed mitigation measures.

6.2 Urban design, landscape and visual amenity

A Visual Impact Assessment was undertaken by AECOM for the Proposal (AECOM 2016b). The findings of the assessment are summarised in this section. The assessment included desktop analysis, site inspection and creation of photomontages. The photomontages provide an indication of what the Proposal may look like from key representative viewpoints once complete, in particular to demonstrate the bulk and scale, noting that materials and finishes are indicative and would be further investigated during detailed design.

6.2.1 Existing environment

Landscape character

The landscape character surrounding Narwee Station is typical of a suburban residential setting with mixed development within a local commercial centre. Residential areas to the north and south of the station are defined by medium density housing (consisting of two to three storey apartments), punctuated by occasional small public parks and a local public school (in the south). Many small local parks have been created where the railway meets residential areas.

The station platforms (including the canopies, overhead wiring and platform buildings) are elevated around five metres above existing street level forming part of the existing landscape character. The station precinct and adjoining road corridors contain mature indigenous and non-indigenous tree plantings which provide some degree of screening within, and beyond the station precinct. Tree plantings continue along local residential street nature strips and throughout residential garden areas.

Visual receivers

Visual receivers are individuals and/or groups of people whose views may be affected by the Proposal. These include users of residential dwellings, commercial properties, road corridors and pedestrian footpaths. The potential visibility of the Proposal from the surrounding area is shown in Figure 15.

Eight visual receiver locations have been identified to represent key viewpoints for assessment of potential impacts on views as a result of the Proposal. These are shown in Figure 16 and described in Table 6.

Table 6 Visual impact assessment receiver locations

No.	Visual receiver	Description
1	Broad Arrow Road	This receiver location assesses the impact of the changes to commercial neighbours and road users at the corner of Broad Arrow Road and Mercury Street
2	Hurst Place	This receiver location assesses the visual impact on commercial neighbours, pedestrians and customers using the underpass in Hurst Place
3	Intersection of Hannans Road / Penshurst Road	This receiver location assesses the impact of the Proposal on road users, active pedestrians and customers at the corner of Hannans Road and Penshurst Road
4	Kardella Reserve	This receiver location assesses the visual impact on passive recreational park users of Kardella Reserve
5	Penshurst Road (eastern side)	This receiver location assesses the impact of the changes on residential neighbours entering and leaving their residencies on the eastern side of Penshurst Road
6	Penshurst Road (western side)	This receiver location assesses the visual impact on commercial neighbours and their customers on the western side of Penshurst Road
7	Hannans Road (corner of Station Lane)	This receiver location assesses the impact of changes on residential neighbours at the corner of Hannans Road and Station Lane (three buildings comprising three storey units)
8	Hannans Road (corner of Nirimba Avenue)	This receiver location assesses the impact of changes on residential neighbours at the corner of Hannans Road and Nirimba Avenue (new two storey residences)

Figure 15 Visual envelope map showing areas visually affected by the Proposal

Figure 16 Visual Impact Assessment Receiver Locations

6.2.2 Potential impacts

Construction phase

Construction activities would tend to be more visible than the operational stage of the Proposal. The construction activities would be temporary and transient in nature. Temporary elements likely to be introduced into the visual environment include:

- fencing and hoarding
- road barriers and signage
- crane and other construction equipment
- site office and amenities.

If a temporary pedestrian access bridge is required during construction (as discussed in Section 3.2) this would add to the visual impacts on the surrounding area in the short term. The temporary pedestrian access bridge would be a relatively large structure in comparison to the existing station features as the clearance between the base of the structure and the overhead wiring is required to be at least 1.5 metres for safety reasons. The temporary pedestrian access bridge would span from Hannans Road and connect to Fisher Place (rather than Hurst Place on the southern side of the station), temporarily changing pedestrian desire lines.

An alternative construction option is the use of an extended (six week) temporary station closure to accelerate construction completion. This option would reduce the temporary visual amenity impacts due to the reduced construction period (up to six months) and remove the need for a temporary pedestrian access bridge.

Night works are likely to require erection of temporary lighting for operational, safety and security purposes. Lighting installations would be placed to avoid light spill to adjoining road corridors and residential areas.

Views towards construction activities would be partially screened by existing tree cover surrounding Narwee Station. However, given that the sensitivity of the construction phase is likely to be moderate (given sensitivity to other impacts such as noise, air quality and traffic), the overall visual impact of construction of the Proposal is considered to be Moderate.

Operational phase

Landscape Character Assessment

The operational phase of the Proposal would result in the following visual impacts on the landscape character of the surrounding area:

- impacts would generally comprise relatively minor changes to a small stretch of a larger existing railway corridor
- the Proposal would extend the visually accessible canopy structure across the existing platform and include a new lift shaft comprising a prominent modern architectural element, with features such as glazing to reduce the bulk and make the element more visually recessive
- changes would be physically separated from the existing heritage Platform Building and of a moderate scale and contemporary design and would not visually compete with the heritage aspects of the station
- well considered new architecture would provide positive new elements within an area with a number of empty shops.

The change in visual amenity would in most cases be only apparent in the area immediately adjacent to the site of the upgrade. The Proposal is in keeping with the existing landscape character and use, notwithstanding the addition of relatively few contemporary architectural elements.

Visual Impact Assessment

An assessment of the visual sensitivity and magnitude of each visual receiver location during the operational phase of the Proposal was undertaken. The results of this assessment are provided in Table 7. Overall, the Proposal would have a moderate-low visual impact on the majority of people living, working in or travelling through the urban landscape surrounding Narwee Station during operation.

Table 7 Operational Visual Impact Assessment

No.	Visual receiver	Sensitivity	Magnitude	Rating
1	Broad Arrow Road (refer to Figure 18)	The sensitivity would be Low. Pedestrian, road user views, as well as ground and first storey views toward Narwee Station from commercial neighbours would be indirect and framed within the Hurst Place streetscape view corridor, as seen from across Broad Arrow Road. Visible portions of the Proposal would be largely restricted to the eastern end of the Station.	The magnitude of change would be Low. The Proposal would form a visually prominent element with views toward the Proposal framed within and terminating the streetscape corridor view. The Proposal would introduce constructed elements (i.e. new platform canopy and lift) which complement the scale and form of some of the existing commercial buildings adjoining the station, and would comprise well considered architectural elements	Low
2	Hurst Place (refer to Figure 18)	The sensitivity would be Moderate. Pedestrian, road user views, as well as ground and first storey views toward Narwee Station from commercial neighbours would be direct and immediate	The magnitude of change would be Moderate. The Proposal would form visually prominent elements within Hurst Place. The Proposal would introduce constructed elements (i.e. new platform canopy and lift) which complement the scale and form of some of the existing commercial building adjoining the station and would compromise well considered architectural elements which provide new, contemporary amenity benefit to the streetscape.	Moderate

No.	Visual receiver	Sensitivity	Magnitude	Rating
3	Intersection of Hannans Road and Penshurst Road	The sensitivity would be Low, assuming pedestrian and road user views are towards Narwee Station from this location.	The magnitude of change would be Moderate. Views from this location would be detailed and include key built elements such as the lift and canopy structure. The visual prominence of the Proposal elements would be accentuated being silhouetted against the sky due to the elevated railway line. Receptor numbers would be high, however, the sensitivity of these receptors to the Proposal is considered to be low because views would be transitory. The Proposal would introduce constructed elements which complement the scale and form of some of the existing commercial and residential buildings adjoining the station.	Moderate - Low
4	Kardella Reserve	The sensitivity would be Moderate, given the potential for the park to be used by passive recreational receptors	The magnitude of change would be Low. Street level views toward Narwee Station from Kardella Reserve are partially screened by existing tree planting alongside Hannans Road. The Proposal would generally be expected to have low levels of visibility from this location, with only the top of the lift shaft visible.	Moderate - Low
5	Penshurst Road (eastern side)	The sensitivity would be Low, comprising pedestrian and road user views, as well as residential neighbours entering and leaving their residences from the street.	The magnitude of change would be Low. Visible portions of the Proposal would be largely restricted to the western end. The Proposal would introduce constructed elements which complement the scale and form of some of the existing commercial buildings adjoining the station.	Low
6	Penshurst Road (western side) Refer to Figure 20	The sensitivity would be Low. Pedestrian and road user views, as well as highly oblique views from some ground and first storey residences towards the Proposal, in addition to commercial neighbours.	The magnitude of change would be Low. The Proposal would be viewed in moderate detail and framed within the Penshurst streetscape view corridor dominated by wirescape. The Proposal would introduce constructed elements which complement the scale and form of some of the existing commercial buildings adjoining the station.	Low

No.	Visual receiver	Sensitivity	Magnitude	Rating
7	Hannans Road (corner of Station Lane) Refer to Figure 22	The sensitivity of receivers would be Moderate. Within the context of a relatively low number of receivers from these locations, ground, second and third storey views toward Narwee Station would be expected from the multi-unit residential apartments along the northern side of Hannans Road.	The magnitude of change would be Low. Views toward the Proposal would be partially screened and filtered by vegetation along Hannans Road.	Moderate - Low
8	Hannans Road (corner of Nirimba Avenue)	The sensitivity would be Low within the context of a low number of residents with direct views to the Proposal.	The magnitude of change would be Low. Views toward the Proposal would be substantially screened and filtered by vegetation along Hannans Road.	Low

Figure 18 to Figure 22 provide photographs of existing views with a photomontage of the Proposal as viewed from sensitive receiver locations. Photomontages have been prepared to illustrate the likely visual changes from a number of key viewpoints. These images focus on viewing the Proposal in its wider setting, at a pedestrian view-level, in terms of the bulk and scale which is particularly relevant to visual impact assessment. The materials and finishes used are indicative only and would be further investigated during detailed design. Figure 9 shows an indicative artists impression of the Proposal providing a close-up view of the upgrade (subject to detailed design).

Figure 17 Existing view looking north-east down Hurst Place to Narwee Station

Figure 18 Proposed view looking north-east down Hurst Place to Narwee Station

Indicative only - Subject to detailed design.

Figure 19 Existing view Penshurst Road looking south towards Narwee Station

Figure 20 Proposed view from Penshurst Road looking south towards Narwee Station

Indicative only - Subject to detailed design.

Figure 21 Existing view from Hannans Road looking south-east towards Narwee Station

Figure 22 Proposed view from Hannans Road looking south-east towards Narwee Station

Indicative only - Subject to detailed design.

6.2.3 Mitigation measures

The overall visual impacts of the Proposal have been determined to range from low to moderate-low for the landscape character and surrounding visual receiver locations. Mitigation measures should be considered to minimise the level of visual impact during the design development, the construction and operation phases of the Proposal.

The detailed design of the Proposal would be undertaken with reference to the recommendations included in the Visual Impact Assessment (AECOM, 2016b) which is included in the list of proposed mitigation measures in Section 7.2, and includes consideration of the selection and location of new tree planting along Hannans Road and Hurst Place frontages that may provide partial screening and selection of materials and colour finishes for new elements of the Proposal to minimise visual impacts.

Measures to mitigate visual impacts during construction would be included in a CEMP for the Proposal and would include measures such as minimising light spill during night works, screening of compounds and minimising tree removal. Refer to Section 7.2 for a list of proposed mitigation measures.

6.3 Noise and vibration

This section provides a summary of the Noise and Vibration Impact Assessment undertaken by AECOM (2016c). The assessment included:

- establishing the existing background noise levels in the vicinity of Narwee Station
- establishing the construction noise management levels and vibration limits that would apply to the upgrade works
- predicting environmental noise and vibration levels at nearby residential and other sensitive receivers due to the upgrade works
- predicting noise levels from additional off-site construction traffic generated by the upgrade works
- identifying mitigation measures where necessary to reduce and manage noise and vibration impacts from the upgrade works to comply with established construction noise management levels and vibration limits
- considering noise from the operation of the upgraded Narwee Station.

As operational noise levels are expected to remain unchanged, no quantitative modelling of operational noise impacts was undertaken.

6.3.1 Existing environment

Noise sensitive receivers

Twenty one representative residential receivers and eight non-residential receivers were selected to represent the noise impacts within areas with similar likely background noise levels as shown in Figure 23.

The closest residential receivers are located on Fisher Place (R1) and Hannans Road (R2) between seven and 22 metres from the Proposal site. Other nearby residential receivers are located on Penshurst Road, Nirimba Avenue and Broad Arrow Road.

The representative non-residential receivers included in the assessment included:

- commercial/retail properties on Fisher Place (N1)

- commercial/retail properties on Hannans Road (N2)
- Narwee Public School (N3)
- Narwee Hotel (N4),
- Salvation Army Church (N5)
- 1st Narwee Scout Hall (N6)
- Beverly Hills Montessori Christian Preschool (N7)
- Narwee Preschool Kindergarten east (N8).

The study area was divided into two Noise Catchment Areas (NCAs). The noise environment at each of the receivers within a NCA is considered to have a similar noise environment.

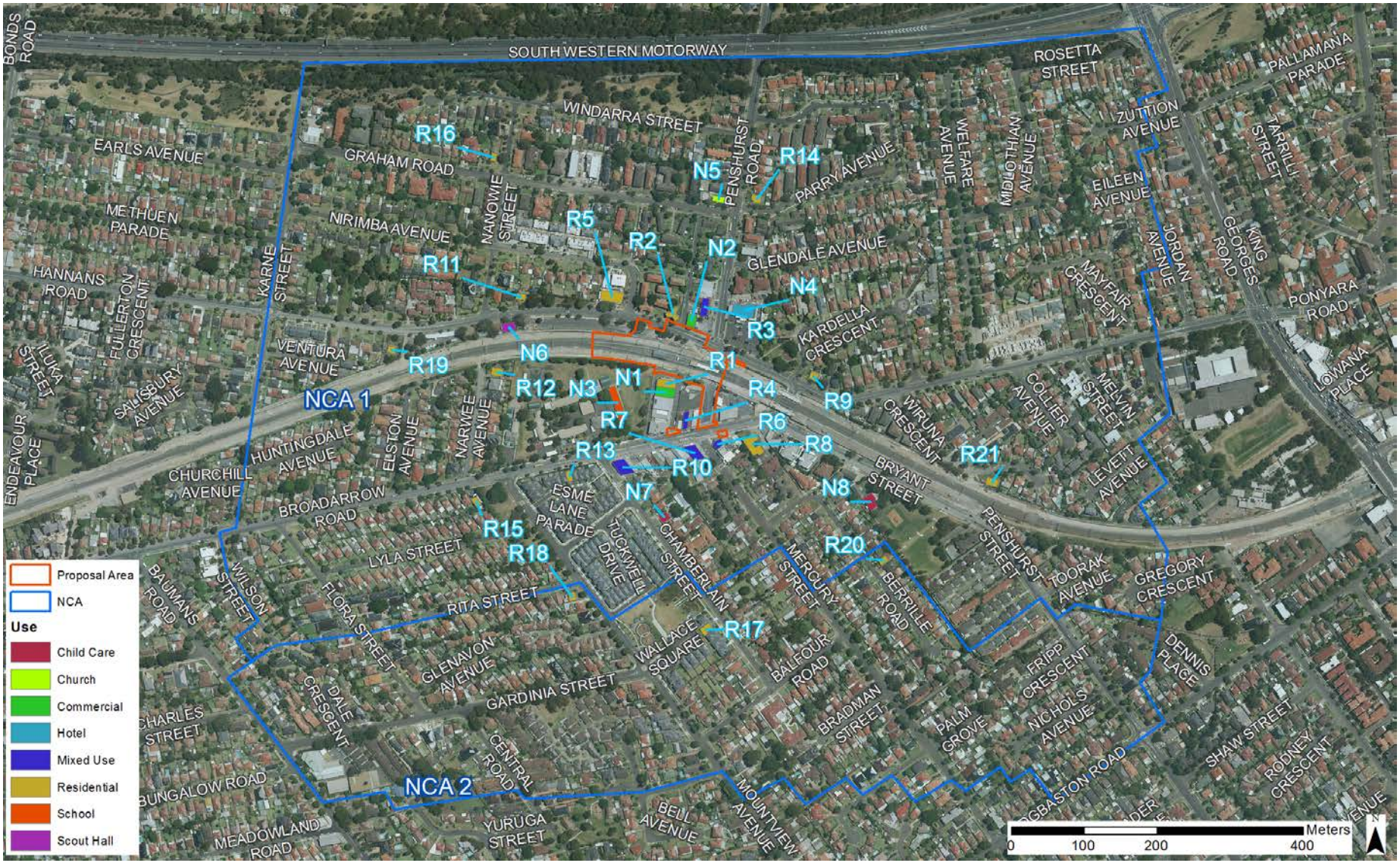


Figure 23 Representative receiver locations

Background noise levels

Unattended noise monitoring was undertaken at two representative receiver locations within the NCAs (NCA 1 - 5 Kardella Crescent, and NCA 2 - 4 Whitfield Avenue).

The acoustic environment indicated the dominant ambient noise source at both monitoring locations is traffic noise from nearby roads. Rail noise is increasingly dominant nearer to the railway. These characteristics are typical of a suburban environment. For both noise loggers, the evening background levels are higher than the daytime background levels due to a traffic peak in the evening as people head home from work (refer Table 8).

Table 8 Existing background and ambient noise levels

NCA	Period[1]	Rating Background Level (RBL) (L_{90})[2]	Ambient noise levels (L_{Aeq})[3]
NCA 1	Day	38 dBA	49 dBA
	Evening	41 dBA	51 dBA
	Night	39 dBA	48 dBA
NCA 2	Day	37 dBA	52 dBA
	Evening	42 dBA	52 dBA
	Night	37 dBA	48 dBA

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday & Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays & Public Holidays.*
2. *The rating background level (RBL) (LA90) represents the noise level exceeded for 90 per cent of the monitoring period.*
3. *The ambient noise level represents the average noise level over the monitoring period.*

Construction noise criteria

The EPA's *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change, 2009) is the principal guideline for the assessment and management of construction noise in NSW. The ICNG recommends standard hours of construction as:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and public holidays: no works

Noise management levels have been determined for receivers as per the procedures in the ICNG. The ICNG prescribes set noise management levels for non-residential receivers such as commercial, schools and places of worship. Noise management levels for residential receivers are calculated based on the rating background level (RBL) + 10 dB(A) (for daytime periods) or the RBL + 5 dB(A) (for evening and night time periods). In addition, a 'highly noise affected' level of 75 dB(A) for residential receivers represents the point above which there may be strong community reaction to noise.

Where works exceed the noise management levels, all reasonable and feasible measures (such as equipment selection and location, construction scheduling and respite periods) should be implemented to reduce noise levels as far as practicable.

The construction noise management levels developed for the Proposal for residential and non-residential sensitive receivers are listed in Table 9 and Table 10 respectively.

Table 9 Construction noise management levels – Residential receivers

NCA	Period	RBL, L_{A90} dB(A)	Standard hours noise management levels, $L_{Aeq,15min}$, dB(A)	Out of hours noise management levels, $L_{Aeq,15min}$, dB(A)
NCA 1	Day	38	48	43
	Evening	38	N/A	43
	Night	38	N/A	43
NCA 2	Day	37	47	42
	Evening	37	N/A	42
	Night	38	48	43

Table 10 Construction noise management levels – Other sensitive receivers

Land use	Noise management levels, $L_{Aeq,15min}$ (applies when properties are in use)
Classrooms at schools and other educational institutions	55 dB(A)[1]
Places of worship	55 dB(A)[1]
Commercial premises (including offices, retail outlets)	70 dB(A)

Notes:

1. *These external management levels are based upon a 45 dB(A) internal noise management level and a 10 dB reduction from outside to inside through an open window.*

Sleep disturbance noise goals have also been established for residential receivers which are based on the *NSW Road Noise Policy* (Department of Environment, Climate Change and Water, 2011). Based on the Policy, the sleep disturbance criteria for both NCA are a screening level of 45 dB(A) $L_{A1(1\ minute)}$) and an awakening reaction at 60-65 dB(A) $L_{A1(1\ minute)}$.

For traffic noise, the criterion applied on public roads generated during the construction phase of a project is an increase in existing road traffic noise of no more than 2 dB(A).

Construction vibration criteria

When assessing vibration there are two categories of vibration criteria: one related to the impact of vibration to human comfort and one relating to the impact on building structures (cosmetic damage).

Human comfort

The assessment of intermittent vibration outlined in the NSW EPA guideline *Assessing Vibration: A Technical Guideline* (AVTG) is based on Vibration Dose Values (VDVs). Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 11. The VDV criteria are based on the likelihood that a person would be annoyed by the level of vibration over the entire assessment period.

Table 11 Preferred and maximum vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Period	Preferred	Max
Critical areas	Day or night time	0.1	0.2
Residences	Daytime[1]	0.2	0.4
	Night time[2]	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night time	0.4	0.8
Workshops	Day or night time	0.8	1.6

Notes:

1. *Daytime period is defined as 7am – 10pm under BS 6472-1992 Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz).*
2. *Night period is defined as 10pm – 7am under BS 6472-1992.*

Structural damage to buildings

There is currently no Australian Standard that provides guidance for assessing cosmetic building damage caused by vibration. The German standard (DIN 4150) provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 12. DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage. The vibration criteria provided below in Table 12 would be adopted for the management of vibration impacts on structures.

Table 12 DIN 4150: Structural damage safe limits for building vibration velocity

Group	Type of Structure	At foundation – less than 10 Hz	At foundation – 10 Hz to 50 Hz	At foundation – less than 10 Hz	At the horizontal plane of the highest floor – all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s
2	Dwellings and buildings of similar design and/or use	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (eg heritage listed buildings)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

Notes:

1. *At frequencies above 100 Hz, the values given in this column may be used as minimum values*

Operational noise criteria

The *Industrial Noise Policy* (EPA, 2000) provides guidance in relation to acceptable noise limits for industrial noise emissions, which includes but is not limited to, noise emissions from mechanical plant.

The assessment procedure in the *Industrial Noise Policy* has two components:

- controlling intrusive noise impacts in the short term for residences
- maintaining noise level amenity for residences and other land uses.

The project specific noise levels established for the operation of the Proposal are summarised in Table 13 and are based on the lower of the intrusive and amenity criteria. The criteria apply to environmental noise emissions from plant and equipment installed as part of the Proposal.

Table 13 Environmental noise emission criteria

Location	Period[1]	Rating background level (RBL)	Intrusive Criteria $L_{Aeq,\ 15\ min}$ dB(A)	Amenity Criteria $L_{Aeq,\ 15\ min}$ dB(A)	Project Specific Noise Level[3]
NCA 1	Day	38	43	55	43
	Night	38	43	45	43
	Evening	38	43	40	40
NCA 2	Day	37	42	55	42
	Night	37	42	45	42
	Evening	37	42	40	42
School classroom[3]	Noisiest 1-hour period when in use		-	45	45
Place of Worship[3]	When in use		-	50	50
Commercial premises	When in use		-	65	65

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday & Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays & Public Holidays.*
2. *The project specific noise levels have been set as an Leq, 15min in order to provide a conservative assessment. Where compliance is achieved over a 15-minute period, it is therefore implied that compliance would also occur over the day, evening or night period.*
3. *As per the INP, a +10 dB correction has been added to convert internal to external noise criteria.*

6.3.2 Potential impacts

Construction phase

Noise

In order to assess the potential noise and vibration impacts from the proposed construction works, the construction phases described in Chapter 3 were further divided into the following indicative scenarios (Table 14 below) to provide a more accurate assessment. Scenarios for

each construction stage have been modelled in SoundPLAN for each construction stage based on the likely construction equipment that would be used to provide details of the potential impact for each stage.

A summary of the predicted construction noise levels for each scenario during standard working hours for residential receivers is shown below in Table 15 and for non-residential receivers in Table 16.

Table 14 Construction assessment scenarios

Scenario	Activity	Stage	Timing
Site establishment and enabling works	Establishment of site compound (erect fencing, tree protection zones, site offices, amenities and plant/material storage areas), establishment of temporary facilities as required	1A	Standard hours or rail possession (likely daytime only)
	Removal of vegetation to allow for new lifts/stairs	1B	Standard hours
	Services relocation	-	Mostly in standard hours, with cutover works (not noisy) during possessions
New lift and platform upgrade	Demolition of existing structures including buildings on the platforms	2A	Standard hours or during rail possession
	Platform modifications, platform extension, lift shaft including piling and foundations for lift shaft	2B	Standard hours or during rail possession
	Construction of lift shaft, stairs, fencing and new canopies	2C	Standard hours or during rail possession
	Installation of lift, installation of fixtures, lighting, signage and CCTV cameras for the station areas	-	Standard hours or during rail possession
	Platform resurfacing, new platform surface drainage and communications installation	2D	During rail possession
Station building works	Reconfiguration of internal station buildings	3A	Standard hours
	Refresh of station building including painting works	3B	Standard hours or during rail possession
Interchange works	Modifications and making good the existing underpass including re-surfacing, lighting and painting	4A	Standard hours
	Taxi zone, kiss and ride, bus stops, bicycle racks and accessible car parking spaces in the car park	4B	Standard hours
	Installation of wayfinding signage, electrical and power supply upgrade works, replanting, landscaping, fencing adjustments and bollards	-	Standard hours

Table 15 Predicted construction noise levels for each scenario during standard hours (dB(A)) – residential receivers

Receiver ID	1A	1B	2A	2B	2C	3A	3B	4A	4B
R1	**74**	**82**	**72**	**68**	**69**	**74**	**68**	**69**	**60**
R2	**68**	**69**	**67**	**64**	**64**	**71**	**64**	**65**	**78**
R3	**59**	**67**	**62**	**64**	**65**	**62**	**55**	**65**	**65**
R4	**49**	**61**	**55**	**57**	**57**	**55**	**49**	**58**	**73**
R5	**58**	**64**	**61**	**58**	**58**	**64**	**57**	**59**	**63**
R6	**52**	**60**	**58**	**60**	**61**	**53**	45	**60**	**76**
R7	**54**	**58**	**58**	**63**	**63**	**51**	44	**64**	**70**
R8	**54**	**53**	**54**	**62**	**60**	**54**	**50**	**62**	**69**
R9	**51**	**63**	**58**	**60**	**60**	**57**	**49**	**62**	**51**
R10	**49**	**52**	**54**	**49**	**50**	**59**	**52**	**51**	**61**
R11	**49**	**58**	**55**	**52**	**53**	**57**	**50**	**53**	**49**
R12	47	**53**	**52**	**50**	**51**	**54**	48	**51**	**49**
R13	44	**51**	**53**	**52**	**52**	**53**	47	**53**	**53**
R14	44	**58**	**52**	**51**	**50**	45	0	**52**	46
R15	< 39	45	44	44	44	45	40	45	< 39
R16	< 39	44	< 39	< 39	< 39	< 39	< 39	< 39	< 39
R17	41	44	47	47	**49**	44	40	49	42
R18	< 39	41	39	39	39	41	< 39	40	< 39
R19	42	**52**	**49**	47	47	**51**	44	47	43
R20	< 39	41	41	41	41	42	0	42	< 39
R21	40	**52**	48	**49**	**49**	**49**	41	**51**	42

Notes:

*Items in **BOLD BLACK** indicate predicted noise impact at this receiver during this work stage is above NML. Items in **BOLD RED** indicate a 'highly affected' residential receiver with level of 75 dB(A) or greater.*

Table 16 Predicted construction noise levels for each scenario during standard hours (dB(A)) – non-residential receivers

Receiver ID	1A	1B	2A	2B	2C	3A	3B	4A	4B
N1	**73**	**72**	68	66	67	68	64	67	64
N2	47	60	51	54	54	43	0	54	47
N3	**59**	**63**	**62**	**59**	**60**	**66**	**59**	**60**	**57**
N4	**56**	**67**	**63**	**65**	**65**	**62**	**55**	**66**	**60**
N5	44	**58**	**52**	**51**	**50**	45	0	**52**	46
N6	49	58	54	51	52	56	49	52	48
N7	42	51	52	51	50	49	43	52	52
N8	44	53	54	53	52	51	45	54	54

Notes:

*Items in **BOLD BLACK** indicate predicted noise impact at this receiver during this work stage is above NML. Items in **BOLD RED** indicate a 'highly affected' residential receiver with level of 75 dB(A) or greater.*

The predicted noise levels indicate that there would be exceedances of the residential noise management levels during standard hours during all assessed stages of construction. The largest numbers of exceedances occur during 'Stage 1B - removal of vegetation'. The largest impacts would be experienced by residences along Fisher Place and Hannans Road. Two residential receivers (R1 on Fisher Place and R2 on Hannans Road) are predicted to be 'highly affected'. It should be noted that the number of trees to be removed would be minimal and the duration would likely be around 1-2 days only.

Construction activities are predicted to exceed noise management levels at some non-residential receivers. These receivers include N1 (a commercial site) N3 (Narwee Public School), N4 (Narwee Hotel) and N5 (Salvation Army Church). Key noisy activities include the use of concrete saws and excavators with hammers.

The level of impact may change depending on the final construction methodology and further assessment would be undertaken if required. During construction, not all equipment would be operating simultaneously at all times and in the one location which is the worst case scenario assumed in the assessment. This which would result in a slight reduction in predicted noise levels.

The exceedances shown above in Table 15 and Table 16 would be mitigated by implementing standard noise mitigation measures provided by the Construction Noise Strategy (TfNSW, 2012c) where feasible and reasonable (refer to Section 6.3.3). The exceedances would be short-term and limited to the duration of the temporary construction period.

Out of hours works

Out of hours works would be required during possessions that typically extend 24-hours a day over a weekend and are required for safety, constructability and traffic reasons. Around six weekend possessions would occur during the construction period as described in Section 3.2.3.

The predicted construction noise levels for each scenario (refer to Table 14 for scenarios) during out of working hours for residential receivers is shown below in Table 17 and for non-residential receivers in Table 18.

Table 17 Predicted construction noise levels for each scenario during out of hours works (dB(A)) – residential receivers

Receiver ID	1A	2A	2B	2C	2D	3B
R1	**74**	**72**	**68**	**69**	**71**	**68**
R2	**68**	**67**	**64**	**64**	**68**	**64**
R3	**59**	**62**	**64**	**65**	**59**	**55**
R4	**49**	**55**	**57**	**57**	**54**	**49**
R5	**58**	**61**	**58**	**58**	**64**	**57**
R6	**52**	**58**	**60**	**61**	**55**	**45**
R7	**54**	**58**	**63**	**63**	**52**	**44**
R8	**54**	**54**	**62**	**60**	**52**	**50**
R9	**51**	**58**	**60**	**60**	**56**	**49**
R10	**49**	**54**	**49**	**50**	**57**	**52**
R11	**49**	**55**	**52**	**53**	**57**	**50**
R12	**47**	**52**	**50**	**51**	**54**	**48**
R13	**44**	**53**	**52**	**52**	**52**	**47**
R14	**44**	**52**	**51**	**50**	**47**	< 39
R15	< 39	**44**	**44**	**44**	**45**	40
R16	< 39	< 39	< 39	< 39	40	< 39
R17	41	**47**	**47**	**49**	**46**	40
R18	< 39	39	39	39	39	< 39
R19	42	**49**	**47**	**47**	**50**	**44**
R20	< 39	41	41	41	41	< 39
R21	40	**48**	**49**	**49**	**47**	41

Notes:

*Items in **BOLD BLACK** indicate predicted noise impact at this receiver during this work stage is above NML. Items in **BOLD RED** indicate a 'highly affected' residential receiver with level of 75 dB(A) or greater.*

Table 18 Predicted construction noise levels for each scenario during out of hours works (dB(A)) – non-residential receivers

Receiver ID	1A	2A	2B	2C	2D	3B
N1	**73**	68	66	67	66	64
N2	47	51	54	54	50	0
N3	**59**	**62**	**59**	**60**	**66**	**59**
N4	**56**	**63**	**65**	**65**	**61**	**55**
N5	**44**	**52**	**51**	**50**	**47**	**< 39**
N6	44	49	54	51	52	56

Notes:

*Items in **BOLD BLACK** indicate predicted noise impact at this receiver during this work stage is above NML. Items in **BOLD RED** indicate a 'highly affected' residential receiver with level of 75 dB(A) or greater.*

N7 and N8 are preschools and so it has been assumed that these would not be impacted by out of standard hours works.

The predicted noise levels indicate that exceedances of the residential noise management levels during out-of-hours works would occur during all assessed stages of construction. The largest numbers of exceedances occur during 'Stage 2A - demolition of existing structures'. The largest impacts would be experienced by residences along Fisher Place and Hannans Road (R1 on Fisher Place and R2 on Hannans Road). Noise levels at 18-20 Fisher Place (R1) are predicted to exceed the noise management levels by more than 25 dB(A). No receivers are predicted to be 'highly affected'.

Some non-residential receivers are predicted to exceed NMLs. These receivers include N1 (a commercial site), N3 (Narwee Public School, which may have evening activities occasionally), N4 (Narwee Hotel) and N5 (Salvation Army Church).

If extended out of hours works are required, additional mitigation measures such as respite breaks would need to be applied (refer to Section 6.3.3). The exceedances would be short term and temporary and limited to the duration of the construction period.

Out of hours works that may be required would be assessed in more detail following confirmation of the construction methodology by the Contractor and would be subject to further approval by TfNSW. This would include appropriate community notification and mitigation measures in accordance with TfNSW's *Construction Noise Strategy* (TfNSW, 2012c).

Sleep disturbance

Noise from intermittent peak noise events has the potential to cause sleep disturbance at the nearest residential receivers.

The predicted results indicate that the awakening reaction criterion of 60–65 dB(A) is predicted to be exceeded at residences within NCA 1 for 2A - demolition of structures, 2B - platform modifications, 2C - construction of lift shaft, 2D - Platform resurfacing and 3B - refresh of Platform Building. However, these activities would be scheduled to occur during day time hours where feasible.

The predicted construction noise levels are typically the worst case noise levels, therefore the majority of actual noise levels are likely to be less than those predicted.

The potential for sleep disturbance would be assessed in more detail following confirmation of the construction methodology by the Contractor and would be subject to additional mitigation measures, if required.

Construction traffic

No traffic counts have been conducted for this Proposal; however the proposed heavy vehicles have been estimated at around 1-5 vehicles per day Monday to Friday. For weekend possession works there would be around 10 heavy vehicles per day. This is a small increase in vehicles compared with existing traffic levels on surrounding roads. Therefore, it is considered that the Proposal would not result in an exceedance of the road traffic noise criteria.

Vibration

Construction scenarios that involve the use of jackhammers or bored piling rigs have the potential to create vibration which disturbs nearby sensitive receivers.

The Noise and Vibration Impact Assessment (AECOM 2016c) concluded that the distances from the nearest receivers to the operation of vibration intensive plant would be sufficient to mitigate potential building impacts including cosmetic damage and would not result in exceedances of human comfort criteria at nearby receivers.

Narwee Station is listed as a heritage item on RailCorp's Section 170 Heritage and Conservation Register and as a heritage item on the *Canterbury Local Environmental Plan 2012*. In order to avoid structural impacts to heritage structures, the proposed works would be undertaken in accordance with the safe working distances outlined in Table 19.

Where work is required within the safe working distances of heritage structures, site-specific safe working distances would be established on-site prior to the vibration generating works commencing.

Vibration intensive work would not proceed within the safe working distances unless a permanent vibration monitoring system is installed approximately one metre from the building footprint, to warn operators in real time (e.g. flashing lights, SMS, or alarm system) when vibration levels are approaching the maximum vibration criteria. In addition, building surveys of sensitive structures within the heritage curtilage would be undertaken in order to assess potential for increased susceptibility to building damage from vibration.

Table 19 Safe working distances of vibration intensive equipment

Plant	Rating/Description	Safe working distance: Cosmetic damage - residential	Safe working distance: Human response
Jackhammer	Handheld	1 m nominal	Avoid contact with structure
Auger bored piling	≤ 800 mm	2 m	2 m

Operational phase

Operational activities at Narwee Station are not proposed to significantly change and as a result the existing noise and vibration levels are unlikely to change.

Plant expected to be associated with the operation of the Proposal includes a new lift which would not produce significant noise emissions. However standard noise controls such as appropriate selection of mechanical plant and adjustments to the PA system should be undertaken during the detailed design phase to achieve the acceptable noise levels identified in the *Industrial Noise Policy.*

No vibration impacts associated with the operation of the Proposal are anticipated.

6.3.3 Mitigation measures

Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the *Construction Noise Strategy* (TfNSW, 2012c) and the Noise and Vibration Impact Assessment (AECOM 2016c).

The CNVMP would be the key management document to prescribe mitigation measures to minimise construction noise and vibration. The measures would focus on contractor inductions, selection and operation of plant and equipment, work scheduling (including respite periods), prescribing safe working distances for vibration intensive equipment, procedures for noise and vibration monitoring and obtaining approvals for out of hours works. The CNVMP would also detail requirements for managing potential vibration impacts to heritage structures through monitoring and safe working distances.

The CNVMP would be supported by the Community Liaison Plan to be prepared for the Proposal, which would detail community notification requirements including letter box drops and phone calls.

As stated in Section 1.1, an alternative construction option is also being considered which may use an extended station closure for around six weeks to allow for an accelerated construction completion, which may reduce the overall program by up to six months. Mitigation measures to address noise and vibration impacts would be determined during detailed design, following further assessment, and included in the CNVMP.

Refer to Table 24 in Section 7.2 for a list of proposed mitigation measures.

6.4 Indigenous heritage

6.4.1 Existing environment

An Aboriginal Heritage Information Management System (AHIMS) search was undertaken for the area covered by the Proposal (the area around Narwee Station) plus a 50 metre radius, on 4 March 2016. The closest Aboriginal site was over one kilometre away and therefore would not be impacted by the Proposal.

The extensive landscape modification and high level of disturbance that has occurred across the Proposal site suggests that intact evidence of Aboriginal land use is unlikely to occur within the boundaries of the Proposal site. The extensive landscape modification and high level of disturbance that has occurred across the Proposal site suggests that intact evidence of Aboriginal land use and culturally sensitive buried landforms are unlikely to occur within the boundaries of the Proposal site. Similarly, the nature of the proposed works would suggest that there is low potential for Aboriginal objects to be impacted.

6.4.2 Potential impacts

Construction phase

Construction of the Proposal would involve some minor excavation and other ground disturbance activities which has the potential to impact Indigenous sites, if present. As no known Indigenous heritage items are located in the vicinity of the Proposal site and the potential for unknown items is considered to be low, the Proposal is unlikely to affect Indigenous heritage during construction.

Operational phase

There would be no risks to Indigenous heritage from the operation of the Proposal.

6.4.3 Mitigation measures

If unforeseen Indigenous objects are uncovered during development, work would cease in the vicinity of the find and the TfNSW Project Manager and TfNSW Environment and Planning Manager are to be notified immediately to assist in co-ordinating next steps which are likely to involve consultation with an archaeologist, OEH and the Local Aboriginal Land Council/s. If human remains are found, work would cease, the site would be secured and the NSW Police and OEH would be notified.

Refer to Table 24 in Section 7.2 for a list of proposed mitigation measures.

6.5 Non-Indigenous heritage

A Statement of Heritage Impact (SoHI) has been prepared by AECOM (2016d) for the Proposal which included a desktop assessment and site inspection of the Proposal site undertaken on 23 February 2016. The assessment of the SoHI is summarised in this section.

6.5.1 Existing environment

A desktop search of historic registers including the World Heritage List, National Heritage List, Commonwealth Heritage List, the Register of the National Estate (non-statutory archive), NSW State Heritage Register, RailCorp's Section 170 Heritage and Conservation Resister and the heritage schedules of the Canterbury LEP and Hurstville LEP was undertaken for the Proposal site and surrounds. In addition a desktop review of historic plans for the station held by the Sydney Trains Plans Room, and other previous reports and documentation was undertaken to inform the assessment.

Database results

The desktop search identified no items listed on the Commonwealth, National or State Heritage Register within the Proposal site or immediate surrounds.

Narwee Railway Station Group, constructed in 1931, is listed on RailCorp's Section 170 Heritage and Conservation Register (No. 4801924). The station is also identified in Schedule 5 of the Canterbury LEP as *'Federation and inter war railway station buildings and pedestrian underpass'* (Item No. I151).

Heritage listed items in and within the vicinity of the Proposal site are listed in Table 20. The extent of the Section 170 heritage listing for the station is shown in Figure 3.

Table 20 Heritage register search results

Heritage List	Heritage Items within vicinity of the Proposal site	Level of Significance
RailCorp Section 170 Register	Narwee Railway Station Group (No. 4801924)	Local
Canterbury LEP 2012	Federation and inter war railway station buildings and pedestrian underpass (No. I151)	Local

Historical background

During construction, the station was known as Podmore. The Tempe-East Hills Railway League's Grand Council suggested the name Graham Park, however, the station was opened as Narwee, which is an Aboriginal word meaning "sun" (RailCorp, 2009. 'Narwee Railway Station Group'). The suburb took its name from the station.

Narwee Station was one of ten similar or identical Inter War suburban railway stations completed in 1931 between Turrella and East Hills. All Platform Buildings on the East Hills line were built to the same general design and plan, to include a Ticket Office, Station Master's office and parcels office. However, Narwee is unusual amongst East Hills stations for its pedestrian subway (underpass) providing access to the brick island platform, one of only two such structures on the East Hills line. The station was originally planned to have stair access from a Penshurst Road overbridge (NSWGR Construction Branch plans dated 1930), which was never constructed (RailCorp, 2009).

Narwee Railway Station Group

The Narwee Railway Station Group comprises of the Platform Building (1931), platform (1931), Booking Office Building (referred in this report as the Ticket Office) (1984), platform canopies (2003) and pedestrian subway (1931). Each of these elements is described in detail below. The SoHI has graded various elements of the station as shown below in Table 21.

Table 21 Narwee Station grading of fabric

Grading	Element meeting criteria
Exceptional	N/A
High	Platform Building, Pedestrian Subway/Underpass (1931)
Moderate	Platform (1931)
Little	Ticket Office (1984)
Intrusive	Platform Canopies (2010)

Platform Building (1931)

The Platform Building is located at the western end of the platform and is a face brick building with cantilevered awnings and corrugated steel roof. It is described in the Section 170 Heritage and Conservation Register listing as an *"austere 1930s platform building with simple Art Deco detailing and fine brick workmanship".*

Windows are timber-framed double-hung, one with original 6-paned top sash, or small timber framed windows with frameless glass or glass louvres. A number of window openings have been bricked up and some sections of brick walling to this building have also been painted over with brown paint. All doors are modern timber flush doors. There is also a nook in the façade providing space for a drink vending machine.

The interior comprises a combined booking/parcels office (Station Master's room), female toilets, waiting room and male toilets. Various electrical conduits have been fitted to the exterior of the building and square profiled downpipes and box gutters are also evident on the exterior, as well an emergency help point intercom and blue metal unit containing an accessible platform-to-train boarding ramp on the northern elevation.

Platform (1931)

The curved island platform is 168 metres in length, with the tracks on either side generally following the curvature. The platform is generally elevated above the adjoining streets on the northern and southern approaches. The platform is wide in the middle (around 9.6 metres) and narrower at the ends (around 6.4 metres) and is a typical curved platform type). It has an asphalt capping and in some areas the original brick detailing can be seen beneath flaking paintwork.

Ticket Office (1984)

The Ticket Office comprises a rectangular brick platform building with awnings on north and south sides, with a shallow pitched corrugated steel roof, timber flush doors and aluminium framed windows. This building was constructed in 1984 and is proposed for demolition as part of the current package of works.

Platform canopies (2003)

Between the two platform buildings is a modern butterfly canopy structure constructed in 2010 to replace the earlier canopy constructed in 2003 with a gabled corrugated steel roof, and

metal mesh screen on the western side. It is supported by steel posts on concrete bases. It has been attached to the eastern end of the Platform Building with a poorly reconciled junction of the lower canopy and the building's northern awning.

Pedestrian subway (1931)

This is a brick structure with a gabled corrugated steel roof which projects above the platform towards the eastern end of the platform. The interior is tiled, and walls are brick or painted brick. The name of the station "Narwee" is in raised painted lettering in an Art Deco style above the street entrances to the pedestrian subway. This element has been subject to significant impacts from the 2013 rail quadruplication project, resulting in nearly complete visual obstruction, particularly on the northern side, through an 'encasement' of original entrance fabric.

Additional elements

There is a heritage interpretation sign on both the northern and southern entrance to Narwee Station. The sign provides a brief historical description of the coming of the railroad to the area and a historic photo of the Official Opening of the line between Kingsgrove and East Hills on 19 December 1931.

Statement of significance

Narwee Station has been assessed against the State Heritage Register criteria in the Section 170 Heritage and Conservation Register to determine the level of significance and related statutory protection. The assessed significance is provided in Table 22.

Table 22 Narwee Railway Station Group statement of significance (OEH, 2009)

SHR Criteria	Statement
Historical significance	Narwee Station is of historical significance as part of the East Hills line, a major 1930s Depression-era public work undertaken under the controversial Premiership of Jack Lang and through its relationship to the development of the suburb of Narwee and the broader East Hills region. That the suburb was named after the railway station is evocative of the historical relationship between the railway station and the development of the suburb.
Aesthetic significance	Narwee Station is of aesthetic significance as an example of a small Inter-War period suburban railway with its 1931 platform and Platform Building matching other East Hills line railway stations in design and style. The Platform Building is very austere in style, with Inter War Art Deco style touches (for example brick strapwork detail to parapets) and is competently executed, exhibiting fine workmanship in its brickwork. The Platform Building is noted for its use of monochromatic brickwork, stepped parapets, irregular fenestration and engaged piers. Narwee is unusual amongst East Hills Railway Stations for its pedestrian subway, one of only two such structures on the East Hills line.
Social significance	The place has the potential to contribute to the local community's sense of place and can provide a connection to the local community's history.
Technical/Research significance	Narwee Station is of research significance for its ability to demonstrate design and construction techniques of the Inter War period. The 1931 Platform Building provides insights into NSW Railways experimentation with styles of architecture and adaptation to Depression period economic conditions.

SHR Criteria	Statement
Rarity significance	The Narwee Station 1931 Platform Building is not rare, as it is part of a cohesive group of 10 similar to identical Inter War suburban railway buildings completed in 1931 between Turrella and East Hills. The pedestrian subway structure is relatively rare, as one of only two such structures on the East Hills line.
Representativeness criteria	Narwee Station is a good representative example of a small, Inter War East Hills line railway station, with some later structures.
Integrity/Intactness criteria	The 1931 Platform Building and the 1931 pedestrian subway have retained a moderate degree of integrity externally and internally, though some brickwork to the subway has been painted, and a separate 1984 ticket office has been added to the platform.

Archaeological heritage potential

Early descriptions of the Narwee area indicate that the region was covered in a dense Ironbark forest. Robert Gardener cleared a portion of the original 1809 land grant, but it is unlikely that the entire property was ever under cultivation. In the late nineteenth and early twentieth century, the land was either unused or used for small orchard, dairying and poultry farms.

Archaeological evidence relating to the pastoral history of the site would be expected to have been ephemeral in nature. Early 19th century evidence relating to this land use, such as fences / postholes, furrows, tracks and early dams, is likely to have been destroyed or displaced during the original construction of the railway line.

There is some potential for remains of the early twentieth century rail construction program to have survived below ground or within structural cavities (voids) across the site, which may include mechanism platforms, metal bracing, track systems, formwork, services, etc. Artefacts related to the social culture of the labourers may also be located, such as small personal objects, common beverage bottles, ceramic and pottery fragments.

There are no specific areas of archaeological sensitivity within the Proposal area. However there is a potential for locating general historic items, e.g. during excavations within the rail corridor. To mitigate the discovery of unknown heritage items TfNSW's *Unexpected Heritage Finds Guideline* (TfNSW, 2015a) would be implemented.

6.5.2 Potential impacts

Construction phase

Narwee Railway Station Group

The objectives of the Proposal are to improve accessibility and the amenity at Narwee Station through a range of upgrade works. As discussed in Section 3.1, the Proposal would involve the following activities that have the potential to directly impact existing heritage elements of the Narwee Railway Station Group:

- demolition of existing structures including the Ticket Office and existing stairs
- partial demolition of the underpass walls to integrate the new stairs and lift layout
- refurbishment of the Platform Building including modifications to the room layout (including demolition of some internal partition walls and opening of the eastern façade for a new Customer Information Window)) while minimising external modifications to maintain the original character of the building.

The removal of the Ticket Office would have negligible heritage impact as this structure was constructed in 1984 and is not of heritage significance. Its removal would enhance the historical and aesthetic significance of Narwee Railway Station Group by returning to the original station layout.

The demolition of existing stairs and partial demolition of the underpass walls to integrate the new stairs and lift would lead to modifications and loss of original fabric. However, the Proposal would contribute to Narwee Station's ability to demonstrate the evolution of a medium sized railway station to the changing expectations and requirements of rail customers.

The opening of the eastern façade of the Platform Building for a new Customer Information Window would lead to a loss of original fabric, however the proposed refurbishment and re-purposing of the Platform Building has the potential to have a positive impact by increasing the visibility, profile and appreciation of the building, and thus the station's historical presence. The refurbishment would not impact on the existing five bay layout of the Platform Building and would only reconfigure those rooms with new partition walls.

The temporary pedestrian access bridge (if required) would intrude on the heritage precinct during construction, but as it is not a lasting form, it would have no long-term heritage impacts.

The new canopy would be designed to closely mirror the design of the existing canopies to achieve visual consistency and the design of the new lift has been developed to minimise the visual impact on the heritage station precinct through the design, form and proportions.

Heritage significance

The Proposal would result in impacts to aesthetic and rarity significance of Narwee Railway Station Group from the partial demolition of the pedestrian subway. However, these works are required for station facilities to comply with key requirements of the *Disability Standards for Accessible Public Transport 2002* and Commonwealth *Disability Discrimination Act 1992*. It is proposed to mitigate some of this impact through heritage interpretation.

The Proposal has the potential to positively impact on the historical, aesthetic and social significance through provision of equitable access to the station, refurbishment of the under-utilised Platform Building (1931), and establishing the original layout of the station group through removal of the Ticket Office (1984). The refurbishment of the Platform Building presents an opportunity to rectify 30 years of unsympathetic modifications to its façade, however there would be some minor impact to the external façade. It is recommended that the detailed design process avoids further internal impacts to retain the fundamental aspects of the Platform Building's heritage character.

The temporary enabling works and landscaping would have no long-term impacts on the assessed heritage significance.

Archaeological heritage potential

There are no known potential archaeological sites in the Proposal site which is outside known earlier development other than the establishment of the existing suburb and construction of the railway line and station. The proposed works are located within the existing platform area and are unlikely to impact on potential archaeological evidence of the historic land use or construction of the station.

Operational phase

The operation of the Proposal would not present an impact on non-Indigenous heritage.

6.5.3 Mitigation measures

A number of mitigation measures would be implemented during detailed design and construction of the Proposal to minimise/avoid heritage impacts. Following completion of

works, the RailCorp Section 170 Heritage and Conservation Register listing description and historical context should be updated to reflect the new works.

Detailed design

The detailed design and construction of the Proposal would be undertaken with consideration to the heritage values of the station.

In order to minimise impacts on the heritage fabric of the station, the following mitigation measures would be implemented during detailed design:

- a Heritage Management Plan (including detailed drawings, documentation and specifications) and Work Method Statement would be prepared as part of the CEMP to address heritage impacts and required management procedures to minimise risks. It would be prepared by the heritage architect and would be submitted to TfNSW. The following aspects should be addressed:
    - the detachment of the platform canopies at both ends of the Platform Building
    - restoration of fabric where feasible, such as 6-pane sash windows
    - selection of paint colour for joinery appropriate to the era and style
    - the unblocking of bricked-in windows and doors
    - the installation of the new Customer Information Window
    - removal of all visually invasive conduits and downpipes from the east elevation of the building and relocate
    - fit out of rooms, where preference is to attach new electrical and communication systems boards to new internal partition walls.
- remove recent paint from subway tiles to re-expose the original Art Deco design and allow original design to meet new modern tiles (colour scheme in keeping / complementary to original) of lift alcove. New colour scheme should be submitted to TfNSW along with the Platform Building Plan of Works for approval.
- the existing Heritage Interpretation Signage at the entrances would be updated to include historic photos of the original pedestrian subway entrances (prior to the 2013 K2RQ works) and a discussion of the significance of design style (Inter War Functionalist and Art Deco) along the East Hills railway line.
- the original 1930's concrete station entrance "Narwee" name sign is essential and would be retained and kept visible (e.g. no new wayfinding signage should obscure the lettering).
- archival recording of the station as a whole prior to the commencement of construction following NSW Heritage Division guidelines *Photographic recording of heritage items using film or digital capture* (NSW Heritage Office, 2006) and *How to prepare archival records* (NSW Heritage Office, 1998).Copies would be provided to Canterbury City Council and Sydney Trains for future reference. In particular the following elements the following elements would be concentrated on:
    - Platform Building (1931)
    - Pedestrian Subway (pedestrian underpass) and stairs (1931)
    - Ticket Office (1984).

Construction

Potential impacts to non-Indigenous heritage during construction would be managed through the implementation of the CEMP. The CEMP would prescribe management measures to

ensure impacts to the heritage fabric of the station are minimised, and impacts to archaeological relics or deposits are avoided. The CEMP would include the following measures:

- a heritage induction would be provided to all on-site staff and contractors involved in the project and would clearly layout the heritage constraints of the site
- inclusion of stop work procedures in the in the unlikely event that intact archaeological relics or deposits are encountered in accordance with TfNSW's *Unexpected Heritage Finds Guideline* (TfNSW, 2015a)
- no further intrusions should be made into subway walls other than the works required for the lift and additional elements should be fixed or adhered to the walls.

Refer to Table 24 in Section 7.2 for a list of proposed mitigation measures.

6.6 Socio-economic impacts

6.6.1 Existing environment

Land use adjacent to Narwee Station comprises residential, commercial, recreational and school uses. The area to the north of the station is characterised by residential (medium to high density), recreational (Frappell Reserve to the west and Kardella Reserve to the east) and commercial (retail, predominantly on Penshurst Road and the Narwee Hotel). The area to the south of the station is characterised by residential (low to medium density), schools (Narwee Public School) and commercial (retail, restaurants and cafes).

Educational and religious facilities in the vicinity of the Proposal include:

- Narwee Public School directly adjacent to the rail corridor to the south-west
- Beverly Hills Montessori Christian Preschool around 170 metres to the south
- Goodstart Early Learning Narwee around 180 metres to the south-west
- Salvation Army Narwee Corps (Church) around 230 metres to the north
- Narwee Preschool Kindergarten around 250 metres to the south-east.

The land surrounding the station is zoned as the Narwee local town centre.

The closest residential properties are immediately adjacent to the Proposal site on Fisher Place and Hannans Road (both approximately 22 metres from the site).

Currently there is limited visual surveillance and poor lighting around Hurst Place and Fisher Place.

6.6.2 Potential impacts

Construction phase

The construction of the Proposal utilising a temporary pedestrian access bridge (if required) has the potential to temporarily impact customers, pedestrians, residents, motorists, businesses and other receivers as a result of:

- changes to accessing station entry points, platforms and nearby footpaths as well as temporary changes to facilities such as the Ticket Office and toilets
- temporary loss of an access path across the railway for customers and the public using the pedestrian underpass to travel from Hannans Road to Hurst Place and a longer path of travel travelling across the temporary pedestrian access bridge

- temporary loss of parking within the Hannans Road commuter car park and on nearby streets (particularly on Hannans Road and Hurst Place)
- temporary changes to existing bus, taxi and kiss and ride facilities
- small increase in truck movements delivering site materials, plant and equipment
- construction noise, dust and visual impacts.

As discussed in Section 1.1, an alternative construction option is being considered which would necessitate the temporary closure of Narwee Station for a period of around six weeks to allow for a reduced construction duration. This would minimise the overall construction related impacts to the local community, but would be an inconvenience for rail customers. Buses would replace trains during this period.

For customers and the public travelling from Hannans Road to Hurst Place, there is an alternative access beneath the railway along Broad Arrow Road, around 90 metres to the east of the station but this would result in longer walking distances. If constructed the temporary pedestrian access bridge would also allow this access to be maintained.

Access for emergency services would be maintained at all times and it is not anticipated that access to residential properties would be significantly affected during construction of the Proposal.

Operational phase

Overall, the Proposal would provide positive socio-economic benefits to Narwee and the Canterbury LGA, including:

- improved accessibility for customers at Narwee Station providing an accessible route to station platforms through the provision of a lift, new stairs and a raised pedestrian crossing at the southern station entrance
- improved customer amenity and facilities at the station including canopies for weather protection along with a new Customer Information Window and Family Accessible Toilet
- new transport interchange facilities including kiss and ride areas, additional bicycle facilities with shelters, upgraded bus shelter, wayfinding signage upgraded and new accessible parking on both sides of the station
- improved lighting and CCTV coverage at Hurst Place and Fisher Place and the Hannans Road commuter car park
- potential increased use of public transport to and from Narwee.

6.6.3 Mitigation measures

A number of environmental safeguards would be implemented to minimise potential impacts on the community with a particular focus on keeping the community informed including:

- mitigation measures in respect of potential impacts on amenity (e.g. noise, dust and visual) as assessed in the relevant sections of this report and listed in Section 7.2 of this report
- establishment of sustainability criteria for the Proposal to encourage construction personnel to purchase goods and services locally helping the local community
- development of a Community Liaison Plan (to be developed by the Contractor prior to construction) which would identify potential stakeholders and the best-practice methods for consultation with these groups during construction. The Plan would also

encourage feedback and facilitate opportunities for the community and stakeholders to have input into the project, where possible

- informing the community of construction progress, activities and impacts in accordance with the Community Liaison Plan
- providing contact details for a 24-hour construction response line, Project Infoline and email address provided for ongoing stakeholder contact throughout the construction phase

As stated in Section 1.1, an alternative construction option is also being considered which may use an extended station closure for around six weeks to allow for an accelerated construction completion, which may reduce the overall program by up to six months. If the temporary station shutdown construction option is adopted, replacement shuttle buses would be provided between Narwee and its adjacent stations (Beverly Hills and Riverwood) at suitable intervals for the duration of the shutdown. Additional mitigation measures would be determined during detailed design, following further assessment, in consultation with the relevant authorities and the local community.

Refer to Table 24 in Section 7.2 for a list of mitigation measures.

6.7 Biodiversity

An Arboricultural Impact Assessment was undertaken for the Proposal (Birds Tree Consultancy, 2016). A site inspection by a qualified arborist was undertaken on 25 February 2016 which included inspection of all trees within areas that may be impacted by the Proposal from ground level. A Visual Tree Assessment was undertaken in accordance with *Visual Tree Assessment Guidelines* (Mattheck and Breloer, 1994). The findings of the assessment are summarised in this section.

6.7.1 Existing environment

The Proposal is located within an urban area which has been modified by a long history of disturbances which have resulted in clearance of native vegetation and replacement by native and exotic vegetation / trees planted as part of infrastructure landscaping works. There are existing stands of mature vegetation along the verges of Hannans Road and other trees planted around the edges of roads and the rail corridor to provide screening.

One class four noxious weed Privet (*ligustrum lucidum*) was identified during the site inspection. Additional species of noxious weeds may be present within the densely vegetated areas, particularly within the rail corridor.

A search of the Atlas of NSW Wildlife (February 2016) found records of 39 threatened species listed under the TSC Act within a 10 kilometre radius of Narwee Station, though none of these records were from within the immediate vicinity of the Proposal site. The nearest recorded threatened species was Downy Wattle (*Acacia pubescens*) (listed as vulnerable) a flora species located around 360 metres from the site. Few fauna species were observed during the site inspection and little fauna habitat is present within the study area.

The tree population of the Proposal site was assessed and the following was identified:

- 87 trees/stands of trees were identified within the Proposal site, Trees 50 and 51 represent stands of Paper-bark (*Melaleuca quinquenervia*)
- the tree population of those assessed in the Proposal site are made up of species that are regularly used as landscaping plants including seven exotic species, 13 Australian native species and one hybrid cultivar of an Australian native species

- none of the subject trees are identified as threatened species or as endangered ecological communities under the provisions of the *Threatened Species Conservation Act 1995* or the *Environmental Protection and Biodiversity Conservation Act 1999*
- no hollow bearing trees were identified within the Proposal site
- some of the indigenous trees/stands of trees identified at the site could be potential nesting habitat for native bird species
- a total of 81 trees are viable to be retained and are to be protected as defined in Section 6.7.3.

Appendix D contains a detailed list of the trees identified and assessed as part of the Arboricultural Impact Assessment.

Tree protection zones were defined for the subject trees in order to define the encroachment of the proposed development in accordance with *Australian Standard AS4970- 2009 Protection of Trees on Development Sites*. The tree protection zones required have been taken as a circular area with a radius 12 times the diameter at breast height of the tree in line with AS 4970-2009. The standard defines a maximum of 10 per cent encroachment and for any encroachment over 10 per cent it's recommended that a site arborist undertake further assessment to determine the viability of the tree due to the proposed activities.

Figure 24 presents the locations of the trees identified and assessed as part of the Arboricultural Impact Assessment and shows the tree protection zones.

Figure 24 Trees / stands of trees and tree protection zones

6.7.2 Potential impacts

Construction phase

Construction activities associated with the establishment of the proposed temporary construction compound adjacent to Fisher Place and the temporary pedestrian access bridge across the station may require the removal of a stand of nine Paper-bark *Melaleuca quinquenervia* trees and a single Robinia *Robinia pseudoacacia 'Frisia'* tree (identified as tree 51 and 84 in Figure 24 respectively). Table 23 provides further details of the potentially impacted trees.

Table 23 Trees potentially impacted as part of the Proposal

Tree No.	Species	Common name	DBH/D[3] (mm)	Associated with local TEC[2]	Offsets required if removed[3]	Note
51	*Melaleuca quinquenervia*	Broad-leaved paper bark	Average 95 mm	No	18	Stand of 9 small trees
84	*Robinia pseudoacacia 'Frisia'*	False Acacia	530 mm	No	4	Medium tree

Notes:

1. *Diameter Breast Height*
2. *Threatened Ecological Communities*
3. *TfNSW, 2013, Vegetation Offset Guide, Sydney (TfNSW 2013d)*

The stand of nine mature Paper-bark *Melaleuca quinquenervia* trees (identified as Tree 51) comprises trees around four metres tall with a canopy spread of two metres. The stand has an approximate average diameter breast height of around 95 millimetres. These trees are in good health and condition with minimal deadwood and epicormic growth[6] and have been assessed as having between 15 and 40 year lifespans. These trees may be impacted to accommodate the temporary pedestrian access bridge if required. Should it be determined that the temporary pedestrian access bridge is required, further assessment would be undertaken during detailed design to investigate opportunities to avoid and/or minimise impacts to these trees.

Tree 84 is a mature exotic specimen of Robinia *Robinia pseudoacacia 'Frisia'* and is approximately 11 metres tall with a canopy spread of 12 metres. The tree has a single trunk with a diameter breast height of 530 millimetres, is in good health and has minimal deadwood and epicormic growth. Removal of this tree may be required to accommodate the establishment of the proposed construction compound adjacent to Fisher Place. Further assessment would be undertaken during detailed design to investigate opportunities to avoid and/or minimise impacts to this tree.

The proposed northern construction compound area adjacent to Hannans Road is within the Tree Protection Zones of trees 40-48 and 50. There is potential for root damage if this area is excavated or used for vehicle and / or materials storage (from compaction). The use of this area would be restricted for use as a location for site sheds or containers supported on a suitable pad footing, adequate to prevent root damage and approved by an arborist prior to installation. No storage of plant, materials or parking of vehicles would be permitted in this area to prevent root damage (from compaction) to trees 40-48, 50.

[6] Epicormic growth is off-shoots on a tree trunk that typically occurs when tree bark is damaged.

There is a potential for the proliferation of weed species as a result of the construction activities without appropriate management strategies. Construction activities have the potential to disperse weeds including species listed as noxious under the *Noxious Weeds Act 1993*. Construction activities also have the potential to import new weed species into the study area. The mitigation measures outlined in Section 6.7.3 would ensure that weed and pathogen importation and spread is minimised.

During construction, noise, dust, light and contaminant pollution is predicted to be minimal, however there may be some indirect impacts to fauna species that may use the adjacent trees as habitat. The mitigation measures outlined in Table 24 would ensure that these indirect impacts would be minimised.

Operational phase

Operational activities at Narwee Station are not proposed to significantly change, and as a result there would be no increased risk to biodiversity.

6.7.3 Mitigation measures

All trees with Tree Protection Zones within 10 metres of proposed work zones (shown in Figure 24) are to be protected and shall be clearly identified and all TPZs surveyed. This includes trees 20, 21, 22, 23, 39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 50, 82, 83. Tree protection would be undertaken in line with *AS 4970-2009 Protection of Trees on Development Sites* and would include exclusion fencing of TPZs.

TfNSW has prepared a *Vegetation Offset Guide* (TfNSW, 2013d) to provide a framework for a consistent approach to offset impacts to vegetation on applicable TfNSW projects and allows for appropriate offsets to be applied for one tree or a group of trees that do not form part of a vegetation community, regardless of whether they are native or not.

Trees are to be retained where feasible and reasonable, however should any trees be removed as part of the Proposal new trees would be planted to meet TfNSW's offset ratio, as a minimum. Those that have been identified for potential removal include one Robinia *Robinia pseudoacacia 'Frisia'* and stand of nine mature Paper-bark *Melaleuca quinquenervia* trees which would require a minimum of 22 trees to meet TfNSW offset ratios. Additional trees that are found to require removal during construction would also need to be approved by TfNSW and offset. Such measures and procedures for tree assessment and removal would be included and implemented as part of the CEMP for the Proposal. This would also include checking trees for active nests, prior to their removal.

Weed control measures, consistent with TfNSW's *Weed Management and Disposal Guideline* (TfNSW, 2015f), would be developed and implemented as part of the CEMP to manage the potential dispersal and establishment of weeds during the construction phase of the project. This would include the management and disposal of weeds in accordance with the *Noxious Weeds Act 1993.*

Refer to Table 24 in Section 7.2 for a list of proposed mitigation measures.

6.8 Contamination, landform, geology and soils

Geotechnical and contamination investigations were undertaken as part of the development of the concept design (Jacobs, 2015). The findings of these investigations are summarised in this section.

6.8.1 Existing environment

Geology and soils

Narwee Station is situated at grade to the west with the platform transitioning into fill in the east. Ground levels dip downwards to the east, with the rail platform constructed above existing ground level on fill near the pedestrian underpass (approximate height of four metres).

The Sydney 1:100 000 geological map published by the NSW Geographical Survey for Sydney indicate that the geology of the Proposal site is comprised of fill (earth fill above natural ground level) and Ashfield Shale described as 'Rwa' (containing grey shales, laminite and fine to medium grained sandstones) from the Wianamatta Group (Department of Mineral Resources, 1983).

Geotechnical investigations undertaken near to the underpass indicated that fill material was encountered to a depth of 0.9 metres. Residual silty clay occurred between 0.9 metres and 2.85 metres, with varying shale units from 2.85 metres to 6.6 metres (a lower strength shale up to 3.8 metres and medium strength shale up to 6.6 metres). Laboratory testing indicated residual clay soils classify as a silty clay, medium plasticity clay and are considered moderately to highly reactive.

Acid sulfate soils

A review of the Australian Soil Resource Information System (ASRIS) National ASS database indicated that there is a low probability of occurrence for acid sulfate soils to occur within the vicinity of the Proposal site.

Salinity

The *Western Sydney Salinity Map* (Department of Infrastructure, Planning and Natural Resources, 2002) indicates that there is a moderate salinity potential within the Proposal site.

Contamination

Contamination investigations undertaken during the concept design development (Jacobs, 2015) did not identify contamination at the proposed location of the lift shaft and did not identify exceedances above normal commercial/industrial land uses in the sample analysed. The *AS 4482.1-2005 - Guide to the investigation and sampling of sites with potentially contaminated soil - Non-volatile and semi-volatile compounds* lists the chemicals used by specific industries. The Standard lists the following chemicals that are commonly associated with railway yards::

- hydrocarbons
- arsenic
- phenolics
- heavy metals
- nitrates and ammonia.

A search on the NSW EPA Contaminated Land Register identified no registered sites near the Proposal site. Caltex service station is located around 40 metres to the south of Narwee Station on Broad Arrow Road with an entrance from Hurst Place.

The risk of impacts from contamination (if any) on human health (workers and general public) from the construction activities is considered to be low and the risk of impacts from contamination (if any) on receiving environments from the construction activities is also considered to be low.

Based on the results of the fieldwork and laboratory analysis, the preliminary waste classification of the material sampled would be general solid waste (non-putrescible). Natural material below surface soils could potentially be classified as Virgin Excavated Natural Material.

Asbestos and hazardous materials

No asbestos was identified during contamination investigations as fragments or as available fibres in the samples analysed. However, the desktop contamination assessment identifies potential building/structure degradation products, contaminant residues adjacent to wooden building structures, railway sleepers and spills and leaks from trains to be a high to moderate risk for construction workers.

6.8.2 Potential impacts

Construction phase

The Proposal would require excavation work for the installation for the foundations and footings for the lift shaft pit and canopy, demolition of the existing Ticket Office and reconfiguration of the Platform Building, the platform regrade and extension and the installation of the temporary pedestrian access bridge (if required).

Other trenching or excavation may be required for footpath and road works, relocation of services, drainage works, new lighting, bicycle parking and shelters, kerb ramps and tree removal.

Soil disturbance

Excavation and other earthworks such as trenching and stockpiling activities, if not adequately managed, could result in the following impacts:

- erosion of exposed soil and stockpiled materials
- dust generation from excavation and vehicle movements over exposed soil
- increase in sediment loads entering the stormwater system and/or local runoff.

These impacts are considered to be low due to the limited level of ground disturbance and site terrain (i.e. relatively even slope). However, it is expected that erosion risks could be adequately managed through the implementation of standard measures as outlined in the 'Blue Book' *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom, 2004).

Contamination

Excavation has the potential to expose contaminants, which if not appropriately managed, can present a health risk to construction workers and the community. Contaminants would also pose an environmental risk if they were to enter nearby waterways through the stormwater infrastructure. As there is potential for onsite contamination, chemical testing and visual characterisation would be undertaken to confirm the composition and nature of excavated material. Where spoil is classified as unsuitable for reuse it would be transferred to an appropriately licensed offsite facility.

There is also potential for activities to result in the contamination of soil through accidental fuel or chemical spills from construction plant and equipment.

The proposed demolition of the Ticket Office has the potential to disturb asbestos containing materials and other hazardous substances such as lead paint from the building structure. Appropriate mitigation measures would be implemented to manage hazardous substances during the demolition (refer Section 7.2). This would include the removal of all hazardous materials from the building by appropriately licensed asbestos/hazardous waste removalists and the provision of a clearance certificate (by an appropriately qualified hygienist) prior to the

demolition of the building. The management of asbestos and hazardous waste is discussed further in Section 6.11.

Operational phase

There would be no operational risks to geology or soils as a result of the Proposal.

6.8.3 Mitigation measures

As part of the CEMP, a site-specific Erosion and Sediment Controls Plan/s would be prepared and implemented in accordance with the 'Blue Book' - *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom, 2004). The Erosion and Sediment Control Plan would be established prior to the commencement of construction and be updated and managed throughout according to the activities occurring during construction.

An environmental risk assessment is to be undertaken prior to construction and must include a section on contamination as per the TfNSW Standard Requirements. Measures to mitigate potential impacts from contaminated soil/materials during construction would be developed and implemented through an unexpected contamination finds procedure and Waste Management Plan as part of the CEMP. All waste would be managed in accordance with relevant legislation.

Refer to Table 24 in Section 7.2 for a list of mitigation measures.

6.9 Hydrology and water quality

A flooding assessment was undertaken during the concept design (Jacobs, 2015) and further augmented by a Stormwater Drainage Investigation and Assessment (AECOM, 2015).

6.9.1 Existing environment

Surface water

Narwee Station is located in the upper reaches of the 2200 hectare Wolli Creek catchment which drains into the Cooks River at Tempe. The upper reach of the catchment is drained through a mixture of lined channels and underground stormwater networks.

The area around Narwee Station is drained through an underground stormwater network. The network surfaces around 200 metres south east of the station into a lined channel near Rasdall Park. Water generally drains from west to east along Hannans Road and Broad Arrow Road parallel to the station.

The quality of surface water runoff in the vicinity of the Proposal site would be impacted by the existing land uses, including the operation of local roads and the rail corridor.

Groundwater

A search of the Department of Primary Industries – Office of Water Groundwater Map identified no groundwater monitoring bores within 500 metres of the Proposal site.

Groundwater was not encountered during the geotechnical investigation which included boreholes to a maximum depth of 10.47 metres (Jacobs, 2015). However, groundwater levels may change over time due to seasonal or other influences such as high rainfall events.

Flooding

There is a kerb lintel pit with a grate on the southern side of the station which captures flows from Hurst Place and flows that come down the footpath from Fisher Place. Two additional pits are located within the underpass that captures flows that make it into the underpass. Pipes

from these pits connect up to the RailCorp drainage system that runs parallel to the railway line on both sides.

A flooding environmental assessment prepared for the Kingsgrove to Revesby Quadruplication project in 2007 identified Narwee Avenue and Narwee Substation as areas that experience flooding. These areas are to the west of the Narwee Public School and outside the Wolli Creek catchment area. Narwee Station is not affected by flooding at these locations (Jacobs, 2015).

A desktop assessment found that Narwee Station does not have a history of flooding. The position of the station within the catchment and analysis of historical flooding information indicates that the risk of flooding at the station is low (Jacobs, 2015).

There is a flooding risk from stormwater running down the slope from the west and entering into the underpass however this appears unlikely as the underpass does not appear to be a conduit for flows. Flows would go down the slope and typically bypass the underpass. The presence of the grated lintel kerb (drainage pit entry) on the southern side would capture the majority of these flows. The large lintel size combined with a grated entry mean that it would be unlikely for blockage to occur. It is assumed that this pit is not designed for a large magnitude flooding event. As a result, culvert surcharge in a larger storm event is a likely possibility. Analysis of the local topography indicates that water exiting the pit would flow towards the east down the driveway of the adjacent property.

The southern and northern entrance is bunded to reduce the likelihood of water overtopping the kerb and flowing into the underpass. A small catchment area (less than 50m^2) would contribute directly to flows that could make their way into the underpass. This would generate minimal flows that would be captured by the existing drainage system within the underpass (Jacobs, 2015).

6.9.2 Potential impacts

Construction phase

Without appropriate safeguards, pollutants (fuel, chemicals or wastewater from accidental spills, and sediment from excavations and stockpiles) could potentially reach nearby stormwater drains and flow into waterways.

Activities which would disturb soil during construction work have the potential to impact upon local water quality as a result of erosion and run off sedimentation.

Direct impacts to the underground stormwater network may occur from station demolition and construction activities. Appropriate controls would be detailed in the CEMP and established to ensure the drainage points are adequately protected during construction activities.

Moderate to heavy wet weather events may cause localised flooding which could increase the potential for soil erosion and sedimentation impacts. Works would need to ensure that the drains inside the underpass are kept unobstructed during construction.

Operational phase

The Proposal would have little to no impact upon the hydrology in the surrounding area. The overall impervious area is not expected to change and the new construction would not block any overland flow paths. The detailed design would take stormwater management into consideration and while the new design does require some drainage modifications to the outlet, such works would be designed and undertaken in accordance with the relevant standards and requirements (AECOM, 2015).

The final drainage arrangements are subject to detailed investigations and assessment during the detailed design phase. Canterbury City Council would also need to be contacted to gain permission and approval to discharge additional stormwater from the station into the council's existing drainage system.

6.9.3 Mitigation measures

During detailed design further hydrological assessment would be undertaken during to determine final drainage arrangements and flooding risks (an assessment has been completed for the concept design stage only).

As noted in Section 6.8.3, an Erosion and Sediment Control Plan would be prepared and implemented for the Proposal to manage risks to water quality. This would include specific controls to protect the underground stormwater network within the Narwee Station site. Other mitigation measures that would be required for construction include regular vehicle and equipment maintenance along with spill kits and spill response procedures. Dewatering (if required) would be undertaken in accordance with TfNSW's *Water Discharge and Reuse Guideline* (TfNSW, 2015b).

Operational risks associated with localised flooding would be addressed during detailed design of the Proposal.

Refer to Table 24 in Section 7.2 for a list of mitigation measures.

6.10 Air quality

6.10.1 Existing environment

Based on the land uses surrounding the Proposal site, the existing air quality is considered to be characteristic of an urban environment. Sensitive receivers in the vicinity of the Proposal include staff and customers at Narwee Station, the Narwee Public School and residential and commercial properties around the station.

A search of the National Pollutant Inventory undertaken on 1 March 2016 for the 2013 to 2014 reporting period identified 18 air polluting substances from two sources in the Canterbury and Hurstville LGA. The closest source was identified at 62 Belmore Road, Punchbowl about two kilometres north-west of the Proposal site.

Other contributors to air quality within the study area would include emissions from motor vehicles on the surrounding road network and the diesel trains on the adjoining rail corridor.

6.10.2 Potential impacts

Construction phase

The key air quality impacts that have the potential to occur during construction would be temporary impacts associated with dust particles and emissions of carbon monoxide, sulphur dioxide, particulate matter (PM_{10}), nitrous oxides, volatile organic compounds and polycyclic aromatic hydrocarbons associated with the combustion of diesel fuel and petrol from construction plant and equipment.

Anticipated sources of dust and dust-generating activities include:

- excavation for the lift shaft and canopy
- other trenching and excavation for footpath and road works, the platform regrade and extension, relocation of services, drainage works, installation of the temporary pedestrian access bridge (if required), lighting, kerb ramps, bicycle shelters and tree removal (if required)
- demolition of the Ticket Office including potential for lead dust and asbestos dust and reconfiguration of the Platform Building
- stockpiling activities

- loading and transfer of material from trucks
- other general construction activities.

The Proposal would have a minimal impact on air quality as it would not involve extensive excavation or other land disturbance with the potential to generate significant quantities of dust. Appropriate measures would be established to manage dust emissions from demolition works.

The operation of plant, machinery and trucks may also lead to increases in exhaust emissions in the local area however these impacts would be minor and short-term.

The implementation of standard air quality management controls (listed in Section 7.2) would minimise the potential for air quality impacts.

Operational phase

Overall impacts of air quality during the operation of the Proposal are considered minimal as the Proposal would not result in a change in land use. Also, as the Proposal would increase access to public transport, the use of public transport would be anticipated to increase and subsequently aim to achieve a relative reduction in private vehicle related emissions in the long-term.

6.10.3 Mitigation measures

Section 7.2 provides a list of mitigation measures that are proposed to manage air quality issues during construction. They are aimed around maintaining and operating plant and equipment efficiently and implementing measures for dust suppression including watering, covering loads and appropriate management of tracked dirt/mud on vehicles. Such measures would be included in the CEMP to be prepared for the Proposal.

A Demolition Management Plan would also be prepared as part of the CEMP and would include mitigation measures to manage and monitor dust emissions (including lead and asbestos dust) from the existing Ticket Office.

6.11 Other impacts

6.11.1 Waste

Construction of the Proposal would generate the following waste:

- surplus building materials
- asphalt and concrete
- hazardous chemical wastes (including paint tins)
- earthworks spoil
- building material wastes (including metals, timbers, plastics, packaging, fencing etc.)
- electrical wiring and conduit waste (from electrical connections)
- demolition waste from the Ticket Office including potential asbestos and hazardous waste (such as lead painted timber from the stairs and pedestrian underpass)
- general waste, including food scraps generated by construction workers.

The Proposal would not result in changes to operational waste management arrangements.

Careful planning of construction activities would ensure that the volume of surplus materials is minimised. A Demolition Management Plan would be prepared as part of the CEMP for the

demolition of the Ticket Office. This plan should include procedures for the removal, handling, storage and disposal of hazardous materials and asbestos.

Waste management would be undertaken in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). A Waste Management Plan would be prepared that would identify all potential waste streams associated with works and outline methods of disposal, reuse and recycling as well as other onsite waste management practices.

The application of the *NSW Sustainable Design Guidelines – Version 3.0* (TfNSW, 2013a) would also result in waste management targets to be developed for the Proposal and would include reuse and recycling.

The handling, storage, transport and disposal of all asbestos and hazardous waste (including lead waste) would be in accordance with the requirements of the PoEO Act, WARR Act and relevant guidelines.

Refer to Section 7.2 for a list of mitigation measures

6.11.2 Utilities

Detailed site survey drawings show there are numerous electrical, drainage, communication and signalling services on the platforms and within the footprint of the proposed construction activities. The services impacted by the Proposal would need to be relocated to enable Narwee Station to remain operational during the redevelopment.

A Dial Before You Dig enquiry was lodged to obtain information on existing services/utilities in and adjacent to the Narwee Station precinct as part of the concept design assessment (Jacobs, 2015). These include a high pressure gas pipeline, gas, high and low voltage cables, rail overhead wiring, telecommunications cables, water and sewer which could impose constraints to the station upgrade and would require temporary relocation during the works.

Asset owners of the high pressure gas pipeline to the north of the station are to be consulted during detailed design and construction to determine specific requirements / mitigation measures for working adjacent to this asset.

All services should be accurately located prior to any detailed design development and mechanical excavation by using service locating (non-destructive digging).

6.12 Cumulative impacts

6.12.1 Existing or potential projects

Cumulative impacts occur when two or more projects are carried out concurrently and in close proximity to one another. The impacts may be caused by both construction and operational activities and can result in a greater impact to the surrounding area than would be expected if each project was undertaken in isolation.

A search of the Department of Planning and Environment's Major Projects Register on 1 March 2016 identified three major development proposals in the vicinity of the Narwee Station site in the last three years including road intersection works, a housing renewal project and factory subdivision works.

A search of the Canterbury City Council Development Application Register and Sydney East Joint Regional Planning Panel register identified six residential minor developments or property upgrade works within one kilometre of the station (three to the north of the station and three to the south) including residential dwelling constructions and fitouts of new buildings. A search of the Hurstville City Council Development Application Register identified no developments occurring within one kilometre of Narwee Station. Potential impacts

Potential cumulative impacts may occur as a result of construction activities occurring simultaneously with the projects listed above. Potential impacts could include:

- increased traffic travelling through the Proposal area and surrounding road network and associated delays for road users
- increased construction noise and vibration levels
- reduced visual amenity.

Consultation would occur with the Canterbury City and Hurstville City Councils, RailCorp / Sydney Trains, and identified developers to minimise potential cumulative construction impacts.

Traffic associated with the construction work is not anticipated to have a significant impact on the surrounding road network.

Based on this assessment, it is anticipated that the cumulative impacts would be negligible, provided that mitigation measures in Section 7.2 are implemented.

6.12.2 Mitigation measures

Consultation with relevant stakeholders listed in Section 6.12 would be undertaken during construction planning where required, to ensure that potential cumulative impacts are able to be minimised. Additional mitigation measures identified as necessary as a result of the consultation would be included in the construction TMP and CEMP for the management of traffic and noise during construction.

Potential cumulative impacts associated with the Proposal would be further considered as the design develops and as further information regarding the location and timing of potential developments is released. Refer to Section 7.2 for a list of mitigation measures.

6.13 Climate change and sustainability

6.13.1 Greenhouse gas emissions

An increase in greenhouse gas emissions, primarily carbon dioxide, would be expected during construction of the Proposal due to exhaust emissions from construction machinery and vehicles transporting materials and personnel to and from site.

The detailed design process would undertake an AS 14064-2 (Greenhouse Gases - project level) compliant carbon footprinting exercise in accordance with TfNSW's *Greenhouse Gas Inventory Guide for Construction Projects* (TfNSW, 2013e). The carbon footprint would to be used to inform decision making in design and construction if the estimated GHG emissions are determined to be greater than the carbon dioxide equivalent established by the National Greenhouse and Energy Reporting threshold.

Due to the small scale of the Proposal and the short-term temporary nature of the individual construction works, it is considered that greenhouse gas emissions resulting from the construction of the Proposal would be minimal. Furthermore, greenhouse gas emissions generated during construction would be kept to a minimum through the implementation of the standard mitigation measures detailed in Section 7.2.

It is anticipated that, once operational, the Proposal may result in an increase in use of public transport and a relative decrease in use of private motor vehicles by customers travelling to and from Narwee. A modal shift in transport usage may reduce the amount of fuel consumed by private motor vehicles with a corresponding relative reduction in associated greenhouse gas emissions in the local area.

6.13.2 Climate change

The dynamic nature of the climate system indicates a need to focus attention on how to adapt to the changes in climate and understand the limitation of adaptation. The effects of climate on the Sydney region can be assessed in terms of weather changes, storm intensity, flooding and increased risk of fire.

Climate change could lead to an increase in the intensity of rainfall events, whereby the rainfall expected to occur in a 100-year average recurrence interval flood event would occur more frequently. Such changes in weather in the Narwee region are unlikely to impact on the Proposal (for more information on flooding refer to Section 6.9), or be impacted by the Proposal.

Climate change could lead to an increase in frequency and severity in bushfires. No bushfire maps were available for the area at the time of this assessment. However, the suburb of Narwee and the surrounding areas are highly urbanised with some small pockets of remnant bushland and are therefore unlikely to be subject to a bushfire risk. The Proposal would be designed with appropriate fire protection measures.

6.13.3 Sustainability

The design of the Proposal would be based on the principles of sustainability, including the incorporation of the *NSW Sustainable Design Guidelines – Version 3.0* (TfNSW, 2013a) and the TfNSW EMS. These guidelines require a number of mandatory and discretionary initiatives to be applied. Refer to Section 3.1.4 for more information regarding the application of these guidelines.

Further positive impacts in relation to climate change and sustainability associated with the Proposal include encouraging a reduction in private vehicle use and increasing the accessibility of public transport services.

7 Environmental management

This chapter of the REF identifies how the environmental impacts of the Proposal would be managed through environmental management plans and mitigation measures. Section 7.2 lists the proposed mitigation measures for the Proposal to minimise the impacts of the Proposal identified in Chapter 6.

7.1 Environmental management plans

A CEMP for the construction phase of the Proposal would be prepared in accordance with the requirements of TfNSW's EMS. The CEMP would provide a centralised mechanism through which all potential environmental impacts relevant to the Proposal would be managed, and outline a framework of procedures and controls for managing environmental impacts during construction.

The CEMP would incorporate as a minimum all environmental mitigation measures identified below in Section 7.2, any conditions from licences or approvals required by legislation, and a process for demonstrating compliance with such mitigation measures and conditions.

7.2 Mitigation measures

Mitigation measures for the Proposal are listed below in Table 24. These proposed measures would minimise the potential adverse impacts of the Proposal identified in Chapter 6 should the Proposal proceed.

Table 24 Proposed mitigation measures

No.	Mitigation measure
	General
1.	A Construction Environmental Management Plan (CEMP) would be prepared by the Contractor in accordance with the relevant requirements of *Guideline for Preparation of Environmental Management Plans,* Department of Infrastructure, Planning and Natural Resources, 2004) for approval by TfNSW, prior to the commencement of construction and following any revisions made throughout construction.
2.	A project risk assessment including environmental aspects and impacts would be undertaken by the Contractor prior to the commencement of construction and documented as part of the CEMP.
3.	An Environmental Controls Map (ECM) would be developed by the Contractor in accordance with TfNSW's *Guide to Environmental Controls Map* (TfNSW, 2015c) for approval by TfNSW, prior to the commencement of construction and following any revisions made throughout construction.
4.	Prior to the commencement of construction, all contractors would be inducted on the key project environmental risks, procedures, mitigation measures and conditions of approval.
5.	Site inspections to monitor environmental compliance and performance would be undertaken during construction at appropriate intervals.
6.	Service relocation would be undertaken in consultation with the relevant authority. Contractors would mark existing services on the ECM to avoid direct impacts during construction.

No.	Mitigation measure
7.	Any modifications to the Proposal, if approved, would be subject to further assessment and approval by TfNSW. This assessment would need to demonstrate that any environmental impacts resulting from the modifications have been minimised.
8.	If a station shut down option is progressed (for around six weeks to allow for an accelerated construction completion), further assessment would be undertaken and additional mitigation measures would be recommended and implemented, as relevant.
9.	Asset owners of the high pressure gas pipeline to the north of the station are to be consulted during detailed design and construction to determine specific requirements / mitigation measures for working adjacent to this asset.
	Traffic and site access
10.	Prior to the commencement of construction, a Traffic Management Plan (TMP) would be prepared as part of the CEMP and would include at a minimum: • ensuring adequate road signage at construction work sites to inform motorists and pedestrians of the work site ahead to ensure that the risk of road accidents and disruption to surrounding land uses is minimised • maximising safety and accessibility for pedestrians and cyclists • ensuring adequate sight lines to allow for safe entry and exit from the site • ensuring access to railway stations, businesses, entertainment premises and residential properties (unless affected property owners have been consulted and appropriate alternative arrangements made) • managing impacts and changes to on and off street parking and requirements for any temporary replacement provision • parking locations for construction workers away from stations and busy residential areas and details of how this will be monitored for compliance • routes to be used by heavy construction-related vehicles to minimise impacts on sensitive land uses and businesses • details for relocating kiss and ride, taxi ranks and rail replacement bus stops if required, including appropriate signage to direct patrons, in consultation with the relevant bus/taxi operators. Particular provisions would also be considered for the accessibility impaired • measures to manage traffic flows around the area affected by the Proposal, including as required regulatory and direction signposting, line marking and variable message signs and all other traffic control devices necessary for the implementation of the TMP. Consultation with the relevant roads authorities would be undertaken during preparation of the construction TMP. The performance of all project traffic arrangements must be monitored during construction.
11.	Communication would be provided to the community and local residents to inform them of changes to parking, pedestrian access and/or traffic conditions including vehicle movements and anticipated effects on the local road network relating to site works.
12.	Road Occupancy Licences for temporary road closures would be obtained, where required.
13.	Access to all private properties and businesses adjacent to the works would be maintained during construction, unless otherwise agreed by relevant property owners.
14.	A Road Safety Audit would be undertaken as part of detailed design and upon completion of construction, and design amendments made as required.

No.	Mitigation measure
15.	Relevant authorisation(s) from the appropriate road authority would be obtained for the proposed operational changes to street parking on Hannans Road and Hurst Place, bus/taxi zones and signage changes.
16.	Should road closures be required, signage would be erected to clearly delineate alternative access so that nearby businesses would operate as normal.
17.	Construction vehicle traffic movements would be restricted to outside of peak road traffic periods and outside of school peak periods, where practicable.
18.	The performance of all project traffic arrangements would be monitored during construction.
19.	The queuing and idling of construction vehicles in residential streets would be minimised through staging of deliveries where practicable.
20.	Pedestrian access to and from the station would be maintained at all times during construction unless bus replacement services are in operation.
	Urban design, landscape and visual amenity
21.	All permanent lighting would be designed and installed in accordance with the requirements of standards relevant to *AS 1158 Road Lighting* and *AS 4282 Controlling the Obtrusive Effects of Outdoor Lighting.*
22.	The detailed design of the Proposal would comply with Crime Prevention Through Environmental Design principles.
23.	Materials and colour finishes for new elements would be selected to minimise visual impacts, including the use of non-reflective finishes to surface and canopy structure.
24.	Light spill from the rail corridor into adjacent visually sensitive properties would be minimised by the use of cut-off lighting, directing construction lighting into the construction areas and ensuring the site is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution, particularly during night works.
25.	An Urban Design Plan (UDP) would be prepared by the Contractor, in consultation with the relevant council, and submitted to TfNSW for endorsement by the Precincts and Urban Design team, prior to finalisation of the detailed design. The UDP, at a minimum, would address the following: • the appropriateness of the proposed design with respect to the existing surrounding landscape, built form, behaviours and use-patterns (including consideration of Crime Prevention Through Environmental Design principles). This is to include but not be limited to: o connectivity with surrounding local and regional movement networks including street networks, other transport modes and active transport networks. Existing and proposed paths of travel for pedestrians and bicycles should be shown o integration with surrounding local and regional open space and or landscape networks. Existing and proposed open space infrastructure/landscape elements should be shown o integration with surrounding streetscape including street wall height, active frontages, awnings, street trees, entries, vehicle cross overs etc o integration with surrounding built form (existing or desired future) including building height, scale, bulk, massing and land-use • design detail that is sensitive to the amenity and character of heritage items located within or adjacent to the Proposal site.

No.	Mitigation measure
26.	A Public Domain Plan (PDP) would be prepared by the Contractor, in consultation with the relevant council, and submitted to TfNSW for endorsement by the Precincts and Urban Design team, prior to finalisation of the detailed design. The PDP, at a minimum, would address the following: • materials, finishes, colour schemes and maintenance procedures including graffiti control for new walls, barriers and fences • location and design of pedestrian and bicycle pathways, street furniture including relocated bus and taxi facilities, bicycle storage (where relevant), telephones and lighting equipment • landscape treatments and street tree planting to integrate with surrounding streetscape • opportunities for public art created by local artists to be incorporated, where considered appropriate, into the Proposal • total water management principles to be integrated into the design where considered appropriate • design measures included to meet TfNSW's *NSW Sustainable Design Guidelines - Version 3.0* (TfNSW, 2013a) • identification of design and landscaping aspects that will be open for stakeholder input, as required.
27.	Worksite compounds would be screened with shade cloth (or similar material, where necessary) to minimise visual impacts from key viewing locations.
28.	Temporary hoardings, barriers, traffic management and signage would be removed when no longer required.
29.	During construction, graffiti would be removed in accordance with TfNSW's Standard Requirements.
30.	During landscaping works, consideration would be given to the selection and location of new tree plantings along Hannans Road and Hurst Place frontages that may provide partial screening of the station from surrounding receivers, and facilitate improved amenity, such as the landscape setting of the station.
	Noise and vibration
31.	Works would generally be carried out during standard construction hours (i.e. 7.00 am to 6.00 pm Monday to Friday; 8.00 am to 1.00 pm Saturdays). Any works outside these hours may be undertaken if approved by TfNSW and the community is notified prior to these works commencing. An Out of Hours Work application form would need to be prepared by the Contractor and submitted to the TfNSW Environment and Planning Manager for any works outside normal hours.
32.	Prior to commencement of works, a Construction Noise and Vibration Management Plan (CNVMP) would be prepared and implemented in accordance with the requirements of the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009), *Construction Noise Strategy* (TfNSW, 2012c) and the Noise and Vibration Impact Assessment for the Proposal (AECOM, 2016c). The CNVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable.

No.	Mitigation measure
33.	The CNVMP would outline measures to reduce the noise impact from construction activities. Reasonable and feasible noise mitigation measures which would be considered, include: • regularly training workers and contractors (such as at the site induction and toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise • avoiding any unnecessary noise when carrying out manual operations and when operating plant • ensuring spoil is placed and not dropped into awaiting trucks • avoiding/limiting simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver where practicable • switching off any equipment not in use for extended periods e.g. heavy vehicles engines would be switched off whilst being unloaded • avoiding deliveries at night/evenings wherever practicable • no idling of delivery trucks • keeping truck drivers informed of designated vehicle routes, parking locations and acceptable delivery hours for the site • minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height where practicable, no throwing of metal items and slamming of doors.
34.	The CNVMP would include measures to reduce the construction noise and vibration impacts from mechanical activities. Reasonable and feasible noise mitigation options which would be considered, include: • maximising the offset distance between noisy plant and adjacent sensitive receivers and determining safe working distances • using the most suitable equipment necessary for the construction works at any one time • directing noise-emitting plant away from sensitive receivers • regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc • using non-tonal reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms for all plant used regularly onsite (greater than one day), and for any out of hours works • use of quieter and less vibration emitting construction methods where feasible and reasonable.
35.	Works would generally be carried out during standard construction hours (i.e. 7.00 am to 6.00 pm Monday to Friday; 8.00 am to 1.00 pm Saturdays). Any works outside these hours may be undertaken if approved by TfNSW and the community is notified prior to these works commencing. An Out of Hours Work application form would need to be prepared by the Contractor and submitted to the TfNSW Environment and Planning Manager for any works outside normal hours.
36.	Where the $L_{Aeq\ (15minute)}$ construction noise levels are predicted to exceed 75 dBA and/or 30 dBA above the Rating Background Level at nearby affected sensitive receivers, respite periods would be observed, where practicable, and in accordance with TfNSW"s *Construction Noise Strategy* (TfNSW, 2012c). This would include restricting the hours that very noisy activities can occur.
37.	To avoid structural impacts as a result of vibration or direct contact with structures, the proposed works would be undertaken in accordance with the safe work distances outlined in the Noise and Vibration Assessment (AECOM, 2016c) and attended vibration monitoring or vibration trials would be undertaken where these distances are required to be challenged.

No.	Mitigation measure
38.	Property conditions surveys would be completed prior to piling, excavation of bulk fill or any vibratory works including jack hammering and compaction for all buildings/structures/roads with a plan distance of 50 metres from the works and all heritage listed buildings and other sensitive structures within 150 metres of the works (unless otherwise determined following additional assessment they are not likely to be adversely affected).
39.	Affected pre-schools, schools, universities and other identified sensitive receivers would be consulted in relation to noise mitigation measures to identify any noise sensitive periods, e.g. exam periods. As much as reasonably possible noise intensive construction works in the vicinity of affected educational buildings are to be minimised.
40.	Work would be conducted behind temporary hoardings/screens wherever practicable. The installation of construction hoarding would take into consideration the location of residential receivers to ensure that 'line of sight' is broken, where feasible.
	Indigenous heritage
41.	All construction staff would undergo an induction in the recognition of Indigenous cultural heritage material. This training would include information such as the importance of Indigenous cultural heritage material and places to the Indigenous community, as well as the legal implications of removal, disturbance and damage to any Indigenous cultural heritage material and sites.
42.	If unforeseen Indigenous objects are uncovered during construction, the procedures contained in TfNSW's *Unexpected Heritage Finds Guideline* (TfNSW, 2015a) would be followed, and works within the vicinity of the find would cease immediately. The Contractor would immediately notify the TfNSW Project Manager and TfNSW Environment and Planning Manager so they can assist in co-ordinating next steps which are likely to involve consultation with an Aboriginal heritage consultant, the OEH and the Local Aboriginal Land Council. If human remains are found, work would cease, the site secured and the NSW Police and the OEH notified. Where required, further archaeological investigations and an Aboriginal Heritage Impact Permit would be obtained prior to works recommencing at the location.
	Non-Indigenous heritage
43.	A heritage induction would be provided to workers prior to construction, informing them of the location of known heritage items and guidelines to follow if unanticipated heritage items or deposits are located during construction.
44.	In the event that any unanticipated archaeological deposits are identified within the project site during construction, the procedures contained in TfNSW's *Unexpected Heritage Finds Guideline* (TfNSW, 2015a) would be followed, and works within the vicinity of the find would cease immediately. The Contractor would immediately notify the TfNSW Project Manager and the TfNSW Environment and Planning Manager so they can assist in co-ordinating the next steps which are likely to involve consultation with an archaeologist and OEH. Where required, further archaeological work and/or consents would be obtained for any unanticipated archaeological deposits prior to works recommencing at the location.
45.	As Narwee Station is listed as a heritage item on RailCorp's Section 170 Heritage and Conservation Register and in the heritage schedules of the Canterbury LEP, Sydney Trains Heritage and Canterbury City Council would be notified of the proposed works.
46.	A suitably qualified and experienced heritage architect would be engaged to provide input to, and review of, the detailed design of the Proposal. Modifications to the scope of works would be undertaken in consultation with the engaged heritage architect to ensure that works may proceed in accordance with heritage best practice.

No.	Mitigation measure
47.	A Heritage Management Plan (including detailed drawings, documentation and specifications) and Work Method Statement would be prepared as part of the CEMP to address heritage impacts and required management procedures to minimise risks. It would be prepared by the heritage architect and would be submitted TfNSW. The following aspects would be addressed: • the detachment of the platform canopies at both ends of the building • restoration of fabric where feasible, such as 6-pane sash windows • selection of paint colour for joinery appropriate to the era and style • unblocking of bricked-in windows and doors • the installation of the new Customer Information Window • removal of all visually invasive conduits and downpipes from the east elevation of the building and relocate • fit out of rooms, where preference is to attach new electrical and communication systems boards to new internal partition walls.
48.	Archival recording of the station as a whole would be undertaken prior to the commencement of construction following NSW Heritage Division guidelines *Photographic recording of heritage items using film or digital capture* (NSW Heritage Office, 2006) and *How to prepare archival records* (NSW Heritage Office, 1998). Copies to be provided to Sydney Trains Heritage and Canterbury City Council for future reference. In particular the following elements should be concentrated on: • Platform Building (1931) • existing pedestrian subway and stairs (1931) • Ticket Office (1984).
49.	To effectively mitigate potential impacts of vibration on the Platform Building, activities that cause vibration would be managed in accordance with German Standard DIN 4150 – Part 3 (DIN 1999) heritage specifications. Real time vibration monitoring would be conducted at commencement of relevant works to confirm compliance with the German Standard DIN 4150. If vibration levels approach the determined trigger level, then the construction activity would cease and the heritage structure would be assessed and alternative construction methodologies developed, where practicable, before construction recommences.
50.	During construction, suitable measures would be put in place to ensure the retained heritage elements are protected from damage. Measures may include hoardings, use of spotters during the movement of equipment and other measures as necessary.
51.	Heritage listed items within the vicinity of the Proposal and proposed mitigation measures to protect the items during construction are to be identified on the ECM and CEMP.
52.	In order to minimise impacts on the heritage fabric of the station, the recommendations of the Statement of Heritage Impacts (AECOM, 2016d) would be implemented, including: • Remove recent paint from subway tiles to re-expose the original Art Deco design and allow original design to meet new modern tiles (colour scheme in keeping / complimentary to original) of lift alcove. New colour scheme would be submitted to TfNSW along with the Platform Building Plan of Works for approval. • No further intrusions should be made into subway walls other than the works required for the lift. No additional elements should be fixed or adhered to the walls. • The existing Heritage Interpretation Signage at the station entrances should be updated to include historic photos of the original pedestrian subway entrances (prior to the 2013 K2RQ works) and a discussion of the significance of design style (Inter War Functionalist and Art Deco) along the East Hills railway line.

No.	Mitigation measure
53.	Wayfinding signage design to be further designed, assessed and installed in co-operation with the engaged heritage architect. The original 1930's concrete station entrance "Narwee" name sign is essential and would be retained and kept visible (e.g. no new wayfinding signage should obscure the lettering).
54.	Copies of the 'as built' construction plans, photographs illustrating the completed works and the Archival Record would be lodged with RailCorp's Office of Rail Heritage as a documentary record of changes to the station.
55.	Prior to and following completion of works, TfNSW would notify Sydney Trains and provide copies of all relevant plans and drawings to allow for Sydney Trains to provide the relevant notification to the Heritage Council and update the RailCorp Section 170 Heritage and Conservation Register listing description and historical context.
	Socio-economic
56.	Sustainability criteria for the Proposal would be established to encourage the Contractor to purchase goods and services locally, helping to ensure the local community benefits from the construction of the Proposal.
57.	Feedback through the submissions process would be encouraged to facilitate opportunities for the community and stakeholders to have input into the project, where practicable.
58.	A Community Liaison Plan would be prepared prior to construction to identify all potential stakeholders and best practice methods for consultation with these groups during construction. The plan would also encourage feedback and facilitate opportunities for the community and stakeholders to have input into the project, where practicable.
59.	Contact details for a 24-hour construction response line, Project Infoline and email address would be provided for ongoing stakeholder contact throughout the construction phase.
60.	The community would be kept informed of construction progress, activities and impacts in accordance with the Community Liaison Plan to be developed prior to construction.
61.	The details of the station shutdown, if required, would be subject to further consideration during detailed design and construction planning in consultation with the relevant authorities and the local community.
	Biodiversity
62.	Construction of the Proposal must be undertaken in accordance with TfNSW's *Vegetation Management (Protection and Removal) Guideline* (TfNSW, 2015d) and TfNSW's *Fauna Management Guideline* (TfNSW, 2015e).
63.	All workers would be provided with an environmental induction prior to commencing work onsite. This induction would include information on the protection measures to be implemented to protect vegetation, penalties for breaches and locations of areas of sensitivity.
64.	Disturbance of vegetation would be limited to the minimum amount necessary to construct the Proposal. Trees nominated to be removed in Table 23 would be clearly demarcated onsite prior to construction, to avoid unnecessary vegetation removal. Trees to be retained would be protected through temporary protection measures discussed below.

No.	Mitigation measure
65.	All trees with Tree Protection Zones (TPZs) within 10 metres of the proposed work zones (as shown in Figure 24) are to be protected and shall be clearly identified and all TPZs surveyed. Trees to be retained and TPZs would be identified in the ECM(s). Tree protection would be undertaken in line with *AS 4970-2009 Protection of Trees on Development Sites* and would include exclusion fencing of TPZs.
66.	All tree protection works shall be carried out before excavation and site works commence. Tree protection works would be inspected and approved by a suitably qualified arborist prior to construction works commencing.
67.	No pedestrian access, vehicular access, and other construction activities are permitted within TPZs including material storage or stockpiling, compaction and filling.
68.	In the event of any tree to be retained becoming damaged during construction, the Contractor would immediately notify the TfNSW Project Manager and TfNSW Environment and Planning Manager to coordinate the response which may include contacting an arborist to inspect and provide advice on remedial action, where possible.
69.	Should the detailed design or onsite works determine the need to remove or trim any additional trees, which have not been identified in the REF, the Contractor would be required to complete TfNSW's Tree Removal Application Form and submit it to TfNSW for approval.
70.	For new landscaping works, mulching and watering would be undertaken until plants are established.
71.	Weed control measures, consistent with TfNSW's *Weed Management and Disposal Guideline* (TfNSW, 2015f), would be developed and implemented as part of the CEMP to manage the potential dispersal and establishment of weeds during the construction phase of the project. This would include the management and disposal of weeds in accordance with the *Noxious Weeds Act 1993.*
72.	The use of the proposed northern construction compound area adjacent to Hannans Road would be restricted for use as a location for site sheds or containers only if supported on a pad footing or pier, adequate to prevent root damage and approved by an arborist prior to installation. No storage of plant, materials or parking of vehicles is permitted in this area to prevent root damage (from compaction) to trees 40-48, 50.
73.	Defined access tracks and entry/exit points are to be used for all vehicle movements.
74.	Offsets and/or landscaping would be undertaken in accordance with TfNSW's *Vegetation Offset Guide* (TfNSW, 2013d) and in consultation with the relevant council, and/or the owner of the land upon which the vegetation is to be planted. Trees earmarked for removal would be offset with a minimum of trees as advised in Table 23. Any additional clearing would also require tree offset planting.
	Soils and water
75.	Prior to commencement of works, a site-specific Erosion and Sediment Control Plan would be prepared in accordance with the 'Blue Book' *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom, 2004) and updated throughout construction so it remains relevant to the activities. The Erosion and Sediment Control Plan measures would be implemented prior to commencement of works and maintained throughout construction.

No.	Mitigation measure
76.	Erosion and sediment control measures would be established prior to any clearing, grubbing and site establishment activities and would be maintained and regularly inspected (particularly following rainfall events) to ensure their ongoing functionality. Erosion and sediment control measures would be maintained and left in place until the works are complete and areas are stabilised.
77.	Vehicles and machinery would be properly maintained and routinely inspected to minimise the risk of fuel/oil leaks. Construction plant, vehicles and equipment would also be refuelled offsite, or in a designated refuelling area.
78.	All fuels, chemicals and hazardous liquids would be stored away from drainage lines, within an impervious bunded area in accordance with Australian Standards, EPA Guidelines and TfNSW's *Chemical Storage and Spill Response Guidelines* (TfNSW, 2015g).
79.	Adequate water quality and hazardous materials procedures (including spill management procedures, use of spill kits and procedures for refuelling and maintaining construction vehicles/equipment) would be implemented in accordance with relevant EPA guidelines and the TfNSW *Chemical Storage and Spill Response Guidelines* (TfNSW, 2015g) during the construction phase. All staff would be made aware of the location of the spill kits and be trained in how to use the kits in the case of a spill.
80.	In the event of a pollution incident, works would cease in the immediate vicinity and the Contractor would immediately notify the TfNSW Project Manager and TfNSW Environment and Planning Manager. The EPA would be notified by TfNSW if required, in accordance with Part 5.7 of the POEO Act.
81.	The existing drainage systems would remain operational throughout the construction phase.
82.	Should groundwater be encountered during excavation works, groundwater would be managed in accordance with the requirements of the *Waste Classification Guidelines* (EPA, 2014) and TfNSW's *Water Discharge and Reuse Guideline* (TfNSW, 2015b).
83.	Further hydrological assessment would be undertaken during the detailed design phase to determine final drainage arrangements and flooding risks (an assessment has been completed for the concept design stage only).
	Air quality
84.	Air quality management and monitoring for the Proposal would be undertaken in accordance with TfNSW's *Air Quality Management Guideline* (TfNSW, 2015h).
85.	Methods for management of emissions would be incorporated into project inductions, training and pre-start/toolbox talks.
86.	Plant and machinery would be regularly checked and maintained in a proper and efficient condition. Plant and machinery would be switched off when not in use, and not left idling.
87.	Vehicle and machinery movements during construction would be restricted to designated areas and sealed/compacted surfaces where practicable.

No.	Mitigation measure
88.	To minimise the generation of dust from construction activities, the following measures would be implemented: • apply water (or alternate measures) to exposed surfaces (e.g. unpaved roads, stockpiles, hardstand areas and other exposed surfaces) • cover stockpiles when not in use • appropriately cover loads on trucks transporting material to and from the construction site and securely fix tailgates of road transport trucks prior to loading and immediately after unloading • prevent mud and dirt being tracked onto sealed road surfaces.
	Waste and contamination
89.	The CEMP (or separate Waste Management Plan, if necessary) must address waste management and would at a minimum: • identify all potential waste streams associated with the works and outline methods of disposal of waste that cannot be reused or recycled at appropriately licensed facilities • detail other onsite management practices such as keeping areas free of rubbish • specify controls and containment procedures for hazardous waste and asbestos waste • outline the reporting regime for collating construction waste data.
90.	An appropriate Unexpected Finds Protocol, considering asbestos containing materials and other potential contaminants, would be included in the CEMP. Procedures for handling asbestos containing materials, including licensed contractor involvement as required, record keeping, site personnel awareness and waste disposal to be undertaken in accordance with WorkCover requirements.
91.	All spoil to be removed from site would be tested to confirm the presence of any contamination. Any contaminated spoil would be disposed of at an appropriately licensed facility.
92.	All spoil and waste must be classified in accordance with the *Waste Classification Guidelines Part 1: Classifying waste (*EPA, 2014) prior to disposal.
93.	Any concrete washout would be established and maintained in accordance with TfNSW's *Concrete Washout Guideline* – draft (TfNSW, 2015i) with details included in the CEMP and location marked on the ECM.
94.	A Demolition Management Plan would be prepared as part of the CEMP and would include mitigation measures to manage and monitor dust emissions (including potential lead and asbestos dust) from the demolition of the existing Ticket Office.
95.	All asbestos must be handled and removed by an appropriately qualified asbestos removalist and disposed of at an EPA licensed facility capable of receiving asbestos in accordance with: • *Code of Practice for the Safe Removal of Asbestos 2005* • *Code of Practice for the Management and Control of Asbestos in Workplaces 2005.*
96.	All hazardous waste (including lead waste) material handling, storage, transport and disposal will be in accordance with the requirements of PoEO Act, WARR Act and relevant guidelines including the Australian Standard 4361.1 Guide to lead paint management Part 1: Industrial applications.
97.	Prior to works commencing, lead paint flakes found around the work area are to be collected and stored as per hazardous waste controls.

No.	Mitigation measure
	Climate change and sustainability
98.	Detailed design of the Proposal would be undertaken in accordance with the *NSW Sustainable Design Guidelines – Version 3.0* (TfNSW, 2013a).
99.	The detailed design process would include a Greenhouse Gases (project level) compliant carbon footprinting exercise in accordance with AS14064-2 and TfNSW's *Greenhouse Gas Inventory Guide for Construction Projects* (TfNSW, 2013e). The carbon footprint would then be used to inform decision making in design and construction.
100.	The detailed design process would undertake a climate change impact assessment with reference to the *Climate Change Impacts and Risk Management: A Guide for Business and Government* (Department of the Environment and Heritage, 2006) and the *ISCA Guidelines for Climate Change Adaptation* (AGIC, 2011) to determine the hazards/risks associated with future climatic conditions. Issues including protecting customers and electrical equipment from wind and rain during storm events, size of guttering, cross flow ventilation, reflective surfaces etc. would be considered in the design.
	Cumulative impacts
101.	The potential cumulative impacts associated with the Proposal would be further considered as the design develops and as further information regarding the location and timing of potential developments is released. Environmental management measures would be developed in the CEMP, and implemented as appropriate.
102.	Consultation with relevant stakeholders would be undertaken during construction planning, where required, to ensure that potential cumulative impacts are minimised. Additional mitigation measures from consultation would be included in the construction TMP and CNVMP for the management of traffic and noise during construction.
103.	During construction, the works would be co-ordinated with other construction activities in the immediate vicinity as required. Consultation and liaison would occur with Canterbury City Council and Hurstville City Council, Sydney Trains, and developers to minimise cumulative construction impacts such as traffic and noise as far as practicable.

8 Conclusion

This REF has been prepared in accordance with the provisions of section 111 of the EP&A Act, taking into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the Proposal.

The Proposal would provide the following benefits:

- improved accessibility for customers at Narwee Station, providing an accessible route to the station platforms through the provision of a lift
- improved customer amenity and facilities at the station including a family accessible toilet, extended canopy coverage and wayfinding signage
- improved transport interchange facilities including formalised kiss and ride areas, provision of accessible parking, upgraded bus facilities and sheltered bicycle facilities on the northern side of the station.

The likely key impacts of the Proposal are as follows:

- temporary changes to vehicle and pedestrian movements to, from and around the station during construction
- temporary noise and vibration impacts during construction
- removal of two (2) untimed parking spaces on Hannans Road and one untimed parking space within the Hannans Road commuter car park to allow for new accessible parking and new kiss and ride area on Hannans Road
- impacts to station heritage fabric through the loss of the existing stairs and partial demolition of the pedestrian underpass walls to integrate the new stairs and lift
- net loss of three toilets as a result of the Platform Building reconfiguration
- removal of trees and vegetation that would require planting offsets
- introduction of new elements such as the new lift and extended canopy into the visual environment.

This REF has considered and assessed these impacts in accordance with clause 228 of the EP&A Regulation and the requirements of the EPBC Act (refer to Chapter 6, Appendix A and Appendix B). Based on the assessment contained in this REF, it is considered that the Proposal is not likely to have a significant impact upon the environment or any threatened species, populations or communities. Accordingly an EIS is not required, nor is the approval of the NSW Minister for Planning or the Commonwealth Minister for the Environment.

The Proposal would also take into account the principles of ESD (refer to Section 3.1.4 and Section 4.6). These would be considered during the detailed design, construction and operational phases of the Proposal. This would ensure the Proposal is delivered to maximum benefit to the community, is cost effective and minimises adverse impacts on the environment.

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Appendix A Consideration of matters of National Environmental Significance

The table below demonstrates TfNSW's consideration of the matters of NES under the EPBC Act to be considered in order to determine whether the Proposal should be referred to Commonwealth Department of the Environment.

Matters of NES	Impacts
Any impact on a World Heritage property? There are no World Heritage Properties in the vicinity of the Proposal.	Nil
Any impact on a National Heritage place? There are no National Heritage places in the vicinity of the Proposal.	Nil
Any impact on a wetland of international importance? There are no wetlands of international importance in the vicinity of the Proposal.	Nil
Any impact on a listed threatened species or communities? It is unlikely that the development of the Proposal would significantly affect any listed threatened species or communities.	Nil
Any impacts on listed migratory species? It is unlikely that the development of the Proposal would significantly affect any listed migratory species.	Nil
Does the Proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action.	Nil
Any impact on a Commonwealth marine area? There are no Commonwealth marine areas in the vicinity of the Proposal.	Nil
Does the Proposal involve development of coal seam gas and/or large coal mine that has the potential to impact on water resources? The Proposal is for a transport facility and does not relate to coal seam gas or mining.	Nil
Additionally, any impact (direct or indirect) on Commonwealth land? The Proposal would not be undertaken on or near any Commonwealth land.	Nil

Appendix B Consideration of clause 228

The table below demonstrates TfNSW's consideration of the specific factors of clause 228 of the EP&A Regulation in determining whether the Proposal would have a significant impact on the environment.

Factor	Impacts
(a) Any environmental impact on a community? There would be some temporary impacts to the community during construction, particularly in relation to noise, traffic, access and visual amenity. The potential temporary shutdown would result in an inconvenience to commuters. Mitigation measures outlined in Section 7.2 would be implemented to manage and minimise adverse impacts.	Minor
(b) Any transformation of a locality? The Proposal would include the introduction of new visible elements in the landscape (including the construction of a new lift, extended canopy coverage and the installation of a new sheltered bicycle rack). The appearance of the new elements would be consistent with the existing station elements and are considered to be common features in urban areas. The extent of vegetation trimming and removal would be determined during the detailed design and construction planning stages and would be minimised as far as practicable.	Minor
(c) Any environmental impact on the ecosystem of the locality? The Proposal may require minor vegetation removal. The extent of vegetation trimming and removal would be confirmed during detailed design and construction planning stages and would be minimised as far as practicable. Any additional trees that are found to require removal, not assessed in this REF, would be subject to further assessment, offsetting and approval from TfNSW.	Nil
(d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? There would be some temporary impacts during construction particularly in relation to noise, traffic and access and visual amenity. Minor vegetation removal may be required. Any additional trees that are found to require removal, not assessed in this REF, would be subject to further assessment, offsetting and approval from TfNSW.	Minor
(e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? The Proposal would have a positive contribution to the locality by creating equitable access to the station platforms from the underpass level. The station is listed on RailCorp's Section 170 Heritage and Conservation Register and the heritage schedule of the Canterbury LEP. The Proposal would result in some minor impacts to some parts of the station that are heritage listed. Impacts to heritage would be minimised through the implementation of the mitigation measures provided in the REF. A desktop archaeological assessment has been undertaken which determined that there is a low risk of encountering archaeological items/deposits and that the Proposal is unlikely to expose historical archaeological relics.	Minor

Factor	Impacts
(f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? The Proposal is unlikely to have any impact on the habitat of protected fauna.	Nil
(g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The Proposal is unlikely to have any impact on endangering any species of animal, plant or other form of like, whether living on land, in water or in the air.	Nil
(h) Any long-term effects on the environment? The Proposal is unlikely to have any long-term effects on the environment.	Nil
(i) Any degradation of the quality of the environment? The Proposal is unlikely to have any degradation of the quality of the environment.	Nil
(j) Any risk to the safety of the environment? The Proposal is unlikely to cause any pollution or safety risks to the environment provided the recommended mitigation measures are implemented. Specific management measures would be implemented to manage asbestos and other hazardous materials that may be encountered during construction or demolition works.	Minor
(k) Any reduction in the range of beneficial uses of the environment? The Proposal is unlikely to have any reduction in the range of beneficial uses of the environment.	Nil
(l) Any pollution of the environment? The Proposal is unlikely to cause any pollution of the environment provided the recommended mitigation measures are implemented.	Minor
(m) Any environmental problems associated with the disposal of waste? The Proposal is unlikely to cause any environmental problems associated with the disposal of waste. Hazardous waste and special waste may be generated from the Proposal. All waste would be managed and disposed of with a site-specific Waste Management Plan prepared as part of the Construction Environmental Management Plan. Mitigation measures would be implemented to ensure waste is reduced, reused or recycled where practicable.	Minor
(n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The Proposal is unlikely to increase demands on resources that are, or are likely to become, in short supply.	Nil
(o) Any cumulative environmental effect with other existing or likely future activities? Cumulative effects of the Proposal are described in Section 6.12, Where feasible, environmental management measures would be co-ordinated to reduce any cumulative construction impacts. The Proposal is unlikely to have any significant adverse long-term impacts.	Nil
(p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The Proposal would not affect or be affected by any coastal processes or hazards.	Nil

Appendix C Sustainable Design Guidelines checklist

Compulsory initiatives

Initiative	Theme	Description	Design (D) or Construct (C) interface	Under consideration
C.1 Carbon footprint	Energy and greenhouse	Undertake AS14064-2 (greenhouse gases – project level) compliant carbon footprinting exercise for all projects with a capital investment value over $10 million in accordance with Transport for NSW's Greenhouse Gas Inventory Guide for Construction Projects. The carbon footprint is to be used to inform decision-making in design and construction. Use standard carbon coefficient values for construction material and fuel usage. Monitor and report the carbon footprint every six months during construction.	DC	Yes
C.5 Renewable Energy	Energy and greenhouse	Purchase at least 25% of site-based electricity energy needs from Green Power or renewable sources during construction of the asset.	C	Yes
C.6 Climate change impact assessment	Climate resilience	Perform a climate change impact assessment for each project worth over $10M using current scientific predictions (i.e. Intergovernmental Panel on Climate Change (IPCC), Commonwealth Scientific and Industrial Research Organisation (CSIRO) etc) to determine the hazards/risks associated with future climatic conditions. Refer to 'Climate Change Impacts and Risk Management: A Guide for Business and Government' and the 'AGIC Guidelines for Climate Change Adaptation' for guidance.	D	Yes
C.7 Design for climate change	Climate resilience	All projects with a capital investment value over $10 million to design out extreme, high and medium risks as identified in the climate change impact assessment where practicable.	D	Yes
C.9 Reduce waste to landfill	Materials and waste	Ensure at least 95 per cent of construction and demolition waste (by weight) is diverted from landfill, and either recycled or reused, for all projects with a capital investment value over $10 million.	DC	Yes

Initiative	Theme	Description	Design (D) or Construct (C) interface	Under consideration
C.11 Reduce cement	Materials and waste	Reduce the absolute quantity of Portland cement by at least 30 per cent, as an average across all concrete mixes, by substituting it with supplementary cementitious materials (such as a fly ash, ground granulated blast furnace slag or alkali activated cements) subject to meeting strength and durability requirements.	DC	Yes
C.13 Heritage conservation and enhancement	Biodiversity and heritage	100 per cent of significant heritage items are identified during project development and design and are protected or beneficially reused where practical. This will require consultation with all relevant Indigenous Heritage groups (where applicable).	DC	Yes
C.18 Monitor and record construction water	Water	Projects that have capital value greater than $10 million are to monitor and record water consumption at the site office, all outlets available to the construction site and other water uses such as from non -potable sources.	C	Yes
C.20 Noise management	Pollution control	Project to comply with the Transport for NSW Construction Noise Strategy and related conditions of approval.	DC	Yes
C.23 Crime Prevention Through Environmental Design (CPTED)	Community benefit	Incorporate CPTED principles during design. This may include natural observation and use of CCTV. Natural observation is achieved through fence, landscape, streetscape and open space design in public or staff supervised areas. This is achieved by minimising narrow corridors, hidden corners and through the use of lighting.	D	Yes

Discretionary initiatives

Initiative	Theme	Description	Design (D) or Construct (C) interface	Under consideration
1.3 Power factor correction	Energy and greenhouse	Install power factor correction (PFC) units to keep the power factor of the system as close to one as possible.	D	Yes
1.6 Real-time (smart) metering	Energy and greenhouse	Monitor and record data of energy use patterns in real time. For tunnels, relay to the Master Control System.	D	Yes
1.13 Green travel plans	Energy and greenhouse	Develop and implement green or sustainable travel plans during construction for employees to get to site offices and construction sites.	C	Yes
1.20 LED lights	Energy and greenhouse	Incorporate energy efficient LED lighting.	D	Yes
1.23 CCTV lighting	Energy and greenhouse	Install low light CCTV monitoring equipment.	D	Yes
2.3 Passenger comfort	Climate resilience	Review levels of passenger comfort to take account of climate change (e.g. provision of additional shelter from winds and driving rain and increased shading from sun in locations where customers wait for transport).	D	Yes
2.8 Protection from extreme weather (sun, rain, wind)	Climate resilience	Consider design measures for protecting customers and electrical equipment from wind and rain during storm events.	D	Yes
2.9 Protect sensitive assets	Climate resilience	Protect sensitive assets (e.g. lifts, escalators) from the effects of extreme climate and weather.	D	Yes
3.5 Optimise design	Materials and waste	Optimise design to minimise material consumption, mass/volume/space use and above ground land use.	D	Yes
3.6 Re-use of structures	Materials and waste	Retain or refurbish existing structures where possible.	DC	Yes
3.7 Recycled concrete	Materials and waste	Reuse concrete, bricks and other structural materials in construction on site where available and suitable.	DC	Yes

Initiative	Theme	Description	Design (D) or Construct (C) interface	Under consideration
3.9 Recycled aggregate	Materials and waste	Use recycled aggregate in non-structural uses (e.g. building base course, sub-grade to any car parks and footpaths, backfilling to service trenches, kerb and gutter).	DC	Yes
3.14 Sustainable structural steel	Materials and waste	Source at least 60 per cent of structural steel (by weight) from a steel fabricator/contractor accredited by the Environmental Sustainability Charter of the Australian Steel Institute.	C	Yes
3.15 Lower embodied energy bar and mesh	Materials and waste	Source at least 60 per cent of bar and mesh that is produced through energy reduction processes such as Polymer Injection Technology.	C	Yes
3.16 Optimal preassembly of reinforcing steel	Materials and waste	Source at least 15 per cent of reinforcing steel from suppliers that use optimal off site fabrication techniques such as engineered reinforcing bar carpet, engineered/customised mesh or prefabricated reinforcing cages.	DC	Yes
3.17 Low VOC paints and finishes	Materials and waste	Specify low volatile organic compound (VOC) paints and finishes. Refer to Green Star – Office Interiors v1.1 available online.	DC	Yes
3.18 Low VOC adhesives and sealants	Materials and waste	Specify all adhesives and sealants as low VOC. Refer to Green Star – Office Interiors v1.1 available online.	DC	Yes
3.20 Timber	Materials and waste	95% of all timber products (by cost) comprise re-used or post-consumer recycled timber, Forest Stewardship Council (FSC) or Australian Forest Scheme (AFS) certified timber, and/or timber from NSW sustainably managed forests.	DC	Yes
3.25 Cut-fill balance	Materials and waste	Balance site works to avoid excess or import of spoil.	DC	Yes
3.29 Segregation of waste	Materials and waste	Enable waste segregation in the design process by including space for the collection and segregation of waste with appropriate marking (e.g. signage) and controls (e.g. lockable lids), located away from sensitive receptors (e.g. water courses). During construction, use facilities and procedures that maximise on-site separation of waste to maximise reuse/recycling.	DC	Yes

Initiative	Theme	Description	Design (D) or Construct (C) interface	Under consideration
3.30 Reuse construction waste	Materials and waste	Maximise reuse of concrete, bricks, earthworks and other structural waste materials.	DC	Yes
3.34 Prevent electrolysis	Materials and waste	Prevent or minimise the effects of stray current electrolysis from electrified railway that increase the rate of corrosion. Such as selecting suitable building materials, avoiding using metal finishes in the vicinity of high voltage electricity, using masking agents or coatings to prevent exposure of metals, and preventing direct contact between metallic parts.	D	Yes
3.36 Pre-fabrication	Materials and waste	Use prefabricated building and civil components (for bridges, walls (retaining, deflection, noise), culverts, platforms, level crossings and tunnel lining etc) to reduce construction waste material usage, pollution risks and travel.	DC	Yes
3.37 Low finish interiors	Materials and waste	Specify low-finish interiors (e.g. exposed brick/rock walls, unpainted galvanised steel, polished concrete walls and floors) to avoid the need for large quantities of paint and/or cement render. Consider graffiti removal in specifying surface textures.	D	Yes
3.40 Façade reuse	Materials and waste	Incorporate existing building facades in station upgrades.	D	Yes
3.41 Coordinate dimensions	Materials and waste	Design for standard material sizes and components to reduce waste and improve ease of assembly and disassembly.	D	Yes
3.43 Durable finishes	Materials and waste	Specify building materials and finishes to demonstrate high quality and durability.	D	Yes
3.47 Correct site layout	Materials and waste	Layout of construction site (including plant and equipment) to be designed to reduce travel distance and double carrying.	C	Yes
4.9 Heritage items in the vicinity	Biodiversity and heritage	Design for the interrelationship between new development/redevelopment and proximate buildings of heritage/cultural significance.	D	Yes
5.15 Permeable and porous surfaces	Water	Design for permeable and porous surfaces to allow for stormwater infiltration (preferably with other treatments such as vegetated swales).	D	Yes

Initiative	Theme	Description	Design (D) or Construct (C) interface	Under consideration
6.4 Avoid dangerous goods and hazardous materials	Pollution control	Use Safety Data Sheets (SDS) to avoid the use of dangerous goods and hazardous materials. See the materials section in Appendix B for details.	DC	Yes
6.5 Apply noise control hierarchy	Pollution control	Apply a hierarchy of control by addressing noise at source first (e.g. orient equipment away from residential receivers), then propagation path (e.g. a noise barrier) and finally at the receiver (e.g. double glazed windows) as a last option (see Rail Infrastructure Noise Guidelines for further information).	D	Yes
7.13 Enhance visual interest of asset	Community benefit	Use lighting, landscaping and/or public art to direct visual interest towards the structure and enhance the visual amenity of the structure.	DC	Yes
7.19 Kiss and ride	Community benefit	Provide for kiss and ride at the station.	D	Yes
7.28 Bicycle locker and/or racks	Community benefit	Provide sheltered bicycle lock ups and/or lockers in or near entrance to the station. Allow for at least 5% of staff use at maintenance facilities. See Section 3.9.3.1 of the ASA Station Design Standard Requirements for further information on bicycle parking requirements at stations.	D	Yes
7.33 Safe pedestrian movement	Community benefit	Make sure that safe movement is promoted for pedestrians and cyclists by minimising vehicle crossings of paths, providing clear signage, and providing freedom from obstacles such as poles, trees etc.	D	Yes
7.38 Reduce vandalism	Community benefit	Minimise risks from vandalism during design, such as designing pedestrian bridges and walkways with a high degree of surveillance or railings, restrict window openings and limit to a maximum 80mm opening.	D	Yes
7.39 Reduce graffiti	Community benefit	Minimise graffiti risks such as through treatment of fencing and other surfaces with anti-graffiti paint or coatings, vegetation cover to deter graffiti or providing designated walls for graffiti.	D	Yes
7.50 Shading	Community benefit	Provide shade through vegetation or structures over platform, concourse, car parks and pedestrian pathway areas and work/lunch areas.	D	Yes

Appendix D Detailed Tree List

The table below provides a list of all trees within the vicinity of the site, a description of each tree, the TPZ radius recommended and each tree's retention value. Refer to Figure 24 for location.

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
1	*Tristaniopsis laurina*	This mature tree is approximately 3m tall with a canopy spread of 2m. It has a single trunk with a diameter at breast height (DBH) of 70mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
2	*Tristaniopsis laurina*	This mature tree is approximately 3m tall with a canopy spread of 2m. It has a single trunk with a DBH of 70mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
3	*Corymbia maculata*	This mature tree is approximately 16m tall with a canopy spread of 12m. It has twin co-dominant trunks from the base with an aggregate DBH of 430mm. This tree is in good health and condition with minimal deadwood and epicormic growth. Due to evidence of a bark inclusion this tree is recommended for removal.	NA	Low
4	*Tristaniopsis laurina*	This mature tree is approximately 2m tall with a canopy spread of 2m. It has a single trunk with a DBH of 65mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
5	*Angophora costata*	This mature tree is approximately 4m tall with a canopy spread of 2m. It has a single trunk with a DBH of 105mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
6	*Angophora costata*	This mature tree is approximately 5m tall with a canopy spread of 2m. It has a single trunk with a DBH of 120mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
7	*Melaleuca quinquenervia*	This mature tree is approximately 9m tall with a canopy spread of 14m. It has twin co-dominant trunks from 1.5m above the base with a DBH of 515mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	6.18	High
8	*Melaleuca quinquenervia*	This mature tree is approximately 10m tall with a canopy spread of 2m. It has multiple co-dominant trunks from 1.7m above the base with a DBH of 540mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	6.48	High
9	*Corymbia maculata*	This semi-mature tree is approximately 6m tall with a canopy spread of 2m. It has a single trunk with a DBH of 80mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
10	*Melaleuca quinquenervia*	This mature tree is approximately 11m tall with a canopy spread of 14m. It has multiple (3) co-dominant trunks from the base with an aggregate DBH of 595mm. This tree is in fair health and condition with a thinning canopy, minimal deadwood, minimal epicormic growth and some apical dieback.	7.14	High
11	*Corymbia maculata*	This semi-mature tree is approximately 6m tall with a canopy spread of 2m. It has a single trunk with a DBH of 80mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
12	*Corymbia maculata*	This semi-mature tree is approximately 6m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
13	*Corymbia maculata*	This semi-mature tree is approximately 8m tall with a canopy spread of 3m. It has a single trunk with a DBH of 85mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
14	*Corymbia citriodora*	This mature tree is approximately 18m tall with a canopy spread of 16m. It has a single trunk with a DBH of 630mm. This tree is in good health and condition with minimal deadwood and epicormic growth. This tree has a number of horizontal end weighted branches overhanging the road, including one with decay evident in a wound caused by mechanical means, probably from passing trucks. We recommend the removal of these branches.	7.56	High
15	*Corymbia citriodora*	This mature tree is approximately 15m tall with a canopy spread of 14m. It has a single trunk with a DBH of 345mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	4.14	High
16	*Corymbia maculata*	This semi-mature tree is approximately 7m tall with a canopy spread of 3m. It has a single trunk with a DBH of 80mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
17	*Corymbia maculata*	This mature tree is approximately 15m tall with a canopy spread of 12m. It has a single trunk with a DBH of 320mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	3.84	High
18	*Corymbia maculata*	This mature tree is approximately 16m tall with a canopy spread of 10m. It has a single trunk with a DBH of 280mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	3.36	High

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
19	*Corymbia citriodora*	This mature tree is approximately 18m tall with a canopy spread of 12m. It has a single trunk with a DBH of 275mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	3.3	High
20	*Corymbia citriodora*	This mature tree is approximately 9m tall with a canopy spread of 10m. It has a single trunk with a DBH of 135mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
21	*Corymbia citriodora*	This mature tree is approximately 8m tall with a canopy spread of 5m. It has a single trunk with a DBH of 140mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
22	*Corymbia citriodora*	This mature tree is approximately 22m tall with a canopy spread of 10m. It has a single trunk with a DBH of 710mm. This tree is in good health and condition with minimal deadwood and epicormic growth. It is recommended to remove horizontal end weighted branches.	8.52	High
23	*Corymbia citriodora*	This mature tree is approximately 10m tall with a canopy spread of 12m. It has a single trunk with a DBH of 205mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.46	High
24	*Corymbia maculata*	This semi-mature tree is approximately 7m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	Low
25	*Corymbia maculata*	This mature tree is approximately 5m tall with a canopy spread of 2m. It has a single trunk with a DBH of 55mm. This tree is in poor health and condition with a sparse epicormic canopy and significant deadwood. This tree is recommended for removal.	NA	High
26	*Corymbia maculata*	This mature tree is approximately 8m tall with a canopy spread of 4m. It has a single trunk with a DBH of 90mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
27	*Corymbia maculata*	This mature tree is approximately 10m tall with a canopy spread of 4m. It has a single trunk with a DBH of 120mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
28	*Corymbia maculata*	This semi-mature tree is approximately 7m tall with a canopy spread of 4m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
29	*Tristaniopsis laurina*	This mature tree is approximately 3m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
30	*Tristaniopsis laurina*	This mature tree is approximately 3m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
31	*Tristaniopsis laurina*	This mature tree is approximately 3m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
32	*Tristaniopsis laurina*	This mature tree is approximately 3m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
33	*Tristaniopsis laurina*	This mature tree is approximately 3m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
34	*Tristaniopsis laurina*	This mature tree is approximately 2m tall with a canopy spread of 2m. It has a single trunk with a DBH of 60mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
35	*Tristaniopsis laurina*	This mature tree is approximately 2m tall with a canopy spread of 2m. It has a single trunk with a DBH of 60mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
36	*Corymbia maculata*	This mature tree is approximately 2m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
37	*Tristaniopsis laurina*	This mature tree is approximately 2m tall with a canopy spread of 2m. It has a single trunk with a DBH of 60mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
38	*Corymbia maculata*	This mature tree is approximately 2m tall with a canopy spread of 2m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
39	*Tristaniopsis laurina*	This mature tree is approximately 2m tall with a canopy spread of 2m. It has a single trunk with a DBH of 60mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
40	*Corymbia citriodora*	This mature tree is approximately 11m tall with a canopy spread of 8m. It has a single trunk with a DBH of 275mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	3.3	High
41	*Corymbia citriodora*	This mature tree is approximately 14m tall with a canopy spread of 12m. It has a single trunk with a DBH of 335mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	4.02	High

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
42	*Corymbia citriodora*	This mature tree is approximately 13m tall with a canopy spread of 8m. It has a single trunk with a DBH of 185mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.22	High
43	*Corymbia citriodora*	This mature tree is approximately 11m tall with a canopy spread of 8m. It has twin co-dominant trunks from the base with an aggregate DBH of 210mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.52	High
44	*Corymbia citriodora*	This mature tree is approximately 9m tall with a canopy spread of 8m. It has a single trunk with a DBH of 180mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.16	High
45	*Corymbia citriodora*	This mature tree is approximately 17m tall with a canopy spread of 14m. It has a single trunk with a DBH of 585mm. This tree is in good health and condition with minimal deadwood and epicormic growth. It is recommended to remove horizontal end weighted branches.	7.02	High
46	*Corymbia citriodora*	This mature tree is approximately 14m tall with a canopy spread of 14m. It has a single trunk with a DBH of 380mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	4.56	High
47	*Corymbia maculata*	This mature tree is approximately 14m tall with a canopy spread of 12m. It has a single trunk with a DBH of 345mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	4.14	High
48	*Corymbia maculata*	This mature tree is approximately 17m tall with a canopy spread of 12m. It has a single trunk with a DBH of 350mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	4.2	High
49	*Corymbia maculata*	This mature tree is approximately 16m tall with a canopy spread of 12m. It has a single trunk with a DBH of 385mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	4.62	High
50	Stand of *Melaleuca quinquenervia*	This is a stand of mature trees approximately 4m tall with a canopy spread of 2m. The stand has an approximate average DBH of 95mm. These trees are in good health and condition with minimal deadwood and epicormic growth.	2	High
51	Stand of *Melaleuca quinquenervia*	This is a stand of mature trees approximately 4m tall with a canopy spread of 2m. The stand has an approximate average DBH of 95mm. These trees are in good health and condition with minimal deadwood and epicormic growth.	2	High

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
52	*Quercus palustris*	This mature tree is approximately 4m tall with a canopy spread of 2m. It has a single trunk with a DBH of 45mm. This tree is in poor health and declining condition with a sparse canopy, significant deadwood, minimal epicormic growth and significant apical dieback. It is recommended to remove this tree and replace with new planting of the same species.	NA	Low
53	*Quercus palustris*	This mature tree is approximately 4m tall with a canopy spread of 2m. It has a single trunk with a DBH of 60mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
54	*Quercus palustris*	This mature tree is approximately 4m tall with a canopy spread of 2m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
55	*Melaleuca quinquenervia*	This mature tree is approximately 16m tall with a canopy spread of 10m. It has twin co-dominant trunks from 1.8m above the base with a DBH of 905mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	10.86	High
56	*Melaleuca quinquenervia*	This mature tree is approximately 11m tall with a canopy spread of 9m. It has twin co-dominant trunks from 1.5m above the base with a DBH of 765mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	9.18	High
57	*Melaleuca quinquenervia*	This mature tree is approximately 7m tall with a canopy spread of 4m. It has a single trunk with a DBH of 380mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	4.56	High
58	*Casuarina spp*	This mature tree is approximately 7m tall with a canopy spread of 3m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
59	*Acacia salicina*	This mature tree is approximately 5m tall with a canopy spread of 6m. It has multiple co-dominant trunks from 1m above the base with an aggregate DBH of 120mm. This tree is in good health and condition with minimal deadwood and epicormic growth. This tree has a short Safe Useful Life Expectancy (SULE).	2	High
60	*Corymbia ficifolia*	This mature tree is approximately 3m tall with a canopy spread of 4m. It has a single trunk with a DBH of 70mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
61	*Casuarina spp*	This mature tree is approximately 7m tall with a canopy spread of 5m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
62	*Casuarina spp*	This mature tree is approximately 5m tall with a canopy spread of 2m. It has a single trunk with a DBH of 50mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
63	*Casuarina spp*	This mature tree is approximately 8m tall with a canopy spread of 4m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
64	*Casuarina spp*	This mature tree is approximately 6m tall with a canopy spread of 3m. It has a single trunk with a DBH of 75mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
65	*Corymbia ficifolia*	This mature tree is approximately 5m tall with a canopy spread of 8m. It has a single trunk with a DBH of 245mm. This tree is in good health and condition with minimal deadwood and epicormic growth	2.94	High
66	*Corymbia ficifolia*	This mature tree is approximately 4m tall with a canopy spread of 3m. It has a single trunk with a DBH of 60mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
67	*Corymbia ficifolia*	This mature tree is approximately 3m tall with a canopy spread of 3m. It has a single trunk with a DBH of 85mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
68	*Corymbia ficifolia*	This mature tree is approximately 3m tall with a canopy spread of 3m. It has a single trunk with a DBH of 70mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
69	*Casuarina spp*	This mature tree is approximately 7m tall with a canopy spread of 6m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
70	*Casuarina spp*	This mature tree is approximately 7m tall with a canopy spread of 6m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
71	*Casuarina spp*	This mature tree is approximately 7m tall with a canopy spread of 6m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
72	*Acacia decurrens*	This mature tree is approximately 9m tall with a canopy spread of 8m. It has a single trunk with a DBH of 140mm. This tree is in good health and condition with minimal deadwood and epicormic growth. This tree has a short SULE.	2	Low
73	*Eucalyptus saligna*	This mature tree is approximately 8m tall with a canopy spread of 4m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
74	*Ligustrum lucidum*	This mature tree is approximately 6m tall with a canopy spread of 8m. It has multiple co-dominant trunks from the base. This tree is in good health and condition with minimal deadwood and epicormic growth. This tree is an environmental pest therefore it is recommended for removal.	NA	Environmental pest
75	*Phoenix roebellinii*	This mature tree is approximately 3m tall with a canopy spread of 3m. It has a single trunk. This tree is in good health and condition with minimal deadwood and epicormic growth.	4	Low
76	*Callistemon viminalis*	This mature tree is approximately 4m tall with a canopy spread of 4m. It has multiple (3) co-dominant trunks from the base with an aggregate DBH of 180mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.16	Moderate
77	*Grevillea 'Honey Gem'*	This mature tree is approximately 5m tall with a canopy spread of 8m. It has a single trunk with a DBH of 185mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.22	High
78	*Syagrus romanzoffianum*	This mature tree is approximately 6m tall with a canopy spread of 5m. It has a single trunk with a DBH of 215mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.58	Low
79	*Grevillea 'Honey Gem'*	This mature tree is approximately 6m tall with a canopy spread of 6m. It has a single trunk with a DBH of 170mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.04	High
80	*Callistemon viminalis*	This mature tree is approximately 7m tall with a canopy spread of 6m. It has a single trunk with a DBH of 200mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.4	High
81	*Ficus lyrata*	This mature tree is approximately 11m tall with a canopy spread of 9m. It has a single trunk with a DBH of 390mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	4.68	High
82	*Elaeocarpus reticulatis*	This mature tree is approximately 4m tall with a canopy spread of 3m. It has a single trunk with a DBH of 80mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
83	*Casuarina spp*	This mature tree is approximately 6m tall with a canopy spread of 2m. It has a single trunk with a DBH of 100mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2	High
84	*Robinia pseudoacacia 'Frisia'*	This mature tree is approximately 11m tall with a canopy spread of 12m. It has a single trunk with a DBH of 530mm. This tree is in good health and condition with minimal deadwood and epicormic growth. Due to the presence of a bark inclusion this tree is recommended for removal.	6.36	Low

Tree No.	Scientific Name	Description	TPZ Radius (m)	Retention value
85	*Ficus benjamina*	This mature tree is located immediately adjacent to existing dwelling and it is approximately 6m tall with a canopy spread of 6m. It has multiple co-dominant trunks from 1.5m above the base with a DBH of 220mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.64	Low
86	*Archontophoenix cunninghamiana*	This mature tree is approximately 8m tall with a canopy spread of 6m. It has a single trunk. This tree is in good health and condition with minimal deadwood and epicormic growth.	4	Moderate
87	*Ficus benjamina*	This mature tree is located immediately adjacent to existing dwelling and it is approximately 8m. It has a single trunk with a DBH of 190mm. This tree is in good health and condition with minimal deadwood and epicormic growth.	2.28	Low